

Imperial Russia's Pioneers in Arctic Aviation

WILLIAM BARR¹

ABSTRACT. In the summer of 1914 an extensive search was mounted by the Imperial Russian government for three expeditions, Sedov's, Brusilov's and Rusanov's, all of which had gone missing in the Arctic. As part of the search effort a naval pilot, Yan Iosifovich Nagurskiy, flying a French-built Maurice Farman floatplane, carried out an aerial search of a substantial portion of the west coast of Novaya Zemlya. In five major flights, totalling 10 hours 40 minutes in the air, Nagurskiy flew some 1060 km. This was the first successful attempt at operating an aircraft anywhere in the Arctic. During that same summer another naval pilot, D.N. Aleksandrov, attached to the Arctic Ocean Hydrographic Expedition aboard *Taymyr* and *Vaygach*, assembled his machine, an Henri Farman, at Bukhta Emma in Chukotka, but it suffered some irreparable damage during a test flight. During the expedition's subsequent wintering off the west coast of Poluostrov Taymyr Aleksandrov used the aircraft engine to power an aerosled, which was successfully used on a survey trip in June 1915. This was probably the world's first functional aerosled.

Key words: Arctic aviation, Nagurskiy, Novaya Zemlya

RÉSUMÉ. Le gouvernement impérial russe entreprit durant l'été de 1914 une importante campagne de recherche tentant de retrouver trois expéditions, celles de Sedov, de Brusilov et de Rusanov, chacune ayant disparu dans l'Arctique. Participant à l'effort de recherche, un pilote naval nommé Yan Iosifovich Nagurskiy vola un hydravion Maurice Farman de construction française en recherche aérienne au-dessus d'une bonne partie de la côte ouest de l'île Novaya Zemlya. Nagurskiy vola quelque 1060 km en cinq vols d'une durée totale de 10 heures 40 minutes. Ces vols furent les premières heureuses tentatives de pilotage d'aéronef dans l'Arctique. Au cours du même été, D.N. Aleksandrov, une autre pilote naval, se joignit à l'expédition hydrographique de l'océan Arctique à bord du *Taymyr* et du *Vaygach* et assembla son appareil, un Henri Farman, à Bukhta Emma dans la Chukotka, mais ce dernier fut endommagé de façon irréparable durant un vol d'essai. Au cours de l'hivernage subséquent de l'expédition près de la côte ouest de la Poluostrov Taymyr, Aleksandrov utilisa l'engin de l'avion pour propulser un traîneau, qui fut employé avec de bons résultats lors d'un voyage de levée en juin 1915. Ce mariage constitua probablement le premier "aérotraîneau" fonctionnel du monde.

Mots clés: aviation dans l'Arctique, Nagurskiy, Novaya Zemlya

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THE MISSING EXPEDITIONS

By what can only be described as a remarkable twist of fate, three separate expeditions went missing in the Russian Arctic in the summer of 1912. One of these was embarked on an attempt at reaching the North Pole, while the other two, totally independently and without any collaboration, were attempting to effect a passage of the Northern Sea Route from west to east.

The North Pole attempt was being made by an expedition led by Leytenant Georgiy Yakovlevich Sedov, a 37-year-old officer in the Imperial Russian Navy, aboard the wooden sealing bark *Svyatoy Foka* (Pinegin, 1948; Barr, 1973; Seleznev, 1964). While bark-rigged the ship also had a 100 hp steam engine and was especially strongly built for work in ice.

Due to shortage of funds, the ship's reserves of coal were lamentably low — slightly less than 115 tonnes, sufficient for only 3–4 weeks of steaming. If all went according to plan, however, this ought to be adequate, since it was not intended that the ship should winter in the Arctic; having landed the expedition as far north as possible on the shores of Zemlya Frantsa Iosifa, *Sv. Foka* was to return to Arkhangel'sk in the fall. The provisions were far from suitable for arctic conditions, being mainly rusks, canned goods, salt beef and salt fish. The expedition had no wireless equipment. And, finally, winter clothing was provided for only the 14 expedition members. *Sv. Foka* sailed from Arkhangel'sk on 14 August 1912.

The second expedition was that of Leytenant Georgiy L'vovich Brusilov (Brusilov, 1914; Al'banov, 1953; Barr, 1975, 1978). With the financial support of his uncle,

Leytenant-General B.A. Brusilov, Brusilov had bought the ship *Blencathra* and had renamed her *Svyataya Anna*. His plan was to take her through the Northern Sea Route from Atlantic to Pacific and he anticipated that he would be able to cover his costs, even in the event of a wintering, by hunting along the way. The total complement of the ship was 24, including a nurse. *Sv. Anna* was well stocked with a good variety of provisions designed to last for 18 months.

The expedition sailed from St. Petersburg on 10 August 1912 and from Yekaterinskaya Gavan' (now Murmansk) on the 28th. She was last seen pushing boldly through the ice in Karskiye Vorota on 16 September 1912.

The third expedition was that of Vladimir Aleksandrovich Rusanov (Petrosov and Derzhavin, 1945; Barr, 1974, 1984). A geologist, with considerable experience of arctic fieldwork obtained on Novaya Zemlya, Rusanov had been commissioned by the Imperial Russian government to explore the coal resources and stake claims on Svalbard. The vessel chosen for the job was a little Norwegian sealer, *Gerkules*, of only 62 tonnes displacement. The expedition personnel totalled 14; apart from Rusanov there were a geologist and a zoologist, as well as a medical officer who also was a qualified geologist.

Having completed a very successful summer's fieldwork on Svalbard, Rusanov announced his intention of attempting the Northern Sea Route to the Pacific. The geologist and zoologist and the ship's bosun declined to participate and left the ship at Grónfjorden. With the remaining 11 people on board, *Gerkules* sailed from Grónfjorden eastward-bound in mid-August 1912. Calling at the settlement of Matochkin Shar on Novaya Zemlya, Rusanov left a telegram dated 31 August that

¹Department of Geography, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0

was to be relayed to St. Petersburg. In it he indicated he planned to reach the Kara Sea by rounding the northern tip of Novaya Zemlya, then pushing eastward. None of the expedition members was ever seen again.

The search effort

As early as the spring of 1913 some public anxiety began to be expressed in St. Petersburg as to the whereabouts and safety of all three expeditions. Specifically a group of members of the Imperial Russian Geographical Society put forward a proposal that searches should be mounted (Pinkhenson, 1962).

