

PANEL ON ARCTIC MAPPING*

OPENING REMARKS

Marc Boyer, Deputy Minister of Mines and Technical Surveys, Ottawa, Canada, and Moderator of the Panel

I feel greatly honored by having been invited to act as Moderator of the Panel on Arctic Mapping and by being thus associated with the deliberations of the American Society of Photogrammetry, a body which enjoys a well-earned reputation for its important contributions to the advancement of the art and science of mapping, so essential today in our world of rapid developments. It is also an honor to be associated with the experts, American and Canadian, who have agreed to act as members of the Panel.

Ever since Frobisher landed on Baffin Island in 1576, and took possession of it in the name of his sovereign, Queen Elizabeth, the fascinating story of the Canadian and American Arctic has been built up by a succession of heroic feats and thrilling adventures. Men have perished in attempting to conquer its forbidding wastes or to unravel its mysteries. In its annals, the foolhardy and the brave both have a part.

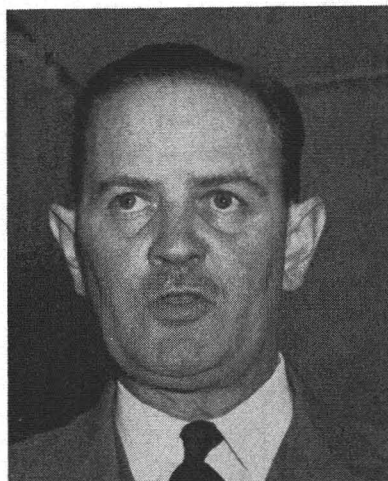
Today the adventurous stage is nearly over, and, as in every other part of the world, modern science and modern ways are at work, bringing ever closer to all of us this vast frontier territory, which has taken on fresh importance as a storehouse of minerals, but more particularly as a new strategic terrain.

Where the early mariner or explorer was seeking adventure, we are now seeking security. Where, a few decades ago, whaling and fur-trading were the only forms of economic development, and many arctic phenomena bordered on the mysterious, now mining and fisheries and power development are bringing in their wake thriving businesses and thriving towns, and scientific investigation is unravelling the secrets of the north.

But though arctic adventure has assumed a more staid, a more sober countenance, the Arctic still holds a spell of grandeur, an exciting flavor, born of its history, its remoteness, and its rigorous

climate. There is something of beauty in the following description of the northlands by Jeannette Mirsky in her book "To the Arctic":

"Were you to travel northward in Asia or America, you would soon leave behind the great northern timberlands. Unevenly the trees thin out, becoming sparse and stunted save where in sheltered valleys they still grow tall and straight. You pass the last outpost of the birch,



MARC BOYER

the cottonwood, the black and white spruce, and before you lies a vast grassy plain, beyond that the sea.

"The woodless, nearly level tundra . . . from October to May is covered by snow, and when that melts, a haggard-looking land appears, lined with streams and lakes, flabby with bogs and swamps. It is the home of clouds and mosquitoes, the breeding-place for millions of birds. Then suddenly, like an exotic quilt thrown over a slept-in bed, spreads the gaudy brilliant flora of moss and grass and flowers."

One would like to dwell longer on these fascinating aspects of the Arctic, but our task today is a little closer to hard facts. Why do we map the Arctic? How do we map the Arctic?

* Nineteenth Annual Meeting of the Society, Hotel Shoreham, Washington, D. C., January 14 to 16, 1953.

First, let us define, for the purpose of our presentation, the term "Arctic." It is not the area delimited by an imaginary line—the Arctic Circle—but a much broader area which, in climatic terminology, could be defined as that region where the average mean temperature for the warmest month is less than 50 degrees Fahrenheit. The southern limit of such an area would closely approximate the tree line. It is to be noted that this tree line extends in places well south of the Arctic Circle, and in some instances as much as 10 degrees, or 700 miles, to the south.

This Arctic region comprises approximately 30 per cent of Alaska, and approximately 25 per cent of Canada.

The past two decades, and particularly the last, including the war and postwar years, have brought about a realization of the importance of the Arctic both politically and economically. This has greatly emphasized the need for maps of the region as being essential for resources development, settlement, defence, and administrative purposes, for transportation by land, air and sea, for meteorology, and for other scientific aspects and endeavors.

