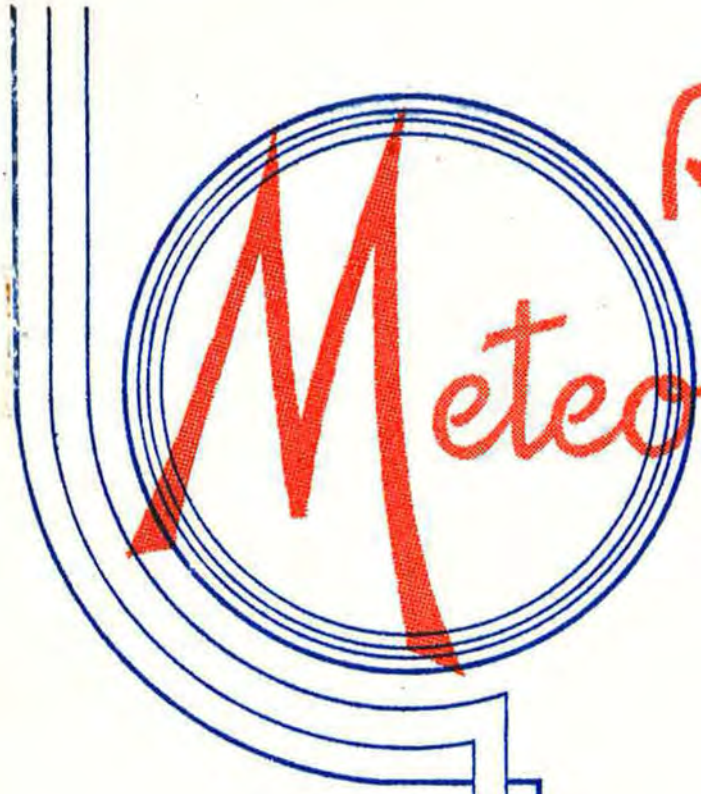

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POST-WAR METEOROLOGY IN CANADA

by

P. D. McTaggart-Cowan

CANADIAN BRANCH

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POST-WAR METEOROLOGY IN CANADA

by

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Assistant Controller, Forecast Services
Meteorological Division, Department of Transport
Canada

Presented as the presidential address
for the Royal Meteorological Society,
Canadian Branch at the Annual Meeting
held in Toronto on January 25, 1951.

PRESIDENTIAL ADDRESS

FOR

ROYAL METEOROLOGICAL SOCIETY

CANADIAN BRANCH

January 25, 1951

POST-WAR METEOROLOGY IN CANADA

1. INTRODUCTION.

1.1. This address tonight is my closing official action as President of the Canadian Branch of the Royal Meteorological Society. Under the terms of the excellently conceived By-Laws, the term of the President is limited to a maximum of two years, which I will have completed upon the closing of this meeting. It is with great pleasure and confidence that I hand over the reins of office to Mr. F. W. Benum: but before doing so, it is my privilege to deliver the annual Presidential address.

1.2. With the many ramifications of active meteorological research in the world today, my problem in the choice of a suitable subject was not from a dearth of material, but from a superabundance.

1.3. On sampling opinion, I found a strong desire on the part of a great number interested in meteorology in Canada to have a brief review of the progress the Service has made over the past five years.

1.4. Accordingly, with the kind permission of the Controller of the Meteorological Division, I am happy to present to you a brief report on post-war Meteorology in Canada.

2. POST-WAR RE-ORGANIZATION.

2.1. The end of the war in Europe saw the Canadian Weather Service emerging somewhat breathless from the Herculean effort required in connection with the British Commonwealth Air Training Plan, and the various other war activities based on Canadian soil. To meet wartime demands, we had to train and employ 400 Meteorologists over and above our pre-war staff. As an alternative measure of our wartime expansion, our civil budget increased by approximately 400%, notwithstanding the fact that a major portion of wartime meteorological expenditure was borne out of National Defence

funds, and, consequently, did not appear in our civil appropriation. Figuratively, we were like the small boy who having suddenly shot up six inches in stature is somewhat discomfited to find himself still in short pants extending only half-way down his thighs. Nevertheless, we were a healthy youth, and all we required was reclothing and redirection of effort.

2.2. The immediate task facing the Controller was to swing from a high-gear intensive military service into an equally high-gear and intensive civilian service. As you will all remember, the end of the war saw a very rapid industrial and economic development in Canada; and with the removal of the wartime security restrictions great demands for meteorological service arose in practically every form of activity carried out in Canada.

2.3. To meet this demand a complete re-organization of our headquarters, and the redistribution of field staff was required.

2.4. During these same past five years, there has been, as you all know, a firm and repeated objective on the part of the Government to reduce Government expenditures. Because of this the re-organization has not been accomplished as quickly as one might have expected, on the basis of wartime experience. Each element of our over-all plan has been studied with great care and diligence by the higher echelons of Government. Even though this has slowed the re-organization below that expected, it has, nevertheless, served to crystalize our thinking on each step; and, in turn, has given an increasing number of higher Government officials a real insight into the requirements of meteorology in Canada, and has thus built the Division on a foundation of fact and understanding.

2.5. Other factors affecting the re-organization were the large number of resignations of professional staff recruited for wartime service returning to their initially chosen professions, together with those who, as a result of the scarcity of scientific personnel in North America, were able to command a higher salary in other scientific fields. There were in the fiscal year 1945 - 46, alone, 117 resignations of the professional staff. This figure will give you some idea of the importance of this particular factor.

2.6. Notwithstanding these limitations very substantial progress has been made over the past five years. We make no pretence that finality has been reached in any of the various facets of meteorological endeavour; but we have travelled a considerable distance along the road leading to the goal which the Controller has so clearly in focus.

2.7. Our present headquarters organization is based on the principle of a horizontal echeloning immediately below the Controller level, rather than on the vertical echeloning used in many other Services. In this

respect our organization, therefore, bears closer resemblance to the pattern established by the United States Weather Bureau than the pattern established by the British Meteorological Office.

2.8. The echelon immediately below the Controller is broken down into the fundamental Services comprising the Meteorological Division. (See Fig. 1). These are:

.1. Forecast Services.

.2. Administrative Services.

.3. Research and Training Services.

.4. Instrument Services.

.5. Basic Weather Services.

.6. Climatology.

2.9. The head of each Service reports directly to the Controller, and is responsibile for internal co-ordination. In the Controller's absence the head of Forecast Services assumes certain additional duties of over-all co-ordination. The main criticism that can be levelled at this structure is the number of people reporting direct to the Controller. There are, however, substantial compensating advantages. It is not claimed that this is the ultimate in headquarters organization, it is merely presented to you as representing our state of evolution.

2.10. In order to give you a brief over-all picture of the progress over the past five years, I will now sketch briefly the development in each of the six Services listed above.

3. FORECAST SERVICES.

3.1. Internally, Forecast Services is broken down into Public Weather, Continental Aviation, Trans-Ocean Aviation, Forecast Office Operation and Management, and Communications.