Some light was cast on one of the expeditions when Kapitan N.P. Zakharov, of *Sv. Foka*, arrived at Arkhangel'sk on 1 October 1913 with four members of his crew aboard the regular mail steamer from Matochkin Shar (Pinegin, 1948; Seleznev, 1964). Zakharov was able to report that Sedov had been forced by heavy ice conditions to winter at Poluostrov Pankrat'yeva, on the northwest coast of Novaya Zemlya. Particularly since *Sv. Foka's* crew was inevitably also forced to winter, this represented a heavy drain on the expedition's reserves of food and fuel. Nevertheless Sedov was still determined to reach the Pole; when Zakharov and his group left the ship in June, Sedov's intention was still to push north to Zemlya Frantsa Iosifa as soon as break-up had released his ship, even though this would mean using driftwood and seal blubber to fire the ship's boilers.

But even this rather disturbing news about Sedov's expedition was more than was received concerning either Brusilov's or Rusanov's expedition. They had simply disappeared without trace. Nonetheless a further three months were to pass before any official moves were made to mount any search efforts. In January 1914 the vice-president of the Russian Geographical Society sent a petition to the Ministry of Internal Affairs to request that the government mount a search expedition (Pinkhenson, 1962). That same month the Council of Ministers yielded to growing pressures and ordered the Naval Ministry, working in collaboration with the Ministry of Internal Affairs, to set in motion a search operation aimed primarily at Sedov's expedition. Not until February 1914, under continued pressure from the Russian Geographical Society, did the government also agree to dispatch a second vessel in search of Brusilov's and Rusanov's expeditions. In view of the fact that all three expeditions were private ventures, mounted without official sanction, and in view of the almost total lack of clues as to where searches should be concentrated, the government's reluctance to become involved is to some degree understandable.

Ultimately four ships were involved in the search for the missing expeditions in the summer of 1914, the selection having been made after consultation with the veteran Norwegian polar explorers Fridtjof Nansen and Roald Amundsen. Two ships, *Eclipse* and *Hertha*, were purchased and a further two, *Pechora* and *Andromeda*, were chartered. Conditions of her insurance stipulated that *Pechora* was unable to proceed farther north than Krestovaya Guba on Novaya Zemlya; for the

same reason *Andromeda's* northern limit was set at Poluostrov Pankrat'yeva.

Since both *Gerkules* and *Sv. Anna* had planned to make the passage of the Northern Sea their goal, it was proposed that a search for both could best be concentrated in the eastern part of the Kara Sea. *Eclipse* was chosen for this task, and the veteran Norwegian arctic explorer, Otto Sverdrup, was engaged to take charge of this operation (Sverdrup, 1928). *Eclipse* was a good ship for the task. A three-masted whaling ship, she had been built in Aberdeen in 1867 and, sailing first out of Peterhead and later Dundee, had made annual voyages to either the Greenland or Davis Strait whaling grounds until 1906, when she had been sold to Norwegian owners. She loaded the supplies for the expedition in Christiania (now Oslo) in June 1914. Apart from provisions for 16 months, 31 dogs, sledges and normal arctic equipment, she also took on a number of unusual-looking wooden crates, which contained a disassembled aircraft. Their stowage was carefully supervised by a Russian naval pilot, Yan Iosifovich Nagurskiy (Fig. 1).



FIG. 1. Yan Iosifovich Nagurskiy, at about the time of his arctic flights.

NAGURSKIY'S EARLY CAREER

A Pole by nationality, Nagurskiy was born on 27 January 1888 and grew up in the village of Shpetal' Dol'ny, on the Vista, where his father operated a windmill, and in the town of Vlotslavek, across the river (Chernenko, 1957; Gal'perin, 1958; Nagurskiy, 1960). On leaving school he worked for a time as a clerk in the district court and then as a country school teacher, but he found neither job satisfying. In 1906 he applied for entrance to the Odessa Infantry College and was accepted in October of that year. There followed three years of military training in the pleasant countryside of the Crimea. He graduated on 6 August 1909 and as a sub-lieutenant was posted to

the 23rd East Siberian Infantry Regiment, stationed at Khabarovsk. This was another pleasant period in his life; he instructed young soldiers at Iman, and both on military exercises and on hunting trips he spent a great deal of time in the woods of the Amur *tayga*. After two years in the Far East, late in 1910 Nagurskiy applied for entrance to the Naval Engineering College in St. Petersburg and was accepted.

At this time, like most of the rest of the world, Russia was in the grip of flying fever. To set this situation in context one recalls that the Wright brothers had made their pioneer flight in December 1903 and that Bleriot had made his flight across the Channel in 1909. In February 1909 the *Silver Dart*, with John McCurdy at the controls, had taken off from the ice of Bras d'Or Lake at Baddeck, Nova Scotia, and had flown about 800 m. In March 1910 Yefimov had made what was hailed by the press as "the first flight by a Russian aviator in Russia" (Gal'perin, 1958:16) at Odessa; in May of that year Sergey Utochkin was making demonstration flights in Moscow. Nagurskiy found that flying was a favourite topic of conversation among his fellow students at the Naval Engineering College; and even more significantly in terms of his career, he met an old friend, Lebedev, who was a member of a flying club and went with him to watch the planes in action. It was not long before he decided to learn to fly.

Under a scheme whereby the government subsidized officers to take flying lessons, Nagurskiy joined the *Imperatorskiy Vserossiyskiy aeroklub* (Imperial All-Russian Aero Club) at Novaya Derevnya early in 1911. Under the guidance of flying instructor Rayevskiy, he made his first flight in a French-built Farman biplane. Some months later he successfully sat the exam for his pilot-aviator's diploma, i.e., a civilian qualification. This involved a flight in a Farman whereby he had to make figure-of-eights around two markers 500 m apart, for a total distance of 5 km. At this time it was considered extremely dangerous to make a banked turn, and hence all turns were slow skid-turns, the aircraft's wings remaining absolutely horizontal throughout. Although he had reservations about this piece of official dogma, for his examination Nagurskiy complied.

In 1911 the *Ofiterskaya Vozdukhoplavatel'naya shkola* (Officers' Airship School) at Gatchina had initiated an aviation section, and it now became Nagurskiy's dream to take the requisite course and attain the rank of *voyenniy letchik* (military pilot). In June 1912 he was officially enrolled in the school (Gal'perin, 1958) and began attending classes at the Volkov airfield, just beyond the Moskovskaya Gate, and flying from Gatchina field. Under the tutelage of Nesterov, who later became a World War I ace, Nagurskiy had learned the technique of making banked turns, but presumably he did not attempt "heretical" maneuvers such as this during his examination, in which he flew a Nieuport. With both theoretical and practical examinations successfully behind him, he was awarded the title of *voyenniy letchik* early in 1913. Despite these other considerable demands on his time, Nagurskiy had continued his studies at the Naval Engineering College and graduated as a naval engineer in July 1913 (Nagurskiy, 1960).

On graduation he joined the Chief Hydrographic Adminis-

tration, although he still continued to fly regularly on an amateur basis. Naturally he was fully aware of the excitement caused by the disappearance of the Sedov, Rusanov and Brusilov expeditions in 1912, and since the Central Hydrographic Administration had been appointed to coordinate the searches for them in 1914, he was more knowledgeable about the topic than most.