It is the purpose of the "Panel on Arctic Mapping" to review the progress being made in this mapping endeavor; the difficulties that have been met, and such improvements and techniques as have been evolved to advance this enormous and difficult task.

The two friendly neighbors—Canada and the United States—have much in common, and here we have an interesting coincidence in dates. In 1867, when four of the then five provinces of Canada signed the pact of Confederation—the official birth certificate of my country—your own country was acquiring from Russia the

Alaska Peninsula. Thus we became partners in a task of mapping and developing these vast regions which border on the Arctic Ocean.

It is significant evidence of the friendly feelings existing between our two countries that you have bestowed on me the honor of presiding over this important aspect of your meeting—the panel on arctic mapping. It will be my pleasure this afternoon to introduce to you the Canadian and American speakers who will cover such subjects as Early Exploration, Aerial Photography, Horizontal and Vertical Control, Charting the Sea Lanes and Harbors, and others relating to mapping in the Arctic.

The list of the speakers appears in the program of the Annual Meeting. It includes Dr. N. L. Nicholson, a senior geographer with the Department of Mines and Technical Surveys, Canada; Wing Commanders R. Thomas and D. S. Ross of the Royal Canadian Air Force and Lieutenant-Colonel Paul E. Gremmler of the U. S. Air Force; Mr. C. H. Ney of the Geodetic Survey of Canada; Commander Hubert A. Paton of the U. S. Coast and Geodetic Survey; Mr. F. C. G. Smith, in charge of the Canadian Hydrographic Office; Mr. B. W. Waugh, Surveyor General of Canada; Col. Gerald FitzGerald, Chief Topographic Engineer of the U. S. Geological Survey, and Col. Albert L. Nowicki of the U. S. Army. I am sure these experts will give you a well-rounded picture of the several important topics which concern arctic mapping. We will invite written questions from the audience to complete the brief presentations of these panel members.

As stated in the program of the Annual Meeting the discussion of the Arctic Map-



ARCTIC MAPPING PANEL

Left to right: Lt. Col. Paul E. Gremmler, Wing Comdr. R. Thomas, Gerald FitzGerald, Wing Comdr. D. S. Ross, Marc Boyer, Lt. Comdr. T. K. Treadwell, F. C. G. Smith, Comdr. Hubert A. Paton, Albert L. Nowicki, C. H. Ney, B. W. Waugh.

ping will be divided into five parts. For each of these there will be one or more papers. Following the presentation of the papers prepared by experts in Arctic Mapping there will be an opportunity for panel members to answer questions asked by members of the audience. It is hoped that those present will fully utilize the opportunity to obtain information from the experts. The time scheduled for the panel may not be adequate for complete answers to all questions, but possibly the questioners can contact the panel members after the end of the meeting.

I think it is befitting that we give credit and pay tribute to the early Arctic explorers, those who paved the way to Arctic exploration and mapping. I think it is also befitting that we ask a geographer to do that task.*

Dr. Norman Leon Nicholson, the first speaker, attended the University of London and five Canadian universities—The University of Western Ontario, McMaster University, the University of Toronto, the University of Ottawa, and McGill University. He first came to Canada in 1940 and was a member of the faculty of the University of Western Ontario from then until he joined the Federal Civil Service, with the exception of service in the Royal Air Force as meteorological observer in the United Kingdom, Belgium, France, and Norway. He is presently in charge of "Canadian Research," which includes the Arctic, in the Geographical Branch of the Department of Mines and Technical Surveys in Ottawa.

Dr. Nicholson has carried out field work in various parts of Canada from east to west. He is presently sessional lecturer at Carleton College in Ottawa. He is a member of the Canadian Board on Geographical Names, and the Canadian Association of Geographers. He is a Fellow in the Royal Geographical Society, American

Geographical Society, and the Canadian Geographical Society. He has represented the Government of Canada on the Commission on Geography of the Pan-American Institute of Geography and History at its meetings in Santiago, Chile, and at other international and geographical conferences.

The hypothetical and imaginary ideas about the Arctic which prevailed in the 16th century are now a matter for the annals, but the daring, courage, the suffering and hardship of the Arctic explorers are truly part of the history of mapping in the Arctic. The advent of the airplane, however, was to prove the largest single contribution to the advancement of exploration and mapping, particularly when it brought in its wake aerial photography and other airborne operations. There are three short papers on this topic.

