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AIR INTELLIGENCE INFORMATION REPORT			
SUBJECT (Unclassified) THE NORTH-POLE DRIFTING STATIONS AND THE HIGH-LATITUDE AIR EXPEDITION OF 1954			
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SUMMARY: (Enter concise summary of report. Give significance in final one-sentence paragraph. List inclosures at lower left. Begin text of report on AF Form 112 - Part II.)			
<ol style="list-style-type: none"> Forwarded herewith is a comprehensive story of the North Pole Drifting Stations currently operating in the Arctic Basin, and of the High-Latitude Air Expedition which was responsible for the launching of these stations in 1954. This latest Arctic enterprise has been covered as widely as possible, including its background, launching methods, supply, personnel, equipment, scientific work, and preliminary results. The value of this report is felt to reside in the fact that over 80 articles which appeared in 1954 in the Soviet press have been compiled to give a systematic presentation of the entire problem. 			
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Introduction

The postwar flow of information on Soviet Arctic activities virtually came to a standstill in 1947 when all matters pertaining to that area were declared a state secret. Thus, since 1947, no reference to the Arctic could be found in Soviet newspapers and periodicals. To be sure, there was a number of monographs published about the Arctic, but all dealt with the period prior to the date of the secrecy order and, in the majority of cases, prior to the last war.

The first indication of at least a partial lifting of the secrecy order came early in January, 1954, when an article on Barentsburg was published in the periodical Ogonek. (Ref.10) Since that time, articles on the Arctic began appearing in the press in ever increasing numbers, reaching the peak in about the second half of the year.

The great majority of these reports featured the North Pole drifting stations which are still in operation in the Central Polar Basin. It now appears that Soviet expeditions to the Arctic were sent quite frequently during the postwar years. They were characterized by increasing complexity of operations and mounting scope of equipment and manpower. The culminating point of these efforts was the so-called High-Latitude Expedition of 1954. The major objective of this expedition was the launching of the two North Pole drifting stations which were regarded as the most efficient means for the exploration of the Arctic areas.

In the course of the past Soviet expeditions, several basic methods of Arctic exploration were developed. One method consisted in making a series of aircraft landings on ice floes, the crew staying on each floe for several days of intensive work. Another method called for non-stop flights to the area of the Pole from a number of points on the coast, using an aircraft equipped with meteorological and other instruments. A third method employed long-term stations drifting on ice floes for a year or more with a carefully prepared program of comprehensive studies.

The High-Latitude Air Expedition of 1954 employed all three methods at the same time.

The following report is a comprehensive presentation of the available data on the 1954 Expedition and, specifically, on the North Pole drifting stations.

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I. Soviet Polar Expeditions During the Past 20 Years.

The High-Latitude Air Expedition of 1954 was a continuation of a series of explorations of the Soviet Arctic carried out at various times since the Thirties. Many of the operations launched during the 1954 expedition were developed previously. Furthermore, many of the sources reporting on the High-Latitude Air Expedition of 1954 contain references to and descriptions of several preceding operations. Since they throw considerable light on the current expedition, this chapter will furnish a brief account of these events.

The first major expedition to the North Pole was undertaken in 1937 by Papanin. It was the first long-term drifting station launched in the area of the Pole. Accordingly, it was later named the "North Pole 1" Drifting Station.

The 1937 expedition consisted of four 4-engine planes of the ANT-6 type, designed by A.N. Tupolev, one 2-engine plane and two light single-engine aircraft of the P-5 and PS types. The main group consisted of the four-engine aircraft; the remaining three lighter planes were used for reconnaissance and auxiliary work.

The ANT-6 was an all-metal low-wing monoplane with four AN-34r engines of 900 Hp each. The tail end of each plane housed a braking parachute to aid in landing on ice floes. The dry weight with water of the aircraft was 12685 kg; fuel and oil weighed 7340 kg. The flying weight of the plane for the final hop to the North Pole was originally estimated at 23 metric tons, The actual amount however, exceeded the specifications.

The four aircraft delivered to the North Pole station about 10 tons of apparatus, equipment and provisions.

The main base of the expedition was Ostrov Rudol'fa. The base was established there near a Polar station in the summer of 1936. Particular attention was given the installation of an airfield capable of receiving four-engine planes on top of a glacier on the island.

The expedition started on March 22, 1937. The route of the four aircraft was as follows: Moskva, - Kholmogory (80 km from Arkhangel'sk) - Nar'yan mar - Matochkin shar - Ostrov Rudol'fa. This trip took 27 days. From the main base the aircraft proceeded to the North Pole area to launch the drifting station.

The chief of the expedition was a member of the Academy of Sciences of the USSR, O. Y. Shmidt. His deputy was the chief of Polar Aviation, M. I. Shevelev. The drifting station was manned by four men, I. D. Papanin, P. P. Shirshov, Ye. K. Fedorov, and E. T. Krenkel'.

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The flight detachment of the expedition was under the command of Mikhail Vasil'yevich Vodop'yanov, who at the same time piloted the flagship of the expedition, one of the four-engine planes, the N-170. The remaining ANT-6 planes were flown by: Vasilii Sergeyevich Molokov (N-171), Il'ia Pavlovich Mazuruk (N-169), and Anatolii Dmitriyevich Alekseyev (N-172).

The drifting station began operation on May 21, 1937, in the immediate vicinity of the North Pole. It ended operations on Feb. 19, 1938, at a point 70°54'N - 19°48'W. During 274 days operation, it drifted over 2500 km. The personnel was removed from the floe by ice-breakers. (Ref. 2).

In 1941, a four-engine ANT-6 plane (N-169) was launched on an expedition to the Pole of Relative Inaccessibility. The commander of the expedition was pilot I. I. Cherevichnyy. M. Ye. Ostrekin headed a group of scientists participating in the flight. Cherevichnyy's plane, called a flying observatory, was equipped with instruments for meteorological, hydrological and magnetic observations. The aircraft took-off in the early spring from Moscow to Franz Josef Land and thence to Vrangell Island. The latter served as a base for three flights to the center of the area called the Pole of Relative Inaccessibility where a number of landings was performed on ice floes. (Ref. 17, 54, 18).

In 65 days of work, Cherevichnyy's plane covered 26000 km. (Ref. 18).

The aim of the 1941 expedition, organized by the Arctic Institute, was to test a new method of Central Arctic research. The flying-laboratory (or flying-observatory) method, as it was called, consisted in making landings on ice floes at previously designated points where an entire complex of scientific observations was to be performed. The test proved successful. At each point, the personnel stayed for several days and measured the depth of the ocean, took samples of water, observed ocean currents, measured the intensity of solar radiation, made meteorological and magnetic observations, and determined the coordinates by astronomic means. (Ref. 6).

The flying-laboratory method was adopted on an unprecedented scale during the postwar years. Each expedition involved scores of scientists of various specialties; oceanologists, geophysicists, meteorologists, ice specialists, aerologists, etc. Each group of scientists was provided with a suitable number of aircraft. The groups had specially made portable tools, such as light power-driven winches with thin but extremely strong cable for sounding great depths, mechanical drills capable of penetrating 3-m ice within several minutes, self-writing instruments which record sea currents, and portable automatic recorders for magnetological work.

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The simultaneous work of scientific groups at several points resulted in a synchronized coverage of large areas of the Central Arctic. At the end of 1954, such observations were performed at more than 200 points. Regular launching of radio sondes determined the temperature, speed, and direction of wind to an altitude of 30 km and over.

The expeditions also carried on a continuous recording of the elements of the earth's magnetic field.

The program of scientific observations, operational planning, and recruiting of scientific personnel for the expeditions, was the work of the Arctic Research Institute of the Main Administration of the Northern Sea Route, with the participation of institutes of the Academy of Sciences and the Main Administration of Hydro-Meteorological Service of the USSR. (Ref.6).

Postwar expeditions to the Arctic became known as High-Latitude Expeditions or High-Latitude Air Expeditions.

In the fall of 1945, pilot M. A. Titlov and navigator V. Akkuratov went on a 4300 km non-stop survey flight across the Pole. It was a long range ice patrol during the Polar night. The data obtained in the survey served as a valuable material for subsequent expeditions sent out at increasing frequencies. (Ref. 17).

In 1946, the icebreaker "Severnnyy Polyus" sailed from Vladivostok for the Arctic carrying on board a scientific expedition of the Main Administration of the Northern Sea Route. The expedition was headed by Igor Maksimov, Deputy Director of the Arctic Institute. Maksimov was an expert on Arctic hydrology and a veteran of six previous Arctic expeditions. The objective of the expedition was the study of the Northern areas of the Chukchi, East Siberian, and Laptev Seas. The expedition also represented the first attempt at sailing the "Northern Variant" of the Northern Sea Route, from East to West. The route of this ship ran north of Ostrov Vrangel'ya, Ostrov Kotel'nyy, and Servernaya Zeml'ya. The expedition was expected to be of great practical value to navigation along the Northern Sea Route. The personnel numbered 35 scientists specializing in modern Arctic hydro-meteorology and geophysics. The scientists were chiefly recruited from the Arctic Institute. Scientific work was directed by Mikhail M. Somov. The ship was equipped with a scientific laboratory and had its own meteorological service. (Ref. 1).

The period of 1948-1949 marked the discovery and subsequent investigation of the submerged Lomonosov Range. The range was discovered in 1948 by a High-Latitude Expedition of the Arctic Institute. The members of the expedition were Leningrad scientists headed by Professor, Ya. Ya. Gakkel', Doctor of Geographical Sciences. (Ref. 63, 30).

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A description of the exploratory work leading to the discovery of the Lomonosov Range was found in an account by M. V. Vodop'yanov, one of the oldest Arctic pilots. Unfortunately, his accounts must be taken with reservations because of contradictions and failure to provide dates. In the following account, Vodop'yanov states that the events described have taken place after the war and that they concerned the discovery of the Lomonosov Range. It could be thus assumed that he describes a part of the work of 1948-49 expeditions.

In April, Cherevichnyy and Kotov took-off in two planes for the Pole of Relative Inaccessibility. Vodop'yanov was the deputy chief of the expedition aboard Cherevichnyy's plane. Ostrov Kotel'nyy was used as a temporary base. On April 9, a landing was made and a camp established at 80°30'N - 150°E. A number of tents was rapidly set up on the floe. The participating meteorologists, magnetologists, and hydrologists were provided with heated dwelling and laboratory tents.

At the same time, other camps were landed at 86°30'N - 157°E and 80°15'N - 177°E. From these bases, aircraft departed daily to set up new short-term stations for one or two, and sometimes for three days of complex observations.

During the same spring, observations were resumed directly at the North Pole itself. Three planes landed precisely in the area of the North Pole. The party included Vodop'yanov, Mazuruk, Akkuratov, flight mechanic Shlyandin, and motion picture operator Troyanovskiy. The observations lasted for nearly 48 hrs.

A year later, another High-Latitude Expedition was organized to the Pole of Relative Inaccessibility. Vast areas of the ocean were covered by measurements.

The variation in ocean depth was discovered to range from 5 to 1 km. resulting in an assumption that a vast submerged mountain range existed in the Arctic Basin. (Ref. 18).

In April of 1950, a High-Latitude Expedition launched the "North Pole 2" Station. This was perhaps the last expedition before the 1954 operation; it also most closely approached the patterns and methods of the latter. (Ref. 6, 44).

Previous expeditions have revealed the need for a systematic and thorough study of seasonal variations in meteorological and magnetic phenomena as well as for a more detailed study of ice drift, distribution and movements of water masses, and the problems of heat exchange between the ocean and the atmosphere. Another important need concerned regular meteorological forecasts from the least known and most remote areas to render weather and ice forecasts for the Northern Sea Route more accurate. (Ref. 6).

The "North Pole 2" Station was launched on April 2, 1950, north of the Pole of Relative Inaccessibility at a point 76°02'N - 166°30'W. (Ref. 68, 4, 6).

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The station was headed by Mikhail M. Somov, Candidate of Geographical Sciences, oceanologist. (Ref. 53, 4). M. Ye. Ostrekin, was the director of scientific work at the station. The personnel of the station numbered 16 men. (Ref. 71, 4) Information is very scant on the personnel as well as all the other aspects of the expedition. Most of the personnel seem to have later served in the 1954 High-Latitude Expedition. However, the following are known to have participated in the work of the "North Pole 2" Station.

Zalman Markovich Gudkovich, 29, oceanographer. (Ref. 13).

Konstantin Mitrofanovich Kurko, radio operator. (Ref. 8).

Vasilii Gavrilovich Kanaki, aerologist. (Ref. 8).

Yevgeniy Pavlovich Yatsun, motion-picture operator. (Ref. 8).

Mikhail Semenovich Komarov, mechanic. (Ref. 8).

The group of scientists drifted for 13 months and completed the assigned cycle of observations. (Ref. 53, 4, 23, 18). The "North Pole 2" Station operated simultaneously with flying observatories. (Ref. 4). One of the notable achievements on the "North Pole 2" Station was a discovery of a warm layer of water at a depth of 75-100 meters in the eastern sector of the Arctic. (Ref. 44). The station ended its work on April 9, 1951. The personnel were taken off the floe at a point 81°45'N - 162°20'W. (Ref. 6, 68).

During its drift, the "North Pole 2" Station was displaced 600 km to the north, covering an intricate drift path of a total length of 2500 km. (Ref. 6).

The "North Pole 2" Station was not equipped as well as the drifting stations of 1954. Comfort facilities were much less adequate in 1950. Many of the drawbacks felt at that time were eliminated from the outset in 1954. (Ref. 8). The air delivery however, followed a similar pattern. In this connection, Vodop'yanov is mentioned as head of a flight detachment which brought to the "North Pole 2" camp about 20 tons of freight, including a cross-country vehicle and fresh food. (Ref. 18).

The tents of the "North Pole 2" Station were left behind on the floe after the personnel was removed in April, 1951. In April 1954, the floe was explored again. The floe was at that time at a point 75°20'W. During the three intervening years it traced a long circular route. It is interesting to note that the tents, abandoned in 1951 on an even surface, were found in 1954 perched on top of tall ice columns. This was due to the fact that the tents protected their ice floor from the sun, while the remaining unprotected surface of the floe kept melting down. The thickness of the floe remained the same because new ice kept growing on the bottom of the floe. (Ref. 6).