3.2. Communications.

3.2.1. On the communications side we have expanded from a teletype system comprising some 7,500 miles of leased circuits, with 216 drops and 13 main relay stations, in 1945, to a total of 21,500 leased miles of circuit, with over 350 connecting teleprinters, and have, at the same time, been able to achieve a great increase in economy and efficiency

by reducing the number of relay stations from 13 to 8. Progress has also been made in communications equipment. All obsolescent model 14 teletype machines have been eliminated from our system, and considerable progress has been made in the next step of replacing the model 15 with the fully automatic model 19 equipment. At the same time progress has been made in the utilization of automatic reperforators and transmitters at the main relay stations, thus ensuring a high loading factor on all circuits. The communications field is by no means static at the present time. Hundred-word-per-minute teletype equipment is not far away. Multiple reperforators and transmitter-distributors are under test to determine their application to meteorological communication problem; and more specialized equipment, such as remote circuit collectors and automatic selecting devices, are in the test and development stage.

3.2.2. Facsimile was introduced into the Canadian weather picture during the closing years of World War II for the transmission of trans-Atlantic weather maps from the Main Office at Dorval to Rockcliffe. Since the close of the war this equipment has been operationally employed in the Maritimes to provide from the Aviation Forecast Office at RCAF Station Greenwood a meteorological service to meet the requirements of the Search and Rescue Co-ordination Centre of the RCAF in Halifax. We have not, in Canada, experienced the rapid growth in the application of facsimile as has been evidenced in the United States. We have been kept fully informed of this development, but geographic and economic factors have dictated a more cautious approach to the problem here at home. However, an additional facsimile network is now in operation to meet military requirements, and within the next few months we will be opening up a radio facsimile circuit from Goose to Frobisher on a combined operationally and experimental basis, from which we hope to be able to formulate plans on the correct place for facsimile in the Canadian Weather Service. The choice of the Goose - Frobisher test bed was two fold: one, to meet immediate operational requirements, and, the other to develop, in connection with the Telecommunications Division, techniques to ensure adequate reliability over the worst possible route, i.e. through the zone of maximum auroral activity.

3.3. Public Weather.

3.3.1. In the Public Weather field a complete re-organization has taken place. We emerged from the war with the basic public forecasting for the whole of Canada done at only two centres - the Toronto headquarters and Vancouver.

3.3.2. In order to meet the tremendous demand which followed the elimination of wartime security, decentralization was essential. Dominion Public Weather Offices were established at Vancouver, Edmonton, Winnipeg, Malton, Dorval, Halifax and Gander; and commencing with the issue

in March of 1946 of the first edition of the Manual of Procedures and Practices for Public Weather Service a complete decentralization of the duties and responsibilities to these offices was accomplished.

3.3.3. Simultaneously, a Verification Centre was established at headquarters in order to maintain a running check on the accuracy of the product, as well as to provide helpful advice and guidance to the field on composition, terminology, style, and related subjects.

3.3.4. MANPUB, as the procedural manual is called, has now gone through two editions, and a valuable collection of books, pamphlets and educational material has been assembled by the Public Weather Section in order to assist the teaching of meteorology in our secondary schools and universities, to assist the general public in the better utilization of our services, and to increase interest and knowledge of meteorology, generally.

3.3.5. The decentralized Public Weather Service has met with continuing favourable public opinion and support, which has led to a steadily increasing work load, so that at the present time, basic regional forecasts are issued at six-hourly intervals at the rate of 480 per day. Educational and informative material is being distributed at the rate of some 60,000 items per year, mainly to educational institutions. A wide variety of special services are provided to forestry, shippers of perishable foodstuffs, transportation organizations, railways, highway departments, fruit growers, and many others.

3.3.6. A new step forward was taken this last month with the opening of the City Weather Office in Hamilton, which acts as a satellite to the Dominion Public Weather Office at Malton. This latest endeavour has been crowned with immediate success; with very modest publicity on its establishment the telephone in the Hamilton City Weather Office started ringing within five minutes of its initial connection to the exchange, and the staff of one Meteorologist and one Meteorological Assistant Grade I is already being worked off their feet with very vital demands for weather service. As an example, the fruit growers in the area have got together and set up a special committee to work directly with the official-in-charge of the Hamilton City Weather Office for the provision of more detailed weather information for their area. The co-operation appears certain to have great economic benefits.

3.3.7. A similar office will shortly be opened in Victoria, B. C., and, if the use now being made of the Hamilton City Weather Office is a criterion, others following this pattern will be demanded and justified by the administrations of other cities across Canada. The service to Maritime interests on both coasts, and on the Great Lakes, has similarly undergone decentralization, expansion, and substantial modification.

3.3.8. The Public Weather field is far from static. I feel that we are only scratching the surface of the need for weather information and advice by Canadian industry and all walks of economic endeavour. Our practices and procedures in this field must not be allowed to ossify for many years to come if we are to remain receptive and retain the ability to meet real and justifiable demands for additional service.

3.4. Continental Aviation.

3.4.1. On the Continental Aviation side of the picture, a similar metamorphosis has taken place. Pre-war practice, developed out of a healthy respect for the flying weather in Canada, consisted of a tailor-made forecast for each flight. With the expansion of commercial aviation in Canada, which, using TCA as an index, rose from 3,000,000 miles in 1939 to 10,000,000 miles in 1945, and an anticipated 16,000,000 miles in 1950, the continuation of this individual type of service became an economic impossibility. Accordingly, by March, 1947, a new set of procedures were issued which established the provision of twelve-hour regional and terminal forecasts each six hours, covering all parts of Canada frequently travelled by aircraft. These forecasts form the basis for flight-planning, and the individual attention to flights is confined to briefings. This, then has transferred the aviation emphasis from individual flight forecasting to a thorough briefing procedure and technique. This change was brought about with the full co-operation of all scheduled air carriers in Canada, and, as a result of their wholehearted support, which extended to all echelons, has been an outstanding success. But, as in the field of Public Weather, a static condition has not been reached. A second edition of MANAIR, as the procedural manual is called, will be going to press soon, involving several improvements but no basic change in philosophy. The extension of procedures to meet the advent of commercial jet transport is already in the planning stage, and activity in this field will continue at a lively rate for many years to come.

3.5. Observing Procedures.

3.5.1. Coupled with our domestic aviation re-organization, came, as a necessary corollary, the tightening and improvement of our observing procedures and practices. This was accomplished also in the fiscal year 1946 - 47, with the issue of the Manual of Standard Procedures and Practices for Weather Observing and Reporting, which became effective on the 1st of January, 1947. This manual has justified the time and effort required for its preparation, and has done a great deal to raise the standard of weather observing and reporting in Canada. Because of the demand for copies, internationally as well as nationally, the first edition ran to two printings. As a result of International Meteorological Organization recommendations a second edition was required, and became effective on the

1st of January, 1949; and, at the present time, arising out of further co-ordination with the United States Weather Bureau, improved techniques of aviation, and the increasing amount of high altitude flying, a third edition is just now going to press and will likely be introduced this coming summer.

3.6. Trans-Oceanic Aviation.

3.6.1. In the field of Trans-Ocean Aviation Weather Service, many milestones have been erected along the path of international progress. Spearheaded by excellent conference and committee work under the aegis of ICAO and IMO, internationally agreed procedures and practices exist for the provision of weather service to trans-ocean aviation throughout the world, encompass sufficient flexibility to permit of regional modifications to adequately cope with local conditions. These procedures follow quite closely the pattern established by the United Kingdom, the United States and Canada in the provision of meteorological service to the wartime aircraft delivered to the fighting fronts.

