

MID CANADA LINE. C W DOPPLER DETECTION-
PROJECT WOOD DUCK 1454-1455

7-25

Doppler Program.

Antenna Switch - Cyril Turner
- Arnold Goodman.

Prototype Switch Detection Equipment - ~~Dah~~ Hansen
Jim Whiskin

Flight Tests & Systems Proving - Jacke Hogarth
- John Caldwell.

Antenna Systems - Jacke Hogarth
- Jack Bateson

Field Operations - Arnon Worwick
- Techs from LF Section.

VEHICLE TYPE:

4x4 Mobile Laboratory

VEHICLE DND NO.:

77-349

REQUIRED FOR PROJECT:

FCC D48-38-03-22 RPL 5533
Lone Wolf, Sense-of-crossing development of
DRB Fence (Mark II Fence)
and FCC D48-38-03-24 RPL 5538
Lone Wolf CW Doppler Detection Systems.

SPECIALLY EQUIPPED:

Box equipped as mobile laboratory, wired
for connection to mains or auxilliary power
supply with stand-pipe on side, insulated
and heated for winter use, DRB Fence trans-
mitter and mains regulator installed.

PRESENT USE:

At RPL awaiting refitting.

FUTURE USE:

Transmitter to be removed, and AN/FPS 503
Receiver installed for urgent tests of
scintillations and false alarms on DRB Fence
equipment, first in Ottawa area, then
possibly in area of Mid-Canada Line.

EXPECTED PERIOD OF
NEED FOR VEHICLE:

For duration of R&D on DRB Fence, at least
two years.



VEHICLE TYPE: 4x4 Mobile Laboratory

VEHICLE DND NO.: 77-389

REQUIRED FOR PROJECT: FCC D48-38-03-22 RPL 5533
Lone Wolf, Sense-of-crossing development of
DRB Fence (Mark II Fence)
and FCC D48-38-03-24 RPL 5538
Lone Wolf CW Doppler Detection Systems.

SPECIALLY EQUIPPED: Box equipped as mobile laboratory, wired
for connection to mains or auxilliary power
supply with stand-pipe on side, insulated
and heated for winter use, DRB Fence trans-
mitter and mains regulator installed.

PRESENT USE: Sited at Burke's Farm station on Fence
detection line.

FUTURE USE: To be refitted with new AN/FPS 503 trans-
mitter for urgent tests of scintillations
and false alarms on DRB Fence equipment,
first in Ottawa area, then possibly in area
of Mid-Canada Line.

EXPECTED PERIOD OF
NEED FOR VEHICLE: For duration of R&D on DRB Fence, at least
two years.

VEHICLE TYPE:

½ ton Chev. Panel.

VEHICLE DND NO.:

53-10456

REQUIRED FOR PROJECT:

PCC No. D48-38-03-22 RPL 5533

Lone Wolf Sense for DRB Fence.

PCC No. D48-38-03-24 RPL 5538

Lone Wolf CW Doppler Detection Systems.

SPECIALLY EQUIPPED:

Nil.

PRESENT USE:

Convey men and materials on these projects, dismantling temporary RPL - Arnprior - Meath DRB Fence line and installing permanent White Lake - RPL - El DRB Fence line with new equipments.

FUTURE USE:

- (1) Convey men and equipment for maintenance of Fence line, particularly at White Lake.
- (2) Also for setting up and maintenance of two station line north of Ottawa for study of scintillations and false alarms on DRB Fence.

EXPECTED PERIOD OF
NEED FOR VEHICLE:

For duration of R&D on DRB Fence, at least two years.

VEHICLE TYPE:

Chev. Station Wagon.

VEHICLE DND NO.:

53-02320

REQUIRED FOR PROJECT:

PCC No. D48-38-03-22 RPL 5533
Lone Wolf Sense for DRB Fence.
PCC No. D48-38-03-24 RPL 5538
Lone Wolf CW Doppler Detection Systems.

SPECIALLY EQUIPPED:

Nil.

PRESENT USE:

Convey men and materials on these projects, dismantling temporary RPL - Arnprior - Meath DRB Fence line and installing permanent White Lake - RPL - EL DRB Fence line with new equipments.

FUTURE USE:

- (1) Convey men for maintenance of White Lake station and for setting up and maintenance of two station line north of Ottawa for study of scintillations and false alarms on DRB Fence.
- (2) Also for support of other sections, e.g. VHF (Janet project) and microwave (Lone Wolf siting).

EXPECTED PERIOD OF
NEED FOR VEHICLE:

The present program will require use of this vehicle for about another four months. The situation will be reviewed from time to time, and the vehicle will be released when the pressure for R&D on the DRB Fence is relaxed.

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

27th July, 1955.

Dr. M. C. Thompson,
Central Radio Propagation Laboratory,
Boulder, Colorado.

Dear Dr. Thompson,

As you know, we are interested in constructing and using the microwave refractometer you have designed. Would it be convenient for Dr. Walter J. Heikkila to visit Boulder August 14th to 19th to discuss the refractometer with you, and obtain the information necessary for us to build one?

Yours sincerely,



for Superintendent,
D.R.T.E. (RPL).

JHE/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

18th July, 1955.

Mr. S. J. Crossman,
Bell Telephone Company of Canada,
Special Contracts Department,
1050 Beaver Hall Hill,
Montreal, P. Q.

Dear Mr. Crossman,

Herewith copy no. 48 of manual for modified CTR-500
equipment on loan as requested.

I regret that I have not been able to find more than
one copy. Please return.

Yours truly,


for Superintendent,
D.R.T.E. (RPL)

JHC/keb

Enclosure

7-29-39
copy sent Archives

MEMORANDUM

29th June, 1955.

To: Superintendent,
D.R.T.E.

Model Measurements of Scatter Cross Sections of Aircraft and Missiles

1. In order to specify precisely the request made by this group for scattering measurements on models, the following requirement is submitted.
2. Measurements are urgently required of the scattering cross section of various aircraft types with particular reference to forward-scatter and the different aspects of the aircraft as are met with in the operation of the bi-static fence system. Appropriate aircraft types at present are the CF-100, F-86, B-47, B-36, B-29, and the Lancaster.
3. Similar measurements of the scattering cross section of a cone and combination of cone and cylinder are also required with particular reference to the early warning detection of IBM with a bi-static radar.

JHC/keb

c.c. Dr. R. Langille

JHC

J. H. Chapman

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

27th June, 1955.

Mr. H. H. Bridon,
Department of Transport,
Meteorological Division,
315 Bloor Street, West,
Toronto 5, Ontario.

Re: File No. 5980-4

Dear Mr. Bridon,

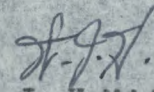
Thank you for your letter of June 23, and the copy of
circular 2109.

The anemometer type U2A seems to be satisfactory for our
purposes. We would therefore like to acquire one. Could you supply
us, and how much would it cost?

I wish to thank you again for your co-operation.

Yours truly,

WJH/keb


(W. J. Heikkila)
for Superintendent,
D.R.T.E. (RPL)

7-2-38
copy DND A
MEMORANDUM

27 June, 1955.

To: Superintendent, D.R.T.E.

Program of Doppler Detection Research Section

Note: Should we call it "Flutter Section"?

Present Program

1. A large amount of "clean-up" work is in progress, to digest, analyze and report on the last years work, e.g., Wood Duck, propagation noise, observation of doppler signals in noise, Mark II, etc., in relative order of priority.

2. Present employment is as follows.

2.1 Propagation Noise - 12-18 month program

Director - W. Heikkila
 Techs. - S. Forshaw (analysis)
 (W. Kitchen - summer employee)
 A. Goodman - (equipment)

2.2 Wood Duck

Director - J. Hogarth
 Techs. - J. Bateson (data analysis)
 J. Caldwell (" ")

2.3 Flutter Systems - 1. Airfield protection scheme (Ring Doppler)
2. Possibility of ICBM detection.

Director - W. Culshaw
 Techs. - E. Mousseau (computer)
 - W. Mathers (Ring Doppler equipment)

2.4 Engineering & Operation

Engineer - K. Lacey
 Tech - J. Wiskin

Presently engaged in setting up and operating Propagation Noise equipment. When time available will go on to airfield protective scheme, etc.

Total Professionals - 4
 Technicians - 7

3. Wood Duck should be complete in about one month, and the reports issued. Hogarth will then be leaving. The three men left, Culshaw (Section Head), Heikkila, Lacey, can then cope with the Propagation Noise project, and one other item, ring doppler, ICBM detection, etc. The section has a full program now, and cannot take on more until Seaman returns from DRNL.

4. Providing we are not required to be able to do large projects on short notice, I am satisfied with the professional staff available. The output of the section will not be large, but should be of high quality.

2

5. The above is subject to review if we decide to study very long base fluttar systems (ICBM).

John H. Chapman

M E M O R A N D U M

24 June, 1955.

To: Mr. J. R. Fisher

Erection of Antennas on 200' Tower, Shirley Bay Site

1. Five drawings are attached on the above subject.
M595E Erection of antennae at 100 foot level
M596E Mounting channel details 100 foot level
M597D Stiffener arrangement for platforms
M610E Erection of antennae at 200 foot level
M611E Mounting channel details 200 foot level.
2. Will you please arrange for manufacture of items shown in M596E and M611E, and erection of antennas and platform stiffeners as shown in M595E, M610E, and M597D.
3. Please note that RPL workshop services are supplying items required for platform stiffeners (M597D).
4. Stiffeners are also to be erected on 50 foot tower at White Lake.

(John H. Chapman)
for Superintendent,
D.R.T.E. (RPL)

7-29-87
C.M. D.A.

Miss Bowers
CLASSIFICATION / Révision 3803-24
CHANGE TO
REPLACÉ PAR UNCLASSIFIED
BY AUTHORITY OF
SUR LA LOI
Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario
FONCTION
23rd June, 1955.

Defence Research Member,
Canadian Joint Staff,
66 Ennismore Gardens,
London, S.W. 7, England.

Attention: Dr. T. W. Straker

Detection of Ballistic Missiles

1. We are making a study of application of Flutter techniques to the EW detection of ICBM, as we told you during your recent visit. Considerable progress has been made, and we think it advisable to consult with workers in the field in the U.S. and U.K. before proceeding further.
2. Two aspects are of particular concern. It is important to determine more specifically the probable shape and aspect in flight of the war-head, and any other information on the scattering properties of the war-head that is available. We are aware that work in the U.K. may not bear directly on the North American problem, but we feel important information can be obtained. Secondly, we are concerned about early warning techniques which may be under development, to prevent duplication and to ensure that we do not overlook any technique or method. Our work is still in the study and proposal stage and the contacts we desire are with those workers in the U.K. who are at the same stage, or somewhat more advanced.
3. We have planned to send Dr. W. Culshaw, who is well known in the U.K. from his long association with RRE, to the U.K. about 18 July. Requests for clearances to various establishments to consult specific individuals have already been sent through the usual channels. A copy of his suggested itinerary is attached.
4. We would appreciate your opinion on how successful Culshaw's projected visit is likely to be, for the stated objects, and also whether his itinerary is in all cases appropriate, and complete. It is recognized here that we must establish contacts and keep closely informed of U.K. work in this field, but we are uncertain if this visit by Culshaw is too soon or should be preceded by any other ground work.

JHC/keb

Original Signed
By
JAMES C. W. SCOTT
Superintendent,
D. R. T. E.

TRANSMITTAL SLIP

DATE

21/6/55

TO:

Kay Bowers

FROM:

P. Rooney

☐ Note and File☐ Note and Return☐ Please Speak☐ Please Answer☐ For Your Approval☐ Take Appropriate Action☒ As Requested☐ For Information☐ For Your Comments☐ For Signature☐ Prepare Reply For My Signature

COMMENTS:

Kay: Mr Scott
made a change in the
second para - not your
typing -

C.A.F.A. 1327

8M PADS OF 100-4-52 (M-5587)

H.Q. 4554-A-1327

P.R.

7-29-76
CDB
DATE 15 JUN 1992
Defence Research Telecommunications
Establishment, SIGNATURE
Radio Physics Laboratory
Defence Research Board
Shirley Bay, Ottawa, Ontario.
FONCTION

21st June, 1955.

Chairman,
Defence Research Board.

Attention: Tels

Project "Lone Wolf"
Vulnerability to Spoofing

1. Reference is made to your DRBS 3803-10(Tels) dated 13th June, 1955.
2. As a result of field strength measurements in the target aircraft and at the ground receiver the Chairman's original request with regard to the range from which an aircraft can detect the Line compared to the range at which the Line will detect the aircraft can now be answered.
3. With a simple receiver, the aircraft can detect the Line readily, and remain undetected until it is within about two miles of an on-base-line (Mid-Canada Line). The off-base system used in the DEW line is similarly vulnerable, though the area of maximum sensitivity is about 20 degrees off the line.
4. The simple receiver designated above would be one similar to the Stoddart Field Strength Meter, type NM 50A, with 20 microvolt sensitivity. A somewhat more sensitive receiver, designed for the ECM task, with 1 microvolt sensitivity (-137 dbw) would detect radiation from the line at any line-of-sight range without difficulty (e.g., 150 miles at 10,000 feet altitude).
5. It appears from this that bistatic warning lines do not have any inherent advantage over radars in regard to pre-detection of the line, if one assumes simple ECM action by the enemy. Further studies, if desired, seem more appropriate to the Operational Research Group.

Original Signed

By

JAMES C. W. SCOTT

Superintendent,
D. R. T. E.

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

17th June, 1955.

Leeds & Northrup Company,
Sales Engineering Division,
4901 Stenton Avenue,
Philadelphia 44, Pa.,
U. S. A.

Attention: Mr. E. D. Moiles

Gentlemen:

Thank you for your letter and Quotation BCS-55-370.

None of the instruments which your catalogue describes fulfills our requirements. The one on which you gave a quotation may do so; however, I am not quite certain I understand what it is.

I wish to measure noise power at very low frequencies. Therefore, the square law device must handle frequencies down to 0.05 cps, or preferably to D.C. It must have a sufficiently large dynamic range to handle the noise peaks without clipping. Also, it must have a long time constant, so that it will measure average, rather than instantaneous power. A vacuum thermocouple would seem to satisfy all these requirements.

In addition, the rms value of the noise I wish to measure fluctuates slowly with time, over a wide range, about 60 db. This means that if the final recording is to be satisfactory on a single scale, then it must be logarithmic. Finally, I wish to have a 6 or 12 channel recorder.

The power level recorder your pamphlet describes fails in two respects. First, it does not work below about 40 cps. Second, it is a single channel instrument. Does the instrument described in your quotation meet our requirements in these respects?

2

Some numbers I would suggest are a thermocouple time constant of 10 secs., and a printing time of 60 secs. per channel. Would these values prevent instability, or bunting, of the recorder?

I hope to hear from you soon.

Yours very truly,

WJH/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

15th June, 1955.

Mr. Al Levy,
American Thermo-Electric Company,
7269 Santa Monica Boulevard,
Los Angeles 46, California,
U. S. A.

Dear Mr. Levy,

Thank you for your catalogue on vacuum thermocouples. Some of your thermocouples do meet most of our requirements. For example, numbers 20 to 23 of the standard line with the insulated heaters. However, the time constants of the units are not mentioned. We wish to have a thermocouple with a time constant of about 30 seconds, but anything from 10 seconds up would be suitable.

Could you tell us what are the time constants of thermocouples 20 to 23?

Yours very truly,

H.F.T.

for Superintendent,
D.R.T.E. (RPL)

WJH/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, Ottawa, Ontario.

10th June, 1955.

Dr. M. C. Thompson,
Central Radio Propagation Laboratory,
Boulder, Colorado.

Dear Dr. Thompson,

Thank you very much for all the information on the microwave refractometer you sent me with Mr. Clare McKerrow.

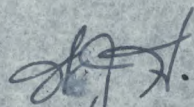
As you probably know, both the National Research Council and the Radio Physics Laboratory here are engaged in experiments on tropospheric propagation of radio waves. We are therefore keenly interested in all possible methods of obtaining information about the condition of the troposphere. The microwave refractometer seems especially promising. Could you send us any more information on your new instrument, such as circuit diagrams or blueprints? That would help us size up the task of building them.

In particular, we are thinking of giving a commercial firm a limited contract to build about 6 of these instruments for us. Could you give us permission to do this?

We would also be very grateful if you could give us any information about analysis of the data obtained using microwave refractometers, and about methods of correlating this data with radio phenomena.

I understand you will be at the Ann Arbor meeting in two weeks. Unfortunately, we will be at the CAP and APS meetings at Toronto, so will not be able to see you. We would be very pleased to see you here the following week if you could come.

Yours truly,


for Superintendent,
D.R.T.E. (RPL)

WJH/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

20th May, 1955.

Instruments (1951) Limited,
300 Parkdale Avenue,
Ottawa, Ontario.

Attention: Mr. Burgess

Dear Sir:

Confirming our conversation of a few days ago, this laboratory has a requirement for a device to measure the rotation and translation of the top of a 200-foot tower. Would your company please quote date of delivery and price of a device to meet the following specification.

A gyroscopic sensing vibragraph to measure: (a) rotation about the vertical (yaw or twist) and (b) vertical movement in direction of projection (pitch) is required, to measure these quantities to an accuracy of at least ± 0.02 degrees. The device must respond to variations at a frequency of 1 cycle per second. Provision is to be made for signal outputs suitable for recording on a 1 ma meter. Power requirements shall be for 110 volt 60 cycle power at less than 10 amperes current.

We would appreciate your co-operation in providing this information as soon as possible.

Yours sincerely,


for Superintendent,
D.R.T.E. (RPL)

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

20th May, 1955.

Liston-Becker Instrument Co., Inc.,
Stamford, Connecticut, U. S. A.

Dear Sirs:

I would like some information on your Model 14 D.C. breaker amplifier.

Briefly, we want to record continuously the power in noise currents in the frequency range from 0.02 cps to 100 cps. This noise power fluctuates slowly, by as much as 40 db. We think we can use heater-thermocouples with this dynamic range by utilizing temperature differences from $.02^{\circ}$ to 200° C. The thermocouple would therefore produce emf's ranging from 0.8 uv to 8 mv. By attenuating this to the range from 0.01 uv to 100 mv, we should be able to use your D.C. breaker amplifier to get a signal varying from 0.1 mv to 1 volt, this we could then record on a Brown Recorder, using a logarithmic slide-wire.

One aspect I am uncertain of is the input impedance of your amplifier. The thermocouple will have an output impedance of about 5 ohms. Will this be satisfactory for feeding your amplifier?

Yours truly,

D.F.V.
for Superintendent,
D.R.T.E. (RPL).

WJH/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

18th May, 1955.

Mr. W. C. Etherington,
386 Millwood Road,
Toronto, Ontario.

Re: Model Aircraft

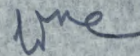
Dear Mr. Etherington,

I must apologize for the delay in answering your letter of May 6th, but we have been giving the matter due consideration, and have visited N.R.C. to discuss whether they would be prepared to make the models.

As a result arrangements are being made for them to be made in the N.R.C. model shop, which we feel would be a more convenient arrangement for us.

However, we thank you for your cooperation in this matter, and for the information you have supplied. Finally should we have any further difficulty we will bear your offer in mind.

Yours faithfully,



WC/keb

W. Culshaw

Dr. Chapman's copy

3803-24

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

16th May, 1955.

Leeds and Northrup Company,
4907 Stenton Avenue,
Philadelphia 44, Pa.,
U. S. A.

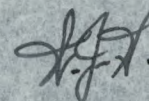
Dear Sirs:

We are doing an experiment in which we wish to make a continuous recording of noise power in each of several frequency bands between 0.02 and 100 cps. Over long periods of time this power may vary by as much as 40 db, and we would like to record the power levels on a single logarithmic scale.

Your folder ND46-51(1) describes your power level recorder. It does not, however, respond to the very low frequencies in which we are interested. Also, it is a single channel recorder, whereas we want 6 or 12 channels. Our plan is therefore to use a heater-thermocouple as a detector and integrator in each channel. We can probably get the required dynamic range by using very small temperature differences. The thermocouple output would be amplified by a Liston-Becker amplifier to give a signal between 0.1 mv and 1 volt. This we hope to record on a Brown or Speedomax recorder with a logarithmic response. We could tolerate an error as high as 5%. Do you make logarithmic slidewires for your multiple-point recorders to handle the dynamic range of 80 db following the thermocouple?

We would appreciate having one of your representatives contact us with regard to this problem.

Yours truly,



for Superintendent,
D.R.T.E. (RPL)

WJH/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

3rd May, 1955.

A I R M A I L

Defence Research Member,
66 Ennismore Gardens,
London, S.W. 7, England.

Attention: Dr. T. W. Straker

Procurement of Dieline Prints

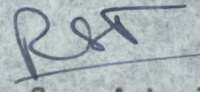
1. Reference is made to our telegram of 28th April, 1955, concerning the a/m subject. The text appearing on the daily diary appears to be a little garbled from the dictated version. This letter is intended to clear up any possible misunderstanding of the request.
2. Culshaw has been informed that dieline prints are available, on a scale of 1:72, for Lancaster, CF-100, and B-36 aircraft, from

Aeromodeller Plans Service,
Model Aeronautical Press Ltd.,
38 Clarendon Road,
Watford, Herts.

In addition to prints of the above mentioned aircraft we would like prints, of similar scale, for the F-86, B-47, and B-29.

3. It has been determined that a period of approximately 6 months will be required if normal procurement channels are used. Since our requirement is rather urgent it will be appreciated if you will procure the items for us.

RST/keb


for Superintendent,
D.R.T.E. (RPL)

DRTE 3800 - 20
CLASSIFICATION/DENOMINATION
CHANGE TO
REPLACÉ PAR

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

3rd May, 1959.

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UNITÉ

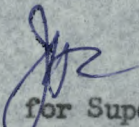
Chairman,
Defence Research Board.

Attention: Tels

Montreal Test Link

1. The program outlined in the attached letter and instruction details accurately the program outlined in earlier discussions with SEG, the Management Contractor, Dr. Whitehead and DRTE. We understand that more complete explorations of low cover, and high cover over the station are being carried out on the spot, but this of course cannot be specified precisely in a general instruction.
2. It is recommended that an assessment be made of the relative deterioration in cover below 1000 feet with decrease in antenna height, or in reference signal. Such an assessment is important for defining the minimum conditions for acceptable sites.
3. It is hoped that the RCAF will maintain this facility for an adequate period of time. The propagation noise measurements should be carried on until the end of the summer at least, in order to obtain data during the periods of anomalous propagation in July and August. Also flight tests for special projects could be carried out this summer on a long link if it were available.

JHC/keb


for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

5th May, 1955.

Model Construction Supplies,
114 Dundas Street, West,
Toronto, Ontario.

Dear Sirs,

We are interested in obtaining models with a scale factor around 1/70 of the following aircraft types:- Lancaster, CF-100, B-29, B-36, F-86, and B-47.

As we require the models to be as precise as possible with regard to shape, etc., it would appear that plastic models might be suitable.

Accordingly, we would be pleased to hear from you as regards what is readily available and any further information you may be able to give us regarding this matter.

Yours faithfully,

W. Culshaw

WG/keb

W. Culshaw

COPY

7-29-35

CLASSIFICATION / DESIGNATION
CHANGE TO RPLS 5538-0
REPLACES RPL
~~CONFIDENTIAL~~

BY AUTHORITY OF

Defence Research Telecommunications

Establishment, 15 JUL 1992

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

APPOINTMENT
FUNCTION

UNIT
UNITÉ

24th March, 1955.

C Tel/ATS,
RCAF,
Victoria Island,
Ottawa.

Attention: S/L R. M. Beatty - SP 2

Lancaster Aircraft 199

1. This letter will confirm telephone conversation (Beatty - Thain) of March 23, 1955, concerning R.P.L. requirement of the a/m aircraft for project "Lone Wolf".
2. I have discussed the subject with Dr. J. H. Chapman and it is his opinion that, upon completion of the flight scheduled for this date for operation "Wood Duck", our present requirements for the a/m aircraft will have been satisfied.
3. Due to the nature of project "Lone Wolfe" we are not able to discount the possibility of future requirements of an aircraft. However, since we do not have, at this date, any formulated plans involving the use of the a/m aircraft, we cannot justify continuation of the present commitment of the a/m aircraft to project "Lone Wolfe".

for Superintendent,
D.R.T.E. (RPL).

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

21 March, 1955.

Mr. J. Chamberlin,
Chief Technician,
Avro Aircraft,
Box 4004,
Terminal A,
Toronto, Ontario.

Dear Sir,

We are interested in obtaining 1/70 scale models of
the following aircraft types:-

- (a) Lancaster
- (b) CF 100
- (c) B 36.

On the information received from Mr. R. J. Templin
of N.R.C. Division of Mechanical Engineering, Aerodynamics, it
appears that you might be able to help us in this matter.

The models would need to be sprayed finally with some
form of copper or other metallic paint, and could with this
proviso be made from any suitable material.

We would therefore be grateful to know whether you
could undertake to supply the above or whether you could supply
us with the drawings necessary to make these models.

Yours faithfully,

WC/keb

W. Culshaw

C O P Y

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PROGRESS REPORT
FOR
THE MID CANADA EARLY WARNING
LINE PROJECT
FROM
FROM 1 SEP 54 - 31 DEC 54

15 JAN 55

SYSTEMS ENGINEERING GROUP

RCAF HEADQUARTERS

OTTAWA, CANADA

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FOREWORD

1. This report summarizes the progress of the implementation phase of the Mid Canada Line Project from 1 Sep 54 to 31 Dec 54. Hereafter progress reports will be issued monthly by the Systems Engineering Group.

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MID-CANADA EARLY WARNING

LINE PROJECT

PROGRESS REPORT NO. 4

1 SEP 54 - 31 DEC 54

1. Introduction

- (a) On 27 Aug 54 the RCAF Systems Engineering Group submitted a Final Report on the Mid-Canada Early Warning Line. This report contained recommendations as to overall systems composition, types of equipment to be used, cost estimates and manpower requirements. Briefly, the Systems Engineering Group recommended that the Mid-Canada Line extend from Hopedale, Labrador to Dawson Creek, B. C., roughly along the 55th parallel and consist of Mk. II Doppler detection equipment supplemented by identification radars at Waterways, Flin Flon and Knob Lake and detection radars in the James Bay area. The Mk. II system envisaged a single line with an average separation of 30 miles between Doppler Detection stations utilizing the AN/FPS 503 (XP-1) 50 watt doppler detection equipment with modification to enable "lobe switching" (Mk. II Doppler) to determine sense of aircraft penetration.
- (b) The Final Report of the Systems Engineering Group was approved by both the United States and Canadian Governments and the implementation phase of the project authorized with a target date for completion as 1 Jan 57. A "Work and Time Schedule" was established, which phases

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implementation as follows; System and Equipment specification to be completed by early summer of 55, setting up a test section of the line during winter and spring of 55 siting for a final line in the summer of 55, delivery of construction materials in the winter and summer of 55 for construction in the spring and summer of 56, procurement of electronic equipment for delivery in the summer of 56 and installation by the end of 56. A Management Contractor, the Trans-Canada Telephone Co., was appointed to carry out implementation of the project, under the direction of the RCAF Systems Engineering Group which was designated as the Design Authority. A preliminary copy of the system specification was completed by the SEG and forwarded to the Management Contractor in Nov 54.

- (c) Since 27 Aug 54, when the Final Report was submitted by the Systems Engineering Group, it has become increasingly evident that the Mk. II line configuration concept recommended, is not feasible because the task of modifying Mk. I equipment for twin lobe operation and automatic switching has proved to be fairly extensive and the development work involved would jeopardize the time schedule to the extent that the operational date would be unattainable. As a result, the Systems Engineering Group have adopted a 60 mile staggered configuration system -- essentially a dual line with a 2 to 5 mile separation between lines and a 60 mile spacing between any two stations in any one line. Mk. I equipment, with minor modifications, can be used in this system and communications accomplished by zig-zagging between stations of both lines.

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2. Financial Status

- (a) In order to fulfill requirements during Phase I of the Mid-Canada Line project, three separate FE's were established. The status of these are as follows:
- (i) FE 35142, in an amount of \$1,000,000.00 was set up to carry out a field survey of the project. Four amendments together with funds committed in an amount of \$13,686.42 have reduced the sum available in this FE to \$44,313.00.
 - (ii) FE 35143 (DCL portion) totalling \$750,000.00 has been reduced by amendments and funds committed of \$427,031.00 to a total of \$72,968.00.
 - (iii) FE 480001 was set up in an amount of \$427,000.00 in favour of the Trans-Canada Telephone System for assistance in fulfilling requirements during Phase I.
- (b) For the implementation Phase II of the project currently under way, Contract Demand FE 469001 was raised in an amount of \$95,000,000.00 for DDP Contract action. This was reduced by Amendment #1 to a new figure of \$51,749,800. to permit allocation of funds to DCL for the construction portion of the project, and leave a reserve of funds within the DND for allocation as required. Requisition # 469001 (1) raised against the above CD/FE in an amount of \$13,100,000.00 was forwarded to DDP 15 Dec 54 to provide services and materials for which plans and specifications are available.
- (c) Contract Demand FE 469002 in an amount of \$29,137,800.00 was raised for Contract Action by DCL Requisition (DND-8) dated 15 Dec 54 requested contract action against this FE totalling \$1,930,000.00 for services and materials currently required.

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3. Map Production

- (a) Production of the 15 mile wide 1/50,000 scale contoured strip maps for use in siting, has progressed as follows:
- Sector I - Hopedale to Cape Jones - completed.
- Sector II - Flin Flon to Cape Henrietta Maria - 97% complete.
- Sector III - Flin Flon to Dawson Creek - 68% complete.
- (b) Copies of all maps completed, have been forwarded periodically to the Management Contractor for use in the office selection of doppler detection sites. The estimated date for completion of map-making is 5 Mar 55.

4. Siting

- (a) All provincial governments have been warned of the impending project and have been advised of the tentative location of Doppler Detection and Section Control Station sites. Right of entry, movement of materials and surveys have been authorized. The establishment of metes and bounds and reservation of property for the Crown is presently under way.
- (b) During the month of October and November, siting operations were carried out in the Gillam-Lesser Slave Lake section of the line. Thirty-three sites were selected, marked with parachutes and rough profiles flown from site to site. This operation was carried out by RCAF and Management Contractor personnel using six helicopters complete with crews and maintenance personnel on loan from the USAF. In the month of December, the locations of these sites were office checked against large scale Army maps, and detailed profiles were produced. In the light of present information as per para I (c), resiting of a number of these locations will be necessary.