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II. The Purpose and Objectives of the High-Latitude Air Expedition to the Central Arctic of 1954.

The official reasons for and aims of the expedition were stated abundantly in the press. The statements followed a few established formulas with considerable faithfulness. The bulk of the statements read as follows:

According to a decision of the Soviet government, the High-Latitude Arctic Air Expedition was launched in the spring of 1954 to study ice and weather conditions, as well as other physical and geographical elements of the Central Arctic. (Ref. 54, 53, 16).

It is further stated that the exploitation of the abundant resources of the Soviet North is possible only if it is based upon a complete development of the Northern Sea Route which serves not only as a communication line between the western and eastern parts of the country, but also for the exportation of raw materials from Siberia. Further development of navigation on the Northern Sea Route, however, requires a thorough knowledge of the geophysical elements of the Arctic Ocean and, especially, of the ice cover. The compilation of reliable weather and ice forecasts calls for an establishment of long-term observation posts close to the Pole. (Ref. 19).

Observation of ice drift is important because the direction and speed of ice movements and the nature of the entire ice mass carried out of the Polar Basin affect to considerable extent the climate of the Arctic Ocean and of the northern part of the Atlantic Ocean. The ice drift also influences the fishing industry in the Northern Atlantic Ocean where Soviet fishing fleets are operating. The southward movement of cold Arctic waters and their effects on the warm currents of the Atlantic flowing towards European shores are important factors in the analysis and accurate forecasting of climatic changes. (Ref. 73).

Another formula states that the main objective of the expedition is to aid in the further expansion of marine navigation on the Northern Sea Route and in the further increase in the volume of freight shipped along the route. (Ref. 16, 59).

The last statement is repeated in precisely this form by quite a number of sources.

The 1954 expedition was also regarded as a continuation of a series of previous prewar and postwar exploratory work. (Ref. 53). The postwar period marked a new phase in Soviet Polar expansion which might be called an all-out attack on the Central Arctic, supported by varied, highly developed technical means. (Ref. 4). The scope of scientific research was exceptionally wide in the case of the 1954 expedition; it was the largest that ever operated in the Arctic. The expedition was excellently equipped with instruments for scientific work and its staff represented the best Polar

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explorers, including the most experienced Polar pilots, who also participated directly in the research work. (Ref. 3). The 1954 exploration was given a new principle of work; the transition from purely expeditionary operations to systematic scientific research conducted by long-term stations organized on drifting ice. (Ref. 53).

Thus, the 1954 expedition was to carry out its work simultaneously in several directions. First, to launch two stations for protracted operations in the Central Arctic; second, to investigate the circumpolar area by a special group of planes; third, to carry out continuous weather and ice observations aboard a plane especially equipped for this purpose. (Ref. 33).

Simultaneous scientific observations conducted by two synchronized stations have never been conducted before. (Ref. 53). It is claimed that only research organized in this manner can reveal the interaction of the atmosphere and the undersea currents with the ice cover. Investigation of the laws governing ice movements in the Central Arctic was expected to reduce the idling time of ships and to improve the speed of freight transportation. The circumpolar region was regarded as the key to the still unknown patterns of ice fluctuations along the Polar sea lane. The work of the drifting stations was also expected to throw light on the changes in the mechanical properties of ice occurring with age. (Ref. 57).

The basic aims drawn up for the 1954 expedition could not be fulfilled by the network of Polar Stations operating along the coast and on the islands of the Arctic Ocean. Their observations and capacities were proved inadequate in this respect. To be reliable, Arctic forecasts must be based on the study of nature and distribution of ice, the circulation of water and air masses, water interchange at various levels, surface and deep water currents, relief of the ocean floor, magnetic phenomena, laws governing the processes in various layers of the atmosphere, quantitative indexes of solar radiation, and organic life in the ocean. (Ref. 53). The entire complex of this work was thus imposed on the High-Latitude Arctic Expedition of 1954. (Ref. 33, 3).

The expedition was mounted by the Main Administration of the Northern Sea Route. However, the Academy of Sciences of the USSR, the Main Administration of the Hydro-Meteorological Service, and other organizations actively participated in this work. (Ref. 33, 52).

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III. The Tasks of the 1954 Expedition.

The Chief of the Main Administration of the Northern Sea Route, Vasilii Fedorovich Burkhanov, was personally in charge of the expedition. (Ref. 4, 11). Zaytsev was the Deputy Chief of the expedition. Dmitriy Ivanovich Shcherbakov, Secretary of the Geological and Geographic Sciences Department of the Academy of Sciences of the USSR was the official Academy representative to the expedition. (Ref. 13). Acting as consultants of the Academy, were Member-correspondents L. A. Zenkevich, and Ye. K. Fedorov, Director of the Institute of Oceanology of the Academy, V. G. Kort, and others. (Ref. 4).

The work of the expedition consisted of the following basic tasks:

1. The launching of two scientific research stations on drifting ice. These were called, "North Pole 3" and "North Pole 4" Drifting Stations; the designation of numbers 3 and 4 stems from the fact that the North Pole Expedition launched in 1937 under Papan was retroactively named "North Pole 1" Drifting Station, while the name "North Pole 2" Drifting Station was given to the 1950 - 1951 expedition of M. M. Somov.

The "North Pole 3" Station was under the command of Aleksey Fedorovich Treshnikov, Candidate of Geographical Sciences, a specialist in oceanology. (Ref. 16). The "North Pole 4" Station was headed by Yevgeniy Ivanovich Tolstikov, Candidate of Geographical Sciences, a veteran Arctic Meteorologist. (Ref. 16). The two drifting stations were to conduct systematic observations according to the wide program of scientific research. The program was set up long before the expedition was launched. (Ref. 3). The two stations were deliberately spaced over 1,000 km. apart in order to cover a large area and to study the differences in the nature of drift ice. (Ref. 4).

2. The launching of a "Special Scientific Detachment" commanded by Ivan Ivanovich Cherevichnyy, a veteran Arctic pilot, and by M. Ye. Ostrekin, who was in charge of the scientific operation of the detachment. (Ref. 11, 23, 6). The Detachment consisted of several groups of aircraft equipped for short-term scientific observations on ice floes, its purpose was to investigate little known regions of the Central Arctic by a series of landings on ice in the area of the Pole. The major task of the detachment was the precise determination of the position and relief of the submerged Lomonosov Range. (Ref. 36, 11, 33, 3).

3. The operation of the so-called "flying observatory" for systematic weather reconnaissance. A supporting role in the work of the High-Latitude Expedition of 1954 was played by special aircraft equipped with meteorological instruments and manned by several scientists under the command of I. M. Dolgin. (Ref. 3). The flying observatory carried on important weather

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and ice research during non-stop flights from one of the coastal ports in the North Pole and back. Most of the sources seem to indicate that there was only one such aircraft in operation. (Ref. 3).

The High-Latitude Expedition returned to Moskva after completing the spring program of work; it left behind the drifting stations to continue their scheduled operations. However, numerous planes of the expedition which participated in the activities, described under points 2 and 3 above, continued to fly supply missions to the drifting stations. (Ref. 36, 48, 46).

IV. The Launching of Drifting Stations and Special Research Detachment.

The basic point of origin of the High-Latitude Expedition of 1954 was Moscow. (Ref. 16). From there, personnel and equipment had to be carried to the Central Basin of the Arctic Ocean. Aircraft was the basic means of transportation of scientific groups over the ice of the Central Arctic Basin. This method, including landings on ice at the sites of scientific observations, has been well tested under Arctic conditions. The preparatory work for the expedition was accomplished in the shortest possible time. (Ref. 53, 33)

During the first week of April 1954, the main group of the High-Latitude Expedition assembled in the morning on one of Moscow airports. The group included a PYe-8 four-engine aircraft, several IL-12 planes and several LI-2 two-engine planes. A number of freight aircraft had already left for the polar regions, while others were expected to join the group on the way. (Ref. 35). The main group flew directly to Arkhangel'sk, where, due to bad weather, it stayed overnight. The next point on the route was Amderma, where the group stopped for dinner and refueling. (Ref. 48, 35). In the evening of the same day the group arrived at the third point, Dikson Island. The aircraft landed on an airfield built on the ice of the bay separating the mainland from the island. The airfield was equipped to handle night landings. (Ref. 35).

Dikson was the main coastal base of the expedition. (Ref. 35). At the same time it was a point where the several groups comprising the expedition split to proceed to their respective destinations.

The air detachment handling the launching of the "North Pole 3" Station was to proceed to Mys Chelyushkin, which was the jump-off point for that station. 031. The air detachment handling the personnel and equipment of the "North Pole 4" Station was bound for Mys Shmidt as the jump-off point. (Ref. 11, 48). Finally, the special Scientific Detachment with the mobile groups of scientists was to establish several intermediate points in the western area of the Pole. (Ref. 35, 11).

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The Bay at Dikson where the airfield was located was organized as a big reloading and supply dump. Crates and boxes with equipment were laid out in a large area and were marked "SP-3" and "SP-4", standing for the "North Pole 3" and "North Pole 4" stations. The two stations' chiefs personally supervised the loading and stockpiling operations. (Ref. 11). The actual launching operation commenced shortly after the arrival of the Expedition at Dikson Island. The pattern of these operations was similar for both drifting stations, the "North Pole 3" and "North Pole 4".

At first, a refueling base was established deep in the Arctic Basin to be used for scouting flights attempting to locate a floe sturdy enough to support the drifting stations. In each case, the floe, finally selected and approved for the main camp, was not suited to receive heavy aircraft. A landing strip was prepared some distance away on a lighter floe where it was much easier to clear the required runway.

Although the landing strip was often referred to as temporary, sources of much later date reported that it was still in use at both stations. Passengers and freight were unloaded there from two-engine aircraft and were transshipped to the main camp by helicopter and a light AN-2 plane.

The following is a detailed account of the launching operations as given by the pertinent reference sources.

1. Launching the "North Pole 4" Station.

On the third day after the start from Moscow, the air detachment assigned to the "North Pole 4" Station, took-off from Dikson Island. (Ref. 35). The detachment was under the command of pilot Mikhail Alekseyevich Titlov, a veteran Arctic flyer. (Ref. 5, 48, 16). Titlov set out for Mys Shmidt via Kresty Kolymskiye, where he stopped overnight. He arrived at Mys Shmidt on the fourth day since the commencement of operations. (Ref. 48). A day after Titlov's departure from Dikson Island, the Chief of the expedition, Burkhanov, followed the same route in the flagship of the expedition piloted by Il'ya Pavlovich Mazuruk, to supervise personally the launching of the "North Pole 4" Station. (Ref. 48). Burkhanov's group also included a part of the scientific force of the "North Pole 4" Station and part of its equipment. This group made the non-stop flight from Dikson Island to Kresty Kolymskiye in about 10 hours. (Ref. 35).

At this point Titlov's detachment included several aircraft, two of which were piloted by veteran Arctic pilots Vitaliy Ivanovich Maslennikov, and A. K. Zhgun. (Ref. 35). The launching operation thus entered a major phase of locating a suitable ice floe for the drifting station.

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In this respect, the first considerations were the accessibility of the floe to aircraft and the reliability of ice. (Ref. 3). On the second day of reconnaissance a suitable floe was located by Mazuruk 600 km north of the mainland. Directly upon discovery, a successful landing was made on it by pilot Zhgun. The floe was designated as "Ice Floe No.1", to be used as an intermediate base of operations and fuel dump in further search for a permanent station floe. (Ref. 48, 35). In the course of this work, the floe was used by at least four aircraft, piloted by Titlov, Maslennikov, and Zhgun. Three days later, a second suitable location was found and declared good enough to support the "North Pole 4" Station. (Ref. 48).

Directly upon the establishment of the site, aircraft loaded with supplies started arriving continuously from air bases at Mys Shmidt, Ostrov Vrangel'ya, Pevek, and Tiksi. (Ref.48,5).

The main base of "North Pole 4" Station was located on a heavy floe of old ice, not far from the landing strip. Although the main floe was convenient for the operation of the station, it was too uneven for the landing of heavy aircraft. Thus, freight brought from the mainland was unloaded from two-engine aircraft onto the landing floe, whence it was transhipped by helicopter and a light AN-2 plane to the main base. (Ref. 36).

The aircraft carried everything necessary for the establishment and operation of the drifting station, including scientific equipment, communications equipment, food supply, personnel tents, housekeeping gear, fuel, etc. from the coastal base points to the intermediate bases. (Ref. 53). The landing strip near the station floe regularly received two-engine aircraft; moreover, even the PYe-8, four-engine transport, mentioned above, was reported to have made routine landings on the strip. (Ref. 48).

2. Launching the "North Pole 3" Station.

While the operations launching the "North Pole 4" Station were in progress, various detachments of the High-Latitude Expedition continued to move systematically from the mainland to the Central Arctic. (Ref. 35). After Titlov's group left for the Chukotka Peninsula, the detachment handling the launching of the "North Pole 3" Station prepared for further operations on Dikson Island. The detachment was under the command of Il'ya Spiridonovich Kotov, a veteran Arctic pilot, and included several planes flown by pilots, Petr Pavlovich Moskalenko (flying an LI-2 aircraft), Nikolay Vasil'yevich Mironenko, and Fedor Anisimovich Shatrov (flying an IL-12 plane). (Ref. 11, 16, 31). From Dikson Island, Kotov's detachment, carrying aboard the chief of "North Pole 3" Station, Treshnikov, and part of his staff, flew to the Mys Chelyuskin jump-off point. Kotov's and

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Moskalenko's planes continued from there beyond the 85th latitude. An ice floe was found in that area suitable as an intermediate base. The crews of the two planes prepared a landing strip on the floe and flashed a message to the rest of the group waiting on Mys Chelyuskin. The next day, the remaining planes landed in the intermediate camp, bringing fuel for the next jump to still higher latitudes. The group flew from Mys Chelyuskin due North to the intermediate camp via Proliv Vil'kitskogo and Severnaya Zemlya (Ostrov Bol'shevik).

The search for the permanent floe for the station was carried on from the intermediate camp by Kotov and Treshnikov who proceeded in a NE direction. (Ref. 11). The scouting mission located a suitable floe; however, as in the case of "North Pole 4" Station, the ice floe was too uneven to receive heavy aircraft. Therefore, a temporary airstrip was established 9 km from the main floe. (Ref. 11). Directly after landing on the airstrip, an ice hole was drilled to determine the thickness of the block. Next, the runway was levelled off by all the participants of the flight. The task was completed in 3 hours. A radio antenna was launched on a cardboard kite and radio contact was established with the continent and other drifting camps. The personnel began the erection of tents, installation of gas ranges, and collection of snow for water. (Ref. 11).