3.7. Ocean Weather Ships.

3.7.1. Perhaps the greatest single advance in the international field has, however, been the establishment of the network of Ocean Weather Ships. These are now operating on both the North Atlantic and North Pacific oceans. The cost of these ships, which is admittedly high, has, I believe, served to cloud in the minds of many the tremendous value of the service they perform. Without them, trans-ocean air travel would not have prospered in the post-war period; and it can be demonstrated that all that make their living on or by the sea are capitalizing directly on the improved weather service made possible by the establishment of these Ocean Weather Ships. Canada has played its full role in this program, initially in 1946 when HMCS WOODSTOCK spent some time in the Pacific west of Vancouver Island, and later in the fiscal year 1947 - 48, when under international agreement, HMCS ST. STEPHEN took up routine duty at Ocean Weather Station Baker in the North Atlantic. This continued as an international commitment discharged by Canada until this year, when, as a result of bilateral agreement with the United States, they assumed our obligations in the Atlantic and we discharged our responsibilities in both Atlantic and Pacific oceans by operating a full station, (i.e. three ships,) at Station Peter, in the Pacific, some nine hundred miles west of Vancouver. With the transfer from the Atlantic to the Pacific the operating responsibility changed from the Royal Canadian Navy to our own Department of Transport.

3.8. Forecast Office Management.

3.8.1. In the field of Forecast Office Operations and Management substantial progress can be reported. Operationally designed furniture

to increase the effectiveness of the staff has been planned and is being brought into service as quickly as economic conditions permit. These include metal forecast desks, rotating file stands for the display of weather reports and forecast materials, and briefing consoles for the maintenance of static meteorological briefing displays. The Ozalid process of reproduction has been modified to permit the full colour reproduction of plotted and analyzed weather charts. This advance has received world-wide recognition, and is paying substantial dividends in all main offices at the present time. The organizational manual put out in draft form in 1947 is still largely in that form, as a result of the great pressure of other activities on this section. However, a general pattern for the organization of main district weather offices has emerged, and is shown in figure 2. As rapidly as possible, all establishments are being brought into line with this model.

3.8. Operational improvements include: (1) the utilization of the prognostic charts as the basis for all forecasting; (2) upper air analysis of the standard levels to at least 500 mb. twice daily; (3) the introduction of differential analysis as a basic technique at an increasing number of offices; and (4) higher level analysis at 400, 300 and 200 mb. levels as pilot projects at key offices to meet the growing requirements for high level flights.

3.8.3. But I have, perhaps, already spent too long on Forecast Services. Perhaps, I may be excused for this error on the basis that one's first love is always the strongest, but I do not wish it to be interpreted in any way as indicating that the evolution in Forecast Services has been any more vital, nor the need for continuing critical study and revision by those in charge is anymore urgent in the other fundamental services comprising the Meteorological Division.

4. ADMINISTRATIVE SERVICES.

4.1. The unsung heroes of the past five years are certainly those comprising Administrative Services of Meteorological Division headquarters. Responsible as they are for the preparation of estimates and the over-all budgetary control, accounts, stores, personnel records, library, duplicating and printing, the success of the operation of the Division as a whole is directly dependent on the success with which Administrative Services discharge their responsibilities. The fact that our annual appropriations have doubled in the past five years will give you some idea of the magnitude of the task they have been called upon to perform. The stores branch, for example, now dispatch as many as 6,000 shipments per year. The personnel section not only had to cope with the great turnover in staff immediately following the end of World War II, but the steady growth of the Service from the low point of 900 at the peak post-war resignation period to its total now over 1,500.

4.2. Through prodigious effort they were able to provide for the International Meteorological Organization's Technical Commission meetings in Toronto in 1947.

4.3. The redeployment of staff, and redirection of effort, required the replanning and printing of practically all forms and charts. As a result the printing section was called upon to expand from a production of some two million impressions in 1945 to nearly four million in 1948. Since then, with the stabilization of some of the basic forms, it has been possible to farm them out to commercial printers, and press time has become available for much needed developmental work and the catching up on wartime climatological reports, printing of which was delayed by war shortage.

5. RESEARCH AND TRAINING SERVICES.

5.1. Research and Training Services have had a very rocky path to follow. In the past five years the inescapable demand in the field, and the large number of professional resignations in the immediate post-war period, required the assignment of every available meteorologist to field duty. As a result the Research and Training Section has remained grossly understaffed. This field expansion has now levelled off and it is hoped that staff will be able to be swung in increasing numbers into this vital Section. Because of the impossibility of recruiting university graduates no new training was undertaken during 1945 - 46, although two very successful refresher courses were held. In the fiscal year 1946 - 47, an advanced course to qualify twelve Meteorologists Grade I for higher rating was successfully completed, but, again, no M.A. recruits were obtained. Recruiting conditions in fiscal year 1947 - 48 permitted of a small introductory course of six men, but, again, no M.A. students could be recruited. At this point, there were 104 vacancies on the professional establishment of the Division.

5.2. In the last two years, largely as a result of additional financial inducements, recruiting has picked up and we are now approaching a fairly healthy level of recruitment, in both the Meteorologist Grade I and higher levels.

5.3. Notwithstanding the small establishment of the Research and Training Section, a great number of scientific papers have been produced. The development of the frontal contour chart, and related techniques, has reflected great credit on the Section.

5.4. A change of head, wherein the inevitable hiatus retarded development to some extent in this Service is now behind us and very healthy progress is now in evidence. The Central Analysis Office, which is a section of Research and Training Services is slowly taking shape.

6. INSTRUMENT SERVICES.

6.1. Instrument Services have similarly had to contend with changes in top bracket, but notwithstanding they have measured up to the post-war requirements for the tremendous back-log of maintenance and repair, shortage of materials and supplies, and the continued demand for more and better instruments.

6.2. The radiosonde section has gone through some lean years where, as a result of international commitments, and production and design problems, a serious shortage of instruments developed. However, it is quite clear that we are now around the bend. For a comparison, in fiscal year 1948 - 49, 4,289 Canadian instruments were produced, while in fiscal 1949 - 50, over 6,500 were assembled and calibrated, in addition to nearly 4,000 United States instrument calibrations, and over 1,200 of the Canadian type assembled and shipped to South Africa.

6.3. Notable improvements in the instrument field include a pyroheliometer, a motor driven psychrometer, a rugged and effective dial display wind equipment, and considerable minor improvements on the other basic instruments. The flexibility and potential of Instrument Services to meet demands and shortages is, I think, interestingly and amply demonstrated by the fact that when clocks of sufficient ruggedness and with design features to withstand Arctic conditions could not be obtained commercially for our barographs, thermographs, anemographs, etc., the Instrument Shop turned to and produced an outstanding clock. They have also worked on the basis of unit replacement, to cut down field servicing, and were so successful in this that a misguided observer at an outlying station, feeling it incumbent upon him to effect minor repairs to a clock, reported that it took him over a week to get inside the cover.

7. BASIC WEATHER SERVICES.

7.1. One of the most interesting developments of the past five years has taken place in the Basic Weather Services. By this, I refer to the establishment of the Joint Arctic Weather Stations - Eureka and Resolute in fiscal year 1947 - 48, Isachsen and Mould Bay in fiscal year 1948 - 49, and Alert this past year.

7.2. I feel that these stations rank in importance with the Ocean Weather Ship program. They will increase in value for many years as our experience of Arctic weather systems and their controlling influence on the weather in the whole northern hemisphere is improved.