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- (c) The Management Contractor is proceeding with the office selection of sites in the Great Whale - Hopedale section of the line, using large scale maps prepared for this purpose by the Army Survey Establishment RCE. This work will continue throughout the winter on all sections of the line, as maps are received from the Army Survey Establishment.
- (d) The Photographic Survey Corporation was engaged to carry out an aerial survey and preliminary investigation of suitable sites, soil conditions and transportation methods along the south shore of Hudson's Bay. Two reports on the survey have been issued by this company. The first covers the operation carried out by aircraft from York Factory to Winisk and shows suitable sites, distances and soil conditions. The second report is an office investigation from available information of the Winisk - Lake River section of the line. Fuel was not available for an aerial survey, of the Winisk - Lake River region. Additional copies of these reports are being procured by the Management Contractor for use by the Design Authority.
- (e) The firm of G. C. MacRostie, Ontario Land Surveyors, has been retained to perform survey work on the Ottawa Valley test line sites at Haley Station, Fitzroy Harbour and South Gloucester, (Ottawa area). Work carried out at each site includes contour surveys, establishment of bench mark and bearing reference lines, and location plans of each property with legal descriptions. The Haley station survey has been completed and the other two are well under way.

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- (f) In the month of September, 1954, a field team selected sites for Section Control Stations in the vicinity of Knob Lake, Great Whale River, Winisk, Amery, Cranberry Portage, Waterways and Dawson Creek.

5. Transportation and Construction

- (a) The Management Contractor has established an office and field headquarters at The Pas, Manitoba headed up by two engineers. These men will administer the transportation and construction phases of the western section of the line. The immediate task of this field office has been the establishment of material marshalling areas and organization of the tractor train operations for the transportation of building materials and fuel during the 1954-55 winter season. One zone engineer will be responsible for operations west of The Pas and the other, east of The Pas.
- (b) In the early part of December, the zone engineers secured 30 acres of land at The Pas, Cranberry Portage, La La Ronge, Fort Black, Waterways and Lesser Slave Lake for use as marshalling areas. The 30 acre plot at Fort Black, ~~Waterways and~~ required clearing; arrangements for which have already been completed. Contractor personnel have been assigned to each marshalling area.
- (c) Two tractor train contracts have been negotiated through Defence Construction Ltd. Patricia Transportation Co. Ltd. have contracted to provide tractor train service in the section of the line from Amery to Deschambault and Standard Gravel and Surfacing of Canada Ltd. in the section from Deschambault west to Lesser Slave Lake. Tractor train operators have also been approached to undertake service along the South Shore of Hudson's Bay from

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York Factory to Lake River.

- (d) Arrangements are under way with the Manitoba Telephone System to provide 25 watt mobile radio telephone equipments for tractor trains, and at a later date for each of the Doppler Detection sites during the construction period. This service will be operated by the telephone company out of The Pas, Manitoba.
- (e) Negotiations are in the process of completion for delivery to the six western marshalling areas on time for tractor train transport this winter, of gravel, barrels of aviation gasoline, diesel oil and lubricant oil, 5,000 gallon capacity fuel tanks, prefabricated building panels and finishing materials for Doppler Detection sites. The delivery to the marshalling yards of prefabricated buildings is 50% complete.
- (f) In the eastern portion of the line, at Great Whale River, an RCAF CMU party have completed a 4000' x 100' airstrip suitable for winter operation of Dakota and C119 (Flying Boxcar) aircraft. A topographical survey is under way to lengthen and widen the airstrip to 6,000 feet and 200 feet respectively, to enable safe operation during the summer months. The CMU have erected three Army General purpose huts for use as barracks, mess hall and garage by Management Contractor personnel.
- (g) During the month of November 54, RCAF and M.C. personnel visited Knob Lake and secured an area $2\frac{1}{2}$ miles from the airport, to be used as an oil and gasoline storage area. Some 18,400 barrels of avgas, diesel oil and lube oil have been shipped from Montreal to Seven Islands where they were unloaded directly into ore cars to be freighted by rail to Knob Lake. These cars are being held in the

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railway yards at Seven Islands and dispatched to Knob Lake at a rate commensurate with handling facilities there. Approximately 50% of the barrels have already reached the storage depot at Knob Lake.

- (h) The responsibility for planning and carrying out all RCAF air operations with respect to the Mid-Canada Line has been allocated to Air Transport Command. ATC are at present engaged in air supply and support of CMU activities at Great Whale River and the choosing of lakeheads based on Management Contractor map selection of Doppler Detection sites in anticipation of fixed wing airlift of POL from Knob Lake to these localities.
- (i) Call-up orders were issued to DCL in the latter part of December for the supply of eighty-four 5,000 gallon fuel storage tanks and building finishing materials for 28 Doppler Detection stations in the western section of the line. Delivery of these materials to the marshalling areas, will have to be effected in time for transport to sites by tractor train this winter.
- (j) The RCAF has made arrangements with the Canadian Army to supply 35 General purpose huts for use as construction camps at Section Control Stations. Six of these huts have been shipped to Knob Lake, six will be shipped to Winisk by tractor train this winter and three have been erected by #2 CMU at Great Whale River. The remainder will be delivered to other SCS sites by April 55.

6. Detection Equipment

- (a) Specifications for the modification kits of the Mk. I Doppler Detection equipment were prepared by representatives of the Design Authority, the Management Contractor and RCA Victor at a meeting held on 16 - 18 Nov 54.

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- (b) A list of requirements for the Mk. II Doppler antenna system was submitted at a meeting of the MC and the Design Authority. At this meeting it was decided that each group present, would prepare a list of equipment changes to be considered for the Mark II prototype.
- (c) During December, representatives of the Management Contractor inspected units of Mark I equipment at the RCA plant in Montreal. On 22 Dec 54 a meeting was held to discuss difficulties encountered by RCA Victor in the design of Mk. II modification kits. Suggested changes for the Mark II prototype were presented at this meeting by representatives of the MC and the Design Authority.

7. Display Equipment

- (a) The requirements of this project for the recording of the doppler signals and the facilities offered by various oscillographic recorders commercially available, have been studied, and a recorder specification is being prepared. A meeting between the Design Authority and Management Contractor has been arranged for the first week in Jan 55 to decide the most desirable mounting arrangement for recorders in the Section Control Operations room. When this decision has been made, the specifications for oscillographic recorders will be completed and presented for DDP action.

8. Radio Relay Equipment

- (a) Preliminary specifications for radio relay equipment were prepared during the month of December and are being submitted to the Design Authority for approval in the first week of January. Following approval the specification will be submitted to DDP for contract

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tendering action. This specification covers transmitters, receivers, associated power supplies, antenna duplexers, service channel, diversity and standby arrangements. The specification is so written that the equipment may operate in any one of the following frequency bands - 420 - 460 MC/S, 1700 - 2300 MC/S, 3900 - 4200 MC/S and 5925 - 7400 MC/S.

9. MULTIPLEX EQUIPMENT

- (a) Preliminary specifications for voice frequency and voice frequency carrier telegraph multiplex and narrow band channel equipment, are in the process of preparation. These specifications are nearing completion and will be submitted to the Design Authority for approval shortly.

10. Auxiliary Communications Equipment

- (a) A study of HF and LF propagation conditions along the line and rearward, was completed by members of the Systems Engineering Group and the Management Contractor. This study will be used as a basis for specifications for communications equipments operating in the high and low frequency bands.
- (b) Firm specifications for contract tenders have been approved by the Design Authority for emergency 100 watt transmitters, emergency receivers and VHF A/G/A antennae. Wuantities required have been established for the above items, as well as other A/G/A equipment and high frequency emergency communications equipment.
- (c) A "call-up order" for emergency communications equipment has been finalized and will be submitted to DDP for contract action in the first week of Jan 55. A similar order for VHF A/G/A communications equipment is being

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prepared for submission to DDP early in January 55.

11. Power Equipment

- (a) Power plant specifications were discussed by members of SEG and the Management Contractor at a meeting held in late December 54. The MC will submit these specifications for approval by the Design Authority in January 55.

12. Radar Equipment

- (a) Extensive investigations have been made into radar systems for both detection and identification purposes. Discussions have been held with representatives of DRB, National Research Council, Lincoln Laboratories and a number of manufacturers of radar equipment. Specifications will be drawn up as soon as requirements are definitely determined.

13. Aircraft Procurement

- (a) Procurement action on 10 S55 helicopters was undertaken by the RCAF and delivery has been completed. The matter of procurement of heavy helicopters (S58 versus H21C) has not been resolved.

14. Test Line

- (a) Three sites have been chosen and survey is nearing completion for a "typical section of the Line" to be located in the Ottawa Valley. This test line will be constructed during the summer of 55. Eight basic doppler equipments for this test line have already been delivered.

15. Barrack Equipment and Furnishings

- (a) A scale of issue for barrack equipment for doppler detection stations has been prepared by SEG and submitted for approval to the Directorate of Personnel Administration.

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16. Training

- (a) A basic training plan for technician personnel to man the Mid-Canada Early Warning line is being developed by the Systems Engineering Group. Active liaison is being maintained with the Management Contractor to prevent duplication of training facilities.

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Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

2nd March, 1955.

Mr. R. A. Sidur, Superintendent Operations,
Project 572,
Western Electric Company,
220 Church Street,
New York 13, N. Y.,
U. S. A.

Dear Mr. Sidur:

The visit by Dr. Hogarth and myself to Streator, Illinois, on 23 to 25 February was both pleasant and successful. The measurements obtained are most informative.

We received excellent co-operation from the Assistant Superintendent, Mr. T. J. Slattery. J. W. Griffin and A. Beauvais were most helpful and assisted us throughout the visit in setting up the equipment and making the measurements.

Please convey our thanks to those members of your staff who arranged our visit to Streator.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

1st March, 1955.

Mr. T. J. Slattery,
Assistant Superintendent,
Western Electric Unit,
Streator, Illinois,
U. S. A.

Dear Tom:

Thanks for making our recent visit to Streator both pleasant, and profitable from the scientific point of view. We are most grateful for the assistance given by yourself, Jay Griffin and Art Beavais in particular.

The measurements are extremely interesting and valuable to us. We will keep Bell Labs informed of the results.

It is possible that further trips to Streator may come my way now but I gather your term there is almost up. It has been a pleasure seeing you again, and I hope our paths will cross again.

With kind regards,

Yours sincerely,

J. H. Chapman

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

1st March, 1955.

Mr. John F. Morrison,
Bell Laboratories,
Whippany, New Jersey,
U. S. A.

Dear John:

The trip to Streator, Illinois, by Hogarth and myself on 23rd to 25th February was most successful. We obtained some very useful measurements on propagation noise (scintillations) over both paths in operation there. The data are being analysed now.

We received excellent co-operation from the personnel on the site, particularly the Assistant Superintendent T. J. Slattery, and from J. W. Griffin and A. Beavais who assisted us throughout.

Don Danforth's visit on Friday 25th was well worth while, as we hope that you will be able to continue measurements for us when your own filter equipment arrives. Don is acquainted now with the purpose and method of the measurements.

We informed Don of experiment "Wood Duck", its set-up and schedule. I will be phoning Herb Weiss at Lincoln when we are certain our feathered friends are co-operating, as he is anxious to send an observer. If you wish, I can give you a call at the same time in case you wish to send someone too.

Thanks very much for the assistance at Streator.

With kind regards,

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Channel

17

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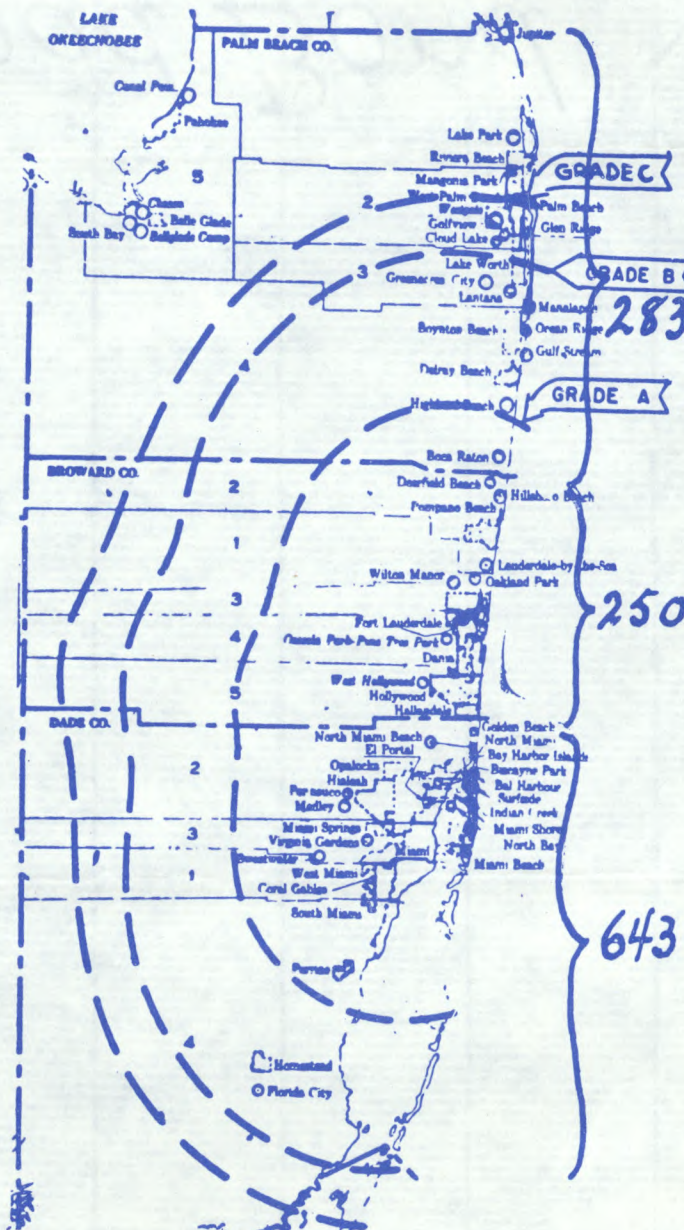
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mail came from:
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(Broward County area)
- 250 - 21%
MIAMI
(Dade County Area)
- 643 or 55%

WITV's OVAL PATTERN COVERS THE GOLD COAST OF FLORIDA

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Defence Research Telecommunications Establishment, **15 JAN 1992**
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, ONTARIO
Ottawa, Ontario. **UNITÉ**

14th February, 1955.

AFHQ/DSEG

Attention: Mr. A. Levin

Propagation Noise at 500 Mc.

1. Attached herewith is a copy of some notes on scintillation noise giving information available to date at this laboratory.

JHC/keb

Enclosure

for Superintendent,
D.R.T.E. (RFL)

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DATE 15 JUN 1992

Defence Research Telecommunications

Establishment, *[Signature]*

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

14th February, 1955.

Dr. J. R. Whitehead,
MacDonald Physics Building,
McGill University,
Montreal, P. Q.

Dear Rennie,

Here are some notes on the scintillation noise measurements to date which you might like to have. These are the general conclusions reached after several months of recording.

With kind regards.

Yours sincerely,

JHE/keb

Enclosure

for Superintendent,
D.R.T.E. (RPL)

CODE DESIGNATORS OF DEW LINE STATIONS

1. A code name not followed by a letter or number indicates a Main station.
2. A code name followed by a letter designation indicates an Intermediate station.
3. A code name followed by a number designation indicates an Auxiliary station.
4. All Intermediate and Auxiliary stations are referenced to the nearest Main station lying to the west of the respective Intermediate and Auxiliary stations. For example: POW 2 is the second Auxiliary station east of Point Barrow. Station POW C is the third Intermediate station east of Point Barrow.

Cape Lisburne *	LIZ 1	Young Point	PIN 2	(12)
Point	LIZ A	Bernard Harbor	PIN B	(13)
Point Lay	LIZ 2	Lady Franklin Point	PIN 3	(14)
Icy Cape	LIZ B	Ross Point	PIN C	(15)
Wainwright	LIZ 3	Point	PIN 4	(16)
Peard Bay	LIZ C	Cape Peel	PIN D	(17)
Point Barrow	POW	Cambridge Bay	CAM	(18)
Cape Simpson	POW A	Sturt Point	CAM A	(19)
Lonely	POW 1	Jenny Lind Island	CAM 1	(20)
Kogru River	POW B	Hat Island	CAM B	(21)
Oliktok	POW 2	King William Island	CAM 2	(22)
McIntyre	POW C	Matheson Point	CAM C	(23)
NAW*	POW 3	Shepherd Bay	CAM 3	(24)
NAIW*	POW D-1	Simpson Lake	CAM D	(25)
NMIW*	POW D-2	W. Simpson Peninsula	CAM 4	(26)
NMS*	BAR	E. Simpson Peninsula	CAM E	(27)
NMIE*	BAR A-1	W. Melville Peninsula	CAM 5	(28)
NAIE*	BAR A-2	Mid Melville Peninsula	CAM F	(29)
NAE*	BAR 1	Igloolik	FOX	(30)
Kay Point	BAR B (1)	Rowley Island	FOX 1	(31)
Shingle Point	BAR 2 (2)	Bray Island	FOX A	(32)
Tununuk	BAR C (3)	Foley Island	FOX 2	(33)
Tuk Tuk	BAR 3 (4)	West Baffin Island	FOX B	(34)
Eskimo Lakes	BAR D (5)	Mid Baffin Island	FOX 3	(35)
Nicholson Peninsula	BAR 4 (6)	Ekalugad	FOX C	(36)
Horton River	BAR E (7)	Henry Kater	HEN	(37)
Cape Parry	BAR 5 (8)	Cape Hooper	HEN A	(38)
Pearce Point	PIN (9)	Kivitoo	HEN 1	(39)
Clinton Point	PIN 1 (10)	Broughton Island	HEN B	(40)
Clifton Point	PIN A (11)	Padloping Island	HEN 2	(41)

* Existing stations

Numbers indicated in parentheses are those by which sites have been designated previously.

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Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

8th February, 1955.

Mr. B. B. Bagnall,
Western Electric Company,
220 Church Street,
New York, U. S. A.

Dear Mr. Bagnall,

I enclose a copy of a letter to Mr. John Morrison at Bell Telephone Laboratories, Whippany, regarding proposed measurements at the 572 Domestic Site, Streater. Mr. Morrison has agreed verbally that there is no objection to these measurements being made by our personnel. He did request that we inform you as soon as possible of the proposed trip to Streater.

The USAF clearance approval for the two men going from this laboratory is given in the letter in order that appropriate action may be taken. The clearances are also being initiated in the normal manner.

I have since been informed that the Bell Telephone Laboratories are unable to supply the particular filter mentioned in the letter and we are taking steps to provide the instrument with the party from Canada.

I would appreciate hearing from you if there is any reason why these plans are not satisfactory to your organization. The dates chosen have no particular significance and we are quite prepared to change them at your convenience.

Yours sincerely,

JHE/keb

for Superintendent,
D.R.T.E. (RPL)

Enclosure

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

7th February, 1955.

Mr. John F. Morrison,
Bell Telephone Laboratories,
Whippany, New Jersey,
U. S. A.

Dear John,

Confirming our telephone conversation of February 5th, it would be appreciated if arrangements could be made for measurements of propagation noise to be made at your Streator, Illinois, sites on February 28th to March 1st.

The measurements would consist of recordings of the receiver output on the 60-mile Flutter link made intermittently over a period of several days. A band pass filter is inserted between the receiver output and a pen recorder, and the noise recorded as the filter bandwidth is varied. In order to do this a filter of the following type is required:

Ultra Low Frequency Band Pass Filter type 330-A,
manufactured by Krohn-Hite Instrument Company,
Cambridge, Mass.

It would be appreciated if the above instrument could be provided at the Streator site for the period 28th February to 2nd March. If necessary, a filter can be provided with the party from Ottawa. This is considered unadvisable due to difficulties with Customs at the border.

The personnel going from this laboratory will be J. H. Chapman and J. E. Hogarth, both covered by USAF clearance approval No. 26246 for the Streator site.

Yours sincerely,

for Superintendent,
D.R.T.E. (RPL)

JHC/keb

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SUR L'AUTORISATION DE

Defence Research Telecommunications

Establishment,

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay, APPOINTMENT
Ottawa, Ontario. FONCTION

UNIT
UNITÉ

31st January, 1955.

Chairman,
Defence Research Board.

Attention: Tels Section

Minutes of Meeting No. 10
Technical Co-ordinating Committee

Herewith Minutes of Meeting No. 10 of the Technical
Co-ordinating Committee held 24th January, 1955, for your retention.

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Enclosure

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Defence Research Telecommunications
DATE Establishment, 1992
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, APPOINTMENT
Ottawa, Ontario, FONCTION
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31st January, 1955.

Mr. H. G. Weiss,
Massachusetts Institute of Technology,
Lincoln Laboratory,
P. O. Box 73,
Lexington 73, Massachusetts.

Dear Herb,

Thank you for the copies of our summary prepared following the meeting on 21st January, 1955. It appears that a copy was used for the Canadian paper which had not been corrected for a number of typographical errors.

To set the record correct the following corrections should be made to the Canadian report:

Section A, para 1 line 3 "provided" should be "prevented"

Section B, para 1 line 1 "called" should be "on"

" " " " " 2 "incidents" should be "incidence"

" " " 2 " 1 "quantitatively" should be
"qualitatively"

" " " " " " "the frequency" should be "as frequency falls"

" " " " " 3 insert "it" after "but"

" " " " " 5 "quantitatively" should be "quantitative"

" " " 3 " 5 insert " $\pm$ " before "13 db"

" " " " " 6 "mean" should be "minimum"

" " " 4 " 1 "directly after" should be "rapidly as"

" " " " " 3 pluralize "angle"

The figure on page 2, the base line 50-60 miles refers to half the distance indicated on the diagram.

The figure on page 3, the arrows indicating the minimum separation of 1000' should be pointed to the transmitters at the mid-point of the system.

Yours sincerely,

JHE/keb

for Superintendent,
D.R.T.E. (REL)

new copy

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BY AUTHORITY OF

Defence Research Telecommunications
Establishment,

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

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31st January, 1955.

Chairman,
Defence Research Board.

Attention: Tels

Doppler Detection System

1. Herewith is one copy of the joint report prepared by representatives of the Lincoln Laboratories and D.R.B. on 21st January, 1955, in Boston, for your information.
2. There are some typographical errors in this copy which are being corrected.

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Enclosure

C O P Y

File 223:03

THE BELL TELEPHONE COMPANY OF CANADA

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BY AUTHORITY OF
SUR L'AUTORISATION DE

DATE

15 JUN 1992

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APPOINTMENT

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TO DISTRIBUTION:

MONTREAL, January 31st, 1955.

Dear Sir:

Enclosed herein is a copy of a letter from Mr. A. Levin expressing the position of the S.E.G. regarding the objective of Section 2.00 "Purpose of the 60 Mile Test Link" (Montreal Area), outlined in the notes on the meeting you attended at the place of the Management Contractor on Wednesday, January 19th, 1955. This letter concerns the importance of the noise measurements to be included in the test line trials.

Please attach this copy of Mr. A Levin's letter to your copy of notes on the meeting held at 1010 Beaver Hall Hill, Montreal, on Wednesday, January 19, 1955.

Yours truly,

D. J. McDonald,
Transmission Engineer,
Special Contract Department.

Distribution:

G/C E. C. Poole
Mr. S. Comach
Dr. J. R. Whitehead
Mr. B. Walker
Dr. J. H. Chapman

Dr. F. G. R. Warren
Mr. A. Levin
Mr. W. J. Morris
Management Contractor (3)

C O P Y

In reply please quote
No. S950-109-80/7 (SEG/E-2)

DEPARTMENT OF NATIONAL DEFENCE

OTTAWA, Ontario.
26 January 1955.

Bell Telephone Company of Canada,
Special Contract Department,
1050 Beaver Hall Hill,
Montreal 1, Quebec.

Attention: Mr. MacDonald

Dear Sir:

Reference to the Minutes of the Meeting of 21 January 1955,
I would like to restate the position of SEG insofar as the propagation
group is concerned in view of the statements as to priority of objective
of 2.00.

- (a) The work on the Foymount link does not render noise measurement on the Montreal Link of less importance.
- (b) The reason for this is that it is expected that the Montreal Link profile will represent a typical Western Link whereas Foymount somewhat resembles a typical Eastern Link and information on both types of link is necessary.
- (c) The 1954 Montreal results dealt largely with Target return and do in fact form a reasonable basis for extrapolation for a 60 mile link. No such detail was produced regarding noise behaviour nor would it be anything like so reasonable to extrapolate.
- (d) The noise determination therefore remains the prime objective as far as the propagation group of SEG is concerned.
- (e) It is of course necessary to provide measurements of target echo amplitude, but since for many reasons these results will necessarily come to hand more slowly than the noise data it is important to set out the relative priority of the information required for the specific purpose of permitting a choice of Doppler baseline length in the Mid-Canada Line.

Yours truly,

(A. Levin)
for Chief of the Air Staff.

7-29-33

RFL 5538-0

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

25th January, 1955.

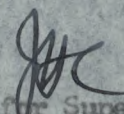
Chairman,
Defence Research Board.

Attention: Tels

Mid-Canada Line
Research on Propagation Noise and Birds

1. It has been decided to include the research on the above items under the inclusive project on Fence systems, FCC No. D48-38-03-24 (Lone Wolf), and not to initiate new project forms. The present plans are as follows.
2. Links from RFL to Meath (60 miles) and to Foymount (68 miles) have been established. Measurements of propagation noise are being made, and data are being reduced. A report on progress will be available shortly.
3. The code name "Wood Duck" has been given to the project on studies of interference from birds. The present plan is to set up three links in the Kingsville, Ontario, area, where the birds are under close control. Canada geese in large numbers are present in the sanctuary there, and controlled experiments on migrating flocks are possible.
4. In order to study the effect of large numbers of milling ducks, such as will be met on the DEW line it is proposed to set up another link at Long Point, Ontario. These two sites have been recommended to us by the Wildlife Service of Department of Northern Affairs as being ideal for our purpose, and much superior to our Ottawa valley sites.
5. The target date for installation of equipment at Kingsville is 1 March, 1955. The intention is to set up at Long Point after the experiment at Kingsville is complete.
6. This information on the planned experiments is being presented at this time in order to accelerate implementation. It is suggested that a meeting be held shortly at DRB Headquarters with the technical and administrative staffs to clear the way for project "Wood Duck".

JHE/keb


for Superintendent,
D.R.T.E. (RFL)

THE BELL TELEPHONE COMPANY OF CANADA

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15 JUN 1992

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To Distribution

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FONCTION

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UNITÉ

January 21, 1955.

Attached hereto is a copy of notes on a meeting held at 1010 Beaver Hall Hill, Montreal, on Wednesday, January 19, 1955.

The meeting discussed the requirements of a test link for doppler experimentation to be carried out in the very near future, in the vicinity of St. Hubert, Quebec. Considerable discussion was carried out on the purpose of this link.

Should you wish to comment on these notes of the meeting, please do so as soon as possible.

Yours truly,

(sgd.) D. J. McDonald

D. J. McDonald,
Transmission Engineer,
Special Contract Department.

Distribution:

1 copy	-	G/C E. C. Poole
1 "	-	Mr. S. Comach
1 "	-	Dr. J. R. Whitehead
1 "	-	Dr. J. H. Chapman
1 "	-	Dr. F. G. R. Warren
1 "	-	Mr. A. Levin
1 "	-	Mr. W. J. Morris
3 copies	-	M.C.
1 copy	-	Mr. B. A. Walker

COPY

9-29-32 CDA

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DATE 15 JUN 1992
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Notes on the Meeting held at
1010 Beaver Hall Hill, Montreal on
Wednesday, January 19, 1955

Present were:

S.E.G.

Dr. F. G. R. Warren
Mr. A. Levin

D.R.B.

Dr. J. H. Chapman
Mr. B. Walker

McGill University

Dr. J. R. Whitehead

R.C.A. Victor Co. Ltd.

Mr. S. E. A. Pinnell
Mr. H. Laks

M.C.

Mr. D. J. McDonald
Mr. D. N. Culver
Mr. Z. H. Krupski
Mr. J. F. Stinson
Mr. S. J. Crossman
Mr. G. H. Anderson
Mr. S. Symbalisty

1:00 INTRODUCTION

1.01 The meeting opened with a discussion regarding the official channels connecting D.R.B., S.E.G. and the M.C. It was agreed that at present the M.C. expects S.E.G. to authorize any or all projects or requests presented to the M.C.

D.R.B. explained that they will be carrying out an experiment that should be considered, together with the experiment that it is to be carried out in the Montreal area and that D.R.B. will desire some assistance from the M.C. on their own project. The M.C. suggested that any D.R.B. requests regarding aid or coordination of experiments should be made through S.E.G. for officiality.

1.02 The purpose of the meeting was described to be that of determining the requirements of a 60 mile test line for immediate experimentation as a doppler link.

2:00 PURPOSE OF THE 60 MILE TEST LINK

The test link in the Montreal area will be primarily concerned with the determination of cover provided by doppler equipment of Modified Mark I type (i.e. the doppler output frequency range shall be extended to 1 c/s), over a 60 mile distance.

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An investigation of low frequency noise shall be carried out to the extent possible, but since D.R.B. are concerned with an experiment on this subject, the Montreal area experiment will consider noise information to be a secondary objective. S.E.G. indicated that noise information is of equal importance to them and requested that an investigation on this regard be carried out as carefully as circumstances permit.

The experiment will include a repetition of the work that was done by Dr. Whitehead during the past summer. Dr. Whitehead described the past summer's work to be that of obtaining the following:-

1. information regarding cover on two 36 mile links on a line over a 72 mile distance.
2. field strength measurements recorded in aircraft, which permitted the determination of the patterns of the Mark I Antennas.
3. 1 - 60 c/s doppler signature recordings on paper chart recorders. (Sanborn recorder)
4. 1000 c bandwidth sound recordings on magnetic tape recorders, (by f.m. technique).
5. field strength of reference signal at the receiver. (Esterline Angus recorder).

The past summer's work required coordination of the following groups:-

U.S.A.F. - 1. bomb plot radar control of aircraft crossings.

R.C.A.F. - 1. target aircraft and crews.
2. v.h.f. communications between aircraft, experimental site and bomb plot.

R.C.A. Victor Co. Ltd. - doppler equipment maintenance, operation, and recording of data.

3:00 LOCATION OF THE TEST LINK

The test link shall be located within optimum useful range of the U.S.A.F. Bomb-Plot radar, (approx. 35 miles radius centered at St. Hubert, Que.).

The station sites should be selected with due consideration to electrical and doppler alarm producing interferences resulting from man-made sources, (i.e. larger towns, busy highways and railway lines).

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Site selection should make use of terrain properties
towards minimizing actual tower heights.