At the same time, the flagship of the expedition with Burkhanov, on board, took-off from Tiksi for the "North Pole 3" to inspect the main floe and give his final approval. He stopped on the way at the intermediate base which had a gasoline dump consisting of fuel barrels to service supply aircraft on their way to the "North Pole 3" floe. (Ref. 36,12).

Directly after the official approval, aircraft fuel was brought to the airstrip for the transfer of accumulated equipment to the main floe. A single-engine AN-2 bi-plane was flown to the camp from the mainland for this purpose. It assumed the role of a shuttle between the airstrip and the main floe, covering the distance of 9 km in a few minutes. The round trip was made every 30-40 min. The plane required only 50 meters of runway. (Ref. 12).

A few days later, a runway was being cleared on the main floe of the station to receive heavy aircraft coming directly from the continent. (Ref. 12). However, as late as the middle of July, planes were landing on the airstrip near the main station floe. The passengers were taken to the station by helicopter. (Ref. 20).

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3. Launching the Scientific Detachment.

The third element of the expeditionary group starting from Dikson Island, was the special Scientific Detachment of Cherevichnyy. As in the Case of "North Pole 3" and "North Pole 4" stations, the personnel and equipment of the detachment were deployed on Dikson Island preparatory to their transfer to the Polar area. Following the same pattern, scientific equipment and fuel of the detachment was to be carried from Dikson to intermediate points and thence, to the Polar Region. Along with the equipment, a group of scientists of the detachment headed by Ostrekin was departing for that region. (Ref. 11, 35).

The special detachment was to establish several bases on ice in the western area of the Pole from which its aircraft was to fly the scientists to various points on ice for observations. (Ref. 35, 36).

4. Air Supply Operations.

The establishment of these groups on their final bases was completed within the first 4 weeks of the expedition. (Ref. 36). During that time transport planes were continuously arriving at the ice floes West and East, carrying freight ranging from automobiles and complex instruments to fresh lemons. (Ref. 5). A report states that on May 6, 1954, all the aircraft participating in the High-Latitude Expedition converged on Dikson Island. (Ref. 20). This might indicate the close of operations other than those connected with the drifting stations, "North Pole 3" and "North Pole 4". These activities were continued. The Main Administration of the Northern Sea Route arranged for a regular air transport service to the drifting stations, delivering literature, mail, instruments, foodstuffs, etc., and carrying back test samples of seawater for chemical analysis and other completed results of scientific research. (Ref. 58, 52, 53, 16). These flights were made from coastal bases such as Tiksi and Dikson, non-stop to the drifting stations. (Ref. 58, 11). There is a number of points along the Northern Coast between Mys Shmidt and Tiksi, with stacks of provisions, equipment, and fuel for the drifting stations. (Ref. 20).

The routine missions were flown by the same pilots who participated in the launching phase of the expedition. Thus, Cherevichnyy, Mironenko; Mazuruk, Titlov, Bakhtinov, Osipov, continued to deliver tons of provisions, dwelling cabins, newspapers, instruments, as well as visitors to the Polar Stations. (Ref. 67, 64)

A large part of freight carried for the expedition was handled by the PYe-8 aircraft. The crew of this plane was composed of picked men among the Polar Aviation personnel. (Ref. 35).

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During dark polar nights, this work was carried on with the same success as in daylight. Polar aviation navigators have developed methods insuring precision and safety during high-latitude flights. The main navigational aid in those operations was the astro-compass. Radio navigational aids fail in the Arctic because of the large distances between the radio stations and the area of operations. The use of the astronomical compass was confined for a long time to meridian flying only, that is, to flying on strictly northerly or southerly courses. This was due to the difficulties in course computation which required the use of true solar time or the time angle of the given meridian. However, as early as 1945, a method of flying on any course was worked out and successfully applied. The method of navigating with the astro-compass is claimed to guarantee not only precision in arrival on target, but also complete safety by precluding loss of orientation.

The polar method of astronomical orientation is very simple and requires not more than one minute for the necessary computations. It is also convenient since no astronomical tables are needed.

Another difficult problem which was successfully solved concerned suitable map projections. Common projections with converging meridians involved a number of considerable difficulties, particularly evident when a square flight pattern was to be followed in the immediate vicinity of the Pole. To avoid confusion, all the existing projections have been abandoned and replaced by the so-called "grid of false meridians", first developed by Mazuruk in 1937. However, it is admitted that much has yet to be done to render Arctic flying as reliable and safe as flying over the continent. (Ref. 17).

The success of the 1954 High-Latitude Expedition is claimed to be mainly due to well-equipped supply bases on the coast and islands of the Arctic Ocean and well developed intermediate supply points established on drifting ice. (Ref. 20). These achievements are also credited to higher speeds of aircraft and the fact that polar pilots have learned to fly in the Arctic in any weather. (Ref. 18). According to a statement by V. Akkuratov, Chief Navigator of Polar Aviation of the Main Administration of the Northern Sea Route, the expedition was made possible by the considerable development of Soviet aviation. The science and practice of aviation have been largely enriched by the flights to the Arctic, particularly by new techniques of flying under complex meteorological conditions and of landing on drifting ice. (Ref. 17).

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V. Scientific and Operational Equipment of the 1954 Expedition

The drifting stations of 1954 are much better equipped than their predecessors. All laborious processes are mechanized. (Ref. 53). Stations are provided with numerous sets of precision instruments specially designed for their work. Instruments for the study of terrestrial gravitation, and for geological and biological investigations at great depths were built by various scientific institutes specifically for the drifting stations. For example, a series of precision instruments for taking samples of bottom soil and marine fauna was constructed by the Institute of Oceanology. Another series of instruments was made by the Geophysical Institute of the Academy of Sciences. (Ref. 3, 58, 72).

One of the most common standard items of equipment used in all phases of the expedition is the hydrological winch for sounding the depth of the ocean. The winch is driven by a gasoline motor manufactured by the Kiyev Motorcycle Plant and contains a very thin steel cable wound on a drum, terminating in a cast-iron weight. (Ref. 13). The sounding cable is lowered by a manually operated crank; power is used only for lifting the cable. The winch is usually installed at the edge of an ice hole made in the floe. Average floes are drilled for depth sounding with 2-m steel bits, while thicker floes are blasted with ammonal. The ice hole together with the winch is usually protected under a tent. (Ref. 49).

Each station is provided with complete laboratories for hydrological aero-meteorological, geophysical, and other scientific work. (Ref. 3, 33).

The standard equipment of each station includes a GAZ-69 cross-country vehicle, and a KD-35 diesel tractor. (Ref. 33, 14, 18, 47).

Electric power plants provide electricity for the radio and lighting installations. (Ref. 47, 58). The airstrips are cleared by snow plows attached to the tractors. (Ref. 4).

Aircraft is represented by a helicopter and a light single-engine plane permanently assigned to each drifting station. (Ref. 18, 47, 16, 53). The helicopters flew under their own power from Moskva and proved to be excellent tools for scientific exploration. It is expected that they will provide in the future a considerable stimulus for geological exploration of the coastal regions of the Arctic. (Ref. 3, 51).

In addition to working equipment, each station is provided with motion-picture projectors, libraries, tape recorders, and pianos. (Ref. 3, 58).

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Emergency areas with stockpiles of food, and with radio stations are prepared at the outskirts of each station for cases of sudden movement or breaking of the ice floes. (Ref. 33, 14).

The personnel of the stations is accommodated in tents and prefabricated cabins.

The tents consist of a dismountable frame of aluminum tubes covered with white fabric on the inside and a dark colored cloth on the outside. A layer of air is trapped between the two cloth walls. The tents are hemispherical in shape and resemble round marquees. The floor consists of a layer of waterproof fabric covered by reindeer skins and plywood. The floor can float the tent in emergency. Comfort heat is produced by cooking-gas ranges and is claimed to be adequate. The gas is supplied in cylinders weighing 20-23 kg each, and containing gas at 15-16 atm. In some cases the tents are also heated by coal. The tents were specially designed for the drifting stations by engineer S.A. Shaposhnikov, who based the design on the native Chukchi hut called "yaranga". (Ref. 69, 34, 32, 18, 54).

The prefabricated cabins were also specially designed for the North Pole drifting stations. The following account describes the construction of these cabins as manufactured by the Fabricating and Assembly Shop of the Leningrad "Sovetskiy" Lumber Mill. The mill built these cabins of special materials with aircraft type plexiglass windows.

The first order for the cabins was received by the mill at the end of March 1954. On the same day, the mill assembled a brigade of 18 men to start the construction. The designer S.A. Shaposhnikov introduced totally new materials and working methods for the job.

The wall boards of the cabins are made of "penoplast" consisting of chemically treated tars. Penoplast is 6 times lighter than wood and just as strong. It also has very good heat insulating characteristics. With an ambient temperature of -60°C , the cabins can maintain an interior temperature of $+16^{\circ}\text{C}$ to $+18^{\circ}\text{C}$. Gas ranges or coal ovens of special construction are installed for heating. The cabins are warm enough to dispense with sleeping bags; instead of these, comfortable cots are used. (Ref. 18).

Each cabin is 4.5 meters long, 2.5 meters wide, and 3.5 meters high. A small entrance hall leads to a room designed for four persons. The cabin is equipped with a gas stove and is wired for electricity at the assembly site. All furniture of the cabins is of the light-weight folding type. (Ref. 54, 47).

The cabins were delivered to the drifting stations by rail, sea and air. After being tested at the stations, the cabins won considerable praise from the station chiefs. At the beginning of August, the Leningrad mill was filling a second order. (Ref. 62).

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There is evidence that the cabins were also manufactured in Moscow. (Ref. 12).

Another source describes a heavier type of prefabricated cabin, being built in Moscow for use in Polar stations. (Ref. 60). No direct indication has been found that these cabins are in use in the North Pole drifting stations; however, since this might be possible and since the heavier cabins are similar to the units described above it is felt that an account of the construction of the second type cabins is pertinent here.

The Moscow Workshop of the Administration for Structural Facings of Glavmosstroy (General Administration of Moscow Construction) is building special portable cabins for Polar workers. The shop actually engaged in the construction is called "The Redwood Shop".

The cabins have a small entrance hall containing the boiler compartment, wash basin and toilet on the right-hand side. The cabin door is oval in form. The entrance hall opens into a large light room of 18 sq. meters designed for four men. The room easily accommodates four beds, a table and chairs. The walls have seven porthole type windows made of double break-proof glass. An emergency escape hatch is provided in the roof to be used when the main door is snowed under. The frame of the cabin is made of dry seasoned pine. The wallboards consist of sheets of a special material, called "arktilit" cemented to the frame. Arktilit is an exceptional material, resistant to snow and water, and finds an ever widening application in shipbuilding. An Arktilit sheet consists of a steel mesh drawn on both sides of a wooden board made of tongue-and-groove planks.

Linen fabric is cemented on the outside of the mesh. The whole sheet is impregnated with a special material. Arktilit sheets cannot be sawed, and must be cut to size with electric shears.

After the Arktilit sheets are placed on the frames of the cabins, glue-impregnated cork crumbs are packed between the walls. The sheets are further secured to the frames with wood screws spaced 50 millimeters apart. Rubber gaskets are inserted between each sheet, hermetically sealing all seams. The sheets are tightened with 96 metal coupling ties of special construction. The walls, floor, and the roof of the cabin are all made of Arktilit. The cabin is mounted on two removable runners also made of Arktilit. The runners are protected in the center by a longitudinal strip preventing side rolls. The transverse bracing of the runners is made of metal.

The cabin weighs about two tons. Four men can assemble it in 5 to 6 hours. (Ref. 60).

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At the drifting stations, the tents and cabins are used for dwelling purposes, to house radio stations and laboratories as well as dining rooms and bath-houses. (Ref. 3, 54). Each prefabricated cabin in the stations is connected to an electrical, radio, and telephone networks. (Ref. 14).

Every single piece of equipment used at the drifting stations was delivered there by air. In the case of prefabricated cabins, tents, tractors, and larger pieces of equipment, they were delivered to the stations in parts and were assembled on the floes. (Ref. 8).

The actual number of aircraft participating in this airlift could not be obtained. However, a rough estimate can be made on the basis of pilots and other flight personnel engaged in this operation and listed in the following sections.

All the sources reporting on this expedition mentioned three types of transport aircraft of Polar Aviation: PYe-8 four-engine transport plane, IL-12 two-engine plane (the IL-12's were painted silver), and LI-2 two-engine plane (the LI-2's were painted dark green). (Ref. 35). The only other type of aircraft mentioned in this connection is the small single-engine AN-2 biplane and the helicopters used at the stations. (Ref. 11, 12).

VI. Personnel of the 1954 Expedition.

The personnel of the Expedition can be roughly divided into the following two main groups: flight personnel and scientists.

1. Flight personnel.

Polar Aviation personnel was not assigned to any one of the main elements of the Expedition with the exception of helicopter and small plane crews which are a permanent part of the drifting station staffs. During the first month of operations, a number of air crews was assigned to the Special Scientific Detachment; subsequently, these crews participated in supply operations for the drifting stations.

There is no direct evidence of the total number of aviators operating within the framework of the Expedition. It might be noted, however, that most of the names given below were repeatedly mentioned in the press in connection with the Expedition, and that after the initial six months new names were seldom encountered.

The source materials make a clear distinction between Arctic veteran fliers with long experience, and relatively younger fliers. Many of the veteran aviators participated in the 1937 expedition to the North Pole. The following list, therefore, will maintain this distinction whenever possible.

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a. Pilots.

Ivan Ivanovich Cherevichnyy. Arctic veteran.

Hero of the Soviet Union; graduated from Osoaviakhim flying school in 1932. In 1941, participated in the air expedition to the Pole of Relative Inaccessibility. Worked for over 20 years in the Arctic and accumulated over 3000,000 km to his credit. During the early stage of the 1954 Expedition, was Chief of the Scientific Research Detachment. Later, he flew supply missions to the drifting stations. (Ref. 5, 67, 16).