PREPARATIONS AND THE VOYAGE NORTH

One day early in 1914 Lieutenant-General M. Ye. Zhdanko, head of the Chief Hydrographic Administration, called Nagurskiy into his office and asked whether, in his opinion, aircraft might profitably be used in the search (Gal'perin, 1958; Nagurskiy, 1960). Although caught off guard, after some deliberation Nagurskiy expressed the opinion that aircraft would be of enormous help in an operation of this kind. Zhdanko then asked him to prepare a proposal on the topic, specifying the type of machine and the support facilities required. Two days later Nagurskiy had compiled the required information; to his surprise and delight, not only was his recommendation to use aircraft accepted, but he was nominated as one of the pilots who would participate and was put in charge of all the arrangements.

Although fully cognizant of the capabilities and drawbacks of all the available makes of aircraft, Nagurskiy was also fully conscious of his own ignorance of the Arctic. He wrote to Roald Amundsen for advice and was pleasantly surprised at the warmth of the famous Norwegian explorer's reply and by his enthusiasm with regard to the future of aircraft in the polar regions (Nagurskiy, 1960).

The choice of the type of aircraft was left entirely to Nagurskiy (Gal'perin, 1958). He decided that he needed a floatplane with a speed of up to 100 kph and an air-cooled engine. This was a period when Russian designers such as I. Sikorskiy, D.P. Grigorovich, I. Gakkel', S.V. Grizodubov, N.P. Lobanov and V.V. Dybovskiy were in the forefront of aircraft design and Russian factories such as the Russko-Baltiyskiy Zavod at St. Petersburg were producing a wide range of different types of aircraft (Nowarra and Duval, 1971). According to Vodop'yanov (1954), Nagurskiy's first choice was a Grigorovich M-5 flying boat, but in this he was overruled by the authorities. Hence Nagurskiy opted for the French biplane produced by Maurice Farman as being next best suited to his needs.

Another pilot, P.V. Yevsyukov, was chosen to fly the aircraft that was to accompany *Eclipse* on her search of the Kara Sea (Chernenko, 1957). His choice of aircraft was an Henri Farman, but due to the outbreak of World War I it was held up at Bergen, and *Eclipse* proceeded without aerial support. Yevsyukov and his mechanic returned to St. Petersburg from Aleksandrovsk (Pinkhensen, 1962).

Nagurskiy left for Paris to supervise the assembly of his machine on 21 May 1914 (Nagurskiy, 1949) and spent the next few weeks at the Maurice Farman factory and at the Renault engine works. The machine he had selected was a biplane mounted on floats, with a 70 hp, air-cooled Renault engine



FIG. 2. A Maurice Farman of the Italian Air Force, 1914. Apart from being on wheels rather than floats and having a different engine, this machine is basically identical to Nagurskiy's.

(Figs. 2 and 6). A recent general description of this type of plane reads:

The 1914 [Farman] was a biplane with the upper wing generally longer than the lower. The lower wing, made up of three hinged sections, was joined by a split-pin system. The wings were supported by wooden struts, usually of ash, braced with steel wire. The tail elements were of similar structure. The framework fuselage was composed of four main longerons joined to the wings and braced with wire. The longerons also gave support to the tail elements. The tail itself was fitted, on the underside, with a steel spring (*béquille*) to assist in braking on landing.

The wings were equipped with ailerons . . . two rubber-tired bicycle wheels sprung by an elastic system made up the landing gear. Skids . . . were sometimes used on the 1914 versions, especially on the Maurice Farman 1914.

The cockpit was of the cabin type, mounted between the wings in a slightly forward position; it could accommodate two, or in exceptional cases, three crew. The engine a 'pusher' type, was mounted aft of the cabin. It drove a walnut propeller with the leading edges sheathed in brass.

As in all aircraft of the period, instrumentation was minimal: an altimeter, a clock, and a manometer. An air pump was available to increase fuel tank pressure where necessary. The sole control was the stick which was used for both ailerons and elevators. (Apostolo and Begnozzi, 1974:44).

Nagurskiy's machine had a payload of 300 kg and was capable of almost 100 kph. Its fuel tank contained enough gasoline for five or six hours' flying. Nagurskiy studied every aspect of the assembly and operation of the machine and its engine and established amicable relations with the French mechanics and assembly workers (Gal'perin, 1958). Up until now Nagurskiy had been serving in the *Pogranichnaya strazha* (Border Guards), but as of 9 June 1914 he was transferred to the Navy.

Since the naval authorities were experiencing difficulty in finding a qualified mechanic in Russia, a telegram was sent to Nagurskiy: "Difficult to find mechanic here; try to recruit Frenchman. Telegraph conditions immediately" (Gal'perin, 1958:37). Nagurskiy raised the matter with one of the mechanics with whom he had been working on the assembly of the plane. The latter agreed, but stipulated a salary of 380 rubles per month, plus hefty life insurance. Nagurskiy relayed this information to Zhdanko and in reply received orders to offer the mechanic 200 rubles (Nagurskiy also pointed out that he himself was getting only 300 rubles per month). The French mechanic refused these terms.

By 14 June Nagurskiy's machine was ready. After 18 test flights Nagurskiy disassembled the machine. On his instructions cockpit and wings had been painted red for better visibility against snow and ice. Packed in eight crates, it was shipped to Christiania (Oslo) with a guaranteed delivery date of 22 June (Nagurskiy, 1949). Nagurskiy was ordered to travel to Christiania to be on hand for supervision of the loading of the plane aboard *Eclipse*. He duly reached Christiania by the 22nd and saw his machine stowed safely aboard.

To his dismay, Nagurskiy was given a very discouraging reception by the expedition leader, Captain I.I. Islyamov, who considered the aircraft to be useless toys that would only occupy valuable space on the ships and contribute nothing to the search (Gal'perin, 1958; Nagurskiy, 1960). But fortunately during this final period of preparation Nagurskiy also met and had a chance to talk with both Roald Amundsen, who was in overall charge of the fitting out of the search expedition, and Otto Sverdrup; both were much more encouraging.

The final send-off of the expedition on 30 June was a major event in the Norwegian capital: Otto Sverdrup was heading for the Arctic once again. On hand were Amundsen, Fridtjof Nansen, the Russian ambassador, the mayor of Christiania, cabinet ministers and politicians and a crowd of several thousands. After a series of toasts and speeches *Eclipse* finally put to sea (Sverdrup, 1928; Nagurskiy, 1949, 1960).