7.3. The number of stations reporting weather in Canada has followed a similar curve to our personnel recruitment. In the closing year of the war there was a total of 1,200 stations of all categories - sixty-nine of them operated by the United States Forces as a wartime measure. There was a steady decrease in the number of stations through until 1948, when the number fell to 949. The number is now on the increase, and has climbed back to 1,117. By next year we will have taken over from the United States all wartime stations operated by them, with the exception of those located at their own military bases in Newfoundland. Synoptic stations have increased from a low of 205 in 1947, to 243. The number of hourly weather stations has fluctuated widely, and has finally stabilized at 120. Radiosonde stations have increased from a low of 17 in 1947, to 29 at the present time. Pilot balloon stations have increased from a low of 51 in 1947, to a high of 65 at the present time.

7.4. These past five years have also seen a steady improvement in the basic training of weather observers. A system of barrier examinations has been inaugurated that will ensure the maintenance of a high standard.

7.5. Improvements have been made in the field inspection of basic weather stations, but the staff changes and promotions have momentarily decimated the ranks of this section and a great amount of work remains to be done in this field.

8. CLIMATOLOGY.

8.1. Climatological Services have had a rocky road, similar to Training and Research, to travel in the past five years. A crippling shortage of professional staff has characterized the fortunes of this section. The fact that in spite of these adversities they have been able to maintain the publication of the Monthly Weather Map, the Monthly Record of Meteorological Observations, the General Summaries of Hourly Weather Observations in Canada, as well as produce the climatic summaries for selected stations in Canada, and the weekly weather summaries for agriculture, is ample evidence of the tremendous effort expended by the few assigned to Climatological duties.

8.2. The road ahead does, however, look brighter. The backlog of wartime records requiring summarization is gradually being whittled down. A microfilming section is rapidly reducing the multitude of original records to microfilm. A start has been made on the introduction of punched card methods in the handling of the statistical data, and, with the levelling off of field requirements, additional professional staff is becoming available.

9. SERVICES TO NATIONAL DEFENCE.

9.1. I have made no mention so far of the service provided to National Defence. As you know, Canada, in variance with United States practice, operates on the single weather service principle, wherein the Meteorological Division is responsible for providing the weather service to meet Navy, Army and Air Force requirements. The development of the service to meet changing National Defence requirements has been facilitated by the establishment of liaison officers with National Defence Headquarters and with the principal R.C.A.F. Commands.

9.2. Service to the R.C.A.F. has been built directly on the experience of World War 2, with a continual development to capitalize on the advantages of facsimile and to meet the requirements of high altitude operations, etc.

9.3. The Royal Canadian Navy, embarking on the operation of a Carrier, required the establishment of a weather office aboard in fiscal year 1946 - 47. This venture has proved singularly successful. In addition, meteorological service equivalent to that supplied to the R.C.A.F. is provided at their Naval Air Station, Dartmouth.

9.4. Various Army exercises have resulted in increasing demands for specialized weather service for that branch of National Defence; and the Defence Research Board has considerable need for services, particularly from the Research and Climatological Sections.

9.5. A short term commissioning scheme to better meet the needs of National Defence was thoroughly investigated during the past five years and had to be shelved for economic and man-power reasons. Recently, however, this scheme has been the subject of renewed study and interest.

10. SERVICE TO OTHER DEPARTMENTS AND AGENCIES.

10.1. Direct service has been provided for a number of other Government Departments and agencies. To choose a few illustrative examples, the Climatological Section is intimately linked with the National Research Council's Building Research with the assignment of a Climatologist to work on the Meteorological problems connected with the building code, and buildings in general. The Research Section has staff seconded for full time duty on such vital projects as Shoran, while Forecast Services work in close collaboration with the Forestry, Marine and other divisions of the government in the provision of specialized services.

11. CONCLUSION.

11.1. In a rapid stock taking such as this certain inescapable questions arise. Primarily one is faced with the question "Are we, as a result of this rapid evolution and expansion, operating efficiently?" Figure 3, I think, provides the answer. This shows, plotted against the routine work output of Forecast Services, (for want of a more general index), the annual cost of the Weather Services. It will be noted that in spite of the expansion, and rising prices generally, the unit cost per forecast has decreased substantially over the past five years. Another index is provided by the number of main centres. While decentralization has been carried out to a very considerable extent, we have been able to reduce the number of main forecast centres from 17 to 12, with a corresponding increase in the second echelon from 6 to 15. Coupled with this, and as I mentioned earlier in this address, the teletype system relay stations have similarly been reduced from 13 to 8. Thus, I feel that while additional operational economies and efficiencies will no doubt be found, as the science of Meteorology and the application of facsimile are improved, nevertheless, with the tools at our disposal at the moment, the Service is on a sound and efficient basis.

11.2. Another fundamental question is undoubtedly, "Have we got a balanced service?" To answer this, figure 4 shows the distribution of expenditure in the Forecast Offices for 1950. Figure 5 shows the distribution of cost of upper air observing stations, and figures 6 and 7 show the distribution of costs on the teletype network.

11.3. Perhaps the most critical analysis can be obtained from the financial pie shown as figure 8. An examination of this figure, I think, provides convincing evidence that we are an unbalanced service at the present time. There is far too little being spent on Climatology and Research and Training. The circumstances which have forced us into this position are understandable and, I believe, were inescapable. The course we have travelled has been clearly in mind over the past five years, but now that staff requirements in the field are levelling off no relaxation in effort to achieve a healthy increase in Climatology and Research must be permitted. An organization with the unbalance of ours cannot survive long as a healthy professional service. Forecast Services, to continue as an efficient body, must receive a continuous supply of new blood in the form of research papers, summaries, refresher courses, instructional and indoctrinational tours, by the Research Section; and must be continually supplied with operational climatological data by Climatological Services for the improvement of services to the general public; not to mention the direct public service which can and should be provided to a greater extent by both Sections.

11.4. As a result of this unbalance, produced by the shortage of staff, certain vital fields have not yet been touched. Such things as flood forecasting remain matters of immediate concern; while the need for basic and continuing research in weather applied to forestry and agriculture should not be longer delayed.

11.5. In spite of thie unbalance we have, however, retained administrative equilibrium. As can be seen in the figure, our headquarters administrative costs are 6.1%, which is a healthy and substantial amount below the maximum permissible 10% normally used as a ready index by government and business.