Il'ya Spiridonovich Kotov. Arctic veteran.

Hero of the Soviet Union. In charge of the launching of the "North Pole 3" Station. (Ref. 5, 16, 53, 11).

Vitaliy Ivanovich Maslennikov. Arctic veteran.

Hero of the Soviet Union. Assigned to Titlov's detachment launching the "North Pole 4" Station. (Ref. 16, 53, 49, 37, 5).

Il'ya Pavlovich Mazuruk. Arctic veteran.

Pilot of the flagship of the Expedition. (Ref. 5, 47, 53, 31).

Viktor Mikhaylovich Perov. Arctic veteran.

Group leader in the Scientific Research Detachment. (Ref. 5, 31, 65, 13).

Mikhail Alekseyevich Titlov. Arctic veteran.

In charge of the launching of the "North Pole 4" Station. (Ref. 5, 16, 53, 11).

Vasiliy Nikoforovich Zadkov. Arctic veteran.

Hero of the Soviet Union. Commander of the PYe-8 four-engine transport. (Ref. 53, 58, 35).

I. G. Bakhtinov. Aircraft commander.

(Ref. 47, 53).

G. Denezhkin.

Co-pilot of Perov's crew operating in the Scientific Detachment. (Ref. 13).

M. N. Kaminskiy. Aircraft commander.

(Ref. 47).

G. A. Korsakov.

(Ref. 17).

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Matvey Il'ich Kozlov. Aircraft commander.

(Ref. 47, 53, 13).

Nikolay Vasil'yevich Mironenko.

Participated in Kotov's detachment launching the "North Pole 3" Station. Later co-pilot of Cherevichnyy's plane on supply missions to the drifting stations. (Ref. 31, 11, 67).

Petr Pavlovich Moskalenko.

Piloted a LI-2 plane. Participated in Kotov's detachment launching the "North Pole 3" Station. (Ref. 16, 11, 36).

Osipov.

Flew supply missions to the drifting stations. (Ref. 64).

Fimenov.

Co-pilot of Kotov's plane. (Ref. 11).

Fedor Anisimovich Shatrov.

Commander of an IL-12 plane. Participated in Kotov's detachment launching the "North Pole 3" Station. (Ref. 47, 31, 11, 35).

Smirnov.

Co-pilot of Mazuruk's flagship. (Ref. 36).

V. G. Sorokin.

Group leader in the Scientific Detachment. (Ref. 5, 31, 13).

Mikhail Protasovich Stupishin.

Flew supply missions to the drifting stations. (Ref. 25, 38, 11).

Mikhail Stepanovich Vasil'yev.

(Ref. 17, 31, 13).

Nikolay Votrin.

Newcomer to the Arctic. Flew missions to the drifting stations. (Ref. 48).

A. K. Zhgun.

Participated in Titlov's detachment launching the "North Pole 4" Drifting Station. (Ref. 5, 17, 31, 35).

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b. Navigators.

Valentin Ivanovich Akkuratov.

Chief Navigator of the Expedition. Active in aviation from 1931. Has over 3,000,000 km over the Arctic to his credit. (Ref. 16, 49).

Pavel Makarovich Banyushevich. Arctic veteran.

Participated in Titlov's detachment launching the "North Pole 4" Drifting Station. Banyushevich is 50 years old, has 2,000,000 km to his credit, lives in Moskva and volunteers for Arctic service every spring. (Ref. 5, 17, 49).

B. I. Ivanov. Arctic veteran.

(Ref. 5, 16).

D. N. Morozov. Arctic veteran.

Navigator of the flagship of the expedition. (Ref. 5, 31, 35).

Nikolay Nikolayevich Zhukov. Arctic veteran.

Participated in the operations of the Scientific Detachment. (Ref. 5, 31).

N. V. Zubov. Arctic veteran.

(Ref. 5, 16, 31, 17).

G. P. Baydalo.

(Ref. 5, 17).

Fedor Andreyevich Burlutskiy.

(Ref. 11, 17).

V. N. Fisenko.

(Ref. 5, 17).

V. P. Padalko.

(Ref. 31, 47).

Mikhail Frolovich Sherpakov.

Navigator of Perov's plane. (Ref. 17, 11, 65)

Nikolay Ternovskiy.

(Ref. 48).

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V. D. Tulin.

(Ref. 16. 5, 17).

c. Flight mechanics.

Valentin Nikolayevich Anan'yev.

(Ref. 11).

Ivan Kryukov.

Second flight mechanic of Maslennikov's plane.
(Ref. 49).

Mokhov.

(Ref. 67).

Shekurov.

(Ref. 67).

Aleksey Il'ich Zaytsev

Senior mechanic. (Ref. 13).

c. Flight radio operators.

Nikolay Alekseyevich Bogatkin.

(Ref. 11)

V. V. Mishustin

(Ref. 13).

Nikolay Yakovlevich Nedoshivin.

(Ref. 49).

Potarushin.

(Ref. 67).

2. Scientific Personnel.

Apart from the scientists participating in the expedition on a full time basis, various members of the Academy of Sciences and other institutions visited the drifting stations for special research work. The following scientists of the Academy worked at the stations:

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Scientists who made spring trips to the stations:

Ye. K. Fedorov, Corresponding member of the Academy of Sciences of the USSR.

(Ref. 3).

Ye. M. Suzyumov, Science Assistant.

(Ref. 3).

D. I. Shcherbakov, Member of the Academy of Sciences of the USSR.

(Ref. 3).

Scientists who made summer trips to the stations:

L. A. Zenkevich, Corresponding Member of the Academy.

(Ref. 3).

V. G. Kort, Doctor of Geographical Sciences.

(Ref. 6).

P. A. Shumskiy, Doctor of Geographical Sciences.

(Ref. 3).

A. Ye. Kriss, Doctor of Biological Sciences.

(Ref. 3).

Furthermore, the following persons made trips to the drifting stations:

M. Klenova, Doctor of Geological Sciences.

(Ref. 25).

Yu. K. Alekseyev, Arctic veteran, designer of a number of new hydrological instruments.

(Ref. 64).

V. S. Suvorov, mechanic, specialist in hydrological instruments.

(Ref. 64).

Physicians Kornyaniskiy, Smolenskii, and Mulyar.

(Ref. 59, 38).

Scientists permanently assigned to the several units of the Expedition will be listed under the respective units.

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3. Personnel of the Drifting Stations.

The lists of personnel for the "North Pole 3" and "North Pole 4" Drifting Stations compiled from the press contain over 20 names for each station. It is felt that this figure approaches closely the actual number of persons permanently assigned to the stations, for several reasons. On one hand, each name has been mentioned by quite a large number of reference sources, while no new names appear in the current sources. On the other hand, one source states that about one-half of the personnel of the station (North Pole 3) are members of the Communist Party. (Ref. 34). Another source reports that the Party organizations at both stations number about 20 Communists. (Ref. 43).

The personnel structure of both stations is very similar. Each station has a group of hydrologists, meteorologists, and aerologists. A single person fulfills the duties of magnetologist and astronomer. The scientists comprise roughly one-half of the station personnel. In some cases, members of the stations acquire other skills, to help the rest of the scientific personnel. Such was the case with Dr. Paleyev on "North Pole 4" station, who learned meteorology. Both chiefs of the stations are candidates of geographical sciences. Again, both deputy chiefs are hydrologists. (Ref. 18, 74).

a. Personnel of the "North Pole 3" Drifting Station.

Aleksey Fedorovich Treshnikov. Chief of the Station.

Candidate of Geographical Sciences. Specialist in Oceanology. Received title of Hero of Socialist Labor for his work in high-latitude expeditions. Graduate of Leningrad State University; student of Yu. M. Shokal'skiy. Participant in 1948-1950 expeditions. The 1954 operation is his 14th expedition to the Arctic. (Ref. 54, 53, 36, 18).

Vladimir Aleksandrovich Shamont'yev. Deputy Chief of the Station. Chief of Hydrological Group.

Engineer oceanologist. Party organizer at the station. Worked in the Arctic for 5 years. (Ref. 18, 74, 54, 49, 58, 12).

Georgiy Andreyevich Ponomarenko. Hydrologist.

(Ref. 53, 58).

Aleksandr Ivanovich Dmitriyev. Hydrologist.

(Ref. 53, 58, 12, 10A).

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G. I. Matveychuk. Chief of Meteorological Group.

Also working as senior hydrologist. Worked in the Arctic for 10 years. (Ref. 53, 38, 10A, 22, 54).

Anatoliy Danikovich Malkov. Meteorologist.

(Ref. 53, 58, 38, 12).

Vasiliy Gavrilovich Kanaki. Chief of Aerological Group.

Worked in the Arctic since 1933. Inventor. (Ref. 22, 18, 53, 54, 58, 12, 49).

Platon Platonovich Poslavskiy. Aerologist.

Worked in the Arctic for 23 years. (Ref. 53, 58, 12),

Igor I. Tsigel'nitskiy. Aerologist trainee.

Youngest member of the station. (Ref. 12, 10A).

Nikolay Yevdokimovich Popkov. Magnetologist, Astronomer.

Also working as geophysicist.. (Ref. 58, 38, 12, 21, 10A, 28A).

I. Kuchuberiya. Geophysicist.

(Ref. 65, 70).

Ivan Stepanovich Peschanskiy.

Candidate of Geographical Sciences. Instructor at Vysshoye Arkticheskoye Morskoye Uchilishche im. S. O. Makarova (Arctic Marine Academy). (Ref. 49).

Konstantin Mitrofanovich Kurko. Chief Radio Operator.

Worked previously in the "North Pole 2" Station. (Ref. 7, 8, 53, 49).

Leonid N. Razbash. Radio operator.

Also working as assistant to Dmitriyev in hydrological group. Member of Komsomol; 26 years old. Worked Chukotka Polar Stations; returned later to Leningrad where he obtained secondary education at the Arctic School. Returned to polar stations after graduation. (Ref. 8, 7, 58, 12, 49).

V. G. Volovich. Physician of station.

Also in charge of provisions. (Ref. 53, 10A, 36).

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Aleksey Fedorovich Babenko. Helicopter Pilot.

Also working as a barber of the station. (Ref. 12, 49, 29).

Minakov. Helicopter navigator.

Also assisting Popkov in magnetological work. (Ref. 38, 21).

A. Medved'

Also reported as helicopter navigator. (Ref. 13A).

Mikhail Semenovich Komarov. Mechanic.

Former pilot; lost an eye in last war. (Ref. 53, 54, 18, 49).

Yevgeniy Pavlovich Yatsun. Motion-Picture Operator and Photographer.

Spent 2 months on "North Pole 2" Drifting Station. (Ref. 11, 53).

Ivan Maksimovich Sharikov. Cook of Station.

(Ref. 61, 36).

Georgiy Ivanovich Kuznetsov. Function undetermined.

(Ref. 26.).

b. Personnel of the "North Pole 4" Drifting Station.

Yevgeniy Ivanovich Tolstikov. Chief of the station.

Candidate of Geographical Sciences. Worked as an synoptician in the Arctic since 1937. Earned considerable reputation as a field worker, conducting Arctic operations under difficult conditions for a number of years. His wife is one of the best meteorologists in the eastern sector of the Arctic. All his children were born beyond the Arctic Circle. Member of the Communist Party. (Ref. 18, 16, 9, 53, 54).

Aleksander Gavrilovich Dral'kin. Deputy Chief of the station.

Candidate of Geographical Sciences, specialist in hydrology. Connected with the Arctic since 1938. (Ref. 64, 24, 18, 5).

M. I. Dem'yanov. Chief of Hydrological Group.

(Ref. 24, 25).

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Mikhail Izvekov. Hydrologist.

Specializing in engineering. (Ref. 24, 25).

L. F. Ovchinnikov. Chief of Meteorological and Hydrological Group.

Specialist in meteorology. (Ref. 64, 24, 59).

G. M. Silin. Meteorologist.

Also working as newspaper correspondent. (Ref. 55, 24).

Shchelkin. Hydrologist.

(Ref. 24).

Barbakin. Hydrologist.

(Ref. 24).

A. I. Delarov. Magnetologist.

(Ref. 24).

Igor Vladimirovich Zavedeyev. Chief radio operator.

In 1952 became DOSAAF champion of radio amateur contest.
In 1953 established a speed record in radio telegraph receiving. (Ref. 7, 8, 59).

Petr Dmitriyevich Tselishchev. Radio operator.

Also working as motion-picture operator. (Ref. 7, 9, 24, 59).

N. R. Paleyev. Physician of station.

Also assisting in meteorological work. (Ref. 18, 59, 75).

V. Ye. Mel'nikov. Helicopter pilot.

(Ref. 24, 48).

Prokhorov. Mechanic.

(Ref. 24).

Gorokhov. Mechanic.

(Ref. 24).

Shutyayev. Mechanic.

Tractor driver. (Ref. 24, 59, 56).

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Shirkov. Mechanic.

(Ref. 56).

Vasil'chenko. Bulldozer driver.

(Ref. 48).

B. N. Tikhonov. Cook of the station.

Returned to the mainland in October for reasons of health. (Ref. 64, 24, 75).

Yvriy Slyunin. Cook of the station.

Arrived in October to replace Tikhonov. Member of Komsomol. (Ref. 64).

Kaznov. Function undetermined.

(Ref. 24).

M. Ivanov. Function undetermined.

(Ref. 56).

Zinchenko. Function undetermined.

Member of Komsomol. (Ref. 56).

VII. The "North Pole 3" Drifting Station

1. The Drift.

The "North Pole 3" Drifting Station was launched on April 9, 1954 at 86°00'N - 175°45'W. (Ref. 68, 16, 4).

From April to July, the floe had been drifting steadily in the northeasterly direction. (Ref. 53). On July 15th, the station was located at 88°02'N - 151°40'W, still drifting northeast. (Ref. 52). During the last days of July the drift changed due North. During the first weeks of August, the station drifted over the eastern slope of Lomonosov Range. (Ref. 22) In August, the station was drifting steadily to the northwest passing 30 km from the North Pole. In the middle of August the station crossed to 89th parallel drifting North. (Ref. 66). On August 25th, the station passed almost directly over the North Pole and, towards the end of the month, crossed over the Lomonosov Range; it continued to drift in the North Pole area through the first half of Sept. (Ref. 21, 68, 12, 40, 42, 44). During the first six months of operation, "North Pole 3" drifted a total distance of 1150 km but was displaced from the starting point by only 450 km. (Ref. 44). By September 21st, the station had reached the Pole, having recently drifted at a rapid rate. (Ref. 50).