After calling at Bergen, Trondheim and Vardø, *Eclipse* reached Aleksandrovsk-na-Murmane on 1 August. Meanwhile, as *Eclipse* steamed north along the Norwegian coast, Zhdanko had been trying frantically to locate a mechanic to accompany Nagurskiy. Yevgeniy Kuznetsov, an experienced aircraft mechanic stationed with the Navy at Sevastopol', in the Black Sea, had written to Islyamov to volunteer for the expedition, and now Zhdanko was trying to cut through red tape to officially enrol Kuznetsov as a mechanic with the expedition and to arrange his transport to Aleksandrovsk. Kuznetsov left Sevastopol' on his journey north on 9 July (Gal'perin, 1958).

The day after *Eclipse*'s arrival at Aleksandrovsk Nagurskiy and his aircraft were transferred to *Pechora*, Captain P.A. Sinitsyn (Nagurskiy, 1949). The final orders the pilot received from Islyamov were to conduct an aerial search of the coast of Novaya Zemlya from Krestovaya Guba north to Poluostrov Pankrat'yeva for any sign of any of the missing expeditions. *Pechora* put to sea on 13 August. Rather incomprehensibly, in his later account Nagurskiy (1960) writes of heading north to Novaya Zemlya aboard *Hertha* with Captain Islyamov in command and with Dr. I.I. Trzhemesskiy filling the position of ship's doctor. In point of fact Trzhemesskiy was aboard Sverdrup's ship, *Eclipse* (Sverdrup, 1928; Starokadomskiy, 1976), and certainly Nagurskiy was aboard *Pechora* rather than *Hertha*.

Once the ship was at sea Nagurskiy met his mechanic, Kuznetsov, for the first time. He was impressed by his enthusiasm and obvious competence but found his traditional stiff attitude to a superior officer somewhat unusual after the relatively informal relations among the flying fraternity (Gal'perin, 1958).

Pechora reached Krestovaya Guba, on the west coast of

Novaya Zemlya (Fig. 3) at 9:00 P.M. on 16 August (Nagurskiy, 1949; Gal'perin, 1958), to find *Andromeda* already lying at anchor. She had arrived just the previous day, having earlier been as far north as Poluostrov Pankrat'yeva. Late that evening *Andromeda*'s captain, G.I. Pospelov, gave an account of his northern foray. *Andromeda* had been stopped by ice between the two Krestoviye Ostrova, Yuzhniy (South) and Severniy (North); prolonged whistle blasts had elicited no response from shore. Pospelov had taken a party ashore, since he knew this was where *Sv. Foka* had wintered. On shore he had found a cairn and in it a note left by Sedov, written in Russian, German, French and English. It read:

Senior Lieutenant Sedov's North Pole Expedition wintered here in 1912-1913. We began our wintering on 20 September 1912 in the bay immediately ESE of here. The expedition left this anchorage on 22 August 1913, bound for Mys Flora on Zemlya Frantsa Iosifa. We have left a supply of provisions for approximately 17 men and for one month and also rifles and shells 12 versts north of here on the top of a cairn on Ostrov Pankrat'yeva. There too we have left second copies of the maps of our work. The expedition urgently requests that whoever finds these maps first should deliver them to the expedition's committee in St. Petersburg.

22 August 1913. Senior Lieutenant G. Ya. Sedov, leader of the North Pole Expedition. (Gal'perin, 1958:48-49.)

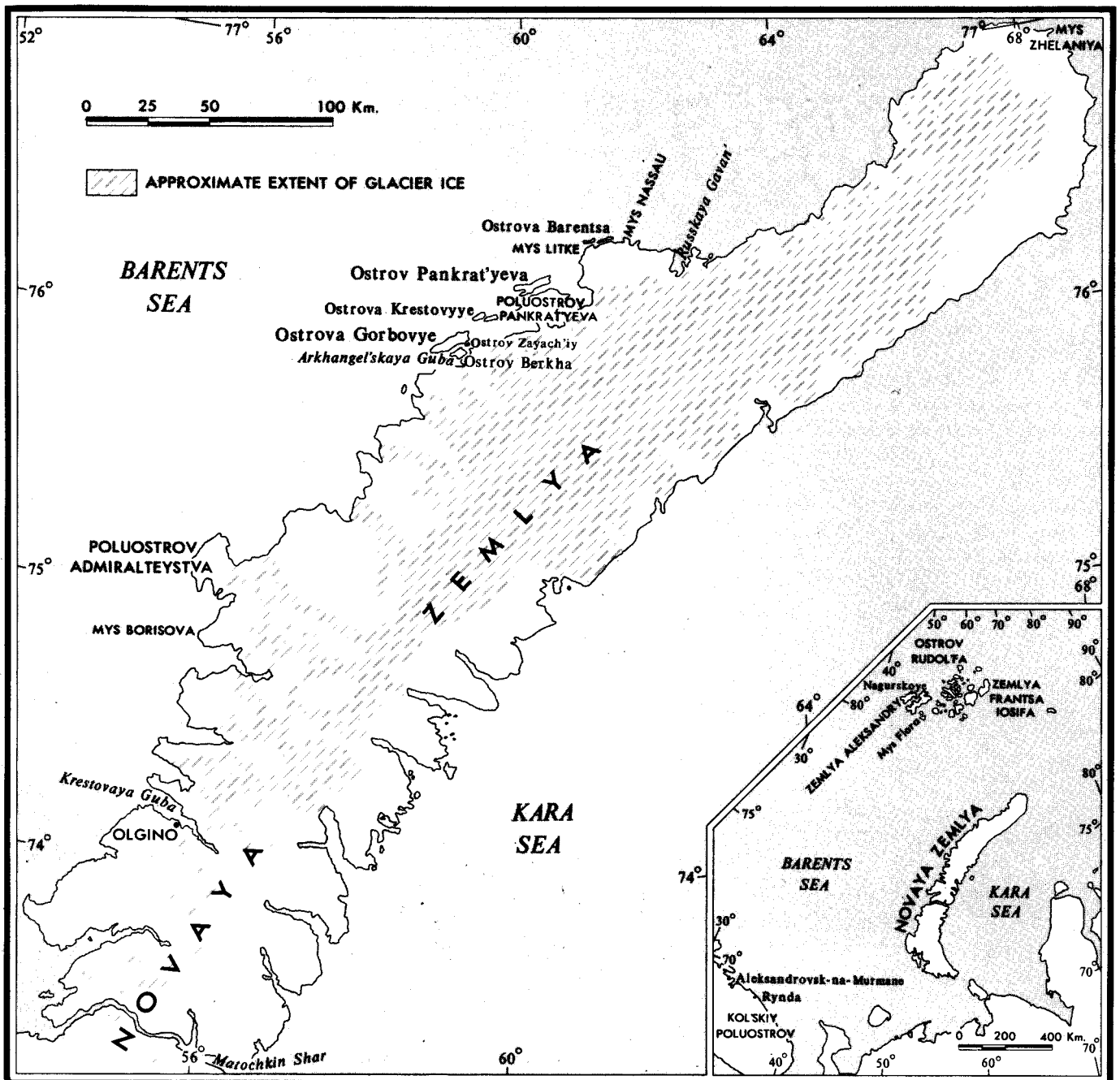


FIG. 3. Map of the north island of Novaya Zemlya showing the area of Nagurskiy's flights. The inset shows the area of operations of Sedov's expedition.