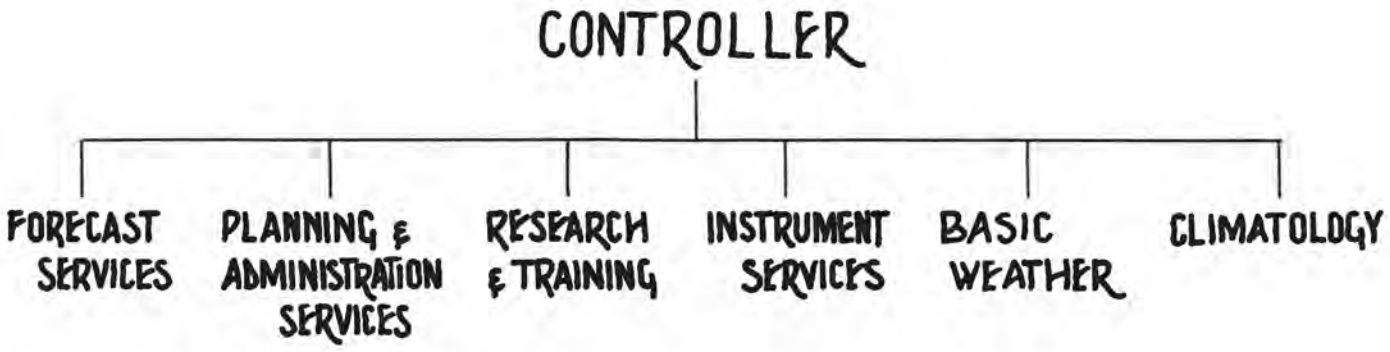

CONTROLLER
FORECAST SERVICES
PLANNING & ADMINISTRATION SERVICES
RESEARCH & TRAINING
INSTRUMENT SERVICES
BASIC WEATHER
CLIMATOLOGY

Fig. 1

DORVAL

MAIN METEOROLOGICAL OFFICE
DOMINION PUBLIC WEATHER OFFICE

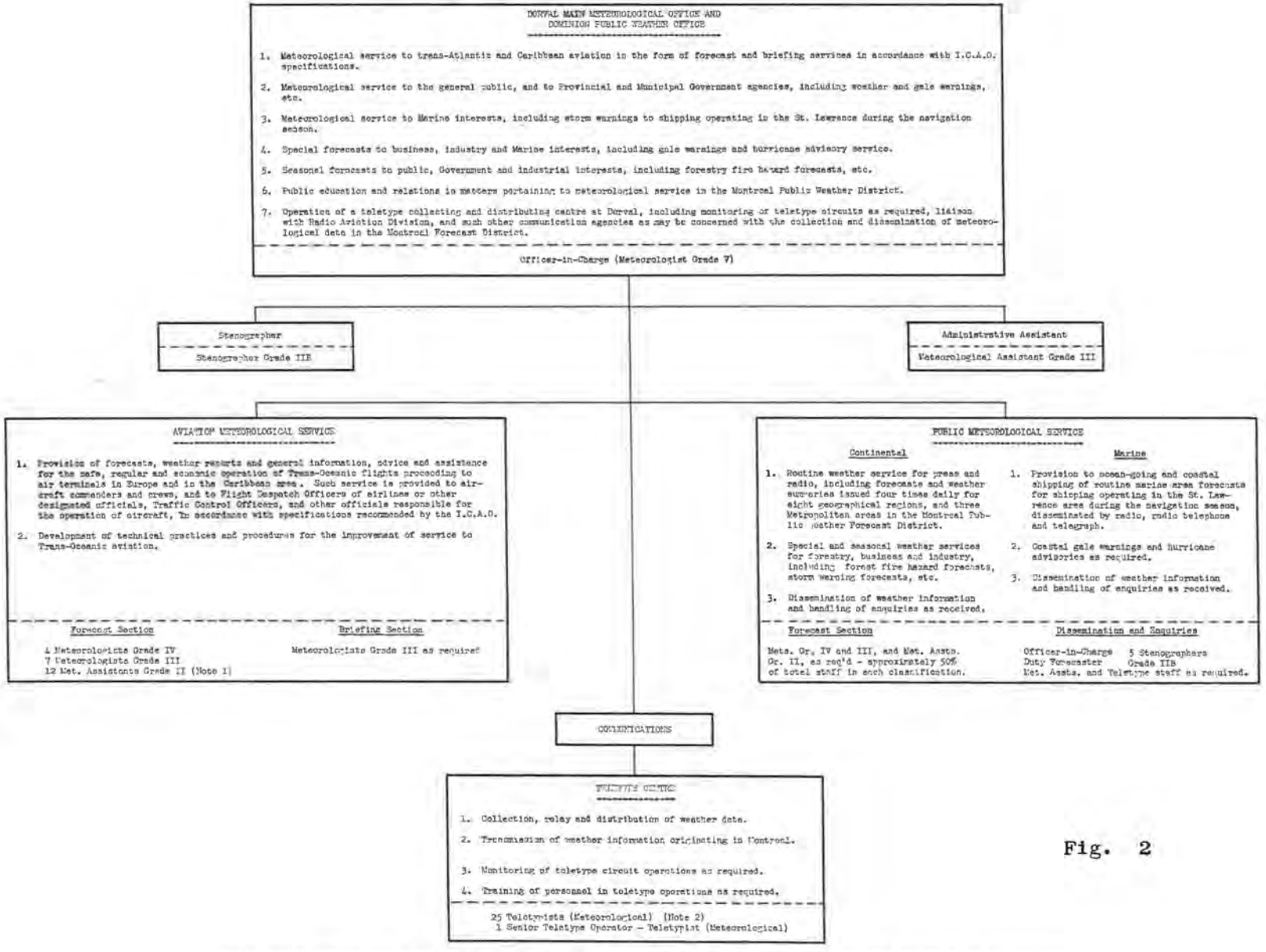
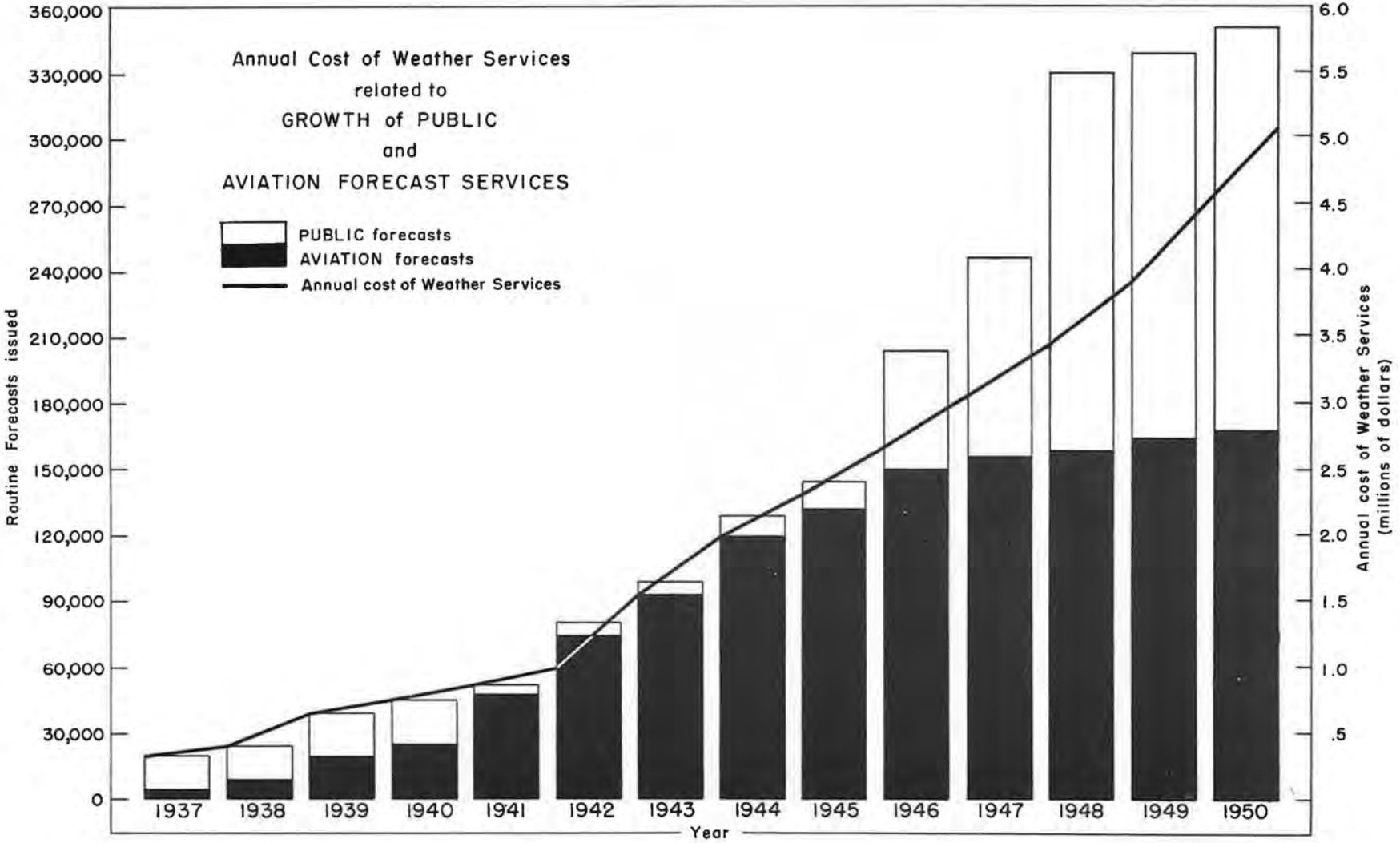