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On December 28th, "North Pole 3" reached a point 88°11'N - 60°23'W. During its 265 days of drift, the station was displaced 600 km NNE from the starting point. Its total path was 1600 km long. The average rate of drift was 6.5 km per 24 hrs. The speed, however, varied within wide limits. For example, during the 3 days, from 22 to 24 of August, the speed was 32 km per 24 hours. (Ref. 68). At the end of December, the station was between the Pole and Greenland, on the divide between two drift patterns. It was expected that the station may be carried out towards the Greenland Sea (Following the path of the "North Pole 1" station) or that it may move toward Ellesmere Land. The ice floe carrying the "North Pole 3" Station was not expected, however, to move far from the North Pole area during the winter period. (Ref. 68).

The station was originally launched at a point selected so as to make it drift either in a closed loop in the Eastern part of the ocean or to close the drift path of the "North Pole 1" Station of 1937. (Ref. 9).

2. The Camp.

The floe of the station is oval in form, 2 km long, 1.5 km wide, and 2-3 meters thick. (Ref. 8, 53, 18). Directly upon the approval of the floe as a permanent foundation for the "North Pole 3" Station, men and equipment were rushed to it at top speed. Within a few days after the launching, the entire personnel has been accommodated in winterized tents equipped with radio and electric light. Scientific installations were set up and a work schedule was established and adhered to. The organization of the station was completed two weeks after the launching. (Ref. 49, 34). At that time, there were over 10 tents on the floe. The freight platform was filled with a hundred tons of cargo and still new planes from the mainland continued to arrive one after another. (Ref. 12). In a few months a regular settlement, or "a real science town" as one source put it, was built on the floe. (Ref. 53).

The camp was laid out according to carefully drawn plans. The tents form a rectilinear street. The scientists are grouped according to profession; hydrologists live in one tent, meteorologists in another, aerologists in a third. A part of the personnel has been later moved into prefabricated cabins when these began arriving at the station. A wardroom or mess-hall is located in a large tent made of two standard units. The mess-hall was later moved to a large ornate house made of snow bricks without windows. The walls and dome of the tent were made of 3 layers of fabric drawn over the metal frame. The floor was covered with a thick layer of tarpaulin and reindeer skins. The windows were round, of the porthole type.

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Working tents which house laboratories, scientific installations and workshops are situated close to the dwelling tents. Dumps with provisions, fuel, and equipment are laid out around the periphery of the camp. At the end of July, the station has received 500 heating gas bottles. (Ref. 69).

In the center of the camp there is an open area called "Sovetskaya Ploshchad" (Soviet Square). A large inflated life boat lies in the center of this area. (Ref. 49, 36, 58, 5).

The meteorological platform is set up to one side from the tents. The flag is flown from the radio mast. (Ref. 36).

Each member of the camp has a work station assigned to him. Automatic recording instruments are connected by cable to central tables installed in the working tents. Devices sensitive to weather or to low temperatures are housed in warm tents. (Ref. 53). Sensitive magnetic devices are protected by walls made of snow bricks. The platform of the aerologists is provided with a hydrogen generator for filling radio sonde ballons. The radio signals from the sondes are received and recorded in the radio tents. (Ref. 58, 38, 12).

Apart from standard equipment, such as the helicopter, capable of lifting 10 to 12 persons, the cross-country vehicle, a large motor generator set for the electric power plant, the personnel was furnished with special devices such as power-driven ice drill invented by M. S. Komarov, mechanic of the station. (Ref. 20, 49).

The station received a motion-picture projector and a piano. (Ref. 38, 12).

The personnel of the station is claimed to have adjusted itself rapidly to the new living conditions. (Ref. 49). In early November work was going on in the camp as usual despite strong frosts. New cabins were being assembled and additional storage dams were being constructed at various points on the floe. The camp was brightly lit with electricity. (Ref. 46).

3. The Radio Station.

The radio tent was used by the operators and equipment prior to the arrival of prefabricated cabins. The radio station of "North Pole 3" went on the air soon after the establishment of the camp. (Ref. 12). The station identification sign is UPOL-3. (Ref. 9). The radio equipment of the station consists of a standard transmitter and receiver set of Soviet manufacture without particular modifications. The set is economical, reliable, and easily portable. (Ref. 7).

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The first prefabricated cabin to arrive at the station was assigned for the radio operators. As the chief operator put it, the cabin was not spacious but much better than the tent; it also had a gas stove, instead of a gas range. Ship-type washing facilities were installed by the inhabitants.

The radio equipment occupies one wall and two tables which also support a typewriter. Both radio operators use the vibroplex instead of the sending key. The typewriter in conjunction with the vibroplex permits operation at speeds higher than conventional.

After the initial period of establishment, the operators found time enough to set up long range communications and particularly, a direct contact with Moscow. For this purpose, a suitable wavelength was selected shortly before September 1954.

All the cabins and tents in the camp have radio outlets, and the radio room serves as the central station of the local public address system. The station is provided with a tape recorder. (Ref. 7).

The operators report that the radio telephone system in the camp works well. However, much trouble is apparently caused by the radio masts. The guy ropes are frequently thawing loose and must be reattached to various heavy objects.

The radio operators are also in charge of the radio station of the helicopter assigned to "North Pole 3". Moscow time is accepted as official at the station. (Ref. 7, 36).

4. Scientific work.

The scientific work of the station is pursued according to a rigid routine. Readings from all instruments are recorded every 3 hours, or 8 times a day, and immediately transmitted to weather bureaus by the radio operator on duty. Aerological data are obtained and transmitted twice a day. Test measurements are frequently run to check the operations of automatic recording devices. (Ref. 38, 44).

The appearance of the sun, even if for a few minutes, is utilized to fix the coordinates of the station. This is based on 2-3 elevations of the sun taken at intervals of 2-3 hours. (Ref. 38).

A snow pavillion is used for magnetological observations. The snow walls are claimed to protect variometers registering changes in the terrestrial magnetic fields from metallic objects.

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The oceanographers, under V. A. Shamont'yev, Deputy Chief of the station, set up their equipment near the edge of the station floe. The hydrological winch is protected by a heated tent. The winch is used to take depth readings, to obtain earth column samples from the ocean floor, and to catch small organisms living at different depths of the sea. Small trawls are lowered and dragged for samples of bottom fauna, such as sea urchins, cockle shells, etc. (Ref. 12, 38).

The hydrogen radio sondes carry a thermometer, automatic recorder, and a tiny radio transmitter. The sonde is tracked with a theodolite. After launching the sonde, the aerologist on duty monitors the flight of the balloon in the radio receiver tent for over an hour, recording the sonde signals relaying weather information at various altitudes. The obtained data are worked out and transmitted to all the weather bureaus in the country, via the Hydro - Meteorological Service. A report on one launching states that in 10 seconds the balloon rose to 60 meters where it sent the first radio signal. At an altitude of 7 km, the temperature was -50°C . The balloon burst at an altitude of 24 km. (Ref. 12, 38).

VIII. The "North Pole 4" Drifting Station

1. The Drift.

The "North Pole 4" Drifting Station was launched on April 6, 1954, at $75^{\circ}48'N - 175^{\circ}25'W$ about 600 km north of Vrangell Island. (Ref. 16, 4, 55, 68).

On July 15, 1954, the station was at a point $77^{\circ}22'N - 174^{\circ}20'E$ and drifting NW. (Ref. 52). Toward the end of July "North Pole 4" was situated 1200 km away from "North Pole 3" and was drifting in the area of the continental shelf. (Ref. 20). During the first three months of operation, the station covered over 400 km in a generally northwest direction. Towards the end of July, the station was crossing the border line of the continental shelf. (Ref. 55). Early in August, the coordinates of the station were, $77^{\circ}27'N - 174^{\circ}17'E$. (Ref. 39). On August 12th and 13th, the station drifted in the southeasterly direction. However, on the second day, the drift reversed itself, changing to NW. (Ref. 25). During the first half of August, the station drifted 60 nautical miles north, crossing the 78th parallel. On August 16th, the station passed within 18 miles of the "Pole of Relative Inaccessibility", where Cherevichnyy landed in 1941. At the same time the station passed beyond the edge of the continental shelf. On August 25th, "North Pole 4" began to drift in a large circle (over 100 miles in circumference) in a clockwise direction. It approached the 80th parallel, then moved back towards the 79th. (Ref. 39, 50, 45).

By the end of August, the station was in operation for 5 months. During that time it drifted 215 nautical miles (400 km). (Ref. 41). On September 17th, it completed the 100-mile

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circle and was again at the exact spot of August 25th. After September 19th, the course changed to North. By the end of September, the drift speed increased to 6-7 miles a day. (Ref. 45). At the end of October, the course shifted about 80° from NNE to NNW. (Ref. 28).

During the first 6 months of the drift the station covered 770 miles. The net displacement amounted to 253 miles approximately in a northwesterly direction. (Ref. 64). On November 3rd, the station was at 80°20'02"N - 177°13'01"E, having drifted a total of 1600 km. By the end of December, the station covered a path of 2000 km with a net displacement of 540 km North. Its drift path was almost parallel to that of "North Pole 2" Station of 1950 - 1951. The average speed of drift of "North Pole 4" was 7.8 km in 24 hrs. The station was expected to follow a circular drift pattern, that is, it was expected to turn next to the East. (Ref. 68).

At the time of launching, the "North Pole 4" Station was over 1000 km south of and near the same meridian as the "North Pole 3" Station. (Ref. 12). The "North Pole 4" was launched comparatively close to the coast in order to study the drift of ice in this area and to investigate the continental shelf. (Ref. 9).

2. The Camp.

The floe of the station is an entire complex of ice blocks with an average thickness of 3 meters and an area of 7 sq. km. It is sufficiently strong and reliable to receive any cargo and to insure prolonged and undisturbed drift in the ocean. (Ref. 5, 53, 33).

Within two to three days after the discovery of the floe by Titlov and Tolstikov, and the approval by Burkhanov, tents, equipment, provisions, and transport vehicles were delivered by air to the floe. (Ref. 33). The supplies were unpacked and sorted, and carried by helicopter from the landing and disembarking area to the permanent camp site several miles away. The helicopter made 15 trips a day for two days. (Ref. 48).

It is not entirely clear whether the landing strip was retained permanently or whether an airfield was ever cleared on the main ice floe. As late as August mention was made that transportation between the airfield and the camp was effected by helicopter. It is known that the four-engine transport plane landed in the station area. (Ref. 48, 5).

The "North Pole 4" Station is laid out in a different pattern than the "North Pole 3" camp. Dwelling tents and prefabricated cabins are arranged in a circle. Names are given to every part of the camp, such as the wardroom, meteorological platform, the helicopter platform, the central baths, etc. All cabins and tents have electricity. (Ref. 36, 53).

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In summer, a period of relatively warm weather (+1°C, to +2°C), accompanied by winds and rain, caused an intensive thawing of ice. The struggle against flooding was taking much of the time. All measures were taken to keep the water away from cabins, service tents, and scientific installations. The main method of drainage was by drilling holes in the ice floe. The operations however, were continued on schedule in spite of these difficulties. (Ref. 18).

Although the weather deteriorated in the beginning of the fall, routine flights of aircraft were not interrupted. (Ref. 39). Likewise, Arctic pilots continued to fly and land on drifting ice during the Polar night. Considerable work was done at that time in receiving and storing the incoming supplies, assembling cabins, installing new instruments, etc. (Ref. 45, 27).

The working day begins at the station at 8 AM and on Sundays and holidays at 9 AM. The work starts at 9 AM. The after dinner rest is obligatory. At 2230 (local time), there is a general retreat, with the exception of the man on watch duty. Local time of the station differs from Moscow time by 10 hrs. (Ref. 75, 64).

Amateur theatricals are given twice a month, amateur concerts of local talents are relayed through the public address system once a month, and sound motion-pictures are shown every Saturday. Every month, fresh potatoes, cucumbers, tomatoes, apples, oranges and lemons are delivered to the station by air. There is a library in the camp. (Ref. 75,53).

A well equipped first aid point is housed in a special tent. The equipment includes medicines, surgical instruments, etc. Medical inspection is carried out once a month. The station doctor plans the daily menus for the personnel. (Ref. 75).

Similarly to the "North Pole 3" Station, the camp was growing at a rapid rate, presenting an aspect of an entire settlement. Freight brought by air included a mechanical ice drill, sounding winches, dog teams, prefabricated cabins, radio masts, windmill power plants, rubber boats, sleds, X-ray and dental equipment, etc. In the fall, the camp received 5 additional prefabricated cabins. Three cabins were used to make a new wardroom with a galley. (Ref. 5, 59, 46, 27).

Masts, and tripods with instruments are everywhere in evidence. Round black tents of duraluminum frames stand above ice holes; these are the observation posts of the hydrologists. A high metal mast with a series of branches supports various meteorological instruments. A separate tent is set aside for magnetic observations.

During the September - October period, the personnel of the station was making intensive preparations for the winter season. Searchlights were set up and tents were moved closer to the center of the camp. (Ref. 41, 27).

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3. The Radio Station.

The "North Pole 4" radio station has equipment powerful enough for reliable communications with Arctic radio centers located at considerable distances. The station identification sign is UPOL-4. The station is in contact with other camps and with aircraft bringing supplies from the continent. Aircraft on their way to the station receive weather reports and radio direction signals. (Ref. 7, 9).

Moscow broadcasts are received daily by short wave. Their reception is good. Medium wavelengths are poor during the Polar day. During the Polar night however, the audibility of medium and long waves is expected to be good.

Every cabin and tent in the camp has a loudspeaker switched to the radio relay network. The settlement also has a telephone network. Thus, the radio room is at the same time a central switchboard and public address center for the drifting camp. (Ref. 7, 53).

The two radio operators of the station are in charge of the radio station of the helicopter and of its radio navigational devices. They also act as projectionists, operating a portable "Ukraine" motion-picture projector installed in the wardroom. (Ref. 7, 53).