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It was decided that the link will be 61 miles long and that its axis would be in a N.E.-S.W. direction with the N.E. $\frac{1}{4}$ point of the line south of the Bomb-Plot location at St. Hubert. The receivers would be located at the St. Hubert end of the link.

4:00 TEST LINE PROPERTIES

D.R.B. were desirous of using an overlapping double line for the experiment near Montreal. This system would provide for easier interpretation of unknowns that may arise, since a simultaneous noise record could be made for both lines.

It was felt that this system was not essential for the primary purpose of the experiment and a compromise was reached whereby two sets of equipment would be installed in one link, each equipment operating on its own frequency. Thus the one geographic link would hold two doppler radar links. The equipment would be distributed so that two receivers are at one end of the link and two transmitters at the other end.

D.R.B. requested that the location of the link be decided upon with the view in mind that another overlapping link may be set up in the future. An inspection of a map of the Montreal area made it apparent that it will be difficult to meet requirements for an overlapping double line system.

S.E.G. requested that two additional antennas be installed on the receiving tower at different heights so that periodic measurements at these heights; (one at ground level, another half way up the tower), could be made as further checks on link coverage and equipment performance.

It was understood that a rigid tower was required at each site. However, the time requirement imposed on this project, (1 month for towers and station buildings), limited the type of tower that would be used. S.E.G. suggested that an anemometer and accelerometer be installed on the towers so that tower vibration and vibration noise could be correlated and experimental data corrected or deleted where necessary. The information obtained with use of the anemometer and accelerometer would be useful in future structures planning.

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Defence Research Telecommunications Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, Ottawa, Ontario.
DATE 15 JUN 1992
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FONCTION UNIT

18th January, 1955.

Chairman,
Defence Research Board.

Attention: Tels

Mid-Canada Line Equipments
Meeting of 17 January.

1. Two copies of draft minutes of the meeting of 17 January are enclosed. It is suggested that one copy be passed to the RCAF, for checking by Mr. Levin.
2. I will obtain Dr. Whitehead's comments on these minutes in the next few days. However I will not be able to follow up any action to correct or amend the draft until next week when I return from New York and Boston.
3. Possibly this record of the meeting is too long to be distributed widely as it stands. If it is desired to circulate the decisions reached to others than those present at the meeting, a condensation giving only to the conclusions might be produced.

[Signature]
For: Superintendent,
B. R. T. E. (RPL).

7-29-30

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DATE 15 JUN 1992

MEETING OF 17 JANUARY, 1955. TO DISCUSS
COMPARISON OF LONG-BASE AND SHORT-BASE DETECTION
SYSTEMS FOR THE MID-CANADA LINE

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Present	Dr. G. S. Field	- Chief Scientist, DRB
	Mr. L. G. Eon	- Tels Section, DRB
	Dr. J. R. Whitehead	- McGill University
	Dr. J. W. Abrams	- Scientific Advisor/CAS
	Mr. A. F. Branscombe	- RCAF SEG
	Mr. A. Levin	- RCAF SEG
	Dr. F.G.R. Warren	- RCAF SEG
	Dr. J. H. Chapman	- DRTE/RPL
	A/C M. M. Hendrick	- C/Tel, RCAF

1. Dr. Field indicated the purpose of meeting was to discuss the differences in opinion between the RCAF SEG and DRB on the feasibility of 60-70 mile Fence links, and the conclusions reached in the DRB "Review of Development Status of Mid-Canada Line Equipments" of January 1955 (DRBS 1-656-267-4 (Tels)). The DRB stand is as follows:-

DRB agrees with the calculations made by the SEG, but hold that there is insufficient experimental evidence to endorse the 60 mile system.

The 60 mile system is based on a reference signal of 2 μ volts as opposed to a reference signal of 10 μ volts on the 35 mile system. If the noise in the reference signal does not drop proportionately (14 db), there is a net decrease - reference signal-to-noise ratio.

2. Mr. Levin summarized the RCAF position by pointing out that the main possibility of serious difficulty on the long base system occurs if the noise on the reference signal increases greatly with an increase in reference signal. Since the increase in reference signal can be considered as due to an increase in earth's radius, it is reasonable to assume that the depth of modulation (percentage modulation) will decrease when the reference signal increases.

3. Trigger Level - The trigger level will be set at -170 dbw, the reference signal being -132 db. If the modulation on the reference signal is 38 db below the reference, then alarming will occur. This alarm ~~is~~ setting is calculated to give cover down to 200 feet. If the false alarm rate is found to be too high, an increase in the alarm level will raise the low cover.

4. False Alarm Rate - The rate for the 35 mile system was computed to be very low, (e.g. 1 per year) on automatic alarm. Examination of the signal is necessary to determine that the alarm is due to an aircraft. Two or three alarms per day per link are accepted as a reasonable false alarm rate, if only to keep the operator at section control station alert.

5. Mr. Levin made the point that the ratio of aircraft signal to reference signal is constant for both 35 and 60 mile systems, if the high and low cover is maintained. This is because the antenna height is adjusted, (200 feet for 60 miles, 50 feet for 35 miles) to maintain low cover, bringing the reference signal back up. (The A/C signal decreases 12 db going from 30 to 60 miles, the reference signal 14 db). Also, if for example, the automatic alarm level is set up to -160 dbw, the low cover is then about 400 feet.

6. Tower Heights - The SEG method is to require only 10 db difference

between A/C signal level at low and high cover. This calls for 100 foot antennas on a 35 mile system, and 200 foot antennas on a 60 mile system. By comparison, the Lincoln method involves increasing transmitter power to maintain low cover, using low towers on a long base line. This increases the gradient in detection sensitivity, and makes some portions of the system inordinately sensitive to birds.

7. Size of Aircraft - The SEG calculations are based on a 1000 square feet of scattering area with 15 db of enhancement. Mr. Levin pointed out that the scatter cross-section of a target at low altitude is roughly the projected area of the target, regardless of the so-called radar cross-section.

8. Cover - The SEG calculations are that there is about 12 db decrease in A/C signal going from 500 feet down to 200 feet. The forward enhancement increases about 15 db going from 10,000 feet down to 200 feet. These two tend to be complementing, maintaining nearly constant sensitivity until a very rapid change occurs below 200 feet.

A 12 db decrease in alarm level (to -160 dbw) will worsen the low cover by a few hundred feet, will increase the loss of cover over the station, but will not affect the high cover.

9. Limitation Sensitivity - The sensitivity is limited by either receiver noise or by reference noise (scintillation). If the reference noise is the limiting factor and is relatively unchanged in going from a 40 mile to a 60 mile system, then the net decrease in system sensitivity is only the ratio 60/40, i.e. 7 db.

The SEG calculations assume that the reference noise is in fact 3db greater on the 60 mile link, compared to a 30 mile link. This is based on the supposition that doubling the path length just doubles the scattered

power contributing to noise.

10. Tower Stability - Mr. Levin reported calculations that tower misalignment of 1 degree and ± 0.7 degrees wobble will produce the same energy as ~~xxxxxxxx~~ scintillation noise on a long base system. It is good engineering practice to specify no more rigid towers than required to maintain received energy due to tower misalignment and sway equal to the minimum propagation noise which is the uncontrolled limiting factor.

11. Summary - A summary of the two systems discussed, labelled System A (35 miles) and System B (64 miles) was produced.

<u>Reference Signal</u> - System A (35 miles)	- 117 dbw	60' towers
System B (64 miles)	- 131 dbw	200' towers
<u>Recording level</u>	- 164 dbw	
Noise in 50 c.p.s.	-174 dbw	

Enhancements

High cover	+ 15 db
Low cover	+ 20 db

Propagation

	Down	Up	
System A	-137	-97	measured
System B	-151	-111	theoretical

These values are exceeded 0.5% of time

Propagation Noise

Not better than

System A =	- 179 dbw	) + 20 db for upward fade at worst
System B =	- 193 dbw	

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Deterioration in Sensitivity - with increase in trigger level

<u>Reference Signal</u>		<u>Deterioration in S/N</u>
uv	dbw	db
1.0	- 137	+ 1
.3	- 147	+ 3
.2	- 151	+ 5
.1	- 157	+ 10
.05	- 163	+ 16

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15 JUIN 1992
[Signature]

Cover

Mid Point

Over Stn.

High Cover - 5000/10,000 to 60,000 feet

System A - 150/ - 160 dbw - 165 dbw

System B - 160/ -166 dbw - 170 dbw

Low Cover - 200 to 5000/10,000 feet

System A - 173 dbw (better than
System B - 185 dbw (high cover

These figures do not include enhancement

Low Frequency Cut-off 1 c/s for both systems

Summary

⁴⁰
System A

⁶⁰
System B

Lo.	Hi.	Over Stn	Lo.	Hi.	Over Stn
	<u>135/145</u>			<u>145/151</u>	
-153-		-156-			-155-
159-	-----				-163-----
				165	

Dashed line shows maximum expected scintillation noise on 20 db upward fade

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12. Mr. Levin raised the question as to the considerations which led DRB to endorse thoroughly a 40 (35) mile system. The decision was based on the relatively large amount of experimental information now available on 40 mile base systems.

The SEG criticized the 40 mile system on the following counts.

<u>Economics</u> - Coast to Coast Installation	<u>System A</u>	<u>System B</u>
Capital Cost	\$143 million	\$94.5 million
Maintenance Costs, annual	\$ 12.1 "	\$ 9.6 "
Man power required	1040	656
<u>Number of Stations</u>		
SCS	10	7
DDS	130	81

13. Dr. Field summarized the view of the meeting at this point, as follows

It was agreed that a detection line could be set up on a 35 (40) mile base which would work satisfactorily in detection of aircraft.

The 64 mile base system appeared as if it would be satisfactory. It would give cover from 200 - 300 feet to 60,000 feet with some increase in the uncertainty of detection over the station. The false alarm rate would probably be acceptable, but information is lacking on propagation noise. It is conceivable that experiment might indicate that the propagation noise will seriously affect the system. While propagation noise is a factor affecting both configurations, it is more serious in the longer base system.

14. System Configurations - It developed during discussion that both systems A and B were staggered, leap-frog configurations with adequate lateral spacing to obtain sense.

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DATE 15 JUN 1992
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15. Mr. Levin questioned Dr. Whitehead as to how the 10 μ volt mean reference signal was determined.

Dr. Whitehead indicated that the lowest reference signal was desirable, which would not lead to deterioration of the system on a 20 db downward fade. This value is 10 μ volts (- 117 dbw).

Mr. Levin then pointed out that the difference in the SEC proposal was that 5 db deterioration in sensitivity $\frac{1}{2}$ % of time was considered reasonable, and this set the mean reference signal at 2 μ volts (- 131 dbw). This 5 db deterioration could be recovered later by reduction of the I.F. bandwidth of the receiver.

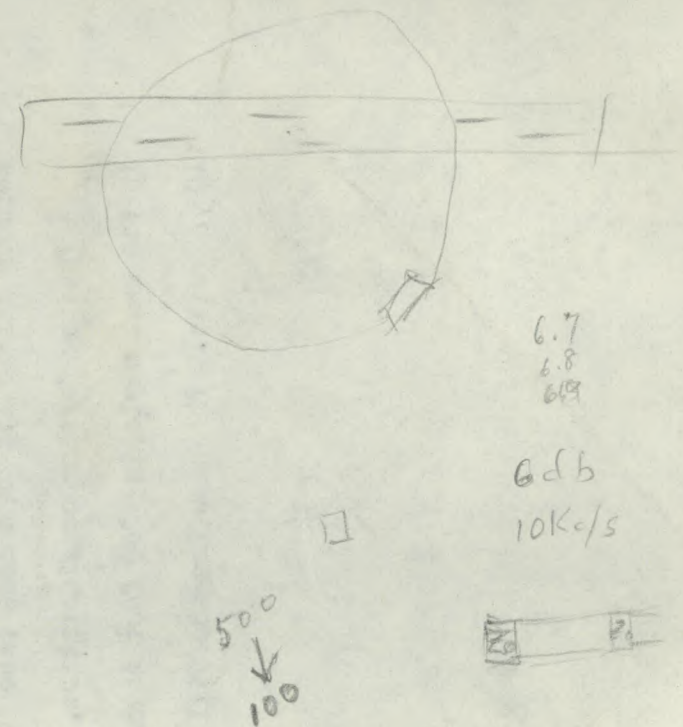
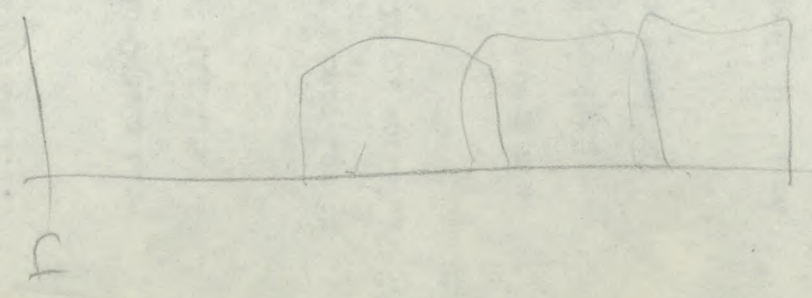
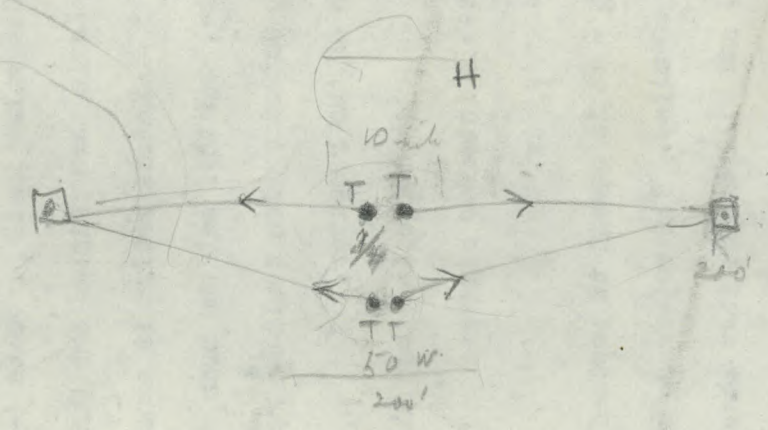
16. A/C Hendrick suggested that the problem of siting the Mid-Canada Line was divisible into two separate parts, East and West, the dividing line being Hudson's Bay.

East - It is agreed to proceed in the eastern section on a base length of 50 to 60 miles. The reference signal will be as close to 10 μ volts as possible, and will not be less than 4 μ volts.

West - It is doubtful if many of the existing sites in the west can be salvaged, and the siting should be re-done next summer. The existing sites do not allow for any alternative system configuration in event of serious difficulty on a long base 60-70 mile arrangement.

Pending further consideration, a system configuration should be sited in the west employing 200 foot towers, spaced to give a reference signal of 10 μ volts. The base lengths will probably be about 50 miles.

PROJECT NO. 1000
 DATE 12 MAR 1965
 DRAWN BY J. J. [illegible]
 CHECKED BY [illegible]
 APPROVED BY [illegible]
 LOCATION [illegible]
 VENDOR [illegible]
 MODEL [illegible]



+ 30 db

COPY

Defence Research Telecommunications
 Establishment,
 Radio Physics Laboratory,
 Defence Research Board,
 Shirley Bay,
 Ottawa, Ontario.

DATE 15 JUN 1992
 SIGNATURE
 APPOINTMENT
 FONCTION
 UNIT
 UNIT

AIR MAIL

14th January, 1955.

Mr. John F. Gusewicz,
 Stainless Incorporated,
 North Wales, Pa. U. S. A.

Dear Mr. Gusewicz:

Reference our telephone conversation of yesterday regarding shipping destination for 50 ft. tower to be erected at Whitelake. I have confirmed by telephone conversation with CGE Custom Broker in Ottawa that you should consign the shipment to Canadian General Electric Co. Ltd., c/o Defence Research Telecommunications Establishment, Radio Physics Laboratory, Arnprior, Ontario, via Canadian Pacific Railway in Canada.

I will arrange for the Freight Agent at Arnprior to advise us when the shipment arrives so that there will be no delay in customs clearance and unloading.

I have obtained quotations from three firms for on and off loading and transporting the 100 ft. tower to Shirley Bay. The lowest quotation was \$4 per ton, based on the assumption that no one piece of shipment to be handled will exceed 1000 lbs. in weight. If you are not able to be here when the shipment arrives I will take appropriate action in the name of your company. I will also get quotations for the 50 ft. tower to be shipped to Arnprior.

I received your wires re shipment of anchor steel and am doing all in my power to trace it. A wire from you this morning stating you are tracing from your end was welcome. We should surely run this down in a couple of days.

I was pleased to have a call from a representative of your firm yesterday afternoon. He planned to be at North Wales today and would convey our discussion to you. The only point on which there will be any change is that the Arnprior shipment need not be held over in Ottawa for Customs Clearance. This will save time and costs.

Sincerely,

A. E. Cooney
 Administrative Officer.

cc - CGE - Mr. Fordsmith

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RPLS 5538-0

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

January 13, 1955.

Chairman,
Defence Research Board.

Attention: DGS

Project submission - RPL 29 - 13
Contract Demand DRB/L-396

1. The m/n project submission and covering contract demand provides for the supply, erection, painting and lighting of two (2) towers required for the "Lone Wolf" Project.
2. Following meetings this week, the Chief Scientist DRB has verbally directed that a 60 - 70 mile Doppler link be established for extensive trials and measurements in connection with "Lone Wolf" Project. In order to do, the 100 ft. tower now on order for the RPL site will require to be extended to 200 ft. with a 15 ft. x 15 ft. platform at the two hundred foot level. This possibility was foreseen and catered for when the footing and foundations and the 100 ft. tower were designed. It, therefore, is merely a matter of supplying and erecting the additional 100 feet of tower and the additional platform.
3. Extending the height of the tower must be done as part of the initial erection. We have therefore advised the supplier of the additional requirement in order that he may plan accordingly and not delay the tower erection project.
4. It is requested that immediate steps be taken to Amend CD/DRB/L-396 in accordance with Amendment No. 1 to our Requisition #456 attached in duplicate and to have DCL Building and Maintenance section obtain a firm quotation for the additional requirement. We estimate the additional requirement will cost approximately \$15,000. It will only be necessary to increase CD/DRB/L-396 by \$9,700 as an estimated surplus of \$5,300 now exists in the contract demand.
5. The RCAF Financial Encumbrance #465005 has not sufficient uncommitted funds to take care of this increase. It is, therefore, necessary to request that the increase be charged to DRTE Vote 713-16-30-611 or Vote 712-13 whichever in your opinion is the more appropriate. Commitment is available in the DRTE Vote and may be used for this purpose. Indications are that cash will be available to pay the invoices this fiscal year. The project will be completed on or about 15 March 1955. Unless Headquarters so decides, it is not proposed that you should seek additional funds from the RCAF to cover this additional requirement.
6. Herewith in triplicate Amendment No. 1 to project submission RPL 29-13 and Amendment No. 1 to our CD requisition No. 456 in duplicate.

A. E. Cooney
for Superintendent
D.R.T.E.

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COMMUNICATION
RPLS 5538-0

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

January 13, 1955.

Defence Construction Limited,
No. 4 Building,
56 Lyon Street,
Ottawa, Ontario.

Attention: Building and Maintenance Section

Dear Sirs:

Steel Towers for Lone Wolf Project

1. You have received Contract Demand DRB/L-396 and Canadian General Electric quotation for the supply, erection etc of two steel towers for the Lone Wolf Project and will issue shortly covering purchase order.
2. As a high level meeting on 10 January 1955, a decision was reached to establish a 60-70 mile Doppler link at RPL Shirley Bay as well as the 30 mile link. This can be done most economically by extending the height of the tower at RPL Shirley Bay from 100 feet to 200 feet and by providing a steel platform at the two hundred foot level. This must be done at the same time as the 100 foot tower is erected and therefore immediate action must be taken to have the supplier provide the additional height and platform along with the original order.
3. We thought it advisable to unofficially inform the supplier (Stainless Incorporated) of the additional requirement and request that you negotiate a firm price for same. When the footings, foundations and 100 ft. tower, were designed, care was taken to ensure that the tower could be extended to 200 ft. There will, therefore, be no need to make design changes.
4. An Amendment to Contract Demand DRB/L-396 requesting officially the additional requirement and providing additional funds will reach you within one week. It would be appreciated if you would use this letter as a basis for initiating action on the additional requirement.

Yours truly,

Superintendent,
D.R.T.E.

Document

7-29-30

cannot be declassified - foreign origin.

~~held~~ in OND Archives.

Lincoln hobs. Jan 55
Joint States of Doppler Lab.

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21 Jan 55
Lincoln hobs

Canadian Experimental Evidence

A. Sources

Experiments of doppler detection systems have been carried out in Canada over the last 3 years as follows:

1. In the summer of 1952 experiments with 9 links were set up under the code name SPIDER WEB, using the original equipment. Considerable inherent noise level ^{prevented} the observation of low frequency propagation noise at that time. Approximately 300 controlled aircraft crossings were made in the course of this experiment.
2. The National Research Council made approximately 100 low-altitude controlled crossings on a three-station set-up comprising 2 diverging 30-mile links.
3. Two short term experiments were made on links respectively 68 miles long over land and 70 miles long over water, to study propagation effects.
4. In the winter of 1952-1953, the GRAY GOOSE trial was made in the vicinity of Churchill on the Hudson Bay and consisted of 4 links approximately 40 miles long. The purpose was to study propagation fluctuations and false alarms generally.
5. In the summer of 1954 a trial was made on 2 links each 36 miles long of the doppler equipment in its latest form. Low equipment noise levels permitted observation of low frequency noise. Simultaneously, field strength measurements were made in the target aircraft on approximately 200 controlled crossings in which the aircraft position was accurately determined by independent ground radar observations. The data from this experiment is still being reduced.

B. Results - Propagation

These results can be discussed as observations ^{on} called fading of reference signal and the incidents ^{etc} of low frequency noise. We conclude that the mean reference signal is predictable on links up to 70 miles within approximately 3 db, following the method of Bullington. Fading well below the horizon is concluded to lie within a total range of 40 db for 99% of the time, Approximately divided as 15 db upward fading and 25 db downward fading.

Quantitatively, the low frequency noise can be said to rise ^{as} the frequency falls below 10 cps. No observations so far made at 10 cps have shown this enhancement noise but it can be detected readily at 1 cps. Below about 1 cps its level is such as to set the limit on performance of this system. It is realized that quantitatively, information on low frequency noise is badly needed and further experiments are now being organized in Canada to obtain measurements.

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Results - System Performance

The most significant information from the 1954 experiment is a quantitative measure of forward scatter. The enhancement over projected cross-section of the target is consistently observed close to the system baseline with the exception of an inverted cone over each terminal point. In these cones, fluctuations within limits ± 13 db are observed with the ~~mean~~ ^{minimum} approximately coinciding with radar cross-section. The experimental enhancement figures over the remainder of the link vary between 25 and 45 db. The higher values are generally found with target heights below 5000 ft.

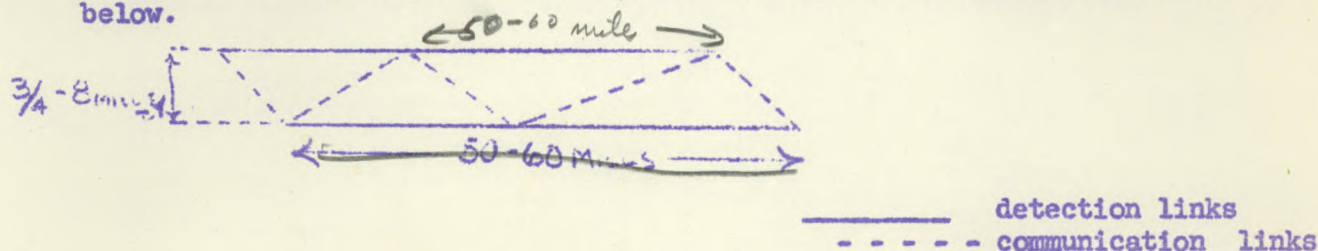
The enhancement falls off ^{rapidly} ~~directly~~ after the target moves away from the system baseline and has substantially disappeared at the distance where the sum of the angle subtended from transmitter and receiver is between 2° and 15° , depending upon such factors as aircraft length, angle of crossing, and position of crossing.

Present Canadian System Concept

The basis of system ideas is a length of link between 50 and 60 miles carefully sited to give a mean reference signal level between 131 and 117 dbw below 1 watt. Antenna heights are expected to lie between 250 and 300 ft, height being adjusted to reference signal level requirements.

Power requirement and receiver specifications are based upon the use of the enhanced target signal close to the baseline, and it is concluded that with the antennas already designed and evaluated in the 1954 experiment, adequate cover will be achieved with a 50 watt transmitter. Considerable operational importance is attached to the examination of the doppler receiver output signal on receipt of an alarm. Thus, an alarm trigger level is proposed at -170 dbw and the lowest anticipated aircraft signal is -160 dbw, occurring at an altitude of about 200 ft. Over the major part of the link aircraft signals will be in excess of -150 dbw.

In the mid-Canada line, manned stations (Section Control Stations) will be about 400 miles apart. Between these stations, the configuration is as below.



The communication stations are spaced an average of 25-30 miles apart. Detection links overlap between alternate pairs of stations. Sense is achieved by the time sequence of the line crossings. Detection cover by virtue of the double line is complete from 200 ft. to 60,000 ft.

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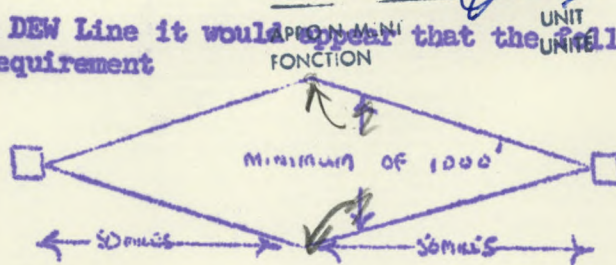
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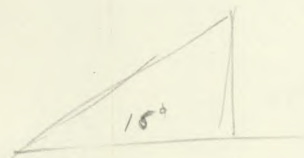
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For the DEW Line it would appear that the following arrangement fulfills the requirement



that sense information is most necessary at the mid-point between the two main radar stations.



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DRBS 056-267-40 (Tels)

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Ottawa, Ont.,
12th January 1955.

DEPARTMENT OF NATIONAL DEFENCE
DEFENCE RESEARCH BOARD

A review of the development status of the
Mid-Canada Line equipments has been made by DRB.

Please find attached one copy of the report
which resulted from this review.

[Signature]
for Chairman,
Defence Research Board.

Distribution

- Chairman, DRB
- Vice-Chairman, DRB
- Chief Scientist, DRB
- Dr. F.H. Sanders, SA/CNS
- Supt Org
- Arctic Sec
- Supt DRTE
- Dr. W.B. Lewis - Chairman, Electronics Research Panel
- Prof. G.A. Woonton - Member, Electronics Research Panel

- Chief of Air Staff, RCAF
- Scientific Adviser CAS/RCAF
- Chief of Telecommunications, RCAF
- Members - Executive Committee - Mid-Canada Line
- Dr. J.R. Whitehead - McGill University
- Mr. S.A.E. Pinnell - RCA Victor Company
- Mr. A. Levin - SEG/RCAF
- Dr. F.G. Warren - SEG/RCAF
- Dr. J.H. Chapman - DRTE
- Dr. J. Hogarth - DRTE
- Mr. B.A. Walker - DRTE

The Chairman,
Defence Research Board, (Attn: Tels Section)
Ottawa.

Receipt is hereby acknowledged of one copy of
"A Review of the Development Status of the Mid-Canada Line
Equipments" dated January 1955.

.....
.....

DATE

15 JUN 1992

REVIEW OF DEVELOPMENT STATUS

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MID-CANADA LINE EQUIPMENTS

JANUARY, 1955

In order to evaluate the development status of the equipment required for the Mid-Canada Line, a series of meetings was called by Dr. G.S. Field, Chief Scientist, DRB, assisted by L.G. Eon, Tels Section, DRB. These took place from the 4th to the 7th of January, 1955.

The First Day consisted mainly of obtaining detailed data on the status of the MK I system. Dr. J.R. Whitehead, McGill University, and Mr. S.A.E. Pinnell, Head of the Research and Development group at R.C.A. Victor Company, Ltd., participated.

The Second Day a visit was made to the DRTE's Electronic Laboratory to discuss with Messrs B.A. Walker and J. Bloom, the Research and Development aspects of the Fence communication problems and sector control equipment design. The visit then extended to the Radio Physics Laboratory to talk with Dr. J.H. Chapman and Dr. J. Hogarth on the status of MK II developments.

The Third Day, in the morning, a more general meeting was held, which included:

From DRTE: Dr. J.H. Chapman, Dr. J. Hogarth, Mr. B.A. Walker.

From NRC: Mr. E.L.R. Webb.

From McGill Univ: Dr. J.R. Whitehead.

From RCA Victor Co.: Mr. S.A.E. Pinnell.

Frank discussions were held on the varying aspects of the Mid-Canada Line equipment, differences in scientific views were reconciled and unanimous agreement was reached on the potential of certain systems. In the afternoon, members of the Systems Engineering Group of the RCAF attended; these were Mr. A. Levin, responsible for siting and Dr. F.G. Warren, responsible for detection equipments.

The meeting discussed systems already considered based on MK I and MK II doppler equipments plus a new proposal by the RCAF which is a leap-frog type of configuration using MK I equipment on a 60 to 70 mile base line.

The Fourth Day the previous day's meeting reconvened with the addition of Dr. W.B. Lewis, Chairman of the Electronics Research Panel. The opportunity was taken to brief Dr. Lewis on the present status of the Mid-Canada Line and to hear his comments and suggestions. Finally, what had been brought out in all the meetings was reviewed and an outline was prepared of the most urgent research and development items still remaining to be done.

It was established during these meetings that basically, the only new important information obtained during 1954 was to be found in the results of trials carried out in the Montreal area by RCA Victor, under the direction of Dr. J.R. Whitehead. These experiments greatly increased our knowledge of forward scatter and showed that enhancements of up to 55 decibels were obtained when the doppler response was utilized down to 1 cycle per second. Noise of a scintillating nature was also detected which seemed to increase rapidly below 3 c.p.s. The effect of this noise on the system increased as the amplitude of the reference signal increased. The exact nature of this scintillating signal is under investigation at DRTE. However, with the data at hand, there is sufficient information to enable the formulation of certain statements which are made below.