Fig. 2

Note 1: One Met. Assistant Grade II Pool Training position is carried on the Dorval M.M.O. establishment for use in either the Dorval M.M.O. or the Dorval D.A.T.O.

Note 2: Includes Teletypist staff for Dorval (UL) Office, and two Teletypist (Met.) Pool Training positions for recruitment of new staff when required.


Annual Cost of Weather Services
related to
GROWTH of PUBLIC
and
AVIATION FORECAST SERVICES
PUBLIC forecasts
AVIATION forecasts
Annual cost of Weather Services
Routine Forecasts issued
Annual cost of Weather Services
(millions of dollars)
Year
360,000
330,000
300,000
270,000
240,000
210,000
180,000
150,000
120,000
90,000
60,000
30,000
0
6.0
5.5
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1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950

Fig. 3

METEOROLOGICAL DIVISION - DEPARTMENT OF TRANSPORT - CANADA

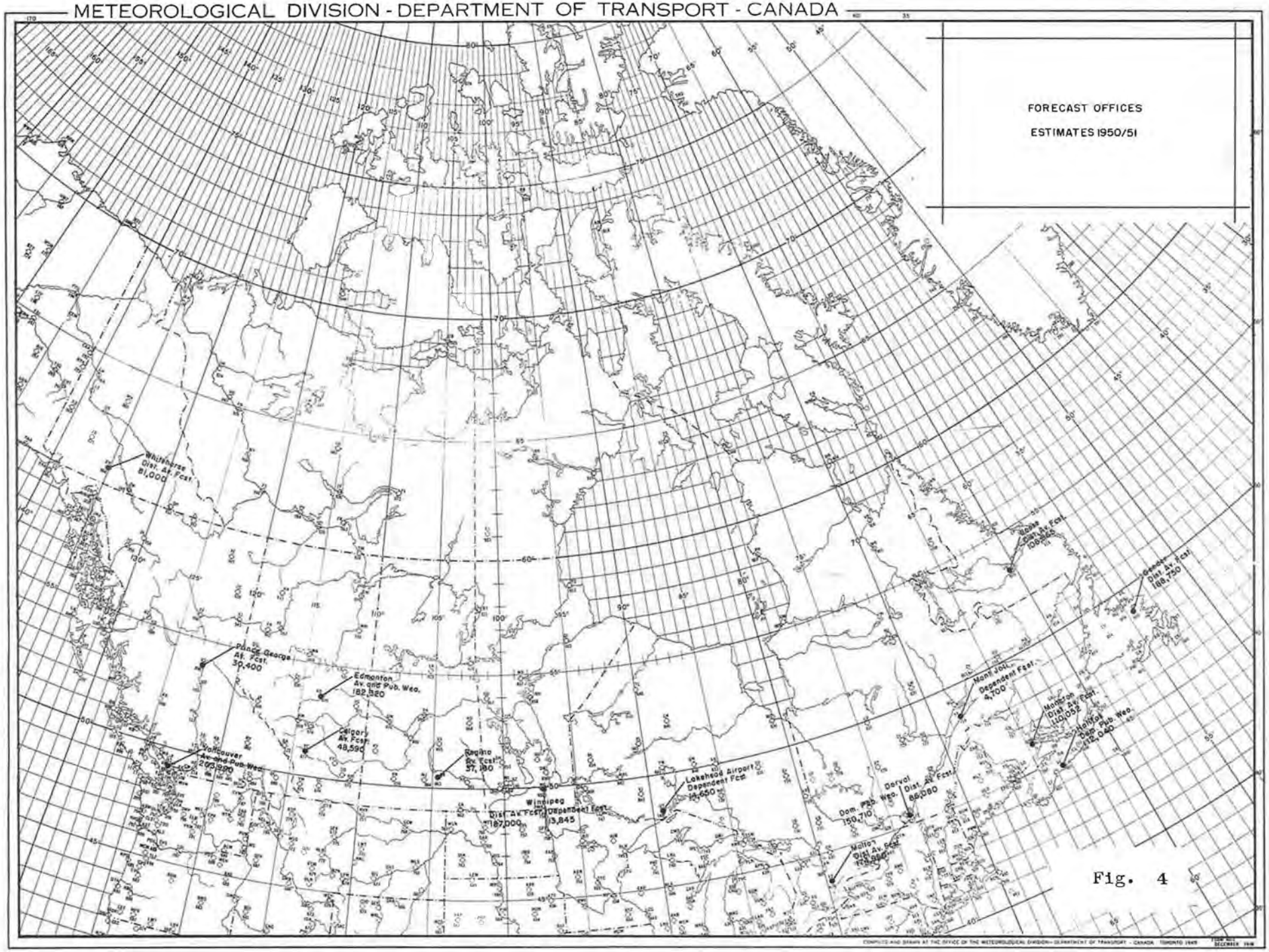


Fig. 4

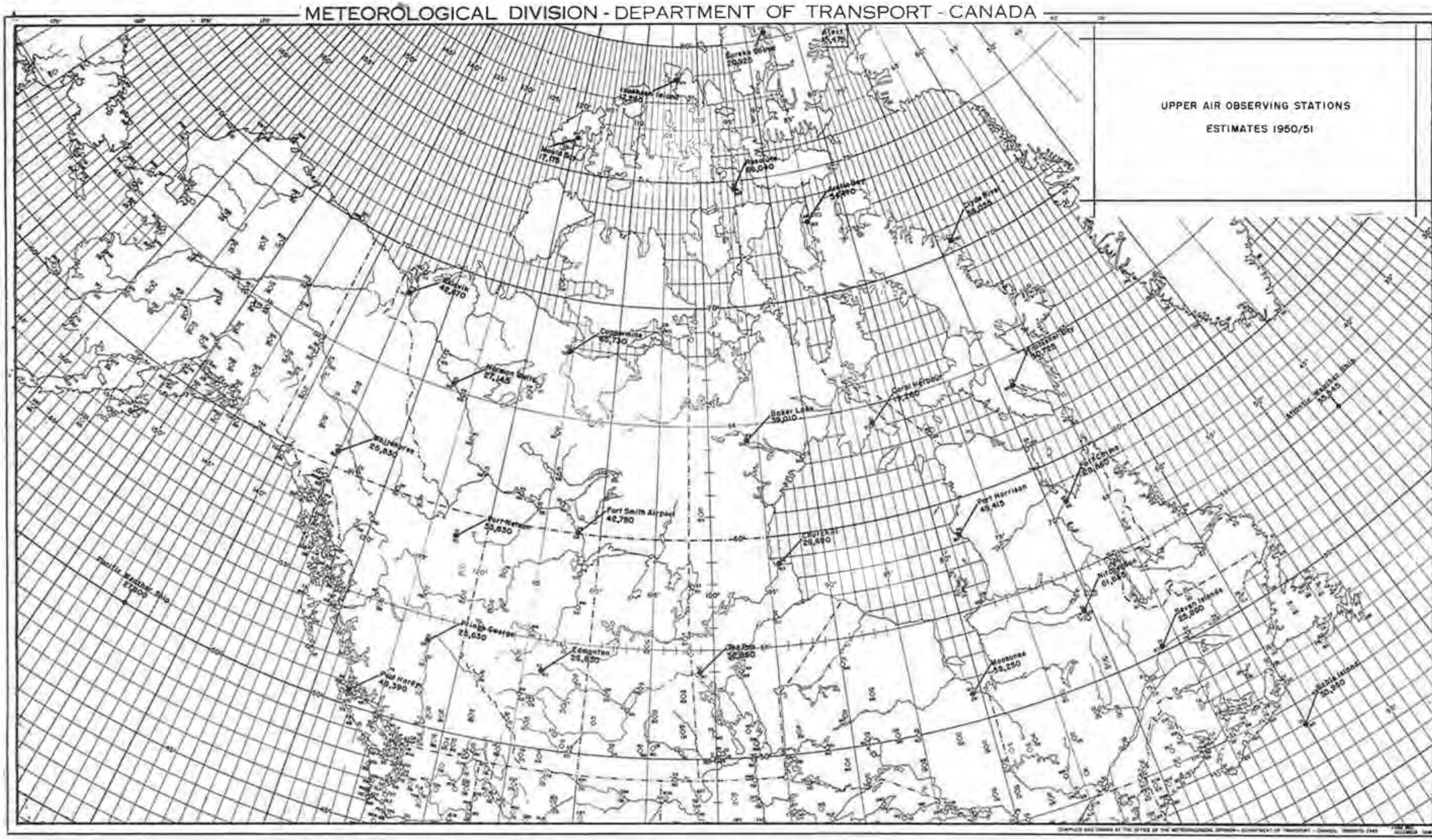

METEOROLOGICAL DIVISION - DEPARTMENT OF TRANSPORT - CANADA
UPPER AIR OBSERVING STATIONS
ESTIMATES 1950/51

Fig. 5

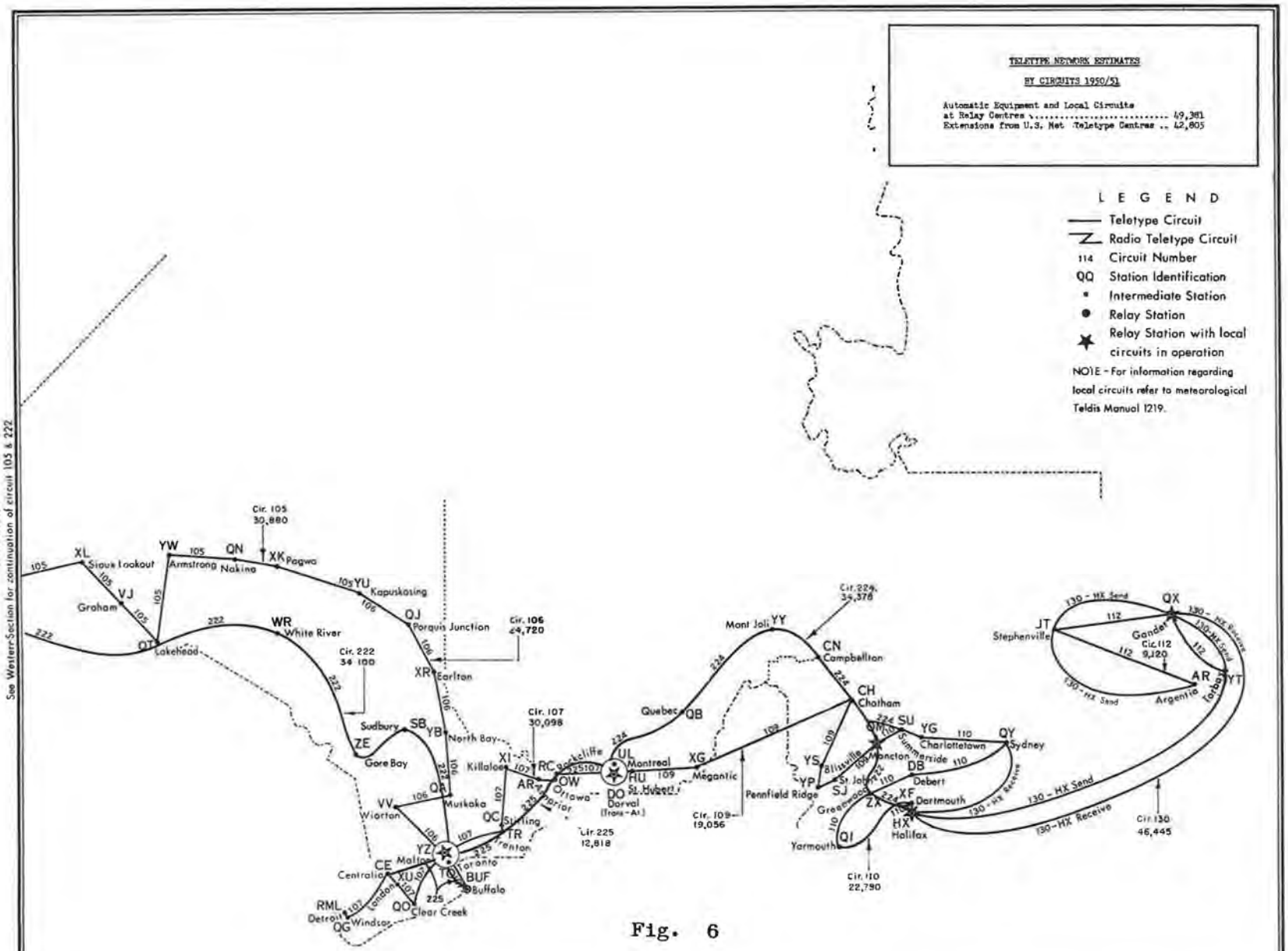
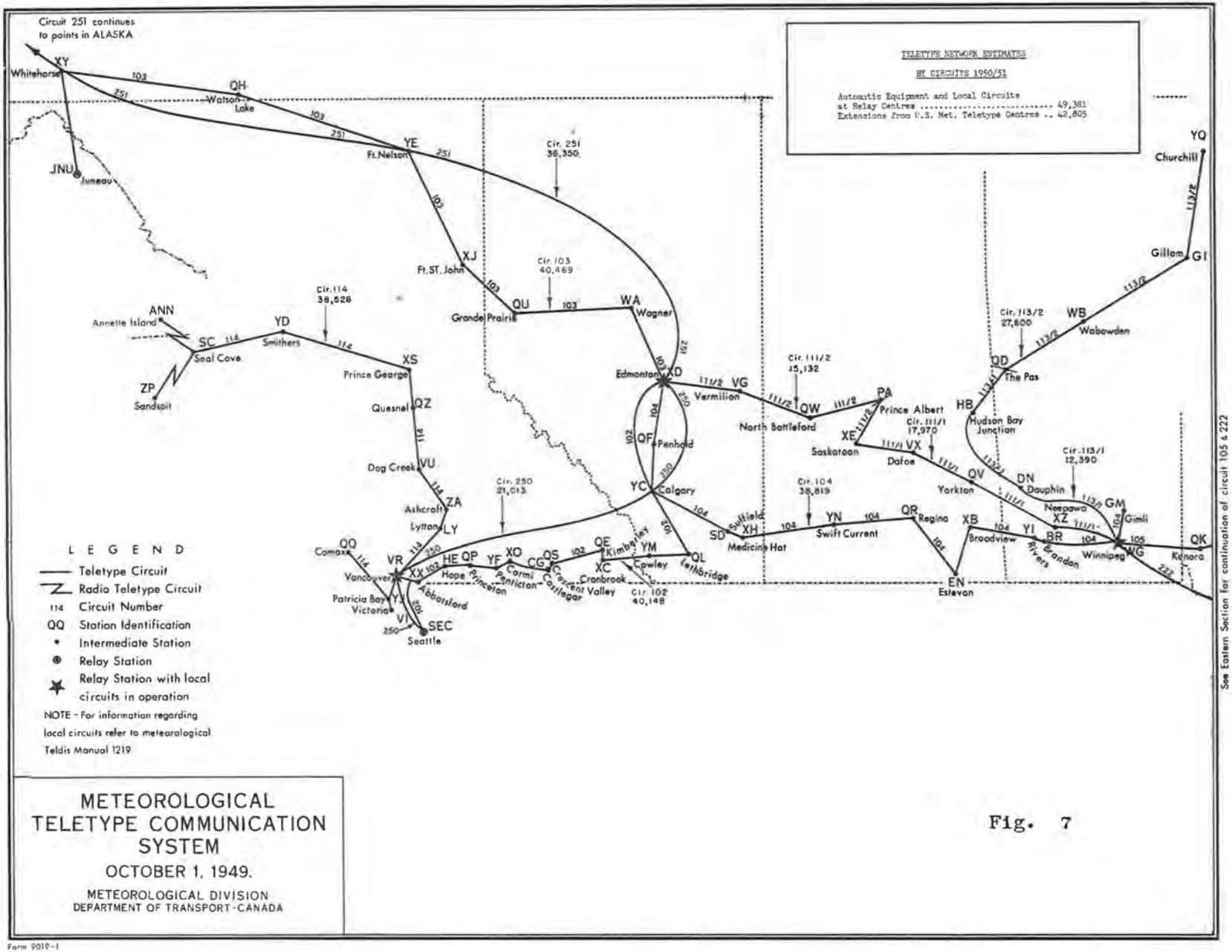