4. Scientific Work.

The scientific tasks of the "North Pole 4" Station include extensive oceanographic observations, daily depth soundings, charting of the ocean floor, taking water temperature at various depths, measured with bathometers featuring tipping thermometers, and the study of currents in the central part of the Arctic. Meteorological observations, carried out from the first day of drift, included studies of the lowest and the highest layers of the atmosphere, direction and speed of wind, stratospheric radio sounding, etc.

The results of observation are transmitted to the continent 8 times per 24 hrs. (Ref. 53). Regular helicopter flights are made into neighboring areas for complex observations. Thus, a wide zone of both sides of the line of the drift is investigated. (Ref. 55).

Beside the helicopter exploration flights, a similar work is done by plane. A. G. Dralkin, Deputy Chief of the station in charge of scientific work, made a detailed study of water masses and ocean depths within a 250 km radius of the station, flying in a plane piloted by Maslennikov. He and his party made many landings on ice floes, drilling ice holes, measuring the depth of the ocean, taking samples of the bottom soil, and determining salinity of water. Dralkin also conducted meteorological observations at distant points moving around by means of the helicopter. (Ref. 18).

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The investigation of oceanic currents is conducted with a newly designed set of instruments developed by the Arctic Institute. (Ref. 34).

The "North Pole 4" Station collected extensive materials on the circulation of ice fields in the Central Arctic. Magnetological observations also yielded valuable results. For example, the origin of magnetic storms in the area was repeatedly observed. (Ref. 50). Samples of soil, fauna, and plankton were taken regularly. Constant attention was given to the radioactive properties of snow cover in this area of the Arctic. Helicopters were used extensively to carry meteorographs aloft. (Ref. 41). Actinometric observations carried out at the station exceeded the assigned quota. (Ref. 18). The chemical composition of water was analyzed at periodic intervals. (Ref. 34).

The overall scientific activity of the station for the 7 month period can be broken down as follows:

About 450 radio sondes and over 400 pilot balloons released (consuming over 1500 meters of hydrogen);

Over 20 deep water hydrological stations;

600 depth soundings (535 during the first 6 months);

18000 observations of ocean current (during the first 6 months);

700 determinations of magnetic declinations;

1700 magnetic observations (during the first 6 months);

500 actinometric observations (400 during the first 6 months);

1300 aerometric observations (during the first 6 months);

1600 meteorological observations;

170 astronomical fixes of coordinates (155 during the first 6 months). (Ref. 64, 28).

The obtained data yielded an accurate picture of the floor relief in the area of the drift. (Ref. 64).

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IX. Special Research Detachment of the High-Latitude Air Expedition.

This detachment constituted the third element of the 1954 High-Latitude Air Expedition, alongside of the North Pole Drifting Stations. (Ref. 33, 3). However, it was not a long-term project, such as the drifting stations, its work being limited to about one month.

The Scientific Research Detachment was under the command of Ivan Ivanovich Cherevichnyy. (Ref. 11). The detachment followed a special method of operation, first developed by this veteran Polar pilot during his expedition to the Pole of Relative Inaccessibility in 1941. (Ref. 17). This method, sometimes called the "flying observatory method" consisted of making landings on ice floes in a specially equipped plane carrying all the instruments necessary for scientific observations. It was thus possible to conduct hydrological, magnetological, actinometric, and astronomical observations in various parts of the Arctic Ocean, covering an immense unexplored area in a short period of time. (Ref. 17, 47).

The specific task of the Scientific Research Detachment of 1954 was the exploration of the area of Lomonosov Range, stretching for about 2000 km, with an average width of 200 km. The detachment had a group of aircraft assigned to it, flown by experienced Polar pilots. (Ref. 23). The scientific work of the detachment was under the leadership of Mikhail Yemel'yanovich Ostrekin, Candidate of Geographical Sciences, Hero of the Soviet Union. Ostrekin is a geophysicist and has worked for many years in the study of the Arctic. (Ref. 6).

The Scientific Detachment was one of the 3 groups radiating from Dikson Island in April 1954 during the launching stage of the High-Latitude Air Expedition. The detachment proceeded to the area of the Pole where it had established several bases for operations. (Ref. 11). The exact coordinates of these bases are not given in the sources, and the initial area of operation can be inferred only directly. For example, a source states that in April 1954, at the time the "North Pole 3" Station was being established, the course line, connecting the "North Pole 3" Station with the camp of the Scientific Detachment, passed near the Pole. The distance from the "North Pole 3" Station to the camp of the detachment was said to be about 2 flight hours. (Ref. 12). Furthermore, another source reports that D. I. Shcherbakov, representative of the Academy of Sciences, visited on May 1st the camp of the Scientific Detachment beyond the 89th parallel. (Ref. 19).

The Scientific Research Detachment consisted of several groups. Each group was carried by one aircraft and consisted of a flight crew of the aircraft and several scientists.

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The first group was headed by Cherevichnyy himself and included the Director of Scientific Operations, Ostrekin, and A. L. Sokolov, oceanographer.

The second group was headed by veteran Polar pilot, V.M. Perov and included G. Denezhkin, co-pilot, Nikolay Mikhailovich Zhukov, navigator, V. V. Mishustin, flight radio operator, Aleksey Il'ich Zaytsev, senior mechanic, Zalman Markovich Gudkovich, oceanographer, and Pavel Konnykh Sen'ko, magnetologist.

The third group was headed by G. V. Sorokin and included Ya. Ya. Gakkel', oceanographer. (Ref. 13).

The detachment might also have included other groups. For example, mention is made of a plane landing in the camp of M. N. Kaminskiy where it stayed overnight. Kaminskiy's camp is referred to in the source as an auxiliary base of the Scientific Research Detachment, situated across the Pole from "North Pole 3" Station and 1980 km distant from Dikson Island via Vize Island. (Ref. 20).

The pattern of operations of the Detachment may be illustrated by the following excerpt from an article describing its activity.

On one of the exploratory missions, Perov's group landed above the eastern slope of Lomonosov Range, about 70 km from the Pole. Cherevichnyy's group was at that point located 100 km away on the western slopes of the Range, while the third group headed by Sorokin was 50 km from Perov, situated on top of the Range. After completing their work, Perov's and Sorokin's groups took-off for headquarters, i.e., Cherevichnyy's camp for May Day celebration. (Ref. 33).

In accordance with the method described above, routine missions of the detachment consisted in making a series of landings at various points within an assigned area, determining astronomical coordinates, taking depth soundings, making magnetic observations, and taking water samples at various depths. (Ref. 23, 36).

Directly after the landing, a hole was blasted in the ice floe to measure the depth of the ocean by means of a power winch. All depth readings were entered in the bathometric working chart which also showed depth records made by Nansen during his "Fram" voyage, by Papanin during his 1937 North Pole Drift, and by the icebreaker "Sedov". The bathometric chart of the Central Arctic was one of the main working sheets of the expedition.

The depth sounding was followed by hydrological work which included recording underwater currents, taking samples of water at various levels, and testing samples of ice. The water samples, poured into bottles, were sent to Leningrad for hydro-chemical analysis.

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Each landing of this type was called "a station" and took about two days of deep-water investigation. Since this involved staying overnight on the floe, the personnel carried dwelling tents. (Ref. 13, 19).

The several groups of the detachment have thus been hopping from station to station while investigating the Lomonosov Range. A popular name "the hoppers", was coined for the participants of the detachment. The hops were undertaken daily by several planes in different directions. (Ref. 13, 33, 3).

The method used by the detachment was also sporadically used by various members of the "North Pole 3" and "North Pole 4" Drifting Stations; furthermore, a series of such missions was performed by a group of scientists in an aircraft piloted by Vitaliy Ivanovich Maslennikov, investigating the eastern part of the Asiatic continental shelf. (Ref. 33). Maslennikov could have been also a member of the Scientific Research Detachment; however, no direct reference was found to that effect. It is possible thus, that individual planes performed regular "flying observatory" missions independently of the detachment and within the framework of the High-Latitude Air Expedition.

The term, "flying observatory" (or "flying laboratory"), leads to some confusion, because, being sometimes used in connection with the Scientific Research Detachment under Cherevichnyy, it was also the official designation of the special aircraft detailed for non-stop flights to the North Pole and back under I. M. Dolgin. (Ref. 3). This aircraft, a fourth element of the High-Latitude Expedition, will be treated in the next chapter.

The Scientific Research Detachment was expected to stay in the Polar Region for about 1 month. (Ref. 36). The flight personnel participating in this detachment were subsequently reported to be flying regular supply missions to the North Pole Drifting Stations 3 and 4. (Ref. 46).

The detachment was equipped with light-weight gas-heated tents of special construction, special Arctic clothing, and a very carefully selected food supply. As special equipment, the detachment had power driven hydrological winches, ice drills, instruments for magnetic and astronomical observations, small water screws for measuring and recording underwater currents, long thin cylinders for taking samples of water, etc. (Ref. 23, 13).

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X. The Flying Observatory

As it was pointed out above, the term "flying observatory" was used in the reports on the High-Latitude Expedition to denote several different concepts. The term was sometimes applied to the Scientific Detachment, and especially to Cherevichnyy's method of ice floe hopping. The most consistent use of this term, however, was found to apply to the aircraft engaged in non-stop weather missions, on behalf of the High-Latitude Expedition of 1954.

Most sources refer to a single flying observatory. The flying observatory made important study of weather and ice conditions during non-stop flights from one of the coastal ports to the North Pole and back. The plane was sending systematic information on weather conditions above the Arctic Ocean to the Expedition headquarters. The flying observatory spent many hours in the air. The weather observations were performed by several astronomers and meteorologists aboard the plane. (Ref. 73, 3).

Personnel of the flying observatory included the following:

I. M. Dolgin, Chief of the flying observatory, Candidate of Geographical Sciences.

P. A. Gordiyenko, Candidate of Geographical Sciences, senior assistant to chief.

N. A. Volkov, Candidate of Geographical Sciences, senior assistant to chief. (Ref. 3, 33).

XI. Current Activities at the Drifting Stations

The drifting stations are still in operation in 1955. The winter season of 1954-1955 with the attendant additional difficulties of Arctic survival was for a long time the object of intensive preparations on the part of the personnel of both stations. The working tents were moved to new places, the galleys were winterized, all installations were regrouped towards the center of the camp. Both stations were prepared to move in case of ice surges to other ice fields. (Ref. 50). Scientific work, however, was never interrupted for a single day.

The around-the-clock meteorological observations are being conducted on schedule. Weather reports are compiled as usual 8 times per 24 hours. The sounding of depth, study of local fauna, and investigation of the higher layers of the atmosphere (radio sounding) are going on.

Both stations hold scientific seminars to evaluate, develop, and summarize obtained data. The stations send regular daily reports to the Main Administration of the Northern Sea Route communicating everything occurring at the stations. (Ref. 50, 38).

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A Polish source reports that the drifting stations carry on interesting studies on the radioactive properties of the snow cover of a large area of the Arctic Ocean. (Ref.15).

The Central Radio Club of the DOSAAF of the USSR organized a contest among the short-wave amateurs in connection with the drifting stations.

The aim of the contest is the achievement of the largest number of two-way radio contacts with the drifting stations.

Two-way radio contact with the "North Pole 3" and "North Pole 4" radio stations may be established, according to the rules, by collective short-wave amateur stations of the DOSAAF. All other amateur short-wave stations may participate as observers only. The time and wavelengths of the contest contacts are set each time by the chiefs of UPOL-3 and UPOL-4 radio stations. The pertinent information (time and wavelength) is given by the following radio stations of the Central Radio Club: UA3KAA, UA3KAB, and UA3KAF, broadcasting on 20, 40, and 80-m amateur wavebands. UPOL-3 and UPOL-4 radio stations may be called only after they have announced the word "Vsem" ("to all"). Calling these stations prior to their call "Vsem", or broadcasting on UPOL-3 and UPOL-4 wavelengths is prohibited. (Ref. 9).

One of the last sources surveyed for this report, dating from January, 1955, states that after nine months of operation of the drifting stations, considerable materials have been collected in oceanology, meteorology, aerology, and terrestrial magnetism. The "North Pole 3" Station was displaced during that time 550 km towards Greenland along a straight line and covered a path of 1600 km.

The radio operators maintain close contact with the mainland. Recently, they have established radio contact with the "Slava" whaling fleet operating in the Antarctic.

A local wallpaper "Vo ldakh" (On Ice) is being regularly issued. (Ref. 51).

XII. Scientific Results of the High-Latitude Air Expedition of 1954.

The work of the expedition covered practically the entire area of the Arctic basin. The investigation was equally comprehensive with respect to the vertical cross-section of the Earth's crust: the study involved the lithosphere, hydrosphere, atmosphere and, finally, biosphere. (Ref. 14).

The results of the expedition and the initial data obtained from the scientific drifting stations yielded valuable materials on the Arctic region. (Ref. 33). This information, as available at this time, is given below, arranged according to the respective branches of science.

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1. Geology.

The most interesting geological phenomenon of the Arctic Basin is the underwater Lomonosov Range extending from Novosibirskiye Ostrova across the North Pole to Ellesmere Land. (Ref. 33).

The Range was discovered in 1948; however, during the 1954 expedition, its outlines were defined with much greater accuracy. The Range forms a number of underwater massives interrupted by passes. It seems to be continuous throughout its length. This is indicated by the fact that waters of equal salinity are consistently colder on the Atlantic side of the Range than on the Pacific side. Breaks in the continuity of the Range would have caused the colder (and denser) waters of the Atlantic side to displace the warmer waters of the Pacific. (Ref. 3, 44).

The Range rises to a height of 2.53 km above the ocean floor and has steep slopes on both sides; the minimum measured depth above the Range is slightly less than 950 m. Prevailing depths along the Range are of the order of 1100 - 1200 m. (Ref. 6). Numerous soundings made by the "North Pole 3" Station indicate that the Range comprises a wide mountainous formation whose elevations vary from 300 to 400 m every few km. In crossing the main part of the range, variations in depth up to 2000 m were recorded for a horizontal distance of less than 8 km. (Ref. 44).

Hydrological work done by the special Research Detachment confirmed the existence of two separate basins in the Arctic Ocean divided by Lomonosov Range: the Western or Atlantic basin and the Eastern, or Pacific basin. Each basin has its own peculiar circulation of water masses. (Ref. 3, 33, 19, 20).