Following this lead, Pospelov had next landed on Ostrov Pankrat'yeva. Here he found a wooden cross with an inscription, but no depot. Then on the northwest end of the island he found a cairn with a space inside for a depot, but it contained only a can of engine oil and a bucket.

Pospelov had left notes in sealed cans at all three locations, which read: "A party from *Andromeda* found a cairn with the following note in a cairn left at the cape on Ostrov Pankrat'yeva . . ." (Gal'perin, 1958:49). But he had had to be content with this less-than-satisfying achievement. By the terms of the ship's insurance he could not push any farther north. Hence he had headed south to Yugorskiy Shar, from where he had reported by wireless to St. Petersburg. He had then been ordered back north to Krestovaya Guba, to rendezvous with *Pechora* (Seleznev, 1964).

Nagurskiy had wanted to establish his base at Ostrov Pankrat'yeva but in this he was frustrated; according to *Pechora's* terms of insurance she could not go any farther north than Krestovaya Guba. Nor could he use *Andromeda* to reach his goal, since the crates containing the plane and spare parts were simply too bulky for that small vessel to handle. Hence he had to resign himself to making Krestovaya Guba his base.

In his later account Nagurskiy (1960) described how he and his mechanic were landed on a deserted arctic beach where they rigged a rough shelter for themselves from the packing crates before assembling the aircraft entirely on their own. In reality the plane was indeed assembled on a beach, but at the settlement of Ol'gino, with the steamer *Pechora* lying offshore and with a willing group of officers and men assisting Nagurskiy and Kuznetsov in their task. They all ate and slept aboard the steamer.

Nonetheless it was still an impressive performance: the weather had deteriorated; rain alternated with snow; the temperature barely reached 1°C during the day and dropped below zero at night. Altogether it was a challenging task. Figure 4 depicts the assembly of Lieutenant Aleksandrov's Henri Farman aircraft, allocated to the *Taymyr* and *Vaygach* expedition (Starokadomskiy, 1976), on the beach at Bukhta Emma in Chukotka at almost exactly the same time. Although the locations lie several thousands of kilometres apart, the aircraft were almost identical and the conditions for the assembly of the two machines could scarcely have been more closely matched.

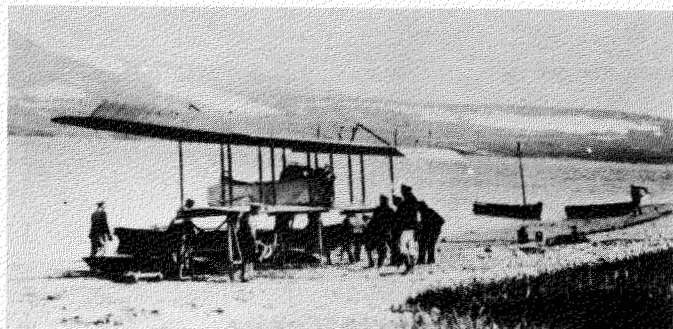


FIG. 4. Aleksandrov's Henri Farman aircraft being assembled on the beach at Bukhta Emma, Chukotka, in late July 1914.

THE AERIAL SEARCH

After two days of work Nagurskiy's Maurice Farman was assembled, fuelled and ready to be tested. Initially there was a slight problem in that a belt of fast ice still obstructed the shore, but an offshore wind conveniently drove it out to sea. A driftwood launching ramp was quickly constructed and the plane was slid down it tail-first into the water. At 3:00 A.M. on 21 August Nagurskiy took off, and after a couple of test circuits, landings and take-offs he declared himself satisfied with the machine's performance.

Anxious not to lose any time, Nagurskiy next fuelled the plane to capacity, stowed aboard a ten-day supply of food-stuffs, a rifle, ammunition, skis and sleeping bags, and with Kuznetsov in the passenger seat, flew north to Ostrova Pankrat'yeva. It was exactly 4:30 A.M. when the machine rose from the water. Flying at a speed of about 100–105 kph and at an altitude of 800 m, Nagurskiy enjoyed fine weather for this maiden arctic flight; visibility was excellent and the thermometer, fastened to a strut, recorded -5°C .

But then the weather began to deteriorate; long, ragged tatters of fog appeared beneath them, and soon the coast had entirely disappeared; only the mountain tops projected above the fog bank. At this point what might have been a serious incident occurred; the factory-installed compass ceased to function. Fortunately Nagurskiy had brought a boat's compass as a spare, and using it, he was able to maintain his course. When the fog began to thin again he recognized the Gorbovoye Ostrova. The straits between the islands were still full of unbroken ice. Soon, in perfect weather, Ostrov Pankrat'yeva drifted below the plane's red wings and Mys Litke appeared ahead. Checking the time, Nagurskiy decided to fly around and examine the Barentsovoye Ostrova before heading back; he planned to make a landing somewhere near Ostrov Pankrat'yeva, where he had arranged for *Andromeda* to meet him with fuel, oil and provisions.

Descending over Ostrov Pankrat'yeva, Nagurskiy soon discovered that there was nowhere suitable for a landing; there was no open water or even level ice visible. Everywhere the ice was ridged and rafted. In addition extensive fog banks covered much of the area. As the plane flew on south the first open water to come into sight was off Mys Borisova, but the high, rocky coast did not look very hospitable. Worse still, long reefs and rock ribs extended well out to sea. But there was little choice; the fuel was all but exhausted and the rendezvous with *Andromeda* had been pre-arranged for somewhere in this area.

Swinging into the wind, Nagurskiy made a perfect landing at precisely 8:50 A.M. The first arctic flight in aviation history had lasted 4 hours 20 minutes and had covered about 450 km. As the plane taxied in toward shore, it suddenly jarred to a halt as one of the floats hit an unseen rock. Fortunately the water was only knee deep and the two men were able to push the plane off the rock and tow it ashore. Having secured the aircraft, they lit a fire, brewed some tea and had a quick meal, then fell asleep beside the fire. They had not slept for some 36 hours.

On waking the two men had breakfast. Then, hauling the

aircraft ashore on a flat slab, they repaired one of the floats, which had been punctured, using a rubber patch reinforced with a piece of tin. Soon afterward they spotted a large bear approaching; reluctantly Nagurskiy was forced to shoot it, since the bear refused to be scared away. That evening *Andromeda* hove into view; Kuznetsov fired a signal rocket, which was answered by another from the ship. Soon the vessel had dropped anchor quite close to shore and fuel for the plane was being ferried ashore. Meanwhile Nagurskiy reported to Kapitan Pospelov on the ice conditions to the north; realizing the significance of this pioneer flight and the value of aerial ice reconnaissance, Pospelov produced a bottle of cognac to celebrate the auspicious occasion. He then requested that on his next flight Nagurskiy investigate ice conditions around Ostrov Zayach'iy, where he was supposed to leave an emergency food depot in a trapper's hut.