Fig. 6

Form 9010



METEOROLOGICAL TELETYPE COMMUNICATION SYSTEM

OCTOBER 1, 1949.

METEOROLOGICAL DIVISION
DEPARTMENT OF TRANSPORT - CANADA

Fig. 7

Form 9019-1

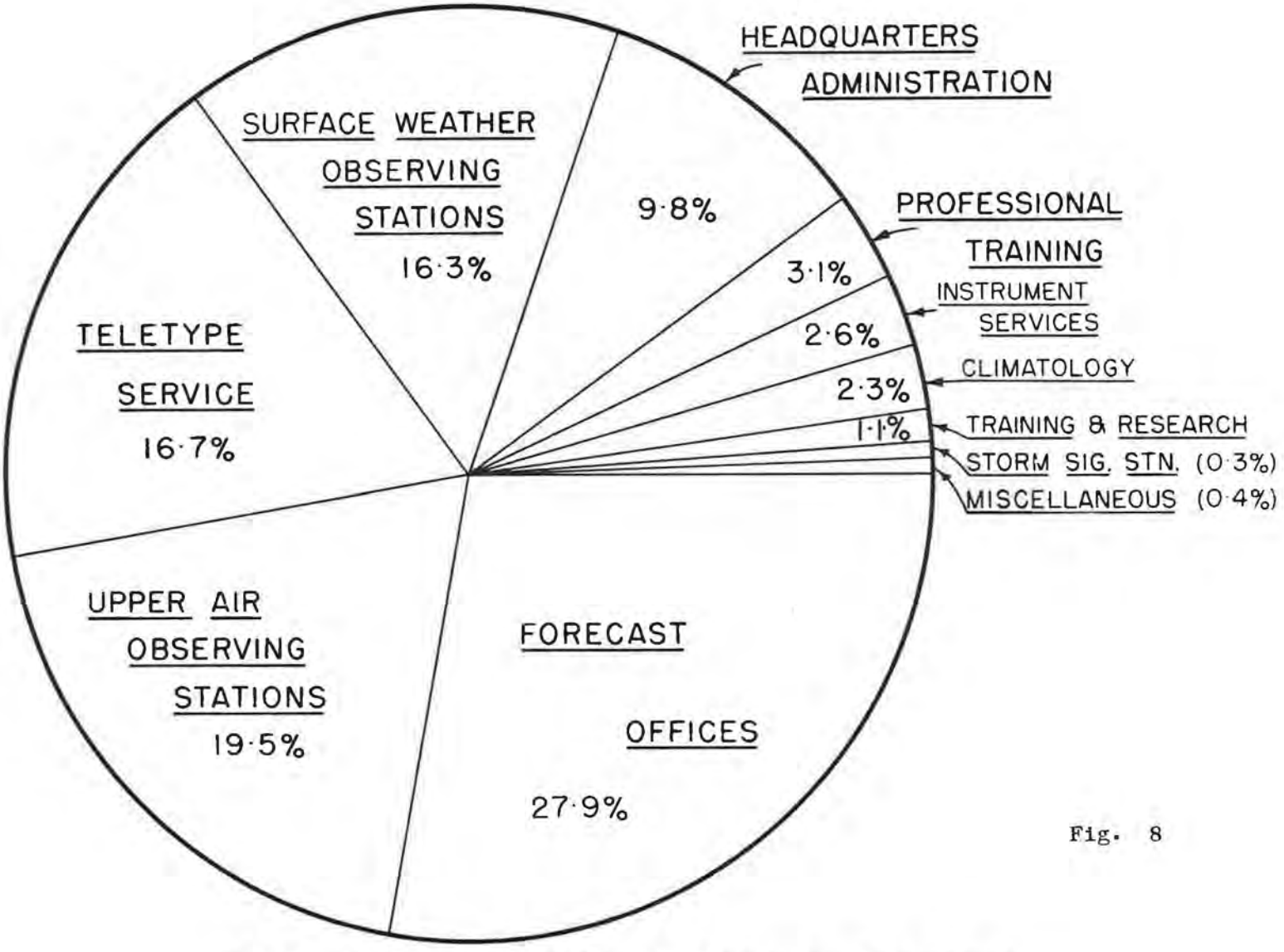


Fig. 8

1950–51 METEOROLOGICAL DIVISION ESTIMATES