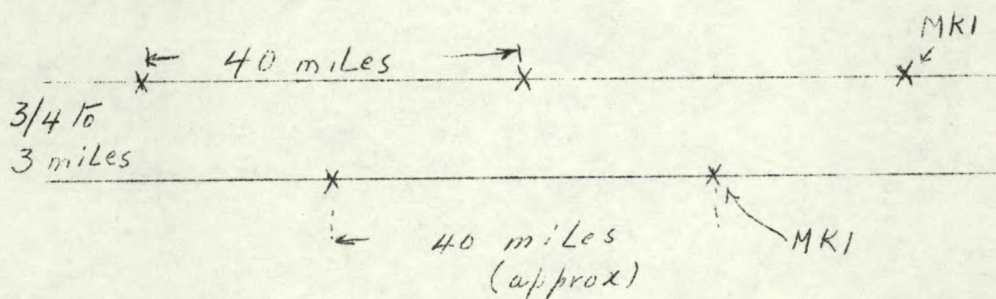
MK I SYSTEM

There is now sufficient theoretical evidence and, with the exception of "birds" (discussed later), also experimental evidence to establish the following:

A staggered double line, utilizing MK I detection equipment with:-

- (a) Stations separated at least $3/4$ mile and preferably 2-3 miles
- (b) Optimum siting for a reference signal of 10 microvolts, can quite safely be immediately engineered in a system for installation on a coast to coast basis.

System Schematic



Siting for received reference signal 10 microvolts.

Details of the information obtainable from such a line and its reliability, are as follows:

ALERTS

Assuming that no alarms except those identified as aircraft are transmitted to Air Defence Command, then; All aircraft crossings give an alert and there is one chance in many thousands of an aircraft not being reported to Air Defence Command.

Detection Cover

All aircraft, large and small, from about 200 ft above terrain to at least 60,000 feet are detected.

Sense

Sense indication (inbound or outbound) is provided in the full cover.

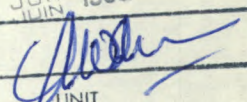
Location

Crossings can, for the fully staggered system, localize crossings to 20 miles.

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ADDITIONAL INFORMATION

Numbers of Aircraft:

There will be a good chance of discriminating between one, two or more aircraft in formation provided these are separated in time by 1 second. Very close formations (precision drill, line abreast, penetrating the beam at right angle) will generally be recognized as more than one aircraft.

Type of Aircraft:

Based on speed alone, it will generally be possible to discriminate between Jet and non-Jet aircraft. There is a possibility that large and small aircraft can be distinguished. An enemy possessed of intimate knowledge of the system could, if he chose to take counter-measures, prevent this identification.

Height:

By examining the amplitude and frequency pattern, it may be possible from time to time to indicate whether the aircraft is flying below 10,000 feet or above 20,000 feet. If the approximate speed of the aircraft crossing the line is known, then its rough height can be obtained.

This system will provide the above information irrespective of outside sources of confusion or interference, such as large flocks of birds (see below) or man-made interference.

This performance is feasible in an operational system providing:

- (a) that optimum siting is maintained
- (b) that the audio (alarm) filter levels have been set for optimum operation for each station
- (c) that the full doppler signal from 1 to 300 c.p.s. is transmitted without distortion and recorded at the sector control station for analysis.

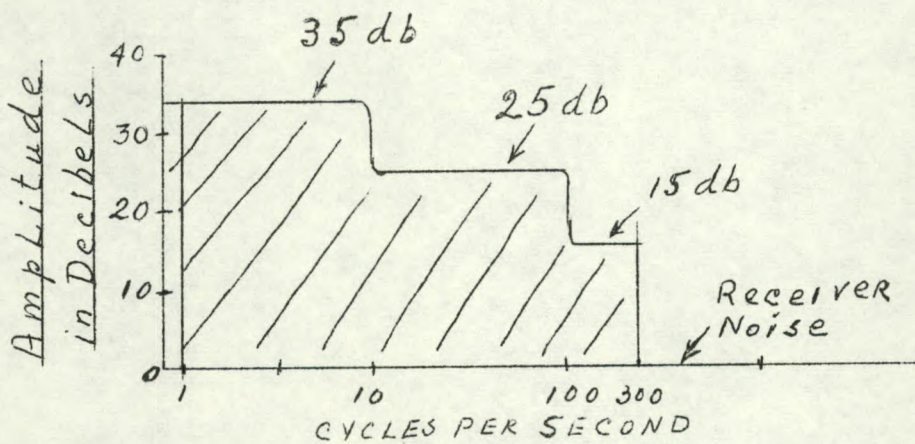
It is accepted, although it is not agreed that it is desirable, that the transmission of 1 to 100 c.p.s. doppler range would provide 99% of the information required.

It is again emphasized that the optimum siting requirement will require extreme care with little room for compromise.

BIRDS

Although the possible identification of flocks of large birds as aircraft in this system has been dismissed as unlikely, it is generally agreed that further experimental evidence is urgently required to dismiss this subject once and for all.

Threshold - Auto-Alarm Filters



Alarms are given only above the threshold and transmitted as a simple on-off code to sector control. In addition, the actual audio doppler frequencies 1 to 300 c.p.s. are transmitted in parallel with the alarm and recorded at sector-control.

Analysis of signals at sector control stations provides the information required to alert Air Defence Command. Certainty of alerting ADC on all aircraft crossings about 100%. False alarms about zero per year.

MK II SYSTEM

The development of the RPL split-beam system is now one of seven versions, six being explored under contract with the Management Contractor by RCA Victor Company, Ltd.

These systems can be divided into two basic ones:

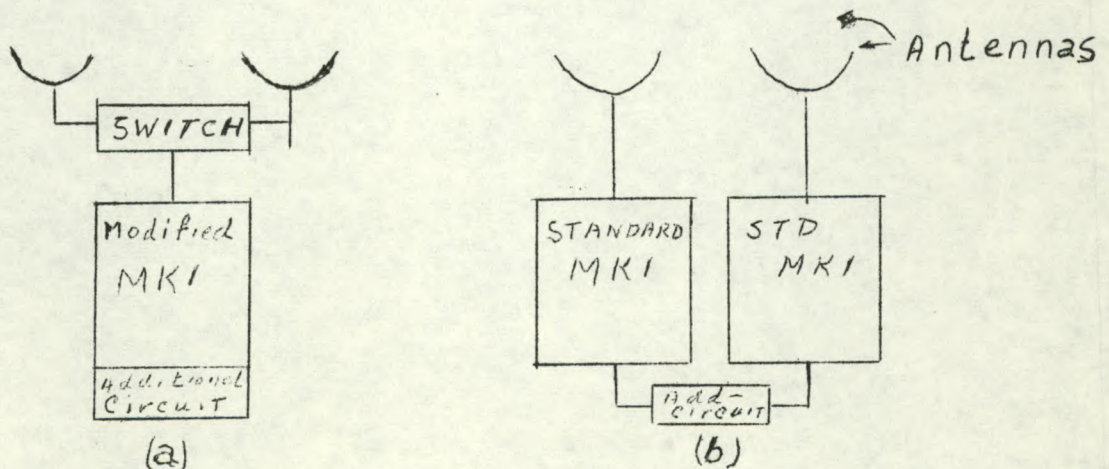
(a) RPL SYSTEM

Operates by switching the input from two antennas and feeding the resultant signal into a single modified MK I receiver.

The MK I receiver provides auto-alarm and the doppler signal which is transmitted for examination, and the split-beam feature provides the sense information from a single line.

(b) RCA SYSTEM

In this case, the inputs of two antennas are fed into two standard MK I receivers. With the addition of a black box containing some 3 tubes the same information is provided as with the RPL Scheme above.



Scheme (a) is time sharing, scheme (b) is not. An attraction of scheme (b) over scheme (a) is that, if development were unsuccessful the MK I receiver could be used as it is.

DETECTION SENSITIVITY

The RPL Switched-Beam System can provide exactly the same sensitivity as that quoted for MK I provided that MK I type of filters and recording equipment are used on the sum channel of the two antennas.

The inherent sensitivity of the sensing feature is estimated at about 10 decibels lower than that of the MK I system. This means that the sense cover must always be smaller than the detection cover.

The RCA Two-Beam System utilizes standard antennas into two MK I receivers with the addition of a simple modification. The capabilities of the RPL system are obtained with an estimated theoretical gain over it of some 4 to 10 db. The gain stability of the two receivers is believed to be of the order of 0.5 db. If the same 4 db of the gain mentioned above is allowed for circuit maladjustments, then it should provide a much more reliable system. This scheme requires further development. It has yet to be fully tested and proven.

* Increased losses in the RPL over the RCA system are made up of:

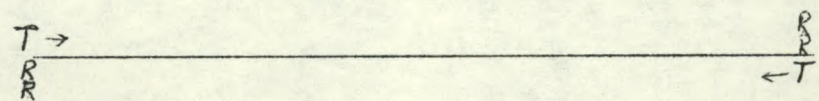
- (a) Time sharing of antennas 3 db
- (b) Other switching losses 1 to 7 db

SITING

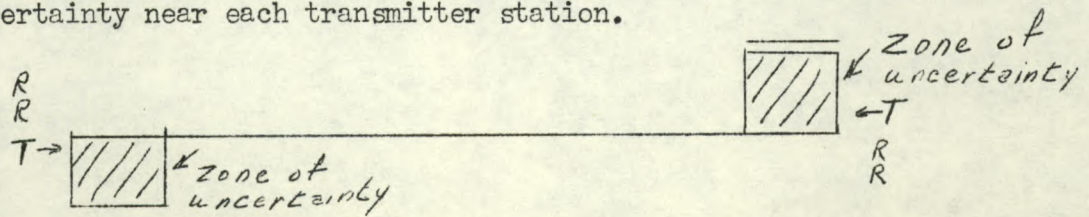
Siting for MK II is as for MK I

SENSE

Complete sense is obtained only when two MK II systems are back to back - 2T 4R and must always be less than the detection cover.



The necessity for a back to back system is due to a 5 mile zone of uncertainty near each transmitter station.



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It is noted that Dr. W.B. Lewis insists that for technical reasons which are not necessarily agreed to by the others in the group, that there is no room for a MK II Time sharing type of system in a modern electronic detecting device.

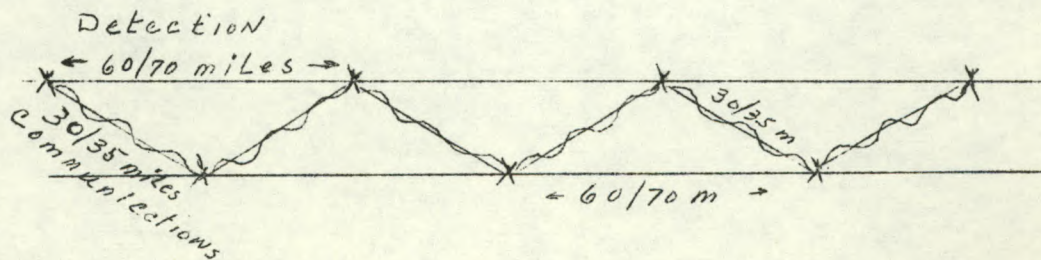
There is no doubt in our minds that the MK II system requires further development which engineering-wise must add at least 7 months. In addition, field trials should be performed to bring the experimental data available up to the standard of that of the MK I.

SYSTEMS ENGINEERING GROUP PROPOSAL

Siting has been completed from Hudson Bay West to Fort Nelson on the basis of a 2000 Mc/s radio-relay communication system with sites on a single line averaging 32 miles over essentially flat terrain. Materials are being stockpiled on some of these sites this winter.

In the Hudson Bay East to Hopedale section rolling terrain with hills of about 1000 feet makes siting more difficult. These sites are being investigated.

The SEG have been considering the possibility of siting doppler MK I stations in essentially a staggered double line with a doppler station separation of 60 to 70 miles and communications every 30 to 35 miles.



The theoretical calculations made by SEG were discussed and we conclude that on the basis of these calculations, this system appears to meet the operational requirements but will have at least 12 decibels less in hand than the 40 mile separation system recommended by DRB.

- 9 -

We further conclude that there is so little experimental data on 60 to 70 mile links that although the theoretical calculations provided by SEG appear to be sound, it is as yet impossible to place a degree of certainty on this scheme. Lack of experimental data also prevents us from estimating the degree of reliability of the information which the system might provide in operation.

Certain basic experimental data must be obtained, in particular the nature and amplitude of noise fluctuations and its effect on the system. This is considered to be the most urgent information required to determine the feasibility of this system.

In addition a system composed of at least two links should be set up to evaluate the remaining parameters of the system.

COMMUNICATIONS

A decision has not yet been made as to the frequency or type of radio-relay equipment which is to be used.

Some work has been done at DRTE with a view to developing circuitry which would enable the detection information to be transmitted over a narrow bandwidth on the radio-relay system. Progress on this work has been slow because of continued uncertainty as to the detection and the communication system to be used. This is an internal DRTE project.

SECTOR CONTROL

One year ago DRTE (EL) began a high priority project to develop sector control equipment. The RCAF having requested in writing that it be terminated, DRTE continued this project on their own at a lower priority. They have acquired experience and have developed some equipment for the recording and analysis of doppler signals, further work is going on.

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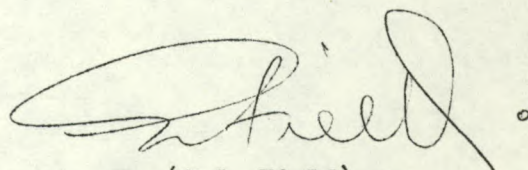
CONCLUSIONS:

It is concluded that a staggered double line of stations utilizing MK I equipment and based on a spacing as indicated in the text, which should average about 40 miles between stations, is a feasible early warning system which, providing it is engineered with care, will provide the information and the reliability required.

There is very little future for the MK II system, except possibly to fill in very special places in the line if such proved to be necessary.

The system now being examined by the SEG which utilizes 60 to 70 miles links and is composed of MK I equipments has been carefully considered. The theoretical calculations placed before us by the SEG representatives appear to be sound.

It is clear, however, that considerable experimental data will have to be gathered before feasibility is properly established.



(G.S. Field)
Chief Scientist,
Defence Research Board.

~~Copy~~

17 January 1955

Meeting of Dr. J. G. Field, 1955 to discuss comparison
of long-base and short-base ~~Mid Canada~~ ^{defection} ~~systems~~ for
the Mid Canada line.

Present. Dr. G. E. Field

Mr. L. G. Eon.

Mr. J. R. Whitehead

Dr. J. W. Abrams.

Mr. A. F. Branscombe

Mr. A. Levin

Dr. F. G. R. Warner

Dr. J. H. Chapman.

A/C M. M. Kendrick

Chief Scientist, DRB
Tech. Section, DRBMr. G. L. Anvers
Scientific Advisor
SA/CASChief Engineer, Telecomm. Systems
RCAF, SEG

..

..

DRTE/RPL

C. Tel., RCAF

1. Dr. Field indicated the purpose of meeting was to discuss the differences in opinion between the RCAF SEG and DRB on the possibility of 60-70 mile Fess links, and the conclusions reached in the DRB "Review of Development Status of the Mid-Canada Line Equipment" of January 1955 (DRBS 1-656-267-4 (Tech)). The DRB stand is as follows:-
DRB agrees with the calculations made by the SEG, but holds that there is insufficient experimental evidence to endorse the 60 mile system.

The 60 mile system is based on a reference signal of 2 μ volts, as apposed to a reference signal of 10 μ volts on the 35 mile system. If the noise in the reference signal does not drop proportionately (14db), there is a net decrease in reference signal-to-noise ratio. This

2.

Mr. Levin summarized the RCAF position by pointing out that the main possibility of serious difficulty on the long base system arises if the noise on the reference signal increases greatly with an increase in reference signal. Since the increase in reference signal can be considered as due to an increase in earth's radius, it may be reasonable to assume that the

depth of modulation, (percentage modulation) ^{will} decrease when the reference signal increases.

3. Trigger level. The trigger level will be set at -170dbw , the reference signal being -132db . If the modulation on the reference signal is 38db below the reference, the alarming will occur. This alarm setting is calculated to give cover down to 200 feet. If the ~~false~~ alarm rate is found to be too high, an increase in the alarm level will raise the low cover.

4. False alarm rate. The rate for the 35 mile system was computed to be very low, (eg 1 per year) on automatic alarm. ~~The~~ Examination of the signal is necessary to determine that the alarm is due to an aircraft. Two or three alarms per day per link are accepted as a reasonable false alarm rate, if only to keep the operator at section control station alert.

5. Mr. Levin made the point that the ratio of aircraft signal to reference signal is roughly constant for both 35 & 60 mile systems, if the ~~the~~ high & low cover is maintained. This is because the antenna height is adjusted, ~~to~~ (200 feet for 60 miles, 50 feet for 35 miles) to maintain low cover, ~~and~~ and by bringing the reference signal back up. (The AC signal decreases 12db going from 30 to 60 miles, the reference signal 14db) Also, if for example, the automatic alarm level is set up to -160dbw , the low cover is then about 400 feet.

6. Tower heights. The SEG method is to require only 10 db difference between A/C signal level at low and high cover. This calls for 100 foot antennas on a 35 mile system, and 200 foot antennas on a 60 mile system.

By comparison, the Lincoln method involves increasing transmitter power to maintain low cover, using low towers ^{for low cover}. This increases the gradient in detection sensitivity, and makes some portions of the system inordinately sensitive to ~~birds~~.

7.
check with
Levin.

Size of aircraft The SEG calculations are based on a 1000 square feet of scattering area with 15 db of enhancement. ~~THE~~ Mr Levin pointed out that the scatter cross section of a target at low altitude is roughly the projected area of the target, regardless of the so-called radar cross section.

8.

Cover: The SEG calculations are that there is about 12db decrease in A/C signal going from 500 feet down to 200 feet. The forward enhancement increases about 15db going from 10,000 feet down to 200 feet. These tend to be complementary, maintaining nearly constant sensitivity until a very rapid change occurs ~~at~~ below 200 feet. A 12db decrease in alarm level (to -160dbm) will worsen the low cover by a few hundred feet, will increase the loss of cover over the station, but will not increase affect the high cover.

9.

Sensitivity: The sensitivity is limited by either receiver noise or by reference noise (scintillation). If the reference noise is the limiting factor, and is relatively unchanged in going from a 40 mile to a 60 mile system, then the net decrease in system sensitivity is only the ratio 60/40, i.e. 76b.

The SEG calculation assumes that the reference noise is in fact 3db greater on the 60 mile link, compared to a 30 mile link. This is based on the supposition that doubling the path length just doubles the scattered power contributing to noise.

Alarm levels.

Noise in 50 cps = -174 dbw in 10db Rec.

Ref signal (35) = -117 dbw (60 foot tower)
(64) = -131 dbw (200 foot tower)

Sensitivity deterioration with change in reference signal		Sensitivity to Signal decrease	
Reference μV	dbw		db
1.0	-137	+1	
0.3	-147	+3	
0.2	-151	+5	
0.1	-157	+10	
0.05	-163	+16	

Cover 1000 square foot target no enhancement.

35 mile system	64 mile system
High Cover: midpath -150 to -160 dbw	-160 to -166 dbw
(5000-60,000) over station -165	(figures uncertain) -170 dbw.

Low Cover -173 dbw -185 dbw
(200)

Enhancement - Assume +15db ~~on~~ ~~all~~ the
high cover
- Assume +20db on the
low cover

Propagation (Assume 0.5% time these values exceeded)
35 mile sept. 64 mile sept.
Downward fades -20db (-137 dbw) 5% -20db (-151 dbw)
Upward fades +20db (-97) +20 (-111 dbw)
(measured) (theoretical)

Receiving level

Propagation Noise
Ref -91 dbw 50 to 5 c/s -166 dbw
50 to 1 c/s -153
50 to 1.3 c/s -146

Ref -103 dbw 50 -10 c/s -173
50 -1 -151
50 -0.3 -145

Ref -137 dbw

Note

Assume lower frequency cut off of 1 c/s.

Reference Signal 35 = -117 dbw Noise -179 dbw
64 = -131 dbw -193 dbw
(all estimated)

There ^{noise} may, pessimistically, be expected to
go up 20db with a 20db upward fade.

Dr Whitehead - 35db increase in signal
(enhancement) in going from 7.5 to 2 c/s
has been observed.

Doppler Frequency cut-off -
Assume 100 mph A/C

Then the first zero of enhancement
will not be at a frequency below one cycle per
second. This will be obtained on a crossing
at 15° . Hence it is reasonable to cut off
at 1 c/s, and all advantages of enhancement
are ~~still~~ retained.

It is possible to reduce the susceptibility
to propagation noise by increasing the
low cut off frequency, and thereby chance
losing ^{slow} A/C.

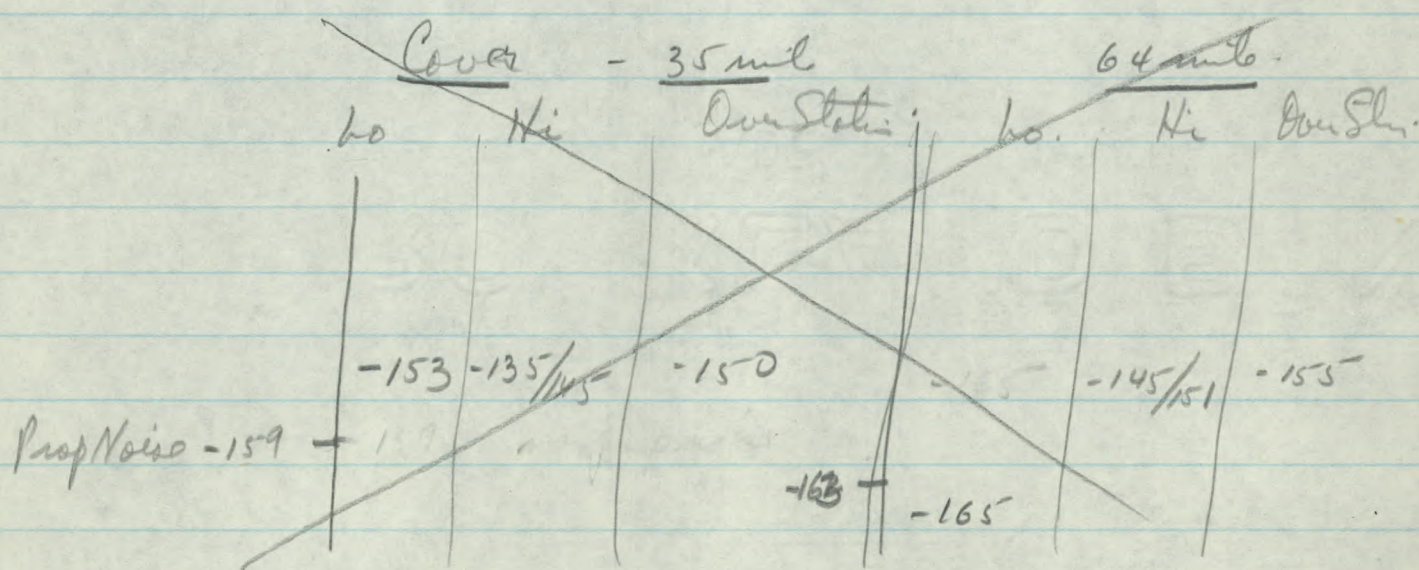


Fig. in a recording channel requires -164 dbw
Alarm level may be set at -170 dbw or
thereabouts.

The above figures may be degraded for the
64 mil system, in a deep (-20db) downward
fade by -5 db due to desensitizing of the receiver.

Tower Stability. - Levin.

$$\text{Displacement} \times \text{wobble} = .07$$

Mean ref. sig with mean wind is more stringent a limitation than max ref. sig. with mean wind.

Eg. Alignment $1^\circ \pm .7^\circ$ wobble

The major lack of information is in the time variability of ~~60 mile~~ noise on the reference signal in a 60 mile link.

Mr. Levin raised the ~~point~~ question as to the amount of information which led DRB to thoroughly endorse a 35 mile system.

DRB decision with det. equip is based on:

- ① No comm. equip
- ② No costing.
- ③ No consideration of time wobble effects on design problems.

PM

SEG criticism of 40 mile system:

- | | | | | | | | | |
|--------------|-----|--------|--------------|--------|-----|-------|-----|------|
| | BOS | 7-10 | Capitol Bldg | 13 | 4.5 | Maint | Man | 1000 |
| ① Economical | BOS | 81-130 | | \$94.5 | 9.6 | 655 | | |
- ② Complications to communication system -
alternates to radio relay & number of
SCS's.

Dr. Field It was agreed that a detection line could be set up on a 35⁽⁴⁰⁾ mile base which would work satisfactorily in detection of aircraft.

The 64 mile base system appeared as if it would be satisfactory. It would give coverage from 200-300 feet to 60,000 with some ^{incorporation} over the station. The false alarm rate would probably be acceptable, ~~providing~~ but information is lacking on ~~propagation~~ noise. It is conceivable that experiment might indicate that the propagation noise will seriously affect the system. While propagation noise is a factor affecting both configurations, it is more serious in the longer base system.

A/C Hendrick summarized.

The problem is in two parts, East & West.

In the East, the ^{staggered} long base system will be installed, with a reference signal median level at 2 to 10 μ V.

In the West, the site should be never greater than 70 miles, on the average 60 miles, with reference signal of -126 dbw. (4 μ V). This may in fact average 50 to 60 miles.

Mr. Lavin

Proven Systems - That earth bulge minimum of 150 feet, maximum less than 400 feet, are required, tower height included.

64 mile: - That 500 feet at each end can be used without exceeding 30 μ V signal.

Whitehead & Levin - The μ volt reference level was picked so that there is no degradation or a downward fade. The μ volt reference level allowed 5 dB degradation or a downward fade, but would be recovered by redesign of the receiver IFs. (8)

East

It is agreed to go ahead on the eastern section on a base ~~not exceeding~~ ^{50 to} 60 miles. The reference signal will be ~~4 to 10 μ v~~ as close to 10 μ v as possible, not less than 4 μ v.

West

~~It was agreed that the uncertainties of siting in the west~~

It was agreed to ~~postpone~~ the ~~decision~~ ~~siting~~ in the west for further consideration.

A reference signal of 10 μ v with 200 foot towers will be obtained, which will entail base lengths of the order of 50 miles.

Summary

1. Ref. Signal - 35 mile - ^{System A} -117 dbw 60' towers
 64 mile ^{System B} -131 200' ..

2. Recording level ~~not by~~ -164 dbw
 Noise in 50 cps -174 dbw

3. Enhancements
 hi wave +15 db
 lo " +20 db

4. Propagation
 System A ^{Down} -137 ^{up} -97
 B ^{1/2%} -151 ^{of time} -111
 theoretical Example

~~Recording level -164 db~~

5. Propagation Noise
 Not better than

System A = -179 dbw } +20 db for
 B = -193 dbw } upward fade

6. Deterioration in sensitivity - with increase in trigger level.
~~increase in trigger level~~

<u>Ref. mV</u>	<u>dbw</u>	<u>Deterioration</u> <u>in S/N</u>
1	-137	+1
.3	-147	+3
.2	-151	+5
.1	-157	+10
.05	-163	+16

7. Cover

Mid Point

Over Str.

High Cover - 5000/10,000 to 60,000

System	A	-150/-160	-165
	B	-160/-166	-170

Low Cover - 200 to 5000/10,000

A	-173db	{ better than hi cover
B	-185db	

8. Low Frequency Cut-off - 1 c/s for both systems

9. Summary

System A

System B

Lo.	Hi	Over Str.	Lo	Hi	Over Str.
	135/145			145/151	
153		156			155
-159-			-163-		
			163		
			165		

10. A Summary of the two systems discussed, labelled System A (35 miles) and System B (64 miles) was produced.

It was generally agreed that both systems.

10. Tower Stability.

Mr. Levin reported calculations that the product of tower displacement and wobble is about 0.07 for the long base system. tower misalignment of 1 degree and ± 0.7 degrees wobble will produce the same energy as seen tiltation noise on a long base system. This ~~is~~ ^{is} good engineering practice to ~~to~~ specify ~~no better tower stability than that already~~ set by the system noise which will produce ~~low frequency~~ no more rigid towers than required to maintain received energy due to tower misalignment and sway ~~at~~ equal to the minimum propagation noise which is the uncontrolled limiting factor.

12.

Mr. Levin raised the question as to the ~~amount of information considerations~~ which led DRB to ~~endorse~~ ~~endorse~~ thoroughly a 40 (35) mile system. The DRB decision was based on the ~~known~~ ~~relatively large amount of~~ ^{presented} information now available on 40 mile base systems.

The SEG criticized the 40 mile system on the following counts.

~~The cost of a coast-to-coast~~

Cost Economics - Coast to Coast Installation	System A	System B
Capital Cost of Coast to Coast	\$143.5 million	\$94.5 million
Maintenance Costs, annual	\$12.1	9.6
Manpower required	1040	656

~~12.2~~ Number of Stations

SCS	10	7
DDS	130	81

12.3 ~~Communications~~
A more complex

~~The radio relay communications system~~

13. Dr. Field summarized the view of the meeting at this point.

It was agreed that a detection line could be set up on a 35 (40) mile base which would work satisfactorily in detection of aircraft.

The 64 mile base system appeared as if it would be satisfactory. It would give cover from

200-300 feet to 60,000 feet with some increase in the uncertainty of detection over the station. The false alarm rate would probably be acceptable, but information is lacking on propagation noise. It is conceivable that experiment might indicate that the propagation noise will seriously affect the system. While propagation noise is a factor ~~in~~ affecting both configurations, it is more serious in the larger base system.

14.

~~Mr. Levin~~ System Configurations

It developed during discussion that both systems A and B were staggered, leap-frog configurations with adequate ^{spacing} to obtain sense.

15.

Mr. Levin questioned Dr. Whitehead as to how ~~why~~ the 10μ volt ^{mean} reference signal was determined.

Dr. Whitehead indicated that ~~this figure~~ the ~~same~~ lowest reference signal was desirable, which would not lead to deterioration of the system on a 20db downward fade. This value is 10μ volts (-117dbw)

~~The~~ Mr. Levin then pointed out that the difference in the SEG proposal was that 5db deterioration in sensitivity $\frac{1}{2}\%$ of time was considered reasonable, and this set the mean reference signal at 2μ volts (-131dbw)

This ^{5db} deterioration could be recovered later by ~~modification~~ reduction of the I.F. bandwidth of the receiver.

16.

A/C Hendrick summarized the discussion at this point ~~to summarize~~ by suggesting suggested that the problem of siting the Mid-Canada line was divisible into two separate parts, East and West, the dividing line being Hudson's Bay. ~~The~~

East.

It is agreed to ~~go~~ proceed in the eastern section on a base length of 50 or 60 miles. The reference signal will be as close to 10 μ volts as possible, and will not be less than 4 μ volts.

West.

→ Pending further consideration, a ^{system} configuration of should be sited in the west employing 200 foot towers, spaced to give a reference signal of 10 μ volts. The base lengths will probably be about 50 miles.