After a few hours' rest Nagurskiy and Kuznetsov took off again at 3:00 A.M. (on 22 August) in clear, sunny weather. Heading north toward the Gorbovye Ostrova, Nagurskiy spotted several discrepancies between the coastline as plotted on the chart and the reality unfolding beneath him; he noted the particularly glaring mistakes on his chart. It was noticeably colder on this flight, and Kuznetsov, who was feeling slightly feverish, began stamping his feet to try to get them warm. Suddenly there was a crack; accidentally he had pounded one of his boot heels right through the thin plywood floor. This, of course, only added to the cold drafts eddying around him.

Soon the plane was flying over Arkhangel'skaya Guba, with the Gorbovye Ostrova to port; the sound and the straits between Ostrova Berkha, Lipotina and Zayach'iy were all still covered with ice. On Ostrov Berkha Nagurskiy spotted a little hut, half drifted over with snow. Selecting a level strip of snow-covered ice, Nagurskiy descended gently and made a perfect landing, the floats gliding across the snow like skis. This flight had lasted 1 hour 45 minutes. By this stage Kuznetsov was shivering and had a pounding headache. After giving him a good shot of cognac, Nagurskiy dug out the sleeping bags and the two men unrolled them on the ice beside the plane's floats, clambered in and fell asleep.

Late that evening *Andromeda* again appeared at the ice edge only a short distance away, and soon the chilled fliers were taken aboard. Kuznetsov was immediately packed off to the sick-bay. Meanwhile Nagurskiy, Pospelov and three seamen went ashore to examine the trapper's hut. Huddled in a gully, sheltered from the wind, it contained only a stove, some remains of food and some Norwegian magazines. Messages on the walls indicated that the last Norwegians had been here five years previously. There were no signs of Sedov's expedition.

The party next walked across to the cairn on Ostrov Zayach'iy, where Sedov had said in his note he would leave food and copies of his maps but which Pospelov had already found to be empty. On reaching it Nagurskiy decided to leave some gasoline and oil for possible future emergencies. Soon a work party had hauled food, gasoline and lubricating oil to the depot. To indicate its presence Nagurskiy left a note at the massive cairn, crowned with a cross that Sedov had left on Ostrov Pankrat'yeva. It read:

A metal drum of gasoline (10 pud) and a can of lubricating oil (4 pud) have been left at a man-made cairn on the inlet located on the southwest coast of Ostrov Zayach'iy. They are intended for aviation. Anyone flying here and finding himself out of fuel may use these supplies. I flew here from Krestovaya Guba in a *Farman* floatplane on 11 August 1914 while taking part in an expedition in search of Sr. Lt. G. Ya. Sedov.

Military pilot Nagurskiy (Gal'perin, 1958:67.)

Next day a severe storm broke. On board ship Nagurskiy was seriously concerned about his plane, which was standing on the sea ice lashed down to pegs. The sea was so wild that Nagurskiy, with Pospelov's permission, had to ask for volunteers to row him ashore. Once ashore he fought his way to the aircraft to find that his fears had been justified: the plane was rocking dangerously in the violent gusts of wind and threatening to tear loose from its lashings at any moment. With the help of the seamen Nagurskiy hauled the machine to a more sheltered spot and lashed it securely. Once the storm died Nagurskiy took the men who had helped him on short flights around the area. He also repaired the leaking float and replaced the propeller that had received some damage.

After three days in bed Kuznetsov was pronounced well again, and on 25 August Nagurskiy and he took off to investigate ice conditions around the Gorbovye Ostrova again. It did not take them long to discover that the gale had broken up the ice and driven most of it out to sea. The north and west sides of Ostrov Zayach'iy were totally free of ice. Encouraged by this information, Nagurskiy swung back south and landed in the open water of Arkhangel'skaya Guba; the two men pulled the aircraft ashore at a sheltered spot.

That evening Pospelov requested that Nagurskiy take him on a flight to reconnoitre ice conditions in the direction of Rus-skaya Gavan'; Nagurskiy agreed. An hour later they took off; climbing to 500 m, Nagurskiy set a course for Mys Nassau in excellent visibility. Suddenly there was a sharp crack from the engine; automatically Nagurskiy cut the engine and began a long glide down to the sea. One can only guess at the captain's reaction. Nagurskiy made a perfect landing; fortunately they were still within sight of the ship and, realizing something was amiss, the first mate dispatched a boat to assist. Both Nagurskiy and the captain were only too conscious of what might have happened if the mishap had occurred at a later stage in their flight.

The plane was towed ashore and Kuznetsov, who had arrived with the boat, began an inspection of the engine. He and Nagurskiy quickly decided that they could do nothing under these conditions; the engine was dismantled and transported out to *Andromeda*, where Kuznetsov began stripping it down in relative comfort. What he found was a broken connecting rod in one of the cylinders; the main shaft was also bent. Closer examination revealed that the damage had been caused by negligence at the factory; some nuts had not been tightened and secured properly.

For over two weeks the aircraft was immobilized, initially because Kuznetsov had the engine in pieces, and subsequently because of a series of snowstorms. Taking advantage of a lull in the bad weather, Nagurskiy set off with a group of sailors

for Ostrov Zayach'iy, where there was supposed to be another Norwegian trapper's hut. They located the hut without too much difficulty; in one of the two rooms they found barrels of salt meat, bags of rusks and cases of assorted provisions. On a table sat a round sealed canister with, beside it, a note reading "Please open." Inside was a neatly folded series of maps and a note in English and French, which read:

Sr. Lieutenant Sedov's North Pole Expedition today left for Mys Flora on Zemlya Frantsa Iosifa. The supply of provisions, approximately enough for 17 men for one month, which it was planned to leave at the cairn on Ostrov Pankrat'yeva as mentioned in the note left by the expedition at the cross at our wintering site on Poluostrov Pankrat'yeva, has been left here, and also second copies of the maps. We did not manage to get to Ostrov Pankrat'yeva since it was icebound. All well with the expedition. I earnestly request that anyone finding the maps we have left here should send them to the expedition's committee in St. Petersburg and to use the provisions in case of need.

Leader of the North Pole Expedition, Sr. Lt. Sedov. 25 August 1913. (Gal'perin, 1958:73.)

On the same sheet of paper was a list of the supplies that had been left: rusks, salt meat, butter, sugar, coffee, tea, rifles and shells. The mystery of the empty depot on Ostrov Zayach'iy was solved. Leaving a note and taking the maps, Nagurskiy and his companions returned to the ship.