Wing Commander Robert I. Thomas joined the RCAF in Vancouver in 1927 as an airframe mechanic. He trained as an NCO pilot in 1928-29, graduating in March, 1929. He then served on forestry work in Western Canada until he moved to Ottawa in 1933 and took part in photo survey operations for the first time in 1934.

Wing Commander Thomas was in charge of the RCAF Meteorological Flight at Fort Smith, Northwest Territories, in the winter of 1936-37. The detachment was one of five which operated throughout the United States, Canada, Alaska, and Newfoundland. He was on Photo Operations from the summer of 1937 to 1939. He was commissioned in 1939 and took part in Coastal Operations on the East and West Coast of Canada during the war. He took over 22 Photo Wing in 1947 and remained in charge until the Wing disbanded in 1950. During this time photo squadrons of the Wing attained 911,000 square miles of photo coverage in one five-month season. Later he was Senior Air Staff Officer at Air Transport Command and is now chief administrative officer at RCAF Station Rockcliffe near Ottawa.

Distinct from the operational aspects of aerial photography are the techniques and photographic equipment particularly adapted to Arctic mapping. Wing Commander Ross, Commanding Officer of the RCAF Photographic Establishment at Ottawa will cover this aspect of aerial photography.

Wing Commander Donald S. Ross was

* Following the usual practice, the Moderator introduced each member of the panel to the audience and presented brief biographical information. To avoid breaking the sequence of the prepared papers, the transcript has been rearranged and all of the biographical information has been concentrated so that it appears that it was given at one time and before the first speaker instead of being scattered through the entire meeting. Minor additions to the biographies have been made utilizing data provided by the Meetings Committee.—EDITOR.

born in Montreal and educated in Nova Scotia. He graduated from Rochester Institute of Technology and Photography Technology in 1940, and entered the Canadian Royal Air Force. He was Command Photo Officer, Eastern Air Command, in 1940; Photo Officer, No. 4 Training Command, 1941-42. He was Commanding Officer, Central Photo Establishment, in 1943. He was then with the Photo RCAF Overseas Headquarters and was a representative of the Canadian Photo Research Committee to the British Air Photo Research Committee, 1944-45.

Wing Commander Ross planned and initiated the RCAF Post-War Photo Research Program in 1946-50. He then attended the Royal Air Force Staff College in England, where he graduated in 1950. Since then he has been Commanding Officer of the Royal Canadian Air Force Photographic Establishment in Ottawa. He is an Associate, Royal Photographic Society of Great Britain, Technical Division

We are very proud in Canada of the work which has been accomplished by the RCAF in aerial photography. No doubt this feeling is also existent in the United States about the U. S. Air Force. Lieutenant Colonel Paul E. Gremmler has been chosen to describe the contribution of the United States Air Force to mapping the Arctic and sub-Arctic.

Lieutenant Colonel Gremmler began his service career in the infantry as both an enlisted man and an officer. He transferred to the Army Air Force in 1942 and was assigned to the First Photo Mapping Group under Colonel Paul T. Cullen. His assignment in the group was with the Third Mapping Squadron, where he spent time on mapping and charting projects in South America, Alaska, Canada, North Africa, China, Burma, and India. He was later assigned to Flight C of the First Photo Reconnaissance Squadron and flew reconnaissance missions in the China-Burma-India Theater for the 20th Bomber Command. He then was assigned to the Third Photo Reconnaissance Squadron located in the Marianas under the 20th Air Force.

Following the war, an assignment to the 91st Reconnaissance Squadron, Photo Mapping, provided a three-year tour in mapping South America. Colonel Gremmler brought the Squadron back to the

States in 1949 to join the Strategic Air Command. He was assigned to the Second Air Force Headquarters as Branch Chief of the Reconnaissance Branch in Operations and is now assigned to the Reconnaissance Requirements in the Strategic Air Division under the Director of Development, Headquarters, U. S. Air Force.

No mapping is accomplished without precise controls. The establishment of these controls in Arctic regions requires much caution and experience and refinement of techniques, and the problem of transportation is sometimes as important as that of improved methods and instruments. Mr. C. H. Ney of the Geodetic Survey of Canada will give us a brief picture of the situation.