It is doubtful if ~~so~~ many of the existing sites in the west can be salvaged, and the siting should be re-done next summer. The existing sites do not allow ~~any~~ latitude ~~for~~ for any alternative system configuration in event of serious difficulty on a long base 60-70 mile arrangement.

Defence Research **Ref Telecommunications** 15 JUN 1992
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, **SIGNATURE**
Ottawa, Ontario. **FONCTION** **SUNIT** **UNITÉ**

14th January, 1955.

Chairman,
Defence Research Board.

Attention: Tels

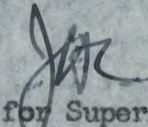
Project "LONE WOLF" - Scintillation Noise
RCAF Station Foymount

1. Permission is requested from the RCAF to install an AN/FPS 503 (XPI) transmitter and antenna at RCAF Station Foymount, for scintillation noise measurements. The site has been visited by Dr. J. E. Hogarth and Mr. W. K. Lacey, and a suitable site chosen. The building known as the radar back-up tower is the most suitable place for the equipment.
2. This building is at present unoccupied. Its use for this purpose has been approved verbally by the C/Tel/O, S/L Baxter, and the Construction Engineering Officer on site. S/L W. W. Abra, AMTS/DCEF, has agreed that our use of the building is acceptable to the Construction Engineering branch, under whose jurisdiction the building still remains.
3. Clearance is requested for the following RPL personnel to visit RCAF Station Foymount as required:

Dr. J. H. Chapman
Dr. J. E. Hogarth
Mr. W. K. Lacey
Mr. J. A. Warwick
Mr. R. F. Sigston
Mr. A. V. Goodman
Mr. J. Bateson
Mr. J. A. Petry

It may be necessary for these personnel to have access to the Operations Room, to observe events on the main radar, and the clearance should therefore be complete. The above personnel are all cleared to Secret.

JHC/keb


for Superintendent,
D.R.T.E. (RPL)

Unclassified

CLASSIFICATION RPLS 5538-0
CHANGE TO
REPLACÉE PAR ~~Unclassified~~

Defence Research Telecommunications
Establishment,

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

BY AUTHORITY OF

SIR T. A. G. G. G.

SIGNATURE

APPOINTMENT

FONCTION

15 JUN 1992

UNIT
UNITÉ

12th January, 1955.

Chairman,
Defence Research Board.

Attention: Tels Section

Minutes of Meeting No. 9
Technical Co-ordinating Committee

Herewith Minutes of Meeting No. 9 of the Technical
Co-ordinating Committee held 4th January, 1955, for your retention.

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Enclosure

COPY

7-29-27
CDA

CLASSIFICATION
CHANGE TO
RECLASSIFIED
BY AUTHORITY OF RPLS 5538
SUR L'AUTORISATION DE
Defence Research Telecommunications Establishment
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

29th December, 1954.

Dr. W. B. Lewis,
Atomic Energy of Canada Limited,
Chalk River, Ontario.

Dear Dr. Lewis,

A great deal of work has been done on Doppler Fence research and development by DRTE, by NRC and by Whitehead and RCA for DRTE since your memos to me of March 1951 and August 1952. In addition a good deal of work has been done in the States. Consequently I will not try to explain the reasons for the development of the Mark II system.

However I do wish to make one or two points and I hope we will have another opportunity to thoroughly thrash out the matter.

First the Mark I equipment as developed by RCA gives a presence alarm, on detection of a signal in narrow bands, covering the range from 10 to 300 cycles.

The Mark II modification gives an additional sense alarm with approximately the same sensitivity as obtained with the Mark I presence alarm up to the same frequency limit of 300 cycles.

Experiments with Mark I have shown that the doppler energy is largely confined to the lowest 50 cycles.

From what you told me, you are apparently convinced that there is significant energy associated with propellor and vibration modulation above or in the vicinity of 3000 cycles. If this is so then neither the Mark I nor the Mark II equipments have been designed to detect it.

Experiments were made by Whitehead with narrow filters covering the audio spectrum up to 1000 cycles. No significant doppler energy was found above 300 cycles. This led to the RCA design of Mark I having filters to cover 10 to 300 cycles.

The switching frequency on Mark II, as I have already told you, was never 3000 cycles but rather 5000 cycles. However, in order that the switching be compatible with the new RCA Mark I AVC this has been changed to 10 kc. Also I understand the immediate plan is to compare the signals from two receivers continuously, thus eliminating switching altogether.

2

The Mark II is being developed as a modification kit to add to the Mark I at the request of the RCAF.

The communication and section station equipment being developed by DRTE permits the recording, speed up and play back of doppler signals from 0 to 50 cycles. In addition it allows for the transmission of the integrated 0 - 300 narrow band presence alarms of Mark I and the 0 - 300 sense alarms of Mark II. It is believed that the sensitive 0 - 300 cycle presence and sense alarms cover the significant range of doppler energy and that the 0 - 50 cycle doppler records provide, some what less sensitive, but important identification information.

Experiments were made by NRC and DRTE to establish the feasibility of using doppler signals recorded from two parallel lines spaced a few hundred yards apart to obtain sense.

If we assume that doppler signals are detectable down to the noise level on such records, providing we record only the 0 to 50 cycle range, the sensitivity comes out about equal to that of the integrated 3 cycle presence alarm where a 12 db signal to noise alarm threshold is used.

In fact, we found that presence alarms often occurred with no detectable doppler records when the 50 cycle doppler band was used. Of course, if a 5000 cycle band had been used the sensitivity would have been 20 db lower.

Part of Whitehead's McGill University contract calls for the study of sensitive methods of detecting small signals of changing frequency in the presence of noise.

Yours sincerely,

(sgd.) James C. W. Scott

James C. W. Scott
Deputy Superintendent,
D. R. T. E.

cc: Dr. Field
Col. Eon

C O P Y

7-29-26
CDA
ATOMIC ENERGY OF CANADA LIMITED

Chalk River, Ont.
Dec. 21, 1954.

Mr. J. C. W. Scott,
Radio Physics Wing,
Defence Research Board,
Shirley Bay, Ontario.

Dear Scott:

I feel that to avoid misunderstand I should put on record the main point of criticism I made to you at the D.R.B. Symposium concerning aspects of the Mark II Fence design and the proposed communication system which I feel are basically unsatisfactory.

I refer to my memo of March 16, 1951, for which I have your signature for copy no. 5. Quoting from this, page 2:

"At the outset it should be determined whether such stations could be manned by personnel of sufficient calibre to be entrusted with the great responsibility of deciding the interpretation of the indications on the radar apparatus. It is suggested that this is impractical. It will therefore be necessary somehow to connect the radar apparatus directly to the communication system.

...

... "the experimental development must be applied to enable the disturbance produced by an aircraft to be distinguished from other disturbances, and even possibly to distinguish the flight of a known aircraft from that of a possible raider. ...

"The suggestion will be seen to involve replaying the recorded signal over a communication channel to an operations centre where it can be assessed. This implies fair quality telephonic communication and this may well prove the most difficult and expensive facility to provide to the chain of stations forming the fringe."

I also wrote to you on August 7, 1952, enclosing another memorandum, from which I quote.

"The human intelligence deciding whether to alert the main radar chain could, if required, be supplied with

....

4. A play-back, speeded if the communication channel is good enough, of the receiver output which caused the automatic alert. This could be a facsimile transmission of a paper record, or a play-back of a magnetic record."

I wrote at that time also to Whitehead, suggesting that he should do something about making a record from the experimental system, and a year later, in September 1953, I raised the matter with Mr. F. R. Deakins of the RCA Victor Company. Mr. J. L. McMurray replied to my letter to Mr. Deakins. I also discussed the matter with Whitehead and summarized the position in a letter to Eon on September 30, 1953, where I said -

"I have also spoken to Whitehead on the subject and find that for "Lone Wolf" he is considering passing the signals over one channel of the communication system to the sector station where they can be continuously recorded and then reproduced, speeded up as required, provided suitable equipment can be developed. He considers the drum device he has started at the Eaton Lab. and to which Mr. McMurray refers, to be a suitable starting point. It would seem highly satisfactory if this could be developed as he suggests and I like the idea of recording at sector headquarters rather than at the individual stations, as I fear the recording equipment may not reach the standard required for untended operation".

It may also be noted that McKinley, commenting on my first memorandum in March 1951 wrote "A bird flying over the station would produce a stronger signal than a four-engined bomber at 50 miles and the characteristics of the two signals would be similar." I replied to this "It was largely because of such considerations that I rejected the suggestion of an automatic alarm and felt it would be necessary for an experienced listener to interpret doubtful signals expecting that in fact there would be characteristic differences which would enable him to distinguish birds from aircraft."

I think these quotations should make it obvious why I fear that switching at 3,000 cycles in the Mark II system and transmitting only frequencies below about 300 cycles to sector headquarters would almost ruin the operational effectiveness of the Fence.

There is another quite separate reason why I reject the Mark II system, at least for any part in the Fence other than additional to Mark I as it seems to me essential, now that untended operation for the stations is planned, that there should be a double line to prevent false alarms and ensure adequate reliability. The spacing between these two lines must be such that the individual stations are independent and no single fault such as a failure of the power supply could throw out both stations. It may be difficult to site the two stations very far apart, but given adequate communications to sector it should be possible to determine sense of crossing even if the stations are only a few hundred yards apart. The Mark II system does not really remove the need for the double line as it does not possess these characteristics of reliability and freedom from false alarms.

Yours sincerely,

(sgd.) W. B. Lewis

W. B. Lewis

WBL/dg

c.c. Lt. Col. L. G. Eon
Dr. G. S. Field

C O P Y

W C C O

Minneapolis 2, Minn.

December 23rd, 1954.

Defence Research Board,
Defence Research Telecommunications Establishment,
Radio Physics Laboratory,
Shirley Bay,
Ottawa, Ontario.

Re: RPLS 5538-0

Attention: Mr. J. H. Chapman, Superintendent,

Dear Mr. Chapman:

Your letter with reference to TV Channel No. 17 has been handed to me for reply.

We do not operate on Channel 17, nor are there any other Channel 17 stations assigned in this area.

Very truly yours,

(sgd.) William McGinnis

William McGinnis
Engineering Supervisor

WMcG:mej

C O P Y

W M I N

Broadcasting Company

AM-FM TV Channel 11

St. Paul and Minneapolis, Minn.

December 22, 1954

Superintendent,
Defence Research Telecommunications Est.,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

RPLS 5538-0

Dear Sir:

Apparently there is some confusion in your reference to Channel 17 in the Twin Cities. WMIN TV transmits on Channel 11 and consequently we are not familiar with any characteristics regarding Channel 17. This frequency was granted to the Twin Cities' area but was turned back to the F.C.C. by the applicant.

Cordially,

(sgd.) Frank M. Devaney

Frank M. Devaney
V.P. - General Manager

mk

C O P Y

W E R E

Cleveland 15, Ohio

December 30, 1954

Superintendent,
Defence Research Telecommunications Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

Ref: RPLS 5538-0

Dear Sir:

In reply to your letter dated December 13, 1954, W E R E-TV holds a construction permit for TV Channel 65.

As yet, W E R E has not started construction of a television station on Channel 65.

For your information, the United Broadcasting Company (WHK-TV) are holders of a construction permit for TV Channel 19.

The W E R E construction permit calls for an ERP of 220 kw at 625 feet above average terrain.

Our planning calls for a 12 kw transmitter, and an antenna gain of 20.

Trusting this information is satisfactory, I remain,

Sincerely,

Radio Station W E R E

(sgd) Harry Dennis

Harry Dennis
Chief Engineer

HD/jk

C O P Y

THE NUNN STATIONS

Lexington, Ky.

December 22, 1954.

Superintendent,
Defence Research Telecommunications Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

In re: RPLS 5538-0
TV Channel No. 18

Dear Sir:

We are in receipt of your letter of December 14 addressed to WLAP in re the above subject.

Your communication should have been addressed to WLEX-TV, which has been granted a construction permit for TV Channel No. 18, so your letter has been forwarded to that station.

Yours truly,

(sgd.) Jean Sturgel,

Jean Sturgel,
Secretary to Gilmore Nunn

C
O
P
Y

KGTV Channel 17

Des Moines

December 20, 1954

Defence Research Telecommunications Establishment
Radio Physics Laboratory
Defence Research Board
Shirley Bay
Ottawa, Ontario
Canada

Gentlemen:

RE: RPLS 5538-0

In answer to your letter of December 13th, KGTV began transmitting on channel 17 on November 15, 1953, with daily operating hours from 4:30 PM to 12:00 midnight. The transmitter power output is 1 kw video, antenna gain 13.2 dbk, and the erp 17.96 kw.

If we can supply you with further information, please let us hear from you.

Sincerely,

(sgd.) Walter R. Hariu

Walter R. Hariu
Chief Engineer.

WRH/eah

C
O
P
Y

WHIZ

WHIZ-TV

Zanesville, Ohio

Dec 21 1954

Defense Research Telecommunications Est.
Ottawa Ontario (RPLS 5538-0)

Gentlemen:

I have your letter of the 13th in which you wish some information on our operation on TV channel #18. We hope we can be of some help to you.

WHIZ-TV originally began operation on channel 50 May 26 1953. We changed to channel 18 on Oct 13 1954. Our transmitter is an RCA TTU-1B with a peak visual power of 1 kilowatt, aural power of 600 watts. Our antenna is RCA type 24DL with $\frac{1}{2}$ degree beam tilt, and a horizontal power gain of 19.2. With a coaxial cable efficiency of 77% this gives us an effective radiated power of 14.9 kw. This antenna is supported by a 455 ft tower.

Test pattern sign on during week days was 9:30 a.m. from October 14 to November 13, 12:30 p.m. from November 14 to December 13, 9:30 a.m. from December 14 till approximately 1 week after Xmas. Saturday and Sundays test pattern sign on was about 12:30 p.m. Normal week day programs commence at 4:55 p.m. and end between 12:00 midnight and 1:00 a.m. Saturday and Sunday programs start at about 1:00 p.m.

If we can be of further assistance, let us know.

Cordially,

(sgd.) Wm. A. Hunt

William A. Hunt
Chief Engineer WHIZ-TV

C
O
P
Y

KATV Channel 7

Little Rock Studios
620 Beech

Pine Bluff Studios
100 Williams Road

Please address
reply to: Little Rock

December 20, 1954.

Defence Research Telecommunications Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

Re: RPLS 5538-0

Gentlemen:

In response to your letter of December 13, 1954, UHF Channel 17 in Little Rock ceased telecasting March 31, 1954, and all of the properties and assets were acquired by the above.

Yours very truly,

(sgd.) John H. Fugate

John Fugate

JHF:SD

C
O
P
Y

WSPA TELEVISION
Channel 7
Spartanburg, S. C.

December 23, 1954.

Defence Research Telecommunications Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

Gentlemen:

Re: RPLS 5538-0

TV Channel No. 17 has never been activated in Spartanburg. This company which secured a construction permit turned it back to the Commission and is out of business.

This company has a construction permit for Channel No. 7 but because of litigation by Greenville and Anderson UHF Television, we are not yet on the air.

Sincerely,

(sgd.) Walter Brown

Walter Brown

WB:MA

C
O
P
Y

W K T V

Channel 13, Utica,
New York

December 17, 1954

Mr. J. H. Chapman
Defence Research Telecommunications Establishment
Radio Physics Laboratory
Defense Research Board
Shirley Bay
Ottawa, Ontario

Dear Mr. Chapman:

Reference is made to your letter of December 13, regarding Channel 19 in Utica, New York. Please be advised that WKTU operates on Channel 13 and not on Channel 19. The latter assignment was formerly awarded to Richard Balch, Inc. in Utica, and subsequently surrendered to the F. C. C. Shortly after, this channel was removed to Massachusetts from Utica and replaced with Channel 54.

For further and complete information, I would suggest you address a letter to the Federal Communications Commission who I am sure will give you all the pertinent data and information you desire.

Sincerely yours,

(sgd.) Michael C. Fusco

Michael C. Fusco
General Manager

mcf/hk

C
O
P
Y

RCA VICTOR COMPANY, LIMITED

1001 Lenoir Street

MONTREAL 30, CANADA

21 December 1954

Superintendent of DRTE
Radio Physics Laboratory
Defence Research Board
Shirley Bay, Ottawa, Ontario

Attn: Dr. J. Hogarth

RE: Contract P.19-2-10
Serial 2-P-4-1162

Gentlemen:

Confirming our telephone conversation of 20 December 1954, during which you indicated that you had not received our Mr. R. B. Lanskail's letter of 7 December 1954, I quote herewith the letter in its entirety:

"The above contract calls for modification kits for the existing AN/FPS-503 XPI Radar Equipment.

The modification kits are based primarily on information by Dr. J. Hogarth of RPL and require experimental work on our part.

Unfortunately, there is some test equipment which we lack and without which we cannot carry on our experiments. It is impossible to purchase or manufacture this equipment without the time allowed, and it would therefore be appreciated if the following could be made available to us for a period of four (4) months:

- a. Require one 24-channel filter bank made by RCA for Project "Spiderweb".
- b. Two AGC amplifiers made by RCA for "Lonewolf" trials conducted last summer.
- c. One Sandborn brush recorder suitable for recording up to at least 50 cycles.

Dr. Hogarth is familiar with all of this equipment. As this matter is urgent, anything which can be done to expedite the supply of these units would be very helpful."

Anything which you could do to expedite the shipment of the above items of test equipment to RCA Victor Company, Ltd., on a loan basis, would be very greatly appreciated. Should you need any additional information with regard to this request, please contact the writer.

Very truly yours,
(sgd. EDWIN W. J. MORRIS)
Government Contracts
Administration Division

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HILLTOP BROADCASTING COMPANY

Peoria, Illinois

WTVH-TV 1000 watts

WTVH-TV Channel 19

December 20, 1954

Mr. John H. Chapman
Defence Research Board
Defence Research Telecommunications Establishment
Radio Physics Laboratory
Defence Research Board
Shirley Bay
Ottawa, Ontario

Dear Mr. Chapman:

This is in reply to your letter of December 13th, File No. RPLS 5538-0.

Channel 19 went on the air in Peoria October 12, 1953. Currently we are operating with an effective radiated power of 214,000 watts; the antenna gain is 22.0; the transmitter power output is 12.5 KW.

Monday through Friday we go on the air at 7:45 AM. Our schedule on Saturday does not call currently for a regular starting time. Very shortly, however, we will start at 9:30 A.M. Sunday we begin operations at 1:00 P.M. Our sign-off period varies from day to day, depending upon the length of our late movie. On an average, we sign off between midnight and 12:30 A.M.

If you need any additional information, don't hesitate to call on us.

Sincerely yours,

(sgd.) Edward G. Smith

Edward G. Smith
General Manager

EGS:aa

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THE UNIVERSITY OF THE STATE OF NEW YORK

Albany 1

December
21
1954

Mr. J. H. Chapman
Defence Research Board
Defence Research Telecommunications
Establishment
Shirley Bay
Ottawa, Ontario
Canada

RPLS 5538-0

Dear Mr. Chapman:

The letter which you addressed to "the Manager, Television Station WTVZ", on December 13, has come to my desk for reply.

In reply to your inquiry I can only say simply that television station WTVZ is one of several stations included in an overall plan for educational television in New York. Unfortunately, no funds have been appropriated for the construction of any of these stations. Although the FCC has issued a construction permit for channel 17 in the name of the University of the State of New York, no move has been made to build the station. There seems little prospect that funds will be available for constructing this station in the near future.

Sincerely yours,

(sgd.) Ward C. Bowen

Ward C. Bowen

WCB:GV

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WBAL WBAL-TV

2610 North Charles Street

Baltimore 18, Maryland

December 20, 1954

Mr. J. H. Chapman
Radio Physics Laboratory
Defence Research Board
Shirley Bay
Ottawa, Ontario

RE: RPLS 5538-0

Dear Mr. Chapman

We have your letter of December 14th, requesting certain information about a television channel #18. Your letter is addressed to station WBAL, but also says Baltimore, Oregon.

For your information, station WBAL in Baltimore, Maryland, operates on Channel 11 and not on Channel 18, as you have indicated. If after receiving this letter you indicate to us that you mean station WBAL on Channel 11 in Baltimore, Maryland, we will then be very happy to forward to you the information you requested.

Yours very truly,

(sgd.) John T. Wilner

John T. Wilner
Director of Engineering

JTW:cm

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CUMBERLAND VALLEY BROADCASTING CORP.
CUMBERLAND, MD.

December 18, 1954.

Mr. J. H. Chapine
Defense Research Telecommunications Establishment
Radio Physics Laboratory
Defense Research Board
Shirley Bay
Ottawa, Ontario

Re: RPLS 5538-0

Dear Mr. Chapine:

In reply to your letter of December 14 addressed to Radio Station WCUM, we have the television grant and not WCUM.

At the present time we have a renewal on our TV grant and our starting date is quite indefinite. We have made no commitments in so far as equipment is concerned wo we are unable to give you any technical information.

Yours very truly,

CUMBERLAND VALLEY BROADCASTING CORP.

(sgd.) M. Virginia Rosenbaum

M. Virginia Rosenbaum
Assistant General Manager

MVR:wk

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GENERAL-TIMES TELEVISION CORPORATION

54 Pratt Street,
Hartford 4, Connecticut

December 17, 1954

Defence Research Board
Radio Physics Laboratory
Shirley Bay
Ottawa , Ontario

RPLS 5538-0
Enclosure

Dear Sir:

WGTH-TV has been on the air since Aug 4th 1954. We are on Channel 18 with 10 KC negative offset.

WGTH-TV has a 12 KW General Electric Transmitter and, with a Four Bay GE Helical, with a gain of 12.41 DB produces an ERP of 214,000 Watts with beam tilt at .64 degrees below horizontal.

The center of the radiating system is at 640 feet above average terrain.

I am inclosing information as to the Broadcast time we have been on.

Yours very truly,

(sgd.) Rogers B. Holt

Rogers B. Holt
Chief Engineer WGTH WGTH-TV

Sunday

Tuesday

12/19 P.m. 1:45
2:00

P.m. 4:30 - 11:05

12/26 1:30
2:00

Wed.

1/2 3:00
3:30
3:45

P.m. 4:30 - 11:05

4:00

Thurs

12/19 4:30

P.m. 4:30 - 11:05

12/26 5:00

7:00

Fri

7:15

P.m. 4:30 - 11:05 (12/17)
12:00 (12/24)

7:30

8:00

"

8:30

"

11:30 (12/31)

9:00

9:30

Sat

10:00

P.m. 1:30 - 10:40

12/19 10:30

12:00

Monday

12/20 P.m.

4:30 thru to 8:00

1/17

8:30 " " 11:05

CLASSIFICATION
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REPLACÉE PAR RPLS 5538-0
BY AUTHORITY OF S E Unclassified
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Defence Research Telecommunications
Establishment, JUN 1992

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

SIGNATURE
APPOINTMENT
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22nd December, 1954.

Chairman,
Defence Research Board.

Attention: CD(A) (Dr. Sanders)

Minutes of Meeting No. 8
Technical Coordinating Committee

Herewith Minutes of Meeting No. 8 of the Technical Coordinating
Committee held 13th December, 1954, for your retention.

for Superintendent,
D.R.T.E. (RPL)

/keb

Encl.

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Channel 17
WTVP

Telephone 8-4304

Post Office Box 108

PRAIRIE TELEVISION COMPANY

Television Center

Southside Drive

DECATUR, ILLINOIS

17 December 1954

Defence Research Telecommunications Establishment
Radio Physics Laboratory
Defense Research Board
Shirley Bay
Ottawa, Ontario

Attention: J. H. Chapman, for Superintendent

Dear Sir: In re: RPLS 5538-0

We are in receipt of your letter dated 13 December 1954, relative to propagation research which your laboratory is conducting. We are submitting below the information which you requested in regard to our Channel 17 operations.

Station WTVP began telecasting August 16, 1953, with a 1 KW RCA transmitter. Under date of October 25, 1954, we increased our power to 12.6 KW visual and 7.56 KW aural. The visual ERP in the horizontal plane is 158.0 and aural ERP in the horizontal plane is 85.6. Carrier is on from 7:30 AM to 9:15 AM and 2:15 PM to midnight. Programs and/or test pattern on from 7:45 AM to 9:01 AM and 2:30 PM to midnight. We have an RCA TFU-24BLS 16-section slotted antenna with power gain of 18.24 in the horizontal plane or 21.5 in maximum lobe. Maximum lobe is 0.6 degrees below the horizontal plane or, in other words, we are using a 0.6 degree beam tilt.

We trust that the above information is sufficient to meet your needs. If we can be of any further assistance to you, please do not hesitate to call on us.

Yours very truly,

(sgd.) H. F. Abfalter

Hubert F. Abfalter,
Chief Engineer.

HFA:kl1

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DEFENCE RESEARCH BOARD

CLASSIFICATION / DÉSIGNATION
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REMP ~~DRBS~~ 401-640-301 (Tels)
BY AUTHORITY OF
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S E C ~~Unclassified~~
Ottawa, Ontario. 15 JUN 1992
9th December 1954

Supt
DRTE

Defence Radio Relay Communications
Canadian General Electric

Attached please find three reports which form part of a study of equipment suitable for defence communications prepared by the Canadian General Electric for submission to the Bell Telephone Company of Canada.

This equipment is essentially General Electric Company (UK) equipment which may be manufactured in Canada by the Canadian General Electric is sufficient orders warrant it.

Mr. G. M. B. Wills is a GEC Consultant Engineer on the staff of the Canadian General Electric Company. He recently visited this office and has left the impression that he is anxious to answer any questions which you might have on the subject of radio relay at Canadian General Electric. He has stated that he would be only too pleased to discuss this subject with DRB staff at any time. If you have such a requirement, I will be pleased to make arrangements for a meeting at any time convenient to you.

Please return the enclosed documents to this office when you have finished with them.

(sgd.) L. G. Eon

for Chairman,
Defence Research Board.

Encl.

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CANADIAN GENERAL ELECTRIC COMPANY LIMITED

Electronics Division

Electronics Equipment Department

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BY AUTHORITY OF
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830 Lansdowne Avenue

Toronto 4, Ontario

Oliver 6511

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Unclassified

SIGNATURE

15 JUN 1992

APPOINTMENT
FONCTION

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December 3, 1954

Our File: 75:Fl-3

Defence Research Telecommunications
Establishment,
Shirley Bay, Ottawa, Ontario.

Attention: Dr. J. H. Chapman

Subject: Defence Communications

Dear Sir:

Further to your discussions with Mr. G. M. B. Wills on December 2nd, we have pleasure in enclosing copies Nos. 15 and 16 of our Proposal No. 72001, "A Study of Equipment Suitable for Defence Communications", together with one copy of each of the supporting GEC specifications, SPO.1350 and SPO.5500.

This study was made for the Special Contracts Branch of the Bell Telephone Company of Canada, in connection with the Mid-Canada Line project.

Yours truly,

(sgd.) G. M. B. Wills

for:

A. D. Hodgson,
Manager,

Communications - Marketing.

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W:jm

DEFENCE RESEARCH BOARD

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C.R. L'AUTORISATION DE
DATE 15 JUN 1992 Ottawa, Ontario
30th August, 1954
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Superintendent,
D.R.T.E.

Permenent Underwater Detecting
and Locating Lines - Part II
by Canadian Westinghouse Company

Enclosed is a copy of the above-mentioned report with a covering letter from Canadian Westinghouse.

It would be appreciated if you would let us have your comments on the report and your opinion as to the feasibility of the proposal at an early date.

If it is generally felt that the proposal has merit, it is intended to call a meeting in the near future to discuss further technical details.

(sgd.) Fred D. Green

for Chairman,
Defence Research Board.

Encl.

C O P Y

CANADIAN WESTINGHOUSE COMPANY LIMITED

REGISTERED MAIL

Chairman,
Defence Research Board,
"A" Building,
OTTAWA, Ont.

Attention: Mr. F. D. Green

Reference: Permanent Underwater Detecting
and Locating Lines
Your Ref: DRBS 411-600-301 (Tels)
Our Ref: Neg. EL-1035

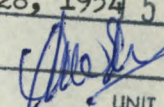
Dear Sir:

On January 8th, 1953, we submitted to you a report entitled "Some Considerations on Permanent Underwater Detecting and Locating Lines", which described a proposed system for the detection and location of underwater targets. This system was based upon the development of a buoy equipped with underwater detecting and radio telecommunication units controlled by coast stations, ships or patrol aircrafts. To allow an unattended operation of three to six months, batteries, operating in conjunction with a mechanism to convert the motion of the sea into electrical power, were considered as the power source.

As suggested in your subsequent letter of March 8th, 1954, to allow the Royal Canadian Navy to complete their evaluation of the proposed system, an investigation of the amount of power in the motion of the sea available for conversion by the buoy into electrical power, has been carried out. As a result of this more recent study, we have prepared and are enclosing four copies of a second report entitled "The Power Within Sea Waves which is Available for Conversion into Electrical Power by a Buoy", which supplements our original submission. This report has been tentatively classified by the Company for security purposes as Secret.

Briefly, it derives an equation for the power available for conversion, and applies it to a typical buoy to show that power of the order of one kilowatt is available in the more common seastates. With the efficiency of the power converting device estimated at 50%, the resulting half kilowatt of electrical power compares favourably with the 100 watts maximum required by existing Sonobuoy equipments. With power outputs of this predicted order, this means of power generation is not limited in its application to Sonobuoy equipments, but could be readily used in buoys carrying coded navigation responders, radio counter measures and radio relay equipments.

As indicated in our report, we believe that the results of the study are sufficiently promising to merit the development of an experimental buoy,

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and a line of attaching this problem has been formulated. We feel that the continuation of this project could best be served by a meeting to discuss further technical details, and we would be pleased to have the personnel involved attend.

Yours very truly,

D. D. McLean, Manager,
Defence Contracts,
Electronics Division.

CLASSIFICATION / DESIGNATION
CHANGE TO RPLS 5538-0

REPLACÉE PAR ~~SECRET~~

BY AUTHORITY OF ~~Unclassified~~

Defence Research Telecommunications

Establishment, 5 JUN 1992

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

APPOINTMENT
FONCTION

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14th December, 1954.

Chairman,
Defence Research Board.

Attention: Tels

Defence Radio Relay Communications

1. With reference to your DRBS 401-640-301 (Tels) dated 9th December, 1954, the Canadian General Electric reports are returned herewith.

2. Mr. G. M. B. Wills has visited both RPL and EL in connection with these equipments of the General Electric Company (UK). He has left us copies of these reports which we are studying with interest.

JHC/keb

Encl.

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

14th December, 1954.

The Manager,
Radio Broadcasting Station WLAP,
Lexington, Kentucky,
U. S. A.