At dawn on 3 September *Hertha* arrived from the north and dropped anchor close to *Andromeda*; Kapitán Islyamov congratulated Nagurskiy on his successful flights and had the decency to confess that he had been wrong in his predictions. He then went on to report that *Hertha* had reached Zemlya Frantsa Iosifa and that three days previously at Mys Flora, on Ostrov Nortbruka, he had found a message, dated 25 July 1914, from Dr. P.G. Kushakov, deputy leader of Sedov's expedition. In it the doctor reported that Sedov had died in a forlorn attempt at reaching the North Pole (for further details see Barr, 1973) and that *Sv. Foka* was now southward bound to Arkhangel'sk although desperately short of fuel. Although a month had now elapsed, there had been no sign of *Sv. Foka* nor had *Hertha* received any wireless messages to say she had reached Arkhangel'sk or any other port. In fact *Sv. Foka* had encountered heavy ice, which, since she was now entirely dependent on her sails, had proved impassable; indeed she was solidly beset for almost a week (Al'banov, 1953). She reached the little port of Rynda on Kol'skiy Poluostrov on 4 September, i.e., the day after Islyamov's conversation with Nagurskiy.

Islyamov's instructions to Nagurskiy were to make a wide sweep out to sea from Ostrova Pankrat'yeva in the hope of spotting *Sv. Foka*, to call at Russkaya Gavan' in case she had taken refuge in that anchorage, and to leave a note there to the effect that coal and provisions would be left for *Foka* on Ostrov Zayach'iy. But first Nagurskiy and Kuznetsov had to repair the plane's engine. The necessary spares had been left at Krestovaya Guba; Pospelov now took them south in *Andromeda*, then back north again with the necessary spare parts to Arkhangel'skaya Guba, where they arrived on 6 September.

Having quickly re-assembled and re-installed the engine,

Nagurskiy tested the aircraft. Winter was rapidly approaching; there was now a substantial dark period every night, which imposed further restrictions on flying time. This time flying solo, Nagurskiy took off at 4:20 P.M. on 12 September and headed west-northwest out to sea at a height of 1200 m; the temperature was -7°C , with a fresh west wind at 8 mps. The weather began to deteriorate; it began to snow heavily and visibility was cut almost to zero. Realizing that his chances of spotting the overdue ship, already slim, were almost infinitesimal under these conditions, Nagurskiy swung back east toward land. At his turning point he was about 100 km from land. The snow ended and soon the coast of Novaya Zemlya in the vicinity of Mys Litke loomed ahead. From there Nagurskiy swung back southwest again to where the two ships lay in Arkhangel'skaya Guba. Shortly before landing he realized that the old, solid ice over which he had been flying for some time was drifting steadily southward and had already reached Ostrov Zayach'iy. Realizing the danger this represented to the two anchored ships, he reported the situation to Islyamov as soon as he landed. *Andromeda* and *Hertha* immediately weighed anchor and headed south to avoid being beset, having first arranged a rendezvous with the aircraft at Krestovaya Guba.

With Kuznetsov in the passenger seat once again, Nagurskiy took off at 1:15 P.M. on 13 September. A westerly wind was blowing at 7 mps. There was a great deal of low cloud and at one point Nagurskiy was unable to see the ground for a considerable period. When the cloud cleared he found himself over the mountainous, glacier-covered interior of Novaya Zemlya, with the Kara Sea clearly visible only a short distance to the east. The steady westerly wind had drifted the biplane well off course. Nagurskiy immediately swung southwest to correct the error. Two hours after take-off the wind shifted into the south, greatly reducing the speed over the ground. Finally, after $3\frac{1}{4}$ hours in the air the little biplane was circling Krestovaya Guba, where *Pechora* was still lying at anchor. Thirty-six hours later *Andromeda* appeared. On orders from Sinitsyn, Nagurskiy and Kuznetsov dismantled the plane, packed it in its crates, and supervised its stowage aboard *Pechora*.

RESULTS AND FINAL REPORT

During his five major flights, totalling 10 hours 40 minutes in the air, Nagurskiy had flown a total of 1060 km. Although he had found no traces of any of the missing expeditions (apart from the cairns and notes left by Sedov), he had been able to make numerous corrections to the charts and had provided invaluable ice reports to the search ships. Most significantly, he had demonstrated the feasibility of flying in the Arctic, despite some extremely poor flying weather.

During his voyage south Nagurskiy compiled a report for Lieutenant-General Zhdanko. Having summarized the major events of his search, he added a series of recommendations for the guidance of future arctic pilots based on his own experience, with some comments as to the future of arctic aviation. These remarks merit being quoted verbatim:

In the upper layers of the air the temperature is lower, but just as variable, as compared with the lower layers. The aeronaut Andree, who made a scientific trip towards the Pole, stated that near the Pole the upper layers of the air must be positive as compared to the lower layers. This hypothesis turned out to be incorrect.

Over the Arctic Ocean changes in wind speed are very frequent, as too are changes in wind direction over short distances. While flying a distance of 200 versts I encountered three or four wind directions.

Fog and overcast conditions are common.

In summer it is possible to fly round the clock since there is full daylight at night. On the basis of the meteorological data which I have checked the best months for flying over the Arctic Ocean I believe to be May and July.

In some places the outline of the coast of Novaya Zemlya does not agree with the charts.

Subsequent expeditions should be equipped with a floatplane which is as portable as possible, so that it can easily be stowed aboard a ship and rapidly assembled and disassembled; it should also have the largest possible payload. One should pay special attention to the floats, which should have at least three longitudinal ribs. With strong floats and supplementary wheels one can manage with a single undercarriage.

One should take spare floats and as many propellers as possible; I broke two propellers in one month of flying. The floatplane should be painted red, as being most conspicuous against white.

A pilot going on an expedition should pay special attention to his outer clothing; his boots should be especially warm and waterproof. His jacket should be made of eider or swan skins and over it he should wear a sheepskin coat; his pants should be of fur; a fur hat, yellow goggles and two pairs of woollen mittens.

He should take the following items with him on the flight: a rifle and shells; a coil of steel cable, which is essential for securing the aircraft and can also be used for other purposes such as diagonal braces. He should have with him smoke flares equipped with parachutes in order to attract attention in emergencies, all essential spare parts for the engine, a few tools and food.

Although flying in the arctic regions is difficult it is entirely feasible and in the future aviation can make a major contribution to hydrography in the following areas: in ice reconnaissance; in discovering new land; in locating and charting underwater obstacles which would be a hazard to shipping. All reefs, banks and shoals are clearly visible from the air.

Photographs from the air can provide accurate data for correcting and amending the charts.