Soil samples taken in the area of the Range indicate that the ocean floor is covered with a thin layer of yellow gray silt. (Ref. 44). A thorough analysis of the samples shows that the floor deposits in the Atlantic and Pacific parts of the Northern Arctic Ocean are substantially different. (Ref. 6).

Trawling of the sea bottom revealed that marine life was much richer in the area of the Lomonosov Range than in the flat regions of the Arctic Ocean. The Lomonosov Range area abounds in molluscs, marine worms, starfish, and sea urchins. (Ref. 44).

The Pacific side of the Range revealed new types of zooplankton not encountered anywhere else in the oceans of the world.

Beside the Lomonosov Range, other features were revealed in the floor of the Arctic ocean, such as submerged ridges, peninsulas and troughs. It was conclusively proved that the depth of 5440 m, obtained in 1927 by Wilkins at a

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point 77°46'N - 175°W, was false. The current soundings show the depth of the ocean at that point to be merely 2000 m. (Ref. 6).

The boundaries and depths of the so-called "continental shelf" of Siberia, the shallow underwater continuation of the mainland, have been defined more closely. The relief of the continental shelf was found to be rather complex, including deep depressions as well as a number of considerable elevations.

The new data radically changed the ideas concerning the nature of the Polar Basin, which heretofore was represented as a gigantic bowl with a relatively even floor about 5000 m deep. (Ref. 3).

The wide coastal shelf, the traverse elevations, and the depth depressions, render the Arctic Ocean similar in type to the Mediterranean. The Arctic Ocean was apparently also formed by a series of drops and elevations along the breaks in the Earth's crust in the former dry land connecting North America with Europe and Asia. (Ref. 3, 33).

This leads to the assumption that a number of geological structures on the northern coasts of Asia and North America, now partially submerged under the ocean, are identical. Greenland, North America, and Asia were thus joined to each other in the Polar area several thousand years ago, forming a single huge continent. Consequently, the Northern Arctic Ocean should be regarded, at least from the geological point of view, as a gigantic sea rather than an ocean. (Ref. 3).

The results of the work of the 1954 High-Latitude Expedition were used to compile a new bathometric chart of the Arctic basin which reflects the modern conception of the complex structure of the ocean floor in this area. (Ref. 6).

2. Hydrology.

Observations of ice drift over the vast area of the Arctic Ocean demonstrated its dependence upon atmospheric and hydrological phenomena, and upon the floor relief. In the Eastern Basin of the Northern Arctic Ocean, formed by the Lomonosov Range, there is a stable clockwise, or anticyclonic drift. An opposite movement is taking place in the Western Basin where ice drifts in counterclockwise direction. Substantial portion of it is carried out of the Northern Arctic Ocean and into the Greenland and Barents Seas. The discharge into the Greenland Sea is irregular, however, with considerable lapses, during which ice circulates on a closed counterclockwise course. The area of this circulation may change substantially depending on synoptic processes. Sometimes, it may be relatively small, covering only the northern part of More Laptevkh. Under other conditions it envelops a

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large region, extending over nearly the entire western part of the Arctic Ocean. In comparison to the relatively immobile, aged ice of the eastern part of the Arctic Ocean (near the Canadian Archipelago, Bofort Sea and partly the Chukotsk Sea), the ice of the western part is less thick, its age hardly exceeding two years. (Ref. 3, 33). The ice very often penetrates into the Greenland and Barents Seas.

On the basis of iceberg observations, precise location of their origin and direction of movement can be determined. The non-uniformity of the entry of icebergs into common drifting path has been established. It has been observed that the icebergs in the western part of the Arctic Ocean are huge and tall, assuming a large table-like form.

Observations were made of the so-called "ice islands" found more frequently in the eastern parts of the ocean; these are large fragments of mainland ice, and usually start drifting from the shores of the Canadian Arctic Archipelago. (Ref. 33).

One of the interesting conclusions reached by the expedition concerns the rejuvenation cycle of ice. The ice cover is rejuvenated annually because the top surface thaws off, while the bottom surface builds up. During a northerly drift, the thickness increases by growing on from underneath, while during a southerly movement the thickness is reduced by melting away on the surface. Thus, in a close-circle drift, the ice cover is fully rejuvenated in 4-5 years. (Ref. 3, 33).

The main means of ice observations is the ice patrol. Ice patrol consists, in essence, of the charting the ice cover of the ocean according to its age and morphological type. The age of ice can be determined by certain outward characteristics which can be distinguished from the air by an experienced observer. The observer should discriminate between fast (shore) ice, open water, water openings, light-gray young ice, two-year ice, old ice, and icebergs.

Ice patrol is being conducted simultaneously by many hydrologists and navigators of Polar Aviation. The Weather and Ice Service uses its data to compile survey charts and forecasts for ships navigating along the northern coasts of Siberia.

For the first time, a complete spring ice pattern has been obtained for the entire Arctic. This is of paramount importance for ice condition forecasts for the navigation on the Northern Sea Route. (Ref. 19, 20).

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3. Meteorology.

The aerometeorological observations carried on regularly by all the scientific groups, aircraft, flying observatories and the entire polar station network covered a large area of the Northern Arctic Ocean and yielded for the first time, a detailed analysis of synoptic processes occurring over the Arctic. (Ref. 33).

Until 1937, the contemporary scientific theory assumed a permanent cap of cool, high-pressure air, and a prevailing clear anticyclonic weather at the North Pole and its vicinity. Observations of the 1937 drifting station showed that the North, just as other areas of the Northern hemisphere, is frequently subject to cyclonic activity creating winds with heavy overcasts and snowfall. This was fully confirmed by the data of the High-Latitude Expeditions of recent years. (Ref. 6).

Thus, warm air masses penetrate from the Pacific Ocean through the Bering and Okhotsk Seas to high latitudes. They diffuse throughout the troposphere above a 200-meter cold stratum to a height of 7-9 kilometers.

Under these conditions, a stationary, slowly filling, central cyclone extends over the circumpolar region. Along the western periphery of this cyclone, cold masses of Arctic air collapse on the European part of the Soviet Union and Western Siberia. (Ref. 33).

A problem which remained obscure for a long time concerned the altitude of the lower limits of stratosphere in the area of the North Pole. This was a subject of considerable controversy among scientists. Systematic aerological observations (radio soundings) carried out in the Polar area afforded a solution to this problem. It appears that the altitude of the bottom limit of the stratosphere varies in the same manner over the Central Arctic as over the mean latitudes. This conclusion is of considerable significance to the study of atmospheric circulation and to the development of weather forecast methods. (Ref. 6).

4. Terrestrial Magnetism.

Before the High-Latitude Expeditions, Soviet charts showing the distribution of magnetic lines (declinations, variations, etc.) in the Central Arctic, were compiled on the basis of theoretical considerations only. It was assumed that, as the magnetic pole is approached, the angle between a freely-suspended magnetic needle and the horizon increased gradually until it reached 90° in the region of the magnetic pole. The horizontal component of the Earth's magnetic field was supposed to decrease with increasing latitudes, reaching zero at the magnetic pole.

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The distribution of the elements of the magnetic field in the central part of the Arctic Basin, however, is far from uniform; a series of data obtained in magnetic observations during the drift of the "North Pole 1" Station (1937) and the "Sedov" voyage, revealed a number of substantial peculiarities in the magnetic field pattern in the Central Arctic. (Ref. 6).

It was found that the horizontal components of the magnetic field, acting along a line directed northeast from Novosibirskiye Ostrova, had a tendency to decrease sharply enough to approach zero. On the other hand, the magnetic meridians through the entire Soviet Sector of the Arctic had a tendency to converge in the area 86°N-180°E.

These observations gave rise to the hypothesis that a "second magnetic pole" existed in the Arctic, in addition to the magnetic pole in the Canadian Arctic Archipelago. Some cartographic institutions accepted this hypothesis as definitive and the "second magnetic pole" began appearing on maps.

The failure to arrive at a correct solution to this problem was mainly due to a lack of direct observations in the huge area northeast of Novosibirskiye Ostrova.

Magnetic observations carried out by the 1954 High-Latitude Air Expedition revealed that the "second magnetic pole" does not exist in the Arctic. (Ref. 6, 33). In its place, a magnetic anomaly extends in a narrow band over a long distance from Taymyr Peninsula, across the North Pole area, to the Canadian Arctic Archipelago. The band, claimed the world's most prominent magnetic anomaly, can be clearly seen on the map of magnetic meridians, which converge into a narrow bunch of almost parallel beams. The magnetic anomaly is supposed to be closely connected with the submerged Lomonosov Range. (Ref. 6, 33, 3).

The band is characterized by sharply depressed values of the horizontal components of the magnetic field, reducing the reliability of the magnetic compass to a considerable extent.

Some regions of the Central Arctic were found to have local magnetic anomalies spreading over comparatively small areas. A number of places showed substantial variations in the magnetic field accompanied by sharp changes in the depth of the ocean.

Portable automatic recording devices (magnetic variometers), left on ice floes, yielded very valuable data on time variations in the Earth's magnetic field in the Central Arctic. For example, it appears that the area of the North Pole has a second zone of increased magnetic activity. Heretofore, only one such zone (zone of maximum intensity of Northern Lights and most intense magnetic perturbations) was known. In the Soviet sector of the Arctic, this zone

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passes in a band across Novaya Zemlya, Taymyr Peninsula, and Vrangell' Island. (Ref. 6, 33).

The data on the variation in the magnetic field are significant to the development of magnetic storm theories; magnetic storms are most intense and frequent in the Arctic and usually disrupt radio communications.

The results of magnetological work of the 1954 High-Latitude Expedition were used as a basis for magnetic charts for flights in high latitudes. (Ref. 6).

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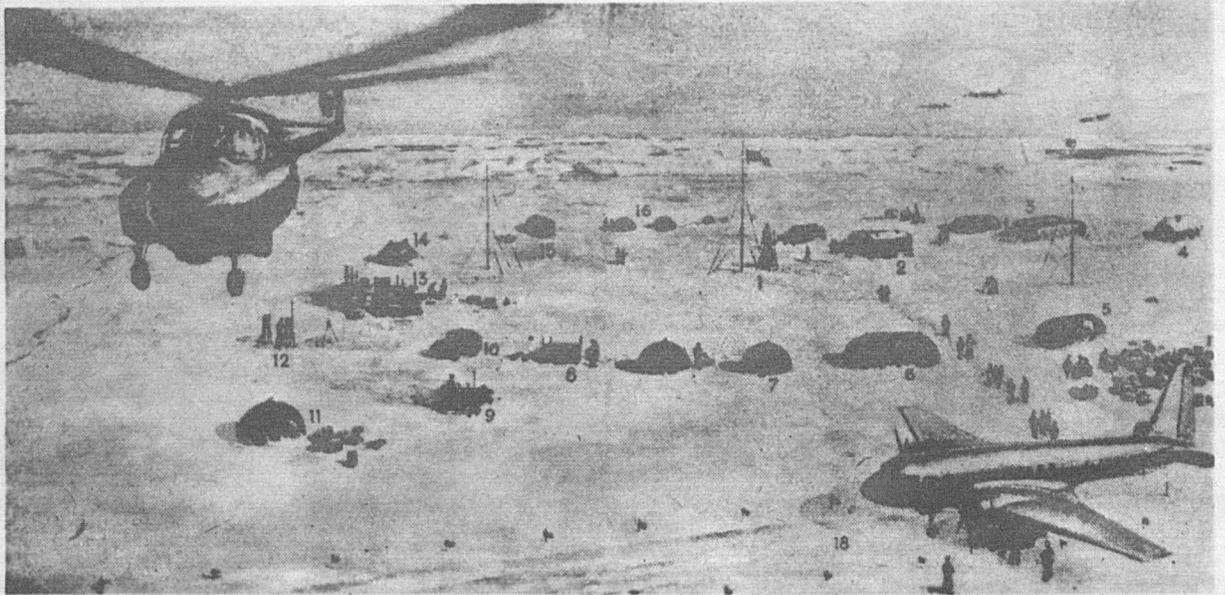
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General view of a North Pole drifting station (the layout probably dates from an early period of drift).

1. High "captain's bridge", from where a 24-hour watch surveys the entire camp.
2. Wardroom.
3. Hydrogen storage for radio sondes.
4. Gas-heated bath.
- 5,6. Double tents used as scientific laboratories.
- 7,11,16. Dwelling tents.
8. Gas bottles.
9. Tractor.
10. Cross-country vehicle.
12. Meteorological platform.
13. Storage of food and supplies.
14. Hydrologists' tent.
15. Radio station tent and antenna.
17. Storage of fuel for aircraft, helicopters, and motor vehicles.
18. Aircraft runway.

Source: Problemy. No. 1. Warsaw, 1955, p. 31.

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Enclosure 3



"North Pole 4" Drifting Station. Unloading tents, heating gas bottles, boxes with provisions, and instruments, brought by air from the mainland.

Source: *Сgonek*. No. 32. August, 1954, center insert.