Dear Sir:

TV Channel No. 18

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 18.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitting power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

for Superintendent,
D.R.T.E. (RPL)

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

14th December, 1954.

The Manager,
Radio Broadcasting Station WBAL,
Baltimore, Oregon,
U. S. A.

Dear Sir:

TV Channel No. 18

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 18.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitting power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

14th December, 1954.

The Manager,
Radio Broadcasting Station WORD,
Spartanburg, South Carolina,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitting power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

for Superintendent,
D.R.T.E. (RPL)

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

14th December, 1954.

The Manager,
Radio Broadcasting Station WCUM,
Cumberland, Maryland,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitting power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

14th December, 1954.

The Manager,
Radio Broadcasting Station KPKW,
Pasco, Washington,
U. S. A.

Dear Sir:

TV Channel No. 19

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 19.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitting power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

14th December, 1954.

The Manager,
Television Station WHIZ,
Elmira, New York,
U. S. A.

Dear Sir:

TV Channel No. 18

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 18.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitting power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

for Superintendent,
D.R.T.E. (RPL)

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WTVH,
Peoria, Illinois,
U. S. A.

Dear Sir:

TV Channel No. 19

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 19.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

Original signed by
J. H. Chapman
for Superintendent,
D.R.T.E. (RPL)

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WMIN,
St. Paul, Minnesota,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WITV,
Ft. Lauderdale, Florida,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WERE,
Cleveland, Ohio,
U. S. A.

Dear Sir:

TV Channel No. 19

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 19.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station KRTV,
Little Rock, Arkansas,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station KQTV,
Des Moines, Iowa,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WTVZ,
Albany, New York,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WCCO,
Minneapolis, Minnesota,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WHIZ,
Zanesville, Ohio,
U. S. A.

Dear Sir:

TV Channel No. 18

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 18.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WKTV,
Utica, Rome,
New York, U. S. A.

Dear Sir:

TV Channel No. 19

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 19.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WTVP,
Dekatur, Illinois,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

for Superintendent,
D.R.T.E. (RFL)

JHC/keb

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WBUF,
Buffalo, New York,
U. S. A.

Dear Sir:

TV Channel No. 17

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 17.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

13th December, 1954.

The Manager,
Television Station WGTB,
Hartford, Connecticut,
U. S. A.

Dear Sir:

TV Channel No. 18

In connection with some propagation research being performed at this Laboratory, we would like some information from you regarding your operations on TV Channel No. 18.

In particular we would like to know the date you began, or intend to begin, transmissions on this channel, the daily transmitting program (times transmitter on and off, with or without video), the transmitter power output, the antenna gain, and the effective radiated power.

This information is of considerable importance in our research, and we will appreciate any effort on your part to give us the data.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

10th December, 1954.

Controller of Telecommunications,
Department of Transport,
#3 Temporary Building,
Ottawa, Ontario.

Attention: Mr. W. B. Smith

Dear Sir:

With reference to your letter 5874-1 dated 6th December, 1954, we appreciate very much receiving a copy of the Canadian-United States Television Agreement.

As suggested in your paragraph 2, we would be pleased to receive the information to keep the tables of assignments up to date.

Yours sincerely,

JHC/keb

for Superintendent,
D.R.T.E. (RPL)

C
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P
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THE BELL TELEPHONE COMPANY OF CANADA

December 4, 1954.

A/C H. B. Long,
A.F.H.Q.,
Victoria Island,
Ottawa.

Dear Sir:

Since the Special Contract Department is now occupying space on the main floor, 6th, 7th and 8th floors of 1010 Beaver Hall Hill, it has been found necessary to revise the security measures in force for this office. In future, all visitors to the Special Contract Department must register at a reception desk on the main floor and, if travelling to any other floor, must secure a building pass which is to be surrendered to the receptionist on the floor being visited. Visitors to the main floor will not require this building pass.

Our Conference Room has been moved to the main floor. If you or your staff are attending a conference here to be held in the Conference Room, it would save trouble if you went directly to the main floor Conference Room and thus avoided the necessity of obtaining a building pass. Would you please see that all your staff are advised of these changed circumstances.

Yours truly,

(sgd.) A. G. Lester

Assistant General Manager.

C
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BY AUTHORITY OF
SUR L'AUTORISATION DE
DATE 15 JUN 1992
DEFENCE RESEARCH BOARD
SIGNATURE [Signature]
APPOINTMENT FONCTION UNIT UNITÉ

DR/12/1

AIR MAIL

66 Ennismore Gardens,
London, S.W. 7.

22nd November, 1954.

The Superintendent,
DRTE/RPL,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario,
Canada.

Attention: Dr. J. H. Chapman

Unattended Power Supply

Please refer to my DR/12/1 of October 13th and your reply RPLS 5538 of October 27th, 1954, regarding the above subject. I think it would be useful for me to clarify the situation regarding these power supplies as the type you are testing and have on order is not in fact the one referred to in my letter of October 13th.

The type you are testing is manufactured by the Electric Construction Company Limited (E.C.C.), Wolverhampton. This unit contains switching components made by Austinlite Limited, Birmingham. I understand that the system which you have on order consists of two separate units (motors and generators) with appropriate switching facilities for change over.

The type made by Austinlite, referred to in my letter, is an entirely different unit containing components manufactured by E.C.C. This unit consists of two motors and a single generator with switching facilities for changing the motors. This system appears to be based on the right philosophy to give high reliability, and, as mentioned in my letter, the experts from Standard Telephones and Cables have a high opinion of its capabilities.

The systems made by E.E.C. and Austinlite are basically different, and I believe it would be most difficult to say which is better for your purposes without making practical trials. It is suggested that it might be well worthwhile to test these two systems in parallel.

I have just had some discussions with Mr. H. Copping, Managing Director, E.C.C. Canada Limited, prior to his return to Canada. He informs me that arrangements have just been completed for him to handle the Austinlite system in Canada, so that he should now be in a position to give you first-hand details regarding the system.

2

CONFIDENTIAL

From what I have heard I suspect there has been a little competitive jealousy between E.C.C. and Austinlite regarding their respective systems as each contains components manufactured by the other. Now that Copping is to handle both systems in Canada, it appears likely that you will get a fair assessment of both.

(sgd.) T. W. Straker

for Defence Research Member,
Canadian Joint Staff, London.

c.c. Chief of Division "A".

CLASSIFICATION / CLASSIFICATION
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Unclassified

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

8th December, 1954.

Chairman,
Defence Research Board.

Attention: CD(A) (Dr. Sanders)

Minutes of Meeting No. 7
Technical Co-ordinating Group

Herewith Minutes of Meeting No. 7 held 29th November, 1954,
of the Technical Co-ordinating Group for your retention.

for Superintendent,
D.R.T.E. (RPL)

Encl.

7-29-25

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BY AUTHORITY OF RPLS 5538-0
SUR L'AUTORISATION DE
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DATE 15 JUN 1962

Defence Research Telecommunications

Establishment.

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

UNIT
UNIT

6th December, 1954.

Chairman,
Defence Research Board.

Attention: CD(A) (Dr. Sanders)

Mid-Canada Line

Minutes of Executive Committee Meeting 24 November, 1954

1. The following comments are made on the Minutes of the first meeting of the Executive Committee of 24 November, 1954.
2. Item 1(c) Decision - "Appendix A" should read "Appendix B".
3. Item 7 Target Dates. If I understand what Dr. Field recommended at the previous Steering Committee Meeting, it was precisely what the Chairman stated "To accelerate a Section of the line", i.e. about a dozen stations between two Section Stations, fully manned and operational.

The purpose would be to provide information on environmental techniques and operational problems in time to correct errors and provide for necessary equipment developments.

It is important to remember that the DRB Fence System does not exist in any form at this time, and that it is naive to expect it to work successfully by 1 January, 1957. A reasonable estimate would be that two years will be required, after the line is put into operation, before performance will approach that required in the OR. Hence there can be no argument against putting a portion of the line into operation as soon as possible.

Project 572 with domestic sites at Streator, Illinois, and northern sites in Alaska, as a prelude to the DEW line is an excellent example of the value of progressive installation.

4. Item 8 The item was raised at the TCG meeting of 29th November. A decision was postponed pending a meeting between DRB and SEG to be called by C/Tel.

The argument for installing a test link in the vicinity of the Mid-Canada Line sites is that the siting problem is more difficult in the Quebec - Labrador region, than in the area further west, and less control of the reference signal level is possible. Present indications are that the nature of scintillations on the Fence reference signal will depend on the type of terrain, trees, and foliage, as well as on the level of the reference. Hence operation of at least one link of Fence equipment in the appropriate environment, for a period of three months to a year is necessary to provide essential information on siting in this area.

The resources of DRTE do not permit our setting up a link at this time. We feel the link should be in operation in May at the latest, to provide useful information in time to affect siting in that area.

Mark I equipment only need be installed, DRTE would arrange to carry out the measurements, and would provide the specialized equipment. The establishment of stations and power supplies, and installation of equipment by the RCAF or MC is necessary.

for Superintendent,
DRTE (RFL)

CLASSIFICATION / DÉCLASSIFICATION
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RPL 5538
CONFIDENTIAL

Defence Research Telecommunications Establishment, 15 JUN 1992

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, APPOINTMENT
Ottawa, Ontario. FONCTION
UNITE

30th November, 1954.

Defence Research Member,
Canadian Joint Staff,
London.

Attention: Dr. T. W. Straker

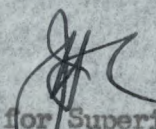
Unattended Power Supply

1. Please refer to your DR/12/1 of 22nd November regarding the above subject. Your comments on the two systems, ECC and Austinlite are very much appreciated. The competitive element you mention has been noticed by us as well.

2. We have had the two ECC units on order for some time. For our purposes they will be more satisfactory than the Austinlite unit with the two motors, as we wish to separate the units eventually. We regard the approach made by these two firms to be much more promising for the ultimate application than anything else we have seen on the market. We agree that for fully unattended operation, the Austinlite twin motor unit is obviously to be preferred.

3. When Mr. H. Copping returns, I expect we will hear more details from him regarding the finer points of the differences between these two products.

JHC:keb


for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

30th November, 1954.

Chairman,
Defence Research Board.

Attention: Tels (Mr. F. D. Green)

Project "Mid-Canada Line"
Work Schedule

1. As requested in conversation (Green - Chapman) of today's date attached is copy of work schedule for Project "Mid - Canada Line".

for Superintendent,
D.R.T.E. (RPL)

C O P Y

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LINCOLN LABORATORY

P.O. BOX 73

Lexington 73, Massachusetts

17 November 1954

Dr. J. H. Chapman
Defence Research Telecommunications Establishment
Radio Physics Laboratory
Defence Research Board
Shirley Bay
Ottawa, Ontario

Re: Low Noise Preamplifier for 500 Mc/s

Dear Dr. Chapman:

I am writing in response to your letter of November 3rd regarding noise figure measurements on the 416B preamplifier.

As a result of your letter I have asked various "experts" about their experience with 416B noise figure measurements in the 500 mc/s frequency range. I have received replies that indicate noise figures ranging from $4\frac{1}{2}$ db to $6\frac{1}{2}$ db. This data has been obtained from Airborne Instruments Laboratory, Motorola, Radio Engineering Laboratories, and from another group at Lincoln Laboratory. We have not yet run down the whole story but will attempt to do so during the next few weeks.

The recommended plate current for the 416B, with 250 volts on the plate, appears to be 19 to 20 milliamperes.

After our investigation in this matter is completed I will pass along the conclusions.

Yours very truly,

H. G. Weiss

C O P Y

7-29-2A

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Defence Research Telecommunications

DATE

Establishment,

Radio Physics Laboratory, 15 JUN 1992

Defence Research Board,

UNIT

Shirley Bay, Ottawa, Ontario

APPOINTMENT
FONCTION

15th November, 1954.

Chairman,
Defence Research Board.

Attention: Tels Section

Long Range Interference to Mid-Canada Line

1. Reference is made your DRBS 1-656-267-4 (Tels) dated 31st August, 1954, and to your DRBS 290-640-267-9 (Tels) dated 15th October, 1954, concerning long range interference to the Mid-Canada Line.

2. A note is attached which comments on the paper by Mr. Levin concerning long range tropospheric interference. It would appear that no measurements are available to check the attenuation of tropospheric propagation with distance beyond about 250 miles.

3. It would be very interesting to check the attenuation of 500 Mc/s transmissions at a distance of 800 miles. This would provide some useful information on the nature of the propagating medium, and enable a better estimate of the field at 2000 miles to be made. At 800 miles range it would not be possible to illuminate a portion of the troposphere which would be common to the fields of the receiving and transmitting antennas, so transmission would be limited to reflection from meteor trails, diffraction fields, or some form of "double hop" scatter propagation.

4. As DRTE/RPL is heavily committed on other problems concerning the Mid-Canada Line, it would not be able to undertake such an experiment until the summer of 1955. It is suggested that the National Research Council might be prepared to take on this type of experiment.

(sgd) Frank T. Davies

Superintendent,
D. R. T. E.

RCL/pr

cc: 5534

C O P Y

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BY AUTHORITY **SECRET**
SUR L'AUTORISATION DE

DATE

15 JUN 1992

SIGNATURE

APPOINTMENT
FONCTION

UNIT
UNITÉ

LONG RANGE INTERFERENCE OF THE MID-CANADA LINE

Mr. A. Levin has suggested the possibility that transmitting installations located in Siberia may be able to produce long range interference of the Mid-Canada Line¹. The realization of such interference would justify large expenditures on the construction of high power transmitters and high gain antennas.

Mr. Levin's accompanying feasibility calculations were based on an extrapolation to a distance of 2000 miles of UHF propagation data for distances of between 40 and 400 miles which have been assembled by Bullington². The extrapolation implied an attenuation of 24 db per octave of distance and predicted a transmission loss of 290 db between isotropic radiators. Although not specifically stated in the text, it is believed that Bullington's data pertain only to overland circuits.

Recent over water measurements by Rogers³ at 220 Mc/s for distances between 100 and 450 miles indicate a linear rather than logarithmic attenuation with distance; the value deduced from Roger's results is 0.13 db per mile. An extrapolation to 2000 miles would predict a transmission loss 247 db in excess of the loss at 100 miles. Assuming that Bullington's diagram predicts the transmission loss at 100 miles (50 db plus the free space transmission loss of 123 db), it follows that this extrapolation predicts a transmission loss of 420 db at 2000 miles.

The predictions resulting from the two methods of extrapolation differ by 130 db, which is rather considerable. It would seem unlikely that this difference is due to the nature of the intervening terrain. Recourse must be made to experiment to determine if either method of extrapolation is valid. If extrapolation of Bullington's diagram is valid, it is evident that long range interference is a serious threat.

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BY AUTHORITY OF ~~SECRET~~
SUR L'AUTORISATION DE
DATE 15 JUN 1992
SIGNATURE
FONCTION

It must be emphasized that the data of Bullington and Rogers represent median transmission losses. Thus, even if calculations based on such data do not predict long range interference at an arbitrary distance with an arbitrary transmitter and an arbitrary antenna, the possibility must not be discounted since temporarily enhanced signals may result from ducting, or scattering by meteor trails and heavily ionized patches in the ionosphere⁴. It is probable that such scattering would occur in the E-Region of the ionosphere which would result in a maximum radius of interference of the order of 1600 miles. The possibility of scattering from higher levels must not be excluded. However, it would seem that the possibility of double hop transmission is unlikely. While a Siberian installation might be of limited use for long range meteor interference, the necessary transmitters and antennas could be brought into closer proximity of the line with aircraft or ships. Long term measurements are a necessary prerequisite for an evaluation of this threat.

J. Crysdale

R. C. Langille

- (1) Note by Mr. A Levin of the RCAF Telecommunications Systems Engineering Group.
- (2) Proc. IRE Vol. 41, no. 1, pp. 132-135 (Jan. 1953) Fig. 4.
- (3) Private communication.
- (4) Preliminary experiments were made to investigate this possibility during the Grey Goose trials (RPL Project Report 27-3-1; March 1, 1954.) The negative result obtained is not considered to be conclusive due to the unnecessarily large frequency deviation and sweep repetition frequency which were employed in this experiment.

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

24th November, 1954.

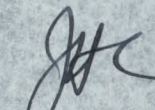
Chairman,
Defence Research Board.

Attention: CD(A)

Minutes of Meeting No. 6
Technical Co-ordinating Group

Herewith Minutes of Meeting No. 6 held 15th November, 1954,
of the Technical Co-ordinating Group for your retention.

Encl.


for Superintendent,
D.R.T.E. (RPL)



DEPARTMENT OF NATIONAL DEFENCE
CANADA

C O P Y

DEFENCE RESEARCH BOARD

5538
IN REPLY PLEASE QUOTE

CLASSIFIED 191-181-267-1
CHANGE TO
REPLACÉE PAR (Tels)

BY AUTHORITY OF ~~CONFIDENTIAL~~ **Unclassified**
SUR L'AUTORISATION DE

DATE

15 JUN 1992

Ottawa, Ontario
17th November 1954.

APPROPRIATE
FONCTION

UNIT
UNITÉ

Supt
DRTE

Project 572
Security Clearance

Attached for your information is copy
of RCAF letter TS-1905-203-2(DAPS) dated 10
Nov. 54, giving details of six month blanket
clearance, commencing 4 Nov. 54, for the
Canadian personnel listed.

for Chairman,
Defence Research Board.

Encl.

C O P Y

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 BY AUTHORITY OF
 SUR L'AUTORISATION DE
 CONFIDENTIAL
 TS-1905-203-2 (DAPS)
 15 JUN 1992
 SIGNATURE
 OTTAWA, Ontario,
 10th November 1954.
 FONCTION

DEPARTMENT OF NATIONAL DEFENCE

Mr. L.G. Eon,
 Telecommunications Section,
 Defence Research Board,
 Department of National Defence,
 Ottawa, Ont.

Dear Mr. Eon:

Project 572- Security Clearances

Reference is made to DRB letter 191-181-267-1 (Tels) dated 1st September 1954. A six month blanket clearance has been received for the personnel listed on the attached sheet to the following establishments, commencing 4th November 1954:

<u>ESTABLISHMENT</u>	<u>USAF Approval Number</u>
(a) USAF HQ, Washington, D.C.	26242
(b) HQs ARDC, Baltimore, Maryland	26243
(c) Bell Laboratories, New York City, N.Y.	26244
(d) Western Electric Company Inc. New York City, N.Y.	26245
(e) Project 572 Domestic Site, Streator, Ill.	26246
(f) Project 572 Sites in Alaska	26247
(g) Project 572 Sites in Newfoundland	26248

<u>Surname and Christian Names in Full</u>	<u>Unit</u>	<u>Appointment</u>
Dr. Sanders, Frederick Henry	DRB	Chief of Division "A"
Mr. Eon, Louis Guy	DRB	Chief of Telecommunications
Dr. Abrams, John Warner	DRB	Operational Research Group
Dr. Lindsey, George Roy	DRB	Operational Research Group
Mr. Cole, Ian Harry	DRB	Operational Research Group
Dr. Petrie, William	DRB	Operational Research Group
Mr. Harwood, Trevor Arnold	DRB	Arctic Section
— Mr. Scott, James Cosne Walter	DRB	Deputy Superintendent
— Dr. Chapman, John Hebert	DRB	DRTE/Radio Physics Laboratory
— Dr. Hogarth, Jack Edwin	DRB	DRTE/Radio Physics Laboratory
— Mr. Thain, Robert Sydney	DRB	DRTE/Radio Physics Laboratory
— Mr. McKerrow, Clarence Arthur	DRB	DRTE/Radio Physics Laboratory
— Mr. Southern, Robert Wallace	DRB	DRTE/Radio Physics Laboratory
Mr. Green, Frederick Douglas	DRB	Telecommunications Section
Dr. Rettie, Richard Samuel	NRC	Div of Radio & Elec Engineering
Dr. Whitehead, James Rennie	McGill	Assistant Professor
— Mr. Walker, B.A.	DRB	DRTE
Mr. Webb, E.L.R.	NRC	Radio & Elec Engr Division
Mr. Kaye, G.D.	DRB	Operational Research Group.

These clearances reflect the US Armed Forces approval only. Separate approval is required from and final arrangements are to be made with the above establishments well in advance of the planned commencement date of any proposed visit. The USAF clearance number shown for each point is to be quoted in any correspondence with these installations.

Yours truly,
 G.R.M. Hunt
 Wing Commander
 for Chief of the Air Staff.

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SAR 909-100480/5 (DAI-3)
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FUNCTION 18 Oct 54
UNIT

RCAF SECURITY POLICY STATEMENT NO. 9 (DAI) (REVISED)

(Cancels and supersedes RCAF Security Policy Statement No. 9 (DAI))

MID-CANADA EARLY WARNING LINE

1 The release of official information concerning the Mid-Canada Early Warning Line (for administrative brevity called the Mid-Canada Line) will be governed by the revised policy contained in this document.

2 Security Classifications

Most matters pertaining to the Mid-Canada Line have been declassified (see para 4). Classified elements are listed below:

(a) Operational Status

Information revealing the state of readiness or the serviceability of the line shall be classified SECRET.

(b) Performance

Information as to capability or operational limitations shall be classified SECRET.

(c) Strength

Information concerning strengths of personnel in various categories employed in the operation of this line shall be classified when necessary to safeguard information pertaining to matters mentioned in (a) and (b) above.

(d) Photographs

Photographs of installations or facilities will be controlled in accordance with the provisions of CAP 425, Chapter 7. Photographs will be classified according to the degree of classification assigned to classified features revealed in individual photographs. (See Appendix "A", Serial 5).

(e) Visits

AFHQ will control all visits of personnel to sites. Co-ordination of such visits shall be made by the directorate in AFHQ sponsoring the visit. Visitors may be afforded access to classified matter with the approval of AFHQ. (Refer to CAP 425, Chapter 5).

(f) Security Clearances

Visitors to and personnel on duty at any site or installation of the Mid-Canada Line shall be cleared in accordance with RCAF security clearance requirements.

3

Control of Release of Information

- (a) While some elements of the Mid-Canada Line have been declassified (see para 4) no information concerning the line is to be released without prior approval of AFHQ. A guide to the release of Official Information is attached as Appendix "A", and lists in column (c) information which is not to be released and in column (d) information which may be released with AFHQ approval.
- (b) It is to be particularly noted that declassification of the location of elements in the Mid-Canada Line does not permit publication of these locations in Canada Air Pilot or any other open source, official or otherwise, without prior reference to AFHQ.
- (c) All civilian and military personnel employed on the sites in the construction phase are to be carefully briefed on their responsibility for protecting official information, and their attention is to be directed to the requirements of the Official Secrets Act of 1939.

4

Security (General)

The following elements of this project have been declassified:

- (a) Locations
- (b) Equipment
- (c) Trade breakdowns
- (d) Postings and transfers
- (e) Logistics and technical services

The declassification action reflected herein is not to be construed as authority to declassify individual documents or items of information without authority of the originator or office of primary interest. (Refer to CAP 425, Chapter 2, Sections 1 and 2).

(sgd.) D. Edwards

D. Edwards, Group Captain
for Chief of the Air Staff

Distribution attached

DISTRIBUTION

<u>Internal</u>	<u>Copy No.</u>	<u>External For Information Only</u>	
CAS	1	CJS Washington	59
VCAS	2	CJS London	60
AMTS	3		
AMP	4		
AFHQ/AUC	5		
VCAS/DFS	6	File	61
DAF	7	DAI/AI3	62
A/STAND	8	DAI/AI3-3	63
CAOps	9	DAFS/AFS2-2	64
DAO	10	CAOps/DF0	65
DOR	11	DFR(Air)	66
DASS	12	AMTS/DSP	67-69
DGD	13	ATel/System	70-71
ORS	14	(Mr. Dodds) DFR	72
CTrain	15	DFR (Mr. Dumsday)	73
DAT	16	Spares	74-80
DGT	17		
Carm	18		
DarmEng	19		
BArma	20		
CTel	21		
DTelOps	22		
DTelEng	23		
CPlansI	24		
DAPS	25		
DAPP	26		
DAI	27		
DOE	28		
AMP/DPA	29		
DPC	30		
DAFC	31		
DPM	32		
DMS(Air)	33		
DAFS	34		
DRA	35		
D/AMTS	36		
AMTS/ALP	37		
ASR	38		
Chief of Material	39		
DMS	40		
DMP	41		
DMM	42		
Chief of Development	43		
DDA	44		
DDB	45		
AAED	46		
CCE	47		
DCEA	48		
DCED	49		

External

ADC HQ	50 & 50A
TC HQ	51
ATC HQ	52
AMC HQ	53
MAC HQ	54
No. 1 TAC HQ	55
No. 12 ADGp HQ	56
No. 14 Trg Gp HQ	57
No. 1 Air Div HQ	58

GUIDE TO THE RELEASE OF OFFICIAL INFORMATION

APPENDIX "A" TO
RCAF SECURITY POLICY
STATEMENT NO. 9 (DAI)
(REVISED) - MID CANADA
EARLY WARNING LINE

Serial (a)	Subject (b)	Objectionable (c)	Unobjectionable (d)
1	LOCATION	(i) Specific location of one or more elements of the line by reference to topographical features, geographic coordinates or other similar means	(i) General statements describing location of the line as extending from coast to coast within a few hundred miles north or south of the 55th parallel. (ii) Names of individual sites where the location is common knowledge.
2	EQUIPMENT	(i) Reference to specific use and location of communications equipment, detection and display equipment and all other equipment in production or installed in the line.	
3	CAPABILITIES AND COVERAGE		(i) General statements describing purpose of line as an aircraft early warning system, etc.
4	ESTABLISHMENT AND PERSONNEL	(i) Unit strength and the overall strength of the project. (ii) Trade breakdown of personnel employed in any element of the line.	
5	PHOTOGRAPHS	(i) Any photograph containing topographical or other features which would identify location of an element of the line.	(i) Official security screened photographs of any element of the line, or portion thereof, or photographs of any personality connected with the project at any stage.

7-29-23

CLASSIFICATION 5338-0
CHANGES TO
REPLACED BY SECRET UNCLASSIFIED

MINUTES OF A MEETING

with RPL

27 October 1954

BY AUTHORITY OF
SUR L'AUTORISATION DE
DATE 15 JUN 1992
SIGNATURE
APPOINTMENT UNIT
FONCTION UNITÉ

Purpose of Meeting

In the study of doppler systems Mk I and Mk II it had become evident that high levels of reference signal imposed severe limits on tower stability and upon antenna pattern equality and balance. At the same time evidence accumulated that because of propagation variations the direction of arrival of the reference signal could not be regarded as constant. While tower stability demands yield to mechanical solutions, the direction of arrival variation imposes fundamental limitation on the sharpness of the antenna patterns useable with any level of reference signal. It also turns out that the transmitter power required is immediately increased if the antenna patterns are broadened. It thus appeared that in cases where the reference signal is necessarily high, e.g. intervisible sites, it might not be possible to use a Doppler system based upon Mk I or Mk II techniques and equipment. Since siting is now proceeding it is imperative to ascertain whether in any section of the line Doppler cannot be installed. The distinction between sections is as follows:

In the region Henrietta Maria to Lesser Slave Lake the terrain is such that practical siting seldom yields a path for the Doppler reference signal less obstructed than the smooth earth case. There is evidence from past trials that in this case variable direction of arrival will cause false alarms only infrequently at periods of abnormally high reference signal.

In the area Cape Jones to Hopedale it is probably inevitable that many links will have virtually free space propagation if siting is done to enable the stations to "look both ways". Under these circumstances the "mean" reference signal will exceed the "peak" signal of the obstructed path by a few db, so that the false alarm rate may become intolerable on these links.

It is therefore imperative to evaluate the magnitude of the direction of arrival variations at the earliest possible date. Until this magnitude is known it cannot be assumed that the present Mk I or Mk II doppler equipment is satisfactory for a line with intervisible sites. In the absence then of this information if an immediate decision had to be made there would be no alternative to a radar line in such cases. The site spacing of such a line would probably be entirely different from that of the doppler line. A decision to use radar would also involve redesign of the communications link in these sections.

A meeting was therefore called in order to discover whether further information was available since the meeting of Sep 15 when some of these problems were discussed in view of the effects of delay in the technical solution upon the proposed implementation schedule.

Proceedings of the Meeting

Present at the meeting were:-

RPL - Dr. Chapman
Dr. Hogarth
Dr. Culshaw
Dr. Hay
Dr. Langille
Dr. Heikilla

ATS - Dr. Warren
F/L Matthews
Mr. S. Tilden
Mr. A. Levin

Dr. Chapman stated that RPL had constituted a "Lone Wolf" Propagation Committee consisting of the RPL personnel mentioned above and had initiated the program given below.

"The evaluation of horizontal and vertical variation of direction of arrival for vertical and horizontal polarization." The time by which results would be available in a form permitting the decisions mentioned in the preamble is estimated as 6 months from this day. Mr. Levin stated that the absence of angle of arrival data would prevent present specification of a doppler system in hilly regions primarily in the eastern section. He stated however that the line Henrietta-Maria to Lesser Slave Lake in most cases was yielding profiles no less obstructed than smooth earth so that this region could be expected to be as satisfactory as the test links. It was noted that even these links gave occasional false alarms at times of abnormal propagation but this was considered tolerable since the paper record permitted their recognition. It was agreed to recommend that siting and map work be concentrated on the Henrietta-Maria - Slave Lake section pending solution of the eastern section problems and to place this recommendation before the other parties to examine further repercussions. Dr. Chapman stated that he felt that a technical solution could eventually be found for every link on a Doppler basis but it was agreed that this solution might involve modified antennae, more power in the transmitter, and modified filters. Such a solution would thus not be entirely in terms of the present equipment.

A. Levin
(A. Levin)
TS 2
(5626)

CLASSIFICATION / ~~REPLACEMENT~~ RPLS 5538-0
CHANGÉ À
REPLACÉ PAR ~~SECRET~~ *Unclassified*
BY AUTHORITY OF

Defence Research Telecommunications
Establishment,

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

DATE
APPOINTMENT
FONCTION

UNIT
UNITÉ

9th November, 1954.

Chairman,
Defence Research Board.

Attention: CB/A

Mid-Canada Line

Minutes of Meeting to Discuss Scintillations
27 October 1954

1. A copy of the minutes of the meeting held at R.P.L.
on the 27th October, 1954, attended by members of the SEG, is
enclosed for your information.

JHC:keh

Encl.

JHC
for Superintendent,
D.R.T.E. (RPL)

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

9th November, 1954.

Chairman,
Defence Research Board.

Attention: Tels (Mr. F. D. Green)

Minutes of Meeting No. 5
Technical Co-ordinating Group

1. Herewith Minutes of Meeting No. 5 held 1 November, 1954,
of the Technical Co-ordinating Group for your retention.

JHC:keb

Encl.