Mr. Ney was born in Bradford, Ontario, and in 1916 was graduated in engineering from the University of Toronto. In 1917-19 he served as a pilot in the RAF in the First Great War and in 1919 joined the staff of the Geodetic Survey. In 1929 to 1937 he pioneered the extension of astronomic control for mapping and charting into Canadian sub-Arctic. In 1945 Mr. Ney was awarded the gold medal by the Professional Institute of the Public Service of Canada for outstanding contribution by a member of the Civil Service of Canada. In 1946 he was awarded the M.B.E. decoration in the King's Honor List of July.

Another expert with a wide experience in horizontal and vertical control for Arctic mapping is Commander Hubert A. Paton, Chief of the Baltimore Photogrammetric Office of the U. S. Coast and Geodetic Survey. Commander Paton was born in Shelby, Michigan in 1899. After elementary schooling there he received a Bachelor of Science degree in civil engineering in 1923 from the University of Oklahoma. He joined the U. S. Coast and Geodetic Survey in 1923. During 29 years of service Commander Paton has conducted various survey parties and served as Junior and Executive Officer of various ships. From September, 1941 through November, 1945, he served as Lieutenant Colonel with the Army. In November, 1949 he was assigned to duty at the Baltimore Photogrammetric Office. Commander Paton holds an aeronautical license as a commercial pilot. He is the author of *Compilation of Trimetrogon Photographs*, a training manual for Army Air Force. He

is a member of the Federal Business Association of Maryland, the American Society of Photogrammetry, and many other societies and associations.

Important is the land, but important also is the sea, which plays a vital role in countries like Canada and the United States, each with thousands of miles of coastline and water passages. If this is true of southerly latitudes in those countries, it is equally true in the more northerly regions of the Arctic. Charting Northern seas and harbors is an important aspect of Arctic mapping.

The first speaker on this subject will be Mr. F. C. G. Smith, Canada's Dominion Hydrographer. Mr. Smith was born in Montreal, where he received his early education. In 1914 he completed the engineering course at Acadia University, Nova Scotia. He joined the Hydrographic Service the same year, and in 1915 enlisted in the Canadian Army overseas. In 1917 he was commissioned as Lieutenant with the Hydrographic Department of the British Admiralty where, for two years, he was engaged in the surveying of mine fields and in other strategic charting operations in the North Sea and English Channel. Mr. Smith returned to Canada in 1919 and has since carried on extensive charting operations in Canadian coastal and inland waters. For six years he had charge of charting in Hudson Strait and Bay, and prepared the first official volume of Sailing Directions for the Hudson Bay Route.

Mr. Smith has written a number of articles for both British and Canadian Geographical and Nautical publications. He is a Fellow of the Arctic Institute of North America and a member of several other societies. In 1952 he was Delegate for Canada at the Sixth International Hydrographic Conference at Monaco. Mr. Smith was selected in 1952 as the outstanding candidate to replace Mr. R. J. Fraser on his retirement as the Dominion Hydrographer.

Hydrographic surveying in the Arctic is not limited to Canadian waters. There is an equally important problem confronting the United States in Alaskan waters in addition to the major contribution made by the U. S. Navy in helping Canada map its own Northern coast lines and water passages. A well-qualified officer of the U. S. Navy Hydrographic Office, Lieutenant Commander T. K. Treadwell will

describe these problems.

Lieutenant Commander Treadwell graduated from the University of Oklahoma with a Bachelor of Science degree in geology. Following civilian work in geology and surveying, he was commissioned in the U. S. Navy in 1942 and was assigned to submarine duty. After the end of the war he was designated as Special Duty Officer specializing in hydrography, and participated in a number of surveys in the Central and South American area. He was assigned to graduate studies at Scripps Institution of Oceanography, where he was in the Hydrographic Survey Group Two as Hydrographic Officer during several Caribbean and Arctic surveys. He is now on duty at the U. S. Navy Hydrographic Office in Washington.

The last of the five main topics covers such problems as mapping programs, aeronautical charts, radar photography, photo-interpretation, radar altimetry, and others. These will be described by three speakers, and I will call first on Mr. Bruce W. Waugh, Surveyor General of Canada.