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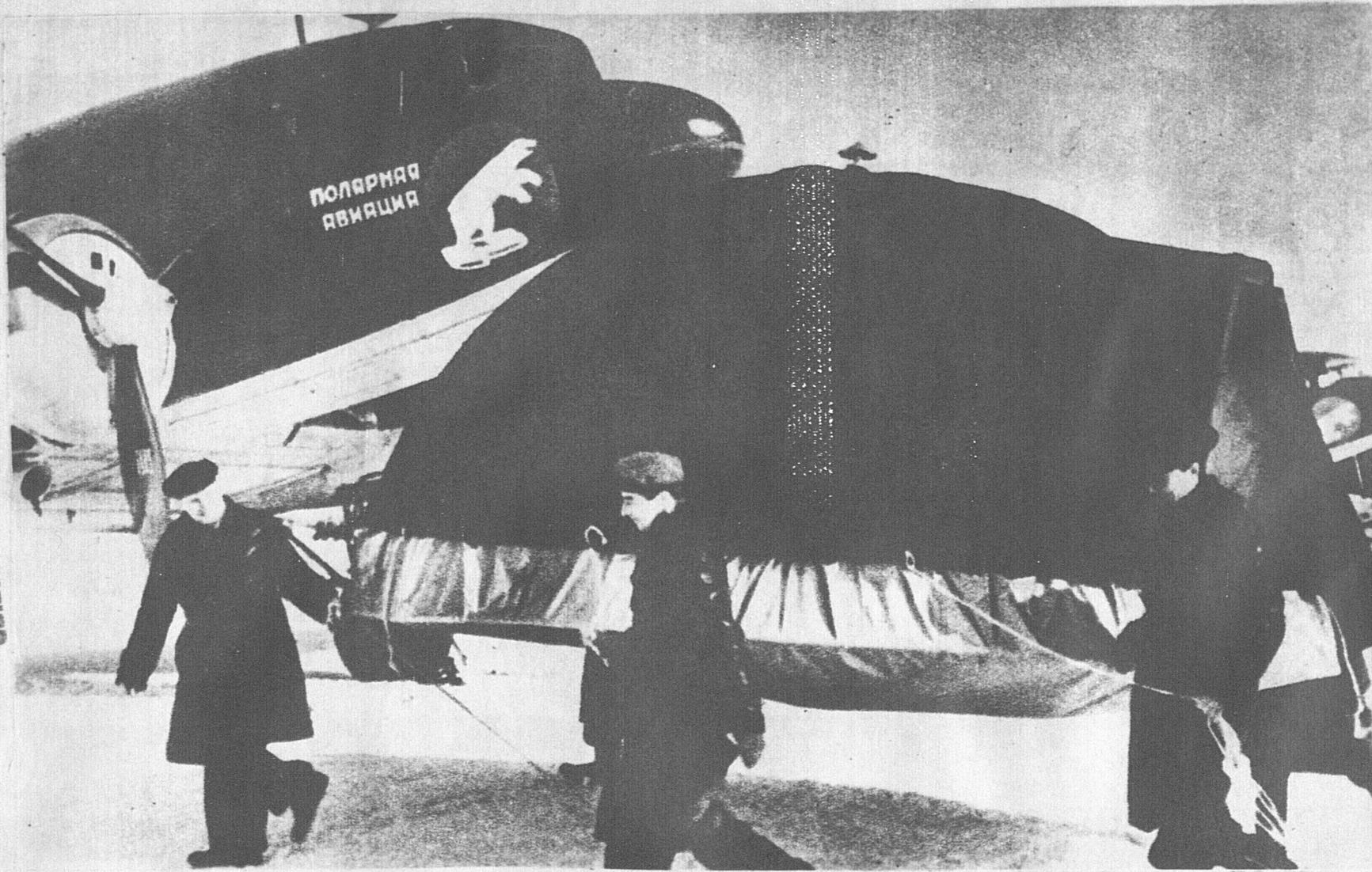
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Enclosure 4



The tent has been unloaded and assembled by the crew of the aircraft. The legend on the aircraft, reads "Polar Aviation." The polar bear is the official emblem of Polar Aviation.

Source: Smena. No. 12. June, 1954, p. 5

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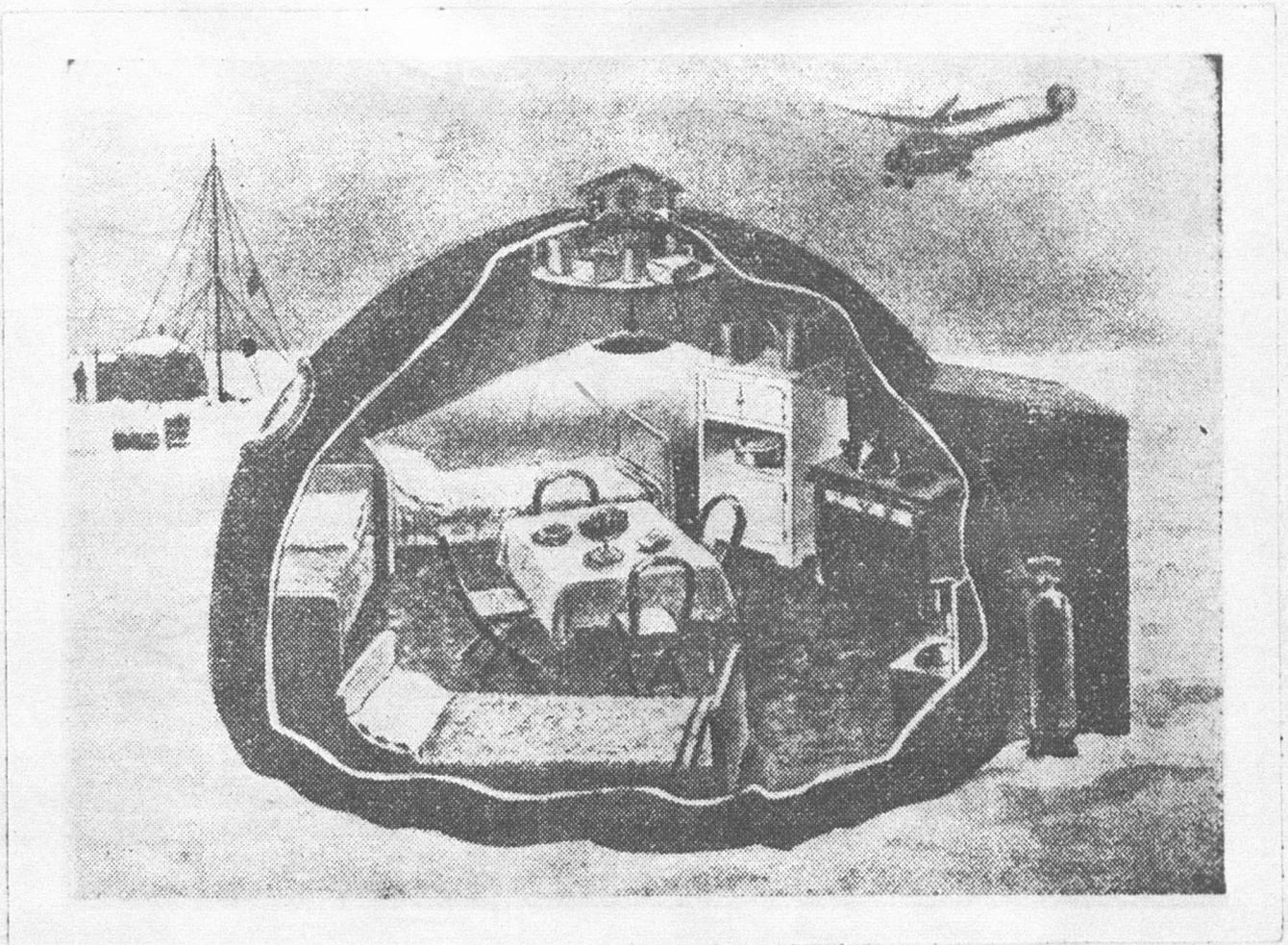
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Enclosure 5



A dwelling tent for 3 persons, equipped with gas heater, wash basin, etc. The tent is light enough to be lifted in an emergency by a helicopter.

Source: Problemy. No. 1. Warsaw, 1955, p. 32.

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A wardroom made of 2 prefabricated cabins.

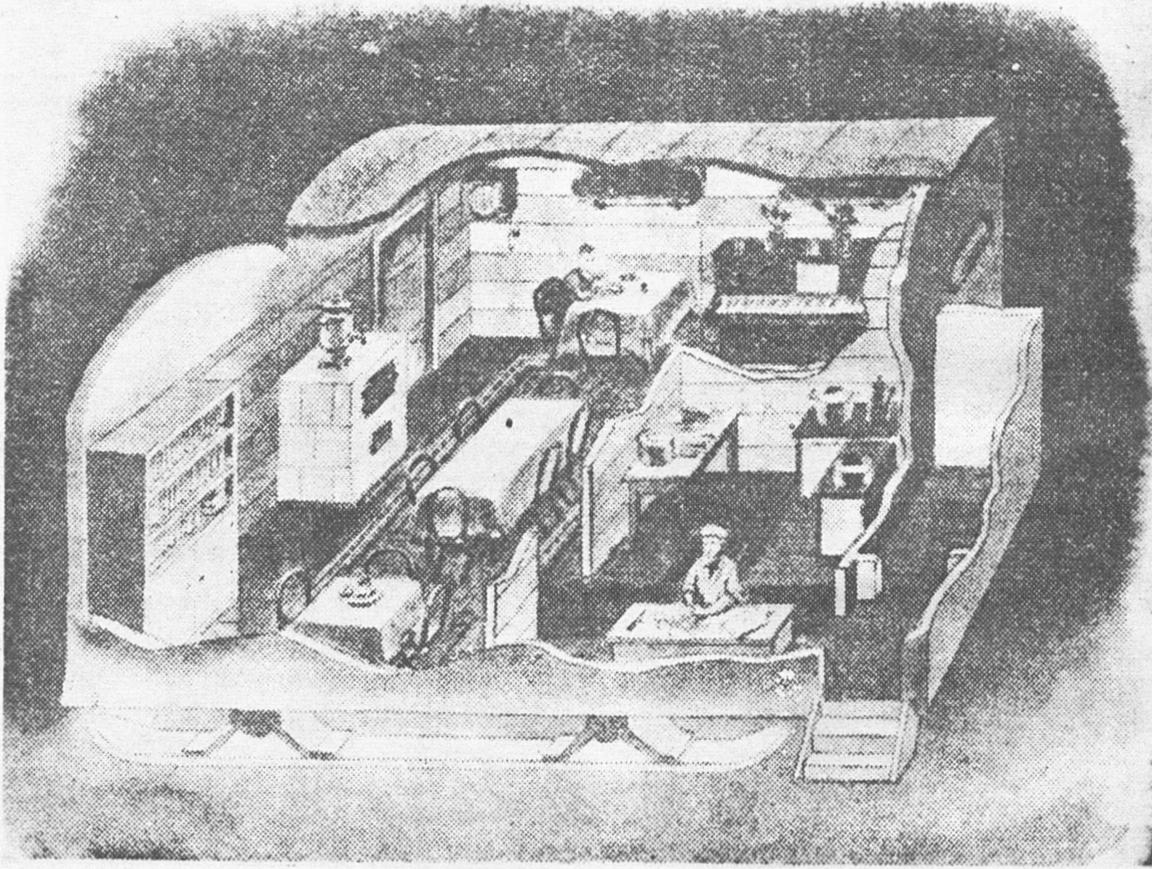
Source: Ogonek. No. 48. November, 1954, p. 26.

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Enclosure 7



Wardroom and galley in a prefabricated cabin
on runners.

Source: Problemy. No. 1. Warsaw, 1955, p. 32.

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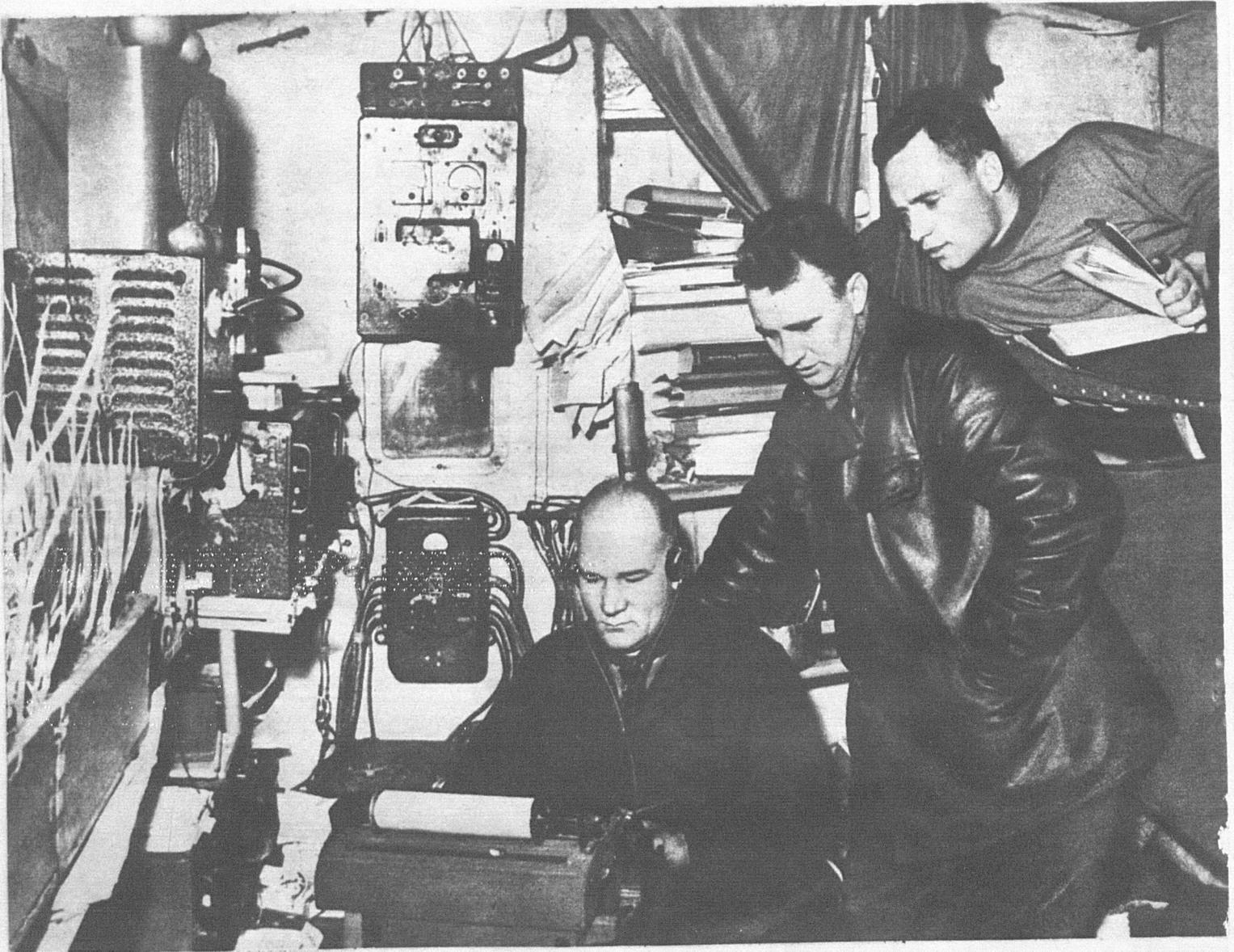
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Enclosure 8



Radio room of the "North Pole 3" Drifting Station. Left to right:
K. M. Kurko, radio operator; A. F. Treshnikov, chief of station;
L. N. Razbash, radio operator.

Source: Ogonek, No. 48. November, 1954, p. 27.

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