JHC
for Superintendent,
D.R.T.E. (RPL)

our copy

RPLS 5538-0

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

3rd November, 1954.

Mr. H. G. Weiss,
Massachusetts Institute of Technology,
Lincoln Laboratory,
P. O. Box 73,
Lexington 73, Mass.

Re: Low Noise Preamplifier for 500 Mc/s

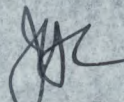
Dear Herb,

We have constructed some preamplifiers from the drawings you so kindly sent us earlier in the summer. We have made measurements of the noise figure and the gain. These are about 7 db and 18 db respectively.

From reports and conversations with you, we understood that a noise figure of about 5 db could be obtained with these units. The question arises as to whether the difference in our measurements is caused by a difference in definition. We have used a noise figure which includes the total noise power. It occurs to us that you might use a definition for noise figure which includes only the excess over thermal noise at the same impedance. This might account for part of the discrepancy.

We are using 416B tubes in the preamplifier with 250 volts on the plate and 22 ma. current. We have no information on the conditions of operation of the tubes for which a very good noise figure was obtained. We would appreciate your comments on these preamplifiers and the measurements we have made.

Yours very truly,



For Superintendent,
D.R.T.E. (RPL)

C

O

P

Y

CD Req. No. 456

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

2nd November, 1954.

Chairman,
Defence Research Board.

Attention: CD(A) and DGS

Steel Towers - "Lone Wolf" Project

1. The attached CD Requisition No. 456 covers the supply and installation of the two (2) rigid steel towers, - one for White Lake and the other for Shirley Bay.
2. The two towers are urgently required, as you know, to carry out further research on Antennaw structure and tower deflection prior to advising RCAF in connection with the Mid-Canada Line.
3. Our preliminary studies and tests show that tower twist must be controlled in order to eliminate false indications. This necessitated specifying a rigid steel tower which would not permit more than 0.1% twist in a wind of one hundred miles per hour.
4. The rigid specification for such a tower necessitated us investigating possible sources of supply in Canada and the U.S.A. This, we have done, without prejudice, and have found only one firm, namely Stainless Incorporated, North Wales, P.Q., can conform to the requirement. This firm is one of, if not, the largest manufacturers of Towers and Masts in the United States.
5. It is urged that DDP negotiate a contract with Canadian General Electric Co. Local 830 Landdowne Avenue, Dufferin St. Annex, Toronto, Ont. for the supply and installation of these twoers by Stainless Incorporated.
6. This project has the highest priority and every effort should be made to have the towers supplied and installed within ninety days.
7. You will note that this contract is charged to "Lone Wolf" funds provided by RCAF. This contract will practically deplete the funds provided by the RCAF for "Lone Wolf".

(sgd.) F. T. Davies

Superintendent,
D.R.T.E. (RFL)

7-29-22

our copy

CLASSIFICATION/DECLASSIFICATION
CHANGE TO RPLS 5528
REPLACÉE PAR S. 5528

BY AUTHORITY OF

Defence Research Telecommunications

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario,

DATE
SIGNATURE
APPOINTMENT
FONCTION

Establishment

UNIT
UNITÉ

2nd November, 1954.

Chairman,
Defence Research Board.

Attention: CD/A

Mid-Canada Line

Studies of propagation variations and tower rigidity

1. For your information, D.R.T.E. is placing maximum priority on the studies of scintillation or twinkling of the Fence reference signal. The program is geared to the time schedule of the SEG report as far as possible.
2. A short-term program to determine the order of magnitude of scintillations and their affects on Mark I and Mark II equipments is under way. A circuit 30 miles long between White Lake and Shirley Bay will be used for studies over an obstructed path. Another circuit between RPL and EL 15 miles long is now being used for high reference signal studies. The two laboratories will be used as firm antenna towers not subject to vibration, and a low (30') tower is now being installed at White Lake. It will be replaced later by a very sturdy 50' steel tower. This work is planned as a preparatory stage to a long term, properly organized study. The results will however be a guide to the RCAF in their siting of the Fence.
3. The long term program will take some time to crystallize, since new techniques of measurement have to be devised. It is felt however that an understanding of the basic processes at work is essential in order to support the RCAF Mid-Canada Line through the next few years.
4. Studies of the tower rigidity needed for Fence systems will be undertaken on a parallel detection line, using a 100' steel tower to be constructed at RPL. This work will be carried on in connection with the design and testing of split beam antennas at the new operations site at RPL.

JHC:keb

for Superintendent,
D.R.T.E. (RPL)

CLASSIFICATION/CLASSIFICATION
CHANGE TO
REPLACÉE PAR RPLS 5538-0
BY AUTHORITY OF Unclassified
SUR L'AUTORISATION DE

Defence Research Telecommunications

DATE Establishment,

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay, POINTMENT

Ottawa, Ontario. FUNCTION

UNIT 5 JUN 1992

29th October, 1954.

Chairman,
Defence Research Board.

Attention: CD/A

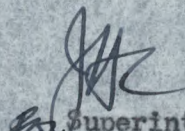
Mid-Canada Line

Participation of RCA Victor in Propagation Studies

1. Conversations with personnel of RCA Victor Company (Sutherland, Pinnell) show that the firm is in need of direction on the subject of their possible participation in propagation studies. Their indecision is resulting in a delay in returning to D.R.T.E. vehicles and other equipment on loan for the summer program with Dr. Whitehead, and delay in delivery of AN/FPS 503 antennas to D.R.T.E.

2. As it has been agreed that RCA will not be requested to make propagation studies, it would be appreciated if you would so inform the Company, and request that they proceed with the shipment of equipment to D.R.T.E.

JHC:keb


Superintendent,
D.R.T.E.

C O P Y

7.29-17
CA

DRBS 1-656-267-4 (Tels)
CLASS. CA. ON/CLASSIFICATION
CHANG. TO
REPLACÉE PAR SECRET
BY AUTHORITY OF Unclassified
SUPER-AUTHORISATION D.
Ottawa, Ontario,
DATE 24th September, 1954.5 JUN 1992
SIGNATURE
AF ON M. NI
FONCTION UNIT
UNITÉ

Chief of the Air Force,
Air Force Headquarters.

Attention: VCAS/CTel

McGill Fence Doppler Equipment
Modification Kits

An information copy of your letter S603-80/7 (CTel) dated 20 Sep 54 addressed to ATS/ATPC has been received. This letter outlines the action required to initiate a project with DRB, to undertake the manufacture of twelve modification kits for fitment to Mk I equipment.

We very much regret that DRB will not be able to undertake the development of modification kits as discussed between A/C M.M. Hendrick, CTel and Mr. J.C.W. Scott, A/Supt, DRTE. Our Superintendent now considers that this work would add a load which he cannot accept, as it would prejudice more fundamental work which is essential to ensure the success of the Mk II equipment.

The inability of DRB to undertake this work was communicated in your absence to G/C Fawcett and G/C Cameron on the 23rd September 54.

We will, however, assist you in any other way we can to discharge your obligations in this matter.

(signed) L.G. Eon

for Chairman,
Defence Research Board.

c.c. Supt DRTE
G/C Fawcett, SEG
Mr. A.B. Hunt, DDP

7-29-21

CLASSIFICATION / DESIGNATION
CHANGE TO
REPLACÉ PAR RPLS 5533

BY AUTHORITY OF
SUR L'AUTORISATION DE

Classified

Defence Research Telecommunications Establishment, 15 JUN 1992

DATE Establishment,

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay, APPOINTMENT

Ottawa, Ontario, ON

UNIT
UNITÉ

29th October, 1954.

VCAS,
RCAF Headquarters,
Ottawa.

Attention: ATS (G/C Poole)

Mid-Canada Line
Antennas for Mark II Fence

1. Further to a meeting held at RFL on 27th October, 1954, attended by Mr. Levin, Dr. Warren and others of the RCAF SEC, you are advised that a receiving antenna for the Mark II Fence can now be specified. It is suggested that the Management Contractor be authorized to proceed with prototype design and manufacture of the antenna along with the Mark II modification kits.
2. The antenna is a twin horn reflector type, similar to the one used by D.R.T.E. in flight tests to date. With redesign it is believed that this antenna will meet the minimum requirements for a two-way looking system. D.R.T.E. will make information necessary for the design available to the designated manufacturer. It is suggested that RCA Victor has the necessary design capability for this type of antenna.
3. The antenna specified above does not have the best characteristics that are possible of attainment. However, in view of the extreme urgency of the project, it is considered advisable that a design be proceeded with at once, as insurance against unforeseen delays in development of a superior antenna.

JHE:keb

for Superintendent,
D.R.T.E. (RFL)

c.c. DRB (Tels)

Mr. B. A. Walker, E. L.

CLASSIFICATION/D... RPLS 5538-0
CHANGE TO
REPLACÉE PAR *SECRET*

Defence Research Telecommunications
Establishment

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

SIGNATURE
APPOINTMENT
POSTION

29th October, 1954.

15 JUN 1954
[Signature]
UNIT
UNITÉ

Chairman,
Defence Research Board.

Attention: Tels

Minutes of Meeting No. 4
Technical Co-Ordinating Group

Enclosed herewith are two copies of the minutes of the
above meeting for your retention.

Encl.

for Superintendent,
D.R.T.E. (RPL)

7-29-20

CDA

CLASSIFICATION/DESIGNATION
CHANGE TO RPLS 5538-0
REPLACÉE PAR SECRET

Unclassified

BY AUTHORITY OF
Defence Research Telecommunications
Establishment,

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

FONCTION

UNIT
UNITÉ

15 JUN 1992

28th October, 1954.

Chairman,
Defence Research Board.

Attention: CD/A

Fence Research and Development

1. Statements have been made which indicate a dangerous misunderstanding of the status and projects of research and development on the DRB Fence. For example, it has been said that contradictory reports are being made by D.R.T.E.; that the Mark I system is unaffected by recent measurements of noise (twinkling) while the Mark II system is seriously effected. It has also been said that D.R.T.E. was depending on a waveguide antenna for Mark II which was proven impractical, and that we are 'shifting' our ground as problems arise.
2. As a matter of record Tels Report 101 was a preliminary study of the feasibility of a DRB Fence based on Mark I equipment in two lines spaced two miles apart to obtain sense. This report was prepared before any false alarm tests had been made. As a consequence of Spider Web trials, and Grey Goose false alarm tests made by D.R.T.E., design changes were made in a re-engineered RCA equipment in order to reduce the incidence of false alarms. This is the equipment designated Mark I. The complete RCA re-engineered Mark I equipment is not yet available for test.
3. However quantitative tests of noise and signal level made this summer by Dr. Whitehead under the direction of D.R.T.E. indicate a previously unforeseen level of noise on the reference signal, so far only observed below 10 c/s. When the reference signal is of the order of several hundred microvolts, it appears that the noise is increased. It must be emphasized that this phenomenon has not yet been sufficiently studied to determine its effects on an operational fence system.
4. This means that provided siting is not relaxed over the siting criteria detailed in Report Tels 102 and provided the sensitivity of the equipment below 10 cycles is sufficiently reduced, false alarms on Mark I equipment will not be serious. Nevertheless, under conditions of ducting, whatever the siting, there will be an undetermined but low probability of false alarming. Reducing this probability on some sites may mean reducing the probability of detection of slow aircraft flying certain tracks. All the above refers to Mark I equipment.
5. The Mark II system is being developed as a modification of Mark I. Essentially it adds a modification kit to Mark I and replaces the Mark I receiving antenna with a new split beam antenna. The important expected advantages are:

- (a) Provision of sense from one line of stations.
 - (b) Reduction of false alarm probability due to the fact that the sense signal is sensitive only to assymetric variations of amplitude.
 - (c) It was expected that (b) would allow a relaxation of siting criteria since a larger reference signal could be tolerated if its variations were symmetric.
 - (d) Owing to the fact that in general the sense signal is as sensitive an alarm as the Mark I narrow filter alarm it was hoped that the latter might be eliminated with the consequent reduction in complexity. It was always recognized however that it might prove desirable to retain the Mark I filter alarm and DRB and the RCAF have always been advised by D.R.T.E. on this basis.
6. D.R.T.E. has consistently advised the RCAF that Mark II research and development (begun only in 1954) was incomplete and that a statement on feasibility could not be made until October 1954. The RCAF as a result of urgent requests was further advised that Mark II feasibility was a reasonable gamble provided that installation was made in such a way that Mark I operation could be used if found necessary. However the RCAF - USAF systems engineering team decided to throw out a Mark I system of two lines on the basis of cost. This left them with the alternatives of Mark II or Radar or a combination.
7. It is not yet known whether twinkling as found on Mark I is accompanied by assymetric variations which would produce false alarms on the Mark II sense signal. It is likely that under some propagation conditions the Mark I alarm system will be more liable to false alarms and under other propagation conditions the Mark II sense signal will be more subject to false alarms. This is being studied at top priority.
8. The essential point is that Mark I₁ provides additional information over Mark I. This is sense from a single line of stations. This sense signal is as sensitive an alarm as the Mark I alarm, at least under normal conditions of propagation and over most of the range between stations. By retaining both Mark I alarm and Mark II sense alarm greater reliability will be attained against the possibility of false alarm. The optimum design of the split beam Mark II receiving antenna is affected by the degree of assymetric twinkling as yet unknown.
9. However it must be made clear that all flight tests to date have been made on a shaped dish designed by N.R.C. with double the horizontal aperture of the RCA Mark I antenna and having the same pattern in the vertical plane through the transmitter. D.R.T.E. has not placed reliance on a waveguide antenna although it was hoped this design would give improved coverage.
10. The increased aperture of the split beam antenna means that the sensitivity to Mark I alarm is not materially affected by the switching process. The Mark II sense alarm is however sufficiently unreliable near the transmitter that prudence demands a second line looking the opposite way be installed on the same sites. The RCAF was advised on this requirement and have taken it into account in their planning.

11. It should be clear from the above that the following problem before D.R.T.E. is one of optimum antenna design in the light of the new and as yet incompletely understood phenomena of twinkling. The optimum design depends on the measurement of assymetric and symmetric fluctuations of the reference signal.

12. The problem before DRB is to properly advise the RCAF. The RCAF has already been advised that at present it appears that siting for Mark II cannot be relaxed over the siting requirements for Mark I as detailed in Tels 102. The RCAF has also been advised that at present it appears that wo lines of Mark II equipment oppositely directed on the same sites will be necessary for complete detection and sense coverage. It may be desirable to again make these two points through official channels.

(sgd.) F. T. Davies

Superintendent,
D. R. T. E.

C O P Y

7-29-19

CDR

CLASSIFICATION / DESIGNATION RRLS 5538-0
CHANGE TO / REMPLACÉE PAR **Unclassified**

BY AUTHORITY OF 28th October, 1954
SUR L'AUTORISATION DE

DATE 14 SEP 1992

SIGNATURE

APPOINTMENT / FONCTION

UNIT / UNITÉ

DRBO DREO

Chairman,
DRB.

Atten: CD(A)

Mid-Canada Line

Mark II Split Beam Antenna

1. The decision of the RCAF to employ Mark II Fence on the Mid-Canada Line for obtaining sense-of-crossing information has necessitated the laying down of formal plans of R & D to support the RCAF. Without such support the probability of operational failure of an untested system such as the DRB Fence is high. This letter is written to acquaint DRB Headquarters of the steps being taken by D.R.T.E. to meet the need to develop suitable receiving antennas.
2. The urgency of the requirement for antenna development for the Mark II Fence is such that the normal period of research must be compressed in order to provide some antennas, not at first the best that can be designed, to meet different deadlines. Consequently, a number of different types of antenna will be developed simultaneously, grouped in three stages.
3. Stage 1 requires the existence of receiving antennas adequate for the engineering planning to be performed by the RCAF on the three station installation in the Ottawa Valley. Since coverage performance is not a subject of primary importance on this chain, a pair of Lone Wolf receiving antennas will be adequate, if an antenna from Stage 2 is not available in time.
4. Stage 2 involves the design and production of an antenna suitable for two-way-looking. Our present knowledge indicates that an improved twin-horn reflector antenna based on the present NRC design will meet the minimum requirement. Such an antenna should be designed and engineered, and logically could be built by RCA Victor under the terms of the contract with the Management Contractor. It is probably that a satisfactory Stage 2 antenna can be designed as a linear array (waveguide), depending upon research progress in Stage 3.
5. Stage 3 involves the design and production of an antenna suitable for one-way looking. This is the ultimate object of research and development to obtain sense from a single line, and means that unambiguous detection and sense is given over any link up to 35 miles long, for aircraft in any course. The specification for a Stage 3 antenna depends on the angle-of-arrival variations of the reference signal (twinkling), which are insufficiently understood at this time. Also it may be desirable ultimately to employ vertical polarization. For these reasons among others, a specification for a Stage 3 antenna cannot be written until further research has been done. Three different

2

configurations, a double waveguide, a single waveguide switched internally which might be used to feed a reflector, and a lens antenna, at this time, all seem worthy of investigation. It is hoped to interest NRC in the single switched waveguide, the other two will be handled by RPL.

6. The above represents a long-term antenna program designed to meet the needs of the RCAF according to the time schedule given in the SEG report. The Mark II Fence, as has been stated previously, is primarily a problem in antenna design. Hence a program of continued research on development to support the RCAF Mid-Canada Line through its construction phase and continuing during the operational phase is essential.

sgd. J. H. Chapman

for Superintendent,
D.R.T.E. (RPL)



DEPARTMENT OF NATIONAL DEFENCE
CANADA

Copy

DEFENCE RESEARCH BOARD

CLASSIFICATION / IN REPLY PLEASE QUOTE

CHANGE TO RPLS 5538-0

REPLACÉE PAR

BY AUTHORITY OF

SUR L'AUTORISATION

Establishment, 5 JUN 1992

Radio Physics Laboratory,

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

SIGNATURE

DEPARTMENT

FONCTION

UNIT

UNITÉ

25th October, 1954.

22nd

Chairman,
DRB.

Attention: CD/A

Installation - Mid Canada Line
Trials on the Mark II Doppler Fence

1. With reference to your DRBS 1-656-267-4, DRBS 1-656-267-4-1 (CD/A) dated 18th October, 1954, addressed to CAS, RCAF, the correctness of the last sentence in para 2 is questionable. The sentence reads "These (siting criteria) are not compatible with those of 2000 Mc/s radio-relay equipment."

2. It is the opinion of DRTE that 2000 Mc/s radio-relay equipment can be used, providing communications towers are sufficiently high. The RCAF SEG proposes 250 foot towers, and our computations confirm that, over smooth earth, such tower heights should be adequate. The report Tels 102 postulated the use of towers no higher than 100 feet, and under this restriction, 2000 Mc/s siting criteria are not compatible with those for the Fence.

Superintendent,
D.R.T.E. (RPL)

C O P Y

7-23-18
CDA

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Unclassified
SECRET
RPL 5538

BY AUTHORITY OF
Defence Research Telecommunications
Establishment, JUN 1992
Electronics Laboratory,
Montreal Road,
Ottawa, Ontario.
SIGNATURE
APPOINTMENT
FUNCTION
5th October, 1954.
UNIT
UNITÉ

Chairman,
Defence Research Board.

Attention: Mr. L. G. Eon, Tels

Spacing of Detection Stations in a Mark II Fence

At the Technical Co-ordinating Committee meeting on September 30th, it was reported by SEG that tentative siting from maps had been completed in the line Amery-Flinflon-Waterways and that siting parties would visit the area during the month beginning October 15th. Station spacing was reported to be 30 miles plus or minus 5 miles, the terrain being generally free from serious natural obstacles. In reply to a question, SEG agreed that this spacing compromised the use of 2000 mc radio relay equipment.

From more recent discussions, it appears possible that siting may in effect be planned to meet the requirements of 2000 mc relay and we believe this to mean a station spacing of the order of 20 miles. It should be made clear to SEG that the Mark II development recommendations of report Tels 102 on Siting Criteria and that in general these cannot be consistent with those for 2000 mc/s. Also where terrain profiles depart significantly from smooth earth (e.g. where they approximate to models D and E of Tels 102) we consider that radio siting of detection stations will be necessary.

B. A. Walker
for Superintendent
D.R.T.E.

7-29-16

CLASSIFICATION / DESIGNATION
CHANGE TO
REPLACÉE PAR
SECRET *classified*

BY AUTHORITY OF
SUR L'AUTORISATION DE

PROGRESS REPORT ON PERFORMANCE OF MARK II DOPPLER

15 JUN 1992

4th October, 1954.

DRTE/RPL

SIGNATURE
APPOINTMENT
FONCTION

UNIT
UNITÉ

1. THE MARK II DOPPLER EQUIPMENT

1.1 Equipment Design

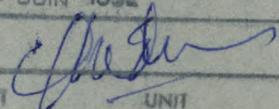
The Mk. II Doppler post-receiver detection equipment as it presently exists consists of 35 tubes inclusive of power supplies. Most of these tubes are used in the low frequency filters. It has been demonstrated that a suitable low frequency filter can be designed from cascade RC networks and it is expected that an equipment better than the one in use can be constructed with the use of 10 tubes (exclusive of power supply) and 8 crystals, or 14 tubes if vacuum tube type phase sensitive detectors are used. In all tests to date no use has been made of electronically regulated power supplies, although present indication would advise their use.

Although D.C. circuits are used in Mk. II more extensively than with Mk. I, the equipment has been shown to stay in satisfactory balance over long period of time. This is made possible by requiring high level signals in the D.C. stages.

The antennas used in the tests to date are the Spider Web antenna for transmitting, and a double-horn reflector antenna for receiving. The waveguide antenna has not been in operation.

1.2 Sensitivity on Target

The Mk. II sensitivity can be shown to compare very favourably with that of Mk. I (over the two-thirds of the link adjacent to the receiver). Sensitivity is here defined in terms of the smallest target detected for a given false alarm rate on both equipments (e.g., one alarm

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UNITÉ

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per month due to random receiver noise).

1.3 Susceptibility to False Alarms

With respect to unwanted disturbances on the reference signal, (AC hum, noise, etc.) it may be said generally that the response of either system is of the same order if the carrier modulation is either random and symmetrical with respect to the receiving antenna system, or discrete and unsymmetrical with respect to the receiving antenna system; but that Mk. II responds more readily than Mk. I to unsymmetrical random noise and less readily to symmetrical discrete noise^{*}. It was on the basis of the last fact that it was hoped that siting criteria would be somewhat relaxed when Mk. II was introduced (Mk. II would be less sensitive to hum modulation in the transmitter).

It is presently felt that propagation disturbances may provide the bulk of the unwanted carrier modulation, and until such disturbances have been analyzed as to their nature it will be impossible to compare the vulnerabilities of Mk. I and Mk. II to this kind of interference. However, in view of the fact that Mk. II requires a somewhat lower frequency cut-off than does Mk. I, and because of the disturbances experienced are greatly enhanced at very low frequencies, it appears reasonable to assume that siting for Mk. II is no less restrictive than for Mk. I.

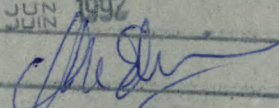
* Examples of random and symmetrical modulation would be white noise in the receiver; of discrete and unsymmetrical, an interfering carrier, to one side, and slightly displaced in frequency; of unsymmetrical and random, a noise source to one side; of symmetrical and discrete, hum on the carrier.

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2. FLIGHT TESTS

2.1 Program of Tests

Flight tests have been carried out on the Mk. II, 24 mile link from August 18th to the present. The tempo of these tests has been considerably slowed down by unfavourable weather, as indicated by the fact that 41 hours and 30 minutes of flying was achieved in the last 13 days of August, as compared to 22 for the whole month of September.

Liaison and navigation for all flights in the current tests has been carried out by F/L Matthews of the Systems Engineering Group.

No suitably tests have as yet been carried out on the 38 mile link.

The flight tests as herein discussed are based on the results obtained with the receiver based at R.P.L.

A total of 356 crossings of the link have been made to date, at heights of 500, 1000, 3000, 6000, and 9000 feet with a C-45 aircraft, and at heights of 20,000 to 28,000 feet with a North Star. Miscellaneous flights have been made with a T-33. Crossings were made at 90°, 45°, 30°, and 15° to the axis of the system, and at points 1, 3, 5, 12, 16, 19, 20, 21, 22 and 23 miles from the receiver. All of the 15° and 30° crossings were made at 1 and 3 mile points, where the system is most sensitive to Doppler frequency assymetry.

For approximately two-thirds of the crossings to date a ten c.p.s. doppler frequency cut-off has been used, and a 3 c.p.s. cut-off for the remainder. It became evident during the tests that something lower than a 10 c.p.s. cut-off was required in order to obtain full double sense indication for certain angular crossings with an aircraft as slow as a C-45.

2.2 Definition of Successful Crossing

The first criterion used for a successful crossing for Mk. II was that an unambiguous deflection of the Esterline-Angus recording meter be obtained on both sides of zero. A second more restrictive and rigorous criterion also used in the analysis was that the sense indication in both directions be of an amplitude exceeding by 20 db the average fluctuations due to receiver noise.

The misses noted below are all due to insufficient amplitude of indication of sense, on at least one side. In no case has a false indication of sense been observed. It is to be emphasized that a "miss" as defined here is not the same as a "miss" as used in report Tels 103, where the term indicated absence of alarm on crossing.

2.3 Coverage in Region not Adjacent to Transmitter

In the region within 16 miles of the receiver a total of 225 crossings were made. 16 of these crossings failed to produce a suitable indication of sense; all of these cases of failure were with the 10 c.p.s. cut-off. Most of the failures have been repeated with a L.F. cut-off at 3 c.p.s. - in each case with success. On the basis of the 20 db criteria, one miss was encountered using the 3 c.p.s. cut-off, a C-45 90° crossing at the midpoint at about 380 feet above ground level. This particular crossing was however successfully repeated on 3 occasions.

2.4 Coverage in Region Adjacent to Transmitter

A total of 131 crossings were made within 5 miles of the transmitter, 14 at 45° and the remainder at 90°. In all, 24 totally unsatisfactory results were obtained, 8 of which were with a cut-off of 3 c.p.s. For a few of the 24 misses, the crossing could have been behind the transmitter; 13 of them were within about $\frac{1}{2}$ mile of the transmitter. For others

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the receiving antenna could have been somewhat misaligned - such misalignment had been noted on a few occasions. It is interesting to note that for most types of crossings for which misses were recorded (except at 500 feet), successful records were obtained at some other time.

The greater portion of the crossings near the transmitter did not meet the 20 db criterion and hence would be classed as misses on that basis.

3. SUMMARY OF FUTURE PLANS

Future work is directed in three main directions. First is the continued improvement of the special Mk. II circuits. Second is the development and testing of improved designs of split beam antenna. The effort on these two will be continued until Mk. II equipment production has proceeded past the time further changes are possible.

The third item is a study of the modulation on the reference signal due to propagation factors. Due to its importance in siting, a very high priority will be placed on this work. An attempt will be made to obtain order-of-magnitude information for paths of different lengths, and degree of obstruction, as soon as possible. A long term program is being initiated, designed to provide the information which will be needed to solve the special problems bound to occur in the operational chain.

$$10 \log_{10} 2 = 3$$

116

3c/s

^{dB}
50 c/s

-189 dBw.

-177 dBw

40 μ V

-107 dBw

-107 dB

5 - 93 dBm

82 dBw

-70 dB

-107 dBw.

1c/s - modn - ~~62 dBw~~ - 50 c/s bw.

8+6

in bad 1-10 c/s av. add 14 dB noise

- 56 dBw,

FACTOR OF INFLUENCE

1. Diurnal Var_m of fading is greater as dist is increased beyond horizon.

C O P Y

7-79-15
CDA

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SUR L'AUTORISATION **EL 5070**

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Defence Research Telecommunications
Establishment
Electronics Laboratory,
Montreal Road,
Ottawa.
SIGNATURE
APPOINTMENT
FONCTION
UNIT
UNITE

15 JUN 1992

22nd September, 1954.

The Chairman,
Defence Research Board.

Attention: CD(A)

Detection Equipment for Mk II Fence

In order to clarify the DRTE position after the discussions this morning, the following notes are submitted:

1. The urgent objective is to produce a manufacturing prototype of a split beam detection equipment such as recommended in the RCAF systems Engineering Group's final proposal.
2. RCA is now manufacturing 12 engineered models of an equipment to an earlier design for two separate lines of stations. (The recent split beam proposal eliminates need for a double line to obtain sense). The first of these models is not yet delivered but it is probable that it will form a sound basis for an engineered prototype of the final equipment. The most significant change required is the addition of split beam facilities. There will probably be some minor changes necessary to meet the detailed requirements of the SEG.
3. It is DRTE's responsibility, under the general instructions to do R & D on the system, to design the components for converting the RCA equipment to split beam working. An experimental equipment has been built and has proved satisfactory in its preliminary tests. Sufficient information has been handed over to the Management Contractor and to RCA to enable technical specifications to be written (at the meetings August 4th at RCA and August 6th at RPL).
4. All the foregoing has referred to detection equipment excluding the antenna for the split beams. Two completely new types of split beam antenna have been designed and constructed but not yet tested. The evaluation of these antennas and some associated propagation studies, together with the construction of an experimental system, will absorb all the available effort of DRTE.
5. The recent verbal proposal that DRTE should accept responsibility for writing full specifications, or raising and supervising a contract for a production prototype detection equipment cannot be accepted. This could only be done at the expense of the more fundamental investigations.

7. Equipment to meet the DRTE commitment as defined above has been built out of our own resources without any necessity to go to industry. The suggestion that we should provide the RCAF with sufficient parts to modify the present RCA equipment for split beam working could only be met by going to industry. We consider that the RCAF requirement could be met incidentally as part of the contract to industry to make a manufacturing prototype detection equipment.

Signed B. A. Walker

Superintendent, DRTE

C O P Y

7-28-14

CLASSIFICATION
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Defence Research Telecommunications
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, SIGNATURE
Ottawa, Ontario, APPOINTMENT
FONCTION
Establishment 5 JUN 1992
UNIT
UNITÉ

Chairman,
Defence Research Board.

Attention: Tels

Mid-Canada Early Warning Line
Request for Experiments by DRB

1. With reference to DRBS 1-656-267-4 (Tels) and RCAF letter S590-11-80/7 (ATS) dated 17 August, action was taken in mid-July to initiate a study of the habits of large migratory birds in the vicinity of the proposed line. The study is continuing, and results will be reported to the RCAF as soon as they are available. The Operational Research Group of DRB is performing this work.
2. Consideration is also being given to the possibility of reducing the sensitivity of the Mk. II Fence to bird alarms by discrimination against birds on a frequency as well as amplitude basis. The problem is complicated by the necessity for retaining full sensitivity on aircraft flying in certain courses which produce very low frequency signals. However some relief is certain. The work is continuing.
3. With regard to the propagation of interfering signals, a search of the literature is being made to determine if an answer is available as to the more correct value of the path attenuation. As well, consideration is being given to setting up an experiment. A more detailed reply will be given in about a week's time.