Mr. Waugh was born in Canada and is a graduate of the University of Toronto in electrical engineering. He has been continuously employed by the Department of the Interior and succeeding departments of the Federal Government in survey work since 1909. He was commissioned as a Dominion Land Surveyor in 1912. Mr. Waugh was employed in the field on legal surveys until 1922, and on topographical surveys until 1927. In 1928 he became Assistant Chief of the Topographical Surveys Division of the Topographical Survey of Canada. In 1941 he was appointed Assistant Surveyor General and in 1947 he became Surveyor General of Canada, succeeding Mr. F. H. Peters. Mr. Waugh is a member of the Engineering Institute of Canada, and the Canadian Institute of Surveying, and has played a considerable part in the development of Canada's aeronautical charts, including the recently organized radar altimeter surveys for contouring purposes.

The next speaker needs no introduction to the members but the many guests here would like some information. Colonel Gerald FitzGerald has been a member of the Geological Survey since 1917. Early in his career he was assigned to topographic mapping projects in Alaska and spent more than 25 years in connection with

Arctic mapping problems. During the war he organized and assisted in the development of trimetrogon mapping and was commissioned in the Air Corps in 1942, where he served as Commanding Officer of the Aeronautical Chart Service until 1946, when he returned to the Geological Survey. He was appointed Chief Topographic Engineer of the Geological Survey on May 22, 1947.

Colonel FitzGerald is past President of the American Society of Photogrammetry and of the American Congress on Surveying and Mapping, is a member of the American Geophysical Union, Washington Society of Engineers, the Cosmos Club, and the Explorers Club. He received the Legion of Merit from General Arnold in 1946 for his work as Commanding Officer of the Aeronautical Chart Service. In 1949 he was awarded the Department of Interior's gold medal for distinguished service.

Last but not least, a member of the highly respected Corps of Engineers of the U. S. Army will tell us why military mapping of the Arctic and sub-Arctic is of such importance. Lieutenant-Colonel Albert Nowicki was born in Milwaukee, Wisconsin and received his education at Marquette University, where he received a civil engineering degree. His advanced degrees in civil engineering were obtained at the University of Minnesota. His experience includes teaching on the faculty of Marquette University and the University of Minnesota in civil engineering and also mapping experience with the Forestry Service, the T.V.A., and the Corps of Engineers.

Colonel Nowicki's civilian position is that of Chief Engineer, Army Map Service, and he is on temporary duty at present with the Army.

THE CONTRIBUTION OF EXPLORERS TO THE MAPPING OF ARCTIC NORTH AMERICA

*Norman L. Nicholson, Assistant to the Director, Geographical Branch,
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SYNOPSIS

Early knowledge and mapping of Arctic—Greeks, Romans, Mercator

The idea of a northwest passage—17th century exploration—Hudson's Bay Company—Mapping methods—limitations—the problem of longitude.

18th century activities—Hearne's overland journey—scientific advance in instruments and ships.

19th century—the north magnetic pole—completion of main outlines of continental coast—the search for Franklin—the beginning of the penetration of the northern islands region.

1880—the whaling industry—the assault on the North Pole—Canadian government expeditions.

The end of old style exploration—advent of the airplane—development of separate systematic branches of geography—modern difficulties.

The debt to explorers—names in the north.

The purpose of this paper is to show how the map of the northern part of this continent was gradually unrolled by the various explorers who visited the area, and at the same time to point out some of the difficulties under which these men worked

so as to account for any apparent limitations of their contributions.

Whatever knowledge the Greeks and Romans had about the northern part of this continent is always a subject of much discussion among Arctic specialists. However, it is certain that they contributed nothing to the maps of Arctic North America as we know them today. The ideas of the ancients were at best hypothetical and imaginary, a state of affairs which existed until the late 16th century. In 1508, for example, a map was published which maintained that under the Arctic Pole there was a towering boulder made of magnetic stone which was 33 German miles in circumference. It was maintained that this boulder was surrounded by a sea which resulted from the water said to flow freely out of the stone. This general idea was preserved to some extent in the polar inset of Mercator's great Chart of the World, published in 1595. This showed a polar whirlpool fed by four channels entering it from the north, south, east and west. But Mercator's map also indicated a through channel from Europe to the Orient. This belief