(signed J. H. Chapman)

for Superintendent,
D.R.T.E. (RPL)

JHC:keb

C O P Y

7-24-13

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RPL 5538-0
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BY AUTHORITY OF
SUR L'AUTORISATION DE

DATE 14 SEP 1992

Defence Research Telecommunications
Establishment,
Radio Physics Laboratory
Defence Research Board, UNIT DRE
Shirley Bay,
Ottawa, Ontario.

10th September, 1954.

Chairman,
Defence Research Board.

Attention: CD/A

Final Report Mid-Canada Line,
by SEG RCAF

1. The report is inaccurate and incomplete in a number of points, most of them minor. The attached detailed list gives our comments. In fairness to the SEG, it should be pointed out that the short-comings of the report are, in the main, admitted and regretted. The task of reconciling the many divergent opinions posed an insurmountable problem.
2. In general, we agree with the conclusions of the report on the use of Mark II Doppler from Hopedale to Dawson Creek. The RCAF has been informed by D.R.T.E. of current progress in the development of this system, but the decision to recommend its use is a technical gamble made by the RCAF on their own initiative. The technical gamble is justified, in the opinion of D.R.T.E., providing provision is made for the use of an acceptable alternative, e.g., Mark I Doppler, in unlikely event of failure of the Mark II to prove out.
3. The portion of the line from Lake River to York Factory should be re-sited sufficiently far south to avoid the flocking region used by large migratory birds. The attached map provided by ORG illustrates the point. If this is done, the danger of false alarms from large flocks of birds will be largely eliminated except during the relatively short periods of migration. Further investigations on this problem are being made by ORG and D.R.T.E.
4. The proposals regarding all phases of communications except the radio portion of a relay system are too indefinite to be assessed properly. The rearward communications appear to consist of leased wire facilities with HF back-up. Even if sufficient capacity can be obtained by these means, which is doubtful, the reliability and redundancy are inadequate. LF should be used for back-up, with Janet considered for primary telegraph communications. The only way to obtain the required voice capacity is through radio relay from some of the SCS's. That insufficient thought seems to have been given to the whole problem is clear in Appendix GI, Tab "A", page 7, and Appendix "D", paras. 16 and 17.

5. The methods of multiplexing the radio relay and of providing for alarm, fault and doppler signal transmission along the line are also too vague to assess (Appendix "D", para 15). It is doubted if the SEG actually have a realizable proposal in this regard. D.R.T.E. is in the process of engineering a feasible, commercially available system.

JHC:keb

(signed) J. H. Chapman

Encl.

for Superintendent,
D.R.T.E. (RPL)

C O P Y

7-29-12
C A

CLASSIFICATION/DENONCIATION
DRBS 2-1-44-55 (Tels)

RECLASSÉE PAR

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SUR L'AUTORISATION DE

Ottawa, Ontario,

DATE 31 August, 1954. 15 JUN 1992

SIGNATURE

APPOINTMENT
FONCTION

UNIT
UNITÉ

Dr. J. R. Whitehead,
c/o RCA Victor Company, Ltd.,
1001 Lenoir Street,
MONTREAL, Que.

Project Lone Wolf
Contract P.69-10-81 (X-55)

Attached please find a spare copy of the DDP Contract with RCA for this project.

As you know, the purpose of this contract was to develop an equipment which would incorporate all the features known to be required as a result of previous research, development and trials with particular emphasis on the knowledge gained on Project Spider Web. Then to engineer prototype equipments suitable for quantity production with full manufacturing drawings. The equipment was to be specially developed to include the best known techniques to ensure the unequivocal detection of all aircraft, simplicity of operation, highest possible reliability of components, with particular emphasis on ease of maintenance.

As full time project officer and particularly because of your scientific and engineering knowledge, the instructions given to you were to translate the above mentioned requirements and any other which in your opinion were desirable, into an equipment specification which would enable the RCA Victor Company to provide the required equipment.

We have now reached a stage where it is essential to know how well the contractor has been able to meet your requirements. Whilst it is possibly too early to expect a full detailed manufacturing specification with drawings, it should be possible to obtain a detailed performance specification, which includes the tests required of the equipment now being manufactured, and soon after the first manufacturing prototype has been produced, the required manufacturing specifications and drawings.

We might point out that the draft copy of Military Specification Project Lone Wolf - 20843 dated 13 May 54 received in August 54 from RCA is hardly what we have in mind, and there is furthermore, no indication that you have concurred in it.

Would you please, therefore, provide us with the following:

- (a) A brief report on what has been accomplished in the light of the above, and where it has been impossible to meet all the requirements which you would have liked to see met, brief reasons why this was not possible.
This report should contain a paragraph indicating whether or not the firm is meeting the terms of its contract (10 copies).

- (b) An equipment specification which incorporates performance characteristics and the tests required. (10 copies).
- (c) At a suitable time, a final specification "quantities to be determined).

It is well within the terms of the contract to instruct the firm to provide you with the necessary facilities to meet the above. It is essential, however, that the documents sent bear your signed approval as Project Officer for DRB on this contract.

Your early action, in particular with (a) and (b) above is required.

Yours very truly,

(orig signed by G. S. Field)

for Chairman,
Defence Research Board.

c.c. Supt. DRTE
VCAS/CTel
DGS

COPY

DEPARTMENT OF DEFENCE PRODUCTION

Refer to File No. P.69-10-81

Ottawa, Ontario,
August 27, 1954.

S E C R E T

Defence Research Board,
Supply Branch,
Room 4110 "A" Building,
Ottawa, Ontario.

Attention: Col. Guy EON

Re: CD.DRB/X-55 "Lonewolf"

Subsequent to a letter from RCA Victor Company Ltd., dated August 12, 1954, copy attached, the following delivery forecast for the first six (6) equipments (four (4) for DRB two (2) to Western Electric) has been promised:

1 Equipment	-	September 27
1 equipment	-	October 2
1 equipment	-	October 11
2 equipments	-	October 16
1 and possibly 2 equipments	-	October 23

A schedule for the balance will be provided as soon as it becomes available.

With reference to paragraph two (2) of the attached letter your comments would be appreciated.

S.I. Comach,
Contracts Administrator,
Radar and Asdic Division,
Electronics Branch.

C O P Y

7-29-4
CDA

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DATE 15 JUN 1992
Defence Research Telecommunications
SIGNATURE Establishment
Radio Physics Laboratory, UNIT
Defence Research Board, UNIT
Shirley Bay,
Ottawa, Ontario.

30 August, 1954.

Chairman,
Defence Research Board.

Attention: CD/A

Project 572 (Corrode) Conclusions

1. Corrode was an American trial to test a radar system under arctic operating conditions.
2. Spiderweb doppler detectors were added at the request of the U.S. before DRB Spiderweb trials had been made.
3. Spiderweb DRB trials showed that this equipment gave positive detection. But the equipment was absolutely unsuitable for operational installation because of high false alarm rate.
4. Grey Goose false alarm tests proved that false ^aalarms were due to inadequate engineering of the equipment. This included poor screening, microphonic mountings and insufficiently regulated power supplies.
5. Corrode tests on the Spiderweb equipment were made without the stringent precautions and modifications of equipment found to be essential on Grey Goose to eliminate false alarms.
6. DRTE fully agrees with the Bell Telephone that unmodified Spider web equipment is unsuitable for Fence installation. This conclusion was established by Spiderweb and Grey Goose tests.
7. The Mark I Doppler Detector, now being completed at R.C.A., has been engineered to eliminate known faults in Spiderweb equipment. It has not yet been tested but there is every expectation that it will give positive alarm with freedom from false alarms, provided it is sited as required in report Tels 102. It will be available for test in October 1954.
8. The Mark II Doppler Detector (to which the Mark I may be converted with a simple modification kit) gives inherent freedom from false alarms with far less stringent siting and stability requirements than the Mark I. It, of course, also has other very important advantages, such as giving reliable sense from a single line.

9. The laboratory Mark II has been partially tested to give positive alarm and sense with elimination of false alarms to a height of 28,000 feet. Tests are continuing and cover to 60,000 feet is confidently expected. However tests are not yet complete.
10. Provided the management contractor takes immediate contract action a manufacturers prototype should be ready for test by March 1, 1955.
11. It was obvious from the beginning that Corrode would recommend the installation of radars. No adequate tests of suitable doppler detection equipment have been made on Corrode so that no reliance can be placed on their recommendations concerning doppler equipment.
12. In my view we should at present rely on Canadian tests and conclusions concerning doppler detection equipment. The U.S. has not developed equipment designed to operate in the 30 to 35 mile range. They are developing high power equipment to work at greater range. This equipment has not yet been properly tested and any conclusions reached concerning it can not be applied to the Canadian equipment.
13. As I undertook verbally, I will prepare, as quickly as possible, a DRTE factual report summarizing and comparing tests, results and conclusions on Spiderweb equipment, Mark I equipment, and Mark II equipment.
14. I have considerable doubt as to the usefulness of the proposed critique of Corrode conclusions so far as Doppler equipment is concerned. We already agree the equipment which they have tested is unsuitable for operational installation. This can be stated where required without an extensive report.
15. DRTE has responsibility for research and development on doppler detectors but not for the comparative assessment of a doppler E.W. Fence system versus a radar system. This has been explicitly undertaken by the RCAF.
16. I will detail on senior officer (Chapman) to obtain further facts and figures on Corrode doppler tests and to collaborate in writing the doppler section of a DRB report on Corrode.
17. The pressure of work does not justify more DRTE personnel on this project.

J. C. W. Scott
Depty Superintendent,
D. R. T. E.

JCWS/pr

Information copy sent to
Chairman, DRB.

C O P Y

CHANGE TO
RGM ACÉ. PAR

BY ALBERT D.

BLR D'ALLOCATION DE RPL 5538-0

DATE 15 JUIN 1952

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SECRET

Defence Research Telecommunications

Establishment,

Radio Physics Laboratory, UNIT

Defence Research Board,

Shirley Bay,

Ottawa, Ontario.

13th August, 1954

VCAS/ATS,
RCAF Headquarters,
Ottawa, Ontario.

Attention: Dr. F.G.R. Warren

Project Mongoose: Frequency Allocation

1. With reference to conversations (Warren - Chapman) on the a/m subject, the following references on RCAF files are pertinent. Letter S600-1 (Ctel), S600-45-4, dated 27 July, 1953, and reply from the Deputy Minister, Department of Transport, 11-17-12, dated 19th August, 1953.
2. Permission to use the frequency band 490-500 Mc/s for one year from 1 June, 1953, on the Spider Web chain was given in a letter from the JTC, reference JTC 15-5-2-1, dated 4th August, 1953, and previous correspondence. RPL is requesting FAWPSC to extend that permission for one year with the intention to apply for further extension if necessary. It is agreed that simultaneous use by the RCAF of this same band in the same area can be arranged without mutual interference.

signed J.H. Chapman

for Superintendent,
D.R.T.E. (RPL)

7-29-10
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M E M O R A N D U M

(1)
CD(A)

One of the important characteristics of any early warning line is its vulnerability to spoofing. This will be to some extent dependent upon the difference between the range at which an approaching aircraft can detect the transmission from the line and the range at which the aircraft is itself detected. I would strongly suggest that you put suitable receivers in some of the aircraft that are used in tests of the line and try to get some quantitative information on this point. It may well be decisive in selecting equipment for the lines that are to be constructed.

Chairman,
Defence Research Board.

18 Jun 54

(2) Tels

Dr. Whitehead might do this while testing the RCA equipt. this summer. Will you please take it up with DRTE.

(sgd) G.S.F.
18.6.54

C O P Y

7-29-10

CASS. CA. 011-11111
CHAIRMAN
MEM. A. E. PAR
BY AUTHORITY OF RPLS 5538-0
SUR L'ADJONCTION DE
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Defence Research Telecommunications
Establishment
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

August 4, 1954.

Chairman,
Defence Research Board.

Attention: Tels Section

Project Lone Wolf
Vulnerability to Spoofing

1. Reference is made to your DRBS 1-656-267-3 (Tels) dated July 7, 1954, concerning the vulnerability of the DRB radio detection equipment to spoofing.
2. Dr. Whitehead is measuring the actual field strength at various altitudes and positions in the field of the antennas as part of the present programme. Hence complete information on the possibility of spoofing will be available without any change in the programme. The field strength is being measured with a Stoddart Field Intensity Meter suitably installed in the aircraft.

(sgd.) R.L.

for Superintendent,
D.R.T.E. (RPL)

RL/pr

7-29-9
USA

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DATE 15 JUN 1992
Defence Research Telecommunications
SIGNATURE Establishment,
Radio Physics Laboratory,
APPOINTMENT Defence Research Board,
FONCTION Shirley Bay,
Ottawa, Ontario.

28th July, 1954

Chief of Air Staff,
R. C. A. F. H.Q.

Atten: G.M. Fawcett. G/C for CAS

Project Mongoose - Use of Vertical Polarization

The points raised by the Systems Engineering Group concerning the use of vertical polarization have merit.

The use of horizontal polarization is very largely a matter of convenience. The required antenna pattern in two dimensions is most easily obtained with horizontal polarization. This is true not only for the Mark I antenna but also for the Mark II antennas now being designed.

Serious consideration will be given to vertical polarization in future design of receiving and transmitting antennas.

(sgd.) J. C. W. Scott

J. C. W. Scott,
Deputy Superintendent,
D. R. T. E. (RPL)

7-29-8

CDA

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BY AUTHORITY of Section 5
SUR L'AUTORISATION DE
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Defence Research Telecommunications
DATE Establishment
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, PO BOX 1992
Ottawa, Ontario.
FONCTION UNIT

28th July, 1954.

Chairman,
Defence Research Board.

Attention: Tels

Project Lone Wolf - Testing of Mk. II Fence

1. With reference to your DRBS 1-656-267-4 (Tels dated 19th July, and RCAF letter S600-80/7 (CTel) dated 15th July, it is requested that aircraft for flight testing the Mark II Fence system be provided according to the following schedules:

- (a) A large four engined aircraft (Comet, North Star, etc.) to fly above 30,000 feet, required for two weeks, from the 15th August - maximum flying time 50 hours.
- (b) A medium-size aircraft (C-45, C-47) to fly up to 20,000 feet, required on call, during August and September - maximum flying time 150 hours.
- (c) A small aircraft (CF-100, F-86, T-33) to fly above 30,000 feet, required in September - flying time 25 hours.
- (d) Up to 5 medium-size aircraft (C-45, C-47) to fly as in (b) above, in formation crossings, required during September - flying time 20 hours.

2. One week's notice can be given of the requirements in (a), (c), and (d) above. Item (b) is a continuing requirement and the aircraft should be available on 24 hour notice.

3. Air-to-ground VHF radio control is essential on all flights. The Radio Physics Laboratory has been provided with RCAF VHF radio equipment, and crystals for 143.46 Mc/s (Rockcliffe Tower frequency) are on hand. If other frequencies are required for control of the aircraft, sufficient warning must be given for RPL to obtain the crystals.

4. Excellent co-operation has been given by RCAF stations Rockcliffe and Uplands in providing occasional aircraft for earlier tests. This formal request is necessary because of the amount of flying which will be required in the next few months.

(sgd.) J. H. C.

for Superintendent,
D.R.T.E. (RPL)

C O P Y

1729-7
CDA

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BY AUTHORITY OF
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S600-80/7 (A13)
DATE 5 JUN 1992
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FUNCTION
Ottawa, Ontario.

DEPARTMENT OF NATIONAL DEFENCE

July 20, 1954.

Chairman,
Defence Research Board.
"A" Building,
Ottawa, Ontario.

Attention: Mr. J. C. W. Scott DRTE/RPL

Project Mongoose - Use of Vertical Polarization

1. Engineering study of the application of the Doppler Detection equipment to Project Mongoose has suggested that there may be some advantage in the use of vertical polarization instead of horizontal polarization as has been used in all previous trials of the system. The main items in this are a possible improvement in scattering cross section for aircraft above the stations, and a decrease in ground reflectivity at glancing angles leading to better low cover and less severe ground reflection lobes.

2. It is requested that a study be made of the desirability of using vertical polarization for this purpose and that any experiments necessary be carried out.

(sgd.) G. M. Fawcett

G. M. Fawcett, G/C
for CAS

C O P Y

7-29-6

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BY AUTHORITY OF S5527-0
SLR L'AUTORISATION DE

DATE 15 JUN 1992

Defence Research Telecommunications
SIGNATURE Establishment,

Radio Physics Laboratory,
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

July 12, 1954.

ORG (Dr. Abrams)

Lone Wolf - Operational Research Projects

Two problems have arisen in connection with the Fence which are in the province of ORG rather than DRTE.

The first concerns false alarms from birds. Lincoln and Western Electric have experienced serious false alarms from birds. The former on their high power "Fluttar" from seagulls near Boston and the latter in the arctic on radar from ducks.

False alarms from flocks of ducks were found to make quite impossible the operation of automatic search and alarm equipment on radar. Ducks gave alarms constantly out to 70 miles.

In order to assess the importance of this problem it is requested that an investigation be made of the habits of birds in the vicinity of the 55th parallel.

The distribution of flocking birds with respect to time and geography is required.

The second problem is the calculation of the probability of more than one aircraft crossing 350 miles of fence within times of one or two minutes.

This question is raised because the DRTE Mark 2 Doppler Detection System proposes a single duplex voice channel to be used as a party line for each section.

This channel will pass Doppler information to section stations without time sharing. That is, there is a probability (however low) that two doppler signals will be transmitted simultaneously with some ambiguity. Alarm and sense, however, will be passed on the same channel, using time sharing, without ambiguity.

Please advise whether ORG can undertake these investigations which are considered urgent.

(sgd.) J. C. W. Scott

James C. W. Scott,
Deputy Superintendent,
D.R.T.E.

C O P Y

DEPARTMENT OF DEFENCE PRODUCTION

A of T

July 19, 1954

P.69-8-442/CD.DRB/L-357/FE 20264/
0507/713-16-30-610

2-P-4-507

To provide for a Research Project covering Bi-Static C. W. Doppler Detection Systems for a period commencing June 1, 1954, and ending March 31, 1955, as detailed in our letter dated May 5, 1954.

1. Salaries

- (a) Services of Professor J. R. Whitehead at the rates of \$500.00 per month commencing June 1, 1954 to September 30, 1954 and \$583.00 per month commencing October 1, 1954 to March 31, 1955.
- (b) All productive labour such as Research Scientists, Radio Technicians and Research Assistants at actual cost.
- (c) Casual labour and secretarial service directly chargeable to this contract at actual cost.
- (d) Overhead 30%.

2. Materials

An initial expenditure of \$600.00 followed by \$150.00 per month will be allowed for the purchase of components, raw materials and other supplies.

- 3. Laboratory equipment, power wiring and such equipment not relevant to normal operation of the University at actual cost.

EST. COST

FILE: DRB 70-0-49-85/L-357 (DGS) DMA. 970

\$19,663.00

4. Laboratory Apparatus

The following equipment chargeable to this contract at actual cost will become the property of the Defence Research Board upon completion of the contract:

- 1 only Standard Signal Generator 290-920 MC/S
(e.g. GR 1021AU).
 - 1 only Audio-frequency oscillator 1 C/S to 100 Kc/s
(e.g. S.E.I.).
 - 1 only Secondary standard multi-range meter
(e.g. Elec. Inst.).
 - 1 only Tube Tester.
 - 1 only Tape-recording apparatus with provision
for f.m.
5. Miscellaneous expenses such as stationery and supplies, telephone service, travelling expenses and other essential items relevant to this project at actual cost.

Progress payments will be made to you every three months which will cover all costs and expenses incurred for that period, throughout the course of the contract as defined at Price above, providing you submit your regular invoices in the manner indicated in the Invoicing Section of this Purchase Order, containing information as set out hereunder.

Progress Payment Invoices shall

- (a) Show the amount claimed or a Progress Payment in respect of the previous claims. Expenditures covering Materials, Equipment and Claims for Salary disbursements covering labour expended must be certified by your bursar.
- (b) Contain a certificate of the Project Officer that all work for which payment is claimed has been used exclusively for the purpose of this contract.

All Progress Payments shall be considered as interim payments only and adjustments shall be made from time to time during the performance of the contract or at the option of Her Majesty upon completion of the contract. Any overpayment to you under this contract resulting from such Progress Payments shall be promptly refunded by you to Her Majesty.

Notwithstanding the foregoing it is understood and agreed that the liability of Her Majesty to you under this contract shall in no event exceed \$19,663.00 without the written authority of the Department of Defence Production and you further agree that you will notify this Department well in advance should it appear that the above stated sum will be exceeded.

Inspection:

Subject to inspection and acceptance by Consignee at destination.

Note 1:

"Research will be under the general supervision of DRTE (Radio Physics Laboratory). Assistance in research and development will be given within the facilities provided under this contract to the overall project at the request of DRTE (Radio Physics Laboratory), or ~~at~~ the project officer appointed to this contract, subject to the approval of the University".

Note 2:

Since this contract is classified as "Confidential" your attention is directed to Section 14 of General Conditions (DDP-26) and to Instructions to Contractors, Tenderers, and others re Security and protection of documents and work. (Form DDP 255 and its Appendix).

Supplemental General Conditions DDP-36 (Research and Development), already in your possession, shall form part of this contract.

C O P Y

7-29-5
C-2

CLASSIFICATION
CHANGE TO
REPLACÉE PAR **Unclassified** ~~SECRET~~

BY AUTHORITY OF RPLS 5538-0
SUR L'AUTORISATION DE

Defence Research ¹⁰⁰² Telecommunications
Establishment,
Radio Physics Laboratory,
Defence Research Board,
Shirley Bay, UNIT
Ottawa, Ontario.

July 21st, 1954.

Chairman,
Defence Research Board.

Attention: Tels - Col. Eon

Mongoose - Doppler Information

1. Reference the question raised by the Chief of Telecommunications, RCAF, in S600-80/7 July, 1954, under this heading, the following views are presented.
2. The lowest 100 cycles provides all the information available in present methods of recording dopplers. The lowest 50 cycles will provide over 95 percent of available information.
3. In view of the fact that doppler records are less sensitive than the alarm, in both Mark I and Mark II, doppler records cannot be completely relied on for additional information. Positive alarm and sense will be obtained on some targets without doppler records.
4. As already stated in our letter of this file and date on "Tests on the Mark II Doppler Detection Equipments" experiments to determine the feasibility of counting aircraft in close formation will be completed in September, 1954.
5. It can be said now that no serious degradation of the ability of the Mark I or Mark II systems to distinguish false alarms or to count aircraft will occur by passing only the lowest 50 cycles.

(sgd.) J. C. W. Scott

James C. W. Scott,
Depty Superintendent,
D.R.T.E. (RPL)

COPY

7-29-4

BY AUTHORITY OF ~~SECRET~~ Unclassified
SUR L'AUTORISATION DE

DATE 15 JUN 1954 5538-0

Defence Research Telecommunications
Establishment, UNIT
Radio Physics Laboratory, FONCTION
Defence Research Board,
Shirley Bay,
Ottawa, Ontario.

July 21st, 1954.

Chairman,
Defence Research Board.

Attention: Tels - Eon

Tests of Mark II Doppler Detection Equipment

1. Reference questions raised by the Chief of Telecommunications, RCAF in S600-80/7, 15 July, 1954, the following answers are given:
2. The Mark II equipment using switched receiving antennas will be fully tested by September, 1954, for low and high coverage.
3. It can be said now that, provided antennas being designed are satisfactory, low and high cover will be equal to that of the Mark I system for both detection and sense.
4. The Mark II system in no way effects the ability to record doppler signals. Consequently the ability to distinguish between one, two or more aircraft by the analysis of recorded dopplers is exactly as good or bad in the Mark I and Mark II systems.
5. However in both systems doppler records are less sensitive than detection and sense alarms.
6. Comprehensive tests of the ability to count aircraft from doppler records will be completed September, 1954.
7. Tests of Mark II coverage and count are being given the highest priority in DRTE and it is a reasonable gamble that favourable answers to the questions raised will be obtained by September.
8. As discussed between A/C Hendrick, the Systems Engineering Group, the Management Contractor and Mr. Scott, it is proposed that DRTE raise a contract immediately to develop a production prototype of the Mark II detection equipment.
9. Technical terms of reference of this proposed contact are now being drawn up in DRTE and will be presented to the RCAF for approval as soon as possible.

(sgd) J. C. W. Scott

James C. W. Scott
Deputy Superintendent,
D.R.T.E. (RFL)

C O P Y

7-29-3
CDA

REMITTANCE PAR Unclassified
BY AUTHORITY OF SECRET
SUR L'AUTORISATION DE Unclassified
No. S600-80/7 (CTel)
DATE 15 JUN 1992
SIGNATURE [Signature]
APPOINTMENT FONCTION UNIT
Ottawa, Ontario.

DEPARTMENT OF NATIONAL DEFENCE

R.C.A.F.

15 July, 1954

Chairman,
Defence Research Board,
National Defence Headquarters,
Ottawa, Ontario.

Trials on the Mark II Doppler Fence

1. Recent conversations with Mr. Scott of RPL and DRTE suggest that the probability of obtaining sense from a single line of the McGill Fence is very high and likely to be experimentally verified by September of this year. Present indications are that the system works well at reasonably low altitudes between the receiver and a point sixteen miles away from the receiver. Beyond this to the transmitter there appears to be a region of doubt.
2. It is also uncertain whether this Mark II equipment is able to distinguish between one aircraft and more than one in close formation passing through the line at one time.
3. You will appreciate the extreme attractiveness of a single line in giving sense, because it will reduce the cost of the project by a very large margin through reducing the number of sites by almost fifty per cent. It also has certain very attractive features in eliminating false alarms and perhaps thereby reducing the communication requirements along the line.
4. For these reasons the Systems Engineering Group is very anxious to have some of the present uncertainties removed as quickly as possible, in order that they may recommend the Mark II system as a possible alternative to the Mark I and to the Corrode for early installation.
5. It would be appreciated, therefore, if you could take all necessary action to expedite the answers on the following questions:
 - (a) Can the Mark II be made to give high cover and complete cover in both detection and sense with a distance of thirty-five miles between stations.
 - (b) Can the Mark II distinguish between one and more than one aircraft in close formation crossing the line.
6. Should the answers to these queries appear favourable, and the technical gamble be agreed between us to be a reasonable one, then it will be necessary for us to consider immediate ways and means of going into a production prototype of this equipment with all possible speed.

(sgd) H.

(M. M. Hendrick) A/C
for CAS

7-28-2

SECRET

~~Unclassified~~

R.C.A.F.

15 July, 1954.

Mongoose - Doppler Information

- (a) To eliminate false alarms, and
- (b) To distinguish between one and more than one aircraft in close formation.

3. May we have your opinion, please, on whether sufficient information to distinguish false alarms and to count aircraft (one or more than one) can be obtained from the bottom 50 cycles of the doppler spectrum.

(M.M. Hendrick) A/C
for CAS

C O P Y

BELL TELEPHONE LABORATORIES

463 West Street, New York 14,

N. Y.

8 July, 1954

Mr. J. C. W. Scott
Defence Research Telecommunications
Establishment
Radio Physics Laboratory
Shirley Bay, Ottawa, Ontario.

Dear Jim:

Again while I am busy pointing out to you that we have not received one of your reports it is being delivered to my desk. Our copies of TELS 103 arrived yesterday. Obviously, I have not had an opportunity to examine it yet.

We would all like to thank you and your associates for the very interesting discussions which we had with you yesterday. As soon as a firm date is set for our next Interim Conference here, we will write directly to you and send the agenda through channels.

Yours very truly,

(sgd) George W. Wheeler

George W. Wheeler
Special Systems Engineer

2421-GWW-MD

Chapman,

Please see that Bell are sent copies of our reports pertaining to the Fence.

J. C. W. Scott

C O P Y

CLASSIFICATION
CHANGING TO
REMARKS

7-2-1
Unclassified

CONFIDENTIAL

RPL 5527-0

BY A MEMBER OF
SUBJ. AREA OR CA. ON DE

Defence Research Telecommunications
Establishment,

DATE 15 JUN 1992

Radio Physics Laboratory,

SIGNATURE

Defence Research Board,

APPOINTMENT

UNIT

Shirley Bay,

FONCTION

UNITÉ

Ottawa, Ontario.

April 9, 1954

Chairman,
DRB.

Attn: DGS through CD/A

Contract with McGill University (Dr. J. R. Whitehead)

It is requested that a contract be raised with McGill University to take effect from June 1, 1954.

The terms of the contract should include the following provisions.

- (1) The subject of research under this contract will be "Bi-static C.W. doppler detection systems" (McGill fence).
- (2) Research will be under the general supervision of D.R.T.E. Assistance in research and development of C.W. doppler detection systems will be given, where facilities provided under this contract are available, at the request of D.R.T.E. or the project officer appointed to this contract, subject to the approval of the University.
- (3) Items of research to be undertaken under this contract include:

(a) Simple Ultra High Frequency (UHF) Receiver

Research to demonstrate the feasibility of developing a simple receiver, possibly of the super regenerative type, with the following characteristics, is required.

Frequency - 500 megacycles
Noise Figure - less than 12 decibels
Band Width - 50 kilocycles
Overall Gain - 120 decibels
Stability - 3 db
- frequency 10 kc/s

(b) Research on Methods of Detection

A study of methods of detection in noise of weak audio-frequency signals of sinusoidal form and continuous changing frequency is required. The study should include methods of detection of one or more signals, of instantaneous measurement of frequency, and of rate-of-change of frequency for various signal-to-noise ratios.

(c) Measurement of Forward Scatter Cross-Sections of Aircraft at 500 mc/s.

A study of the variations of forward scatter cross-sections, of aircraft to be specified, is required. Detailed theoretical calculations are not required but it is assumed that the study will involve measurements made on actual aircraft. Special facilities not available at the University but necessary for the measurements may be made available by the Defence Research Board.

- (4) The contract will bear security classification Confidential. Items 3a and 3b are Unclassified providing no reference is made to applications of the research. Items 3c and research under (2) will be confidential.

It is understood that financial arrangements have already been tentatively agreed to between Dr. Whitehead and CE/A. Professor Foster is in agreement with these financial arrangements as is DRTE.

(sgd) J. C. W. Scott

for Superintendent,
D.R.T.E. (RPL)



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Ottawa, ON K1A 0N4

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Ottawa, ON K1A 0N4

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