Past expeditions attempting to reach the North Pole have all been unsuccessful since they badly overestimated man's endurance and energy when faced with the thousands of versts which must be covered, full of obstacles and very difficult conditions.

As being an enormously rapid means of transport aviation is the only way to resolve this problem. (Nagurskiy, 1949:226.)

Nagurskiy submitted this report on his return to Petrograd on 14 October 1914. In a personal interview Zhdanko congratulated him warmly and told him that he was to be awarded the Order of Sv. Stanislav. After answering all of Zhdanko's questions, Nagurskiy put forward a proposal for flying to the North Pole (Gal'perin, 1958). He proposed a main base on Ostrov Rudol'fa, the most northerly island of the Zemlya Frantsa Iosifa group, as being at the same time accessible by

sea in a normal year. From there to the Pole he proposed establishing support bases every 200 km, each with two airstrips with food and fuel depots. Three such intermediate depots would be required. This plan bears a striking resemblance to that adopted for the establishment of Papanin's group at the North Pole in 1937 (Papanin, 1938). Zhdanko was genuinely intrigued by the idea but tactfully suggested that since there was a war on, it would have to be postponed for the moment.

A fairly detailed report on Nagurskiy's flight, mounted in an embossed leather folder lined with white satin, was prepared by the Naval Ministry for the tsar's perusal (Gal'perin, 1958). It was returned to Grigorovich, the Naval Minister, with the annotation in the tsar's handwriting: "We have read with pleasure" (Gal'perin, 1958:84). On this occasion Nagurskiy was awarded the Order of Sv. Anna, third class.

NAGURSKIY'S LATER CAREER

In the meantime Nagurskiy was engaged in the war in the Baltic. His personal file provides only a sketchy picture of his military career during this period. By an order of the commander-in-chief, Sixth Army, dated 20 May 1915, he was promoted to shtabs-kapitan (junior captain) (Chernenko, 1957); then on 6 June 1915 he was transferred back to the Navy with the rank of leytenant. In September 1915, "for bravery and valour displayed under various circumstances" he was awarded the Order of Sv. Anna, fourth class, with the inscription "For valour" (Gal'perin, 1958). A month later, in October 1915, his file bears the entry "For distinguished service in action against the enemy awarded the Order of Sv. Vladimir, with swords and bows" (Gal'perin, 1958:85). An Order of Sv. Vladimir, second class, soon followed.

During this period Nagurskiy was stationed at Kil'ka on Ostrov Ezel, flying patrols over the Baltic aimed particularly at intercepting German ore carriers hauling iron ore from Luleå to Germany. During one such sortie over the Gulf of Riga in the summer of 1917, while leading a flight of 12 *Grigorovich* floatplanes, he encountered a flight of German *Taube* aircraft (Gal'perin, 1958). Nagurskiy's plane was badly damaged by machine-gun fire and the engine quit. Although wounded in the leg, Nagurskiy managed to glide down to a landing on the sea. When the Germans began shooting up the damaged aircraft Nagurskiy and his co-pilot took to the water. The plane sank but the two men survived. After floating for about two hours in their life jackets in the bitterly cold water, they were amazed and delighted when a Russian submarine appeared. The downed airmen were spotted and hauled aboard, and soon the submarine was returning to base. There Nagurskiy was taken to hospital.

But in the meantime, having seen his plane go down and the Germans attack the helpless machine on the water, Nagurskiy's fellow pilots had reported that he had been killed in action. This report was officially relayed to Vlotslavek, where Nagurskiy's mother was so overcome that she soon died. Another result of this quite understandable error is to be found in the entry on Nagurskiy in the second edition of the *Bol'shaya Sovetskaya Entsiklopediya* (Vvedenskiy, 1954), which gives 1917 as Nagurskiy's date of death.

In fact, after recovering from his wounds on 9 August 1917 Nagurskiy was appointed a staff officer in the newly formed *Upravleniye morskoy aviatsii i vozdukhoplavaniye* (Administration for Naval Aviation and Airships) and was posted to Petrograd. Like so many others, he did his best to adjust to the turmoil of the Revolution. Then in 1918, having been granted a leave, he travelled home to Poland to see his family. The avalanche of events that ensued in Poland made it impossible for him to return to Russia, and when a friend of the family offered him a job as engineer in a small sugar factory, he accepted. When Poland declared war on Russia Nagurskiy refused to fight. He warned his family to say nothing about his service record in Russia, and when he was obliged to register with the police, in the column headed "Military service, position and rank," he wrote "Other ranks" (Gal'perin, 1958:91). This subterfuge in combination with the earlier false report of his death effectively obliterated all trace of Yan Iosifovich Nagurskiy, the Russian aviator.

Nagurskiy married and moved to Warsaw, where he worked as an engineer in a design office. He avidly followed the progress of events in the Soviet Arctic and especially the role played by aviation in operations such as the rescue of *Chelyuskin's* shipwrecked crew from the ice of the Chukchi Sea in 1934 or the establishment of Papanin's *Severnnyy Polyus I* (North pole I) drifting station in 1937. With the Nazi occupation of Poland in 1939, Nagurskiy found himself out of work and he struggled to exist by running a small antique store. The store became a storage and dispersal centre for chemicals for making home-made grenades and for medical supplies during the Warsaw Uprising. Having survived that shambles, in post-war Poland Nagurskiy became the head of a major department in a design office.

He continued to follow events in the Soviet Arctic. Then, during the winter of 1956, at a meeting at the Palace of Science and Culture he happened to meet a Polish writer, Tsentkevich, who in a book about the Arctic had stated that Nagurskiy was dead. Nagurskiy could not resist the temptation and introduced himself. The outcome was that an article about Nagurskiy appeared in a Polish newspaper next evening, followed by an interview on Polish radio (Chernenko, 1957), and soon his "resurrection" hit the headlines in the Soviet press. The result was a flood of letters from all over the Soviet Union and, most importantly, an official invitation from Soviet arctic pilots to visit the Soviet Union (Gal'perin, 1956, 1958).

On 27 July 1956 Nagurskiy flew to Moscow; this was his first visit to Russia in almost 40 years. Waiting to meet him were the famous Soviet arctic pilots Boris Grigor'yevich Chukhnovskiy, M.V. Vodop'yanov, M.I. Shevelev and M.A. Titlov. Chukhnovskiy was the first Soviet pilot to fly in the Arctic, starting with ice reconnaissance flights around Novaya Zemlya in 1924 (Belov, 1959). Vodop'yanov had been one of the seven pilots who had carried out the evacuation of the crew of *Chelyuskin* from their ice camp in April 1934 and in May 1937 had landed Papanin and his party at the North Pole (Belov, 1969; Vodop'yanov, 1954) (Fig. 5). Shevelev had also taken part in this latter operation, while Titlov had flown ice reconnaissance aircraft during World War II and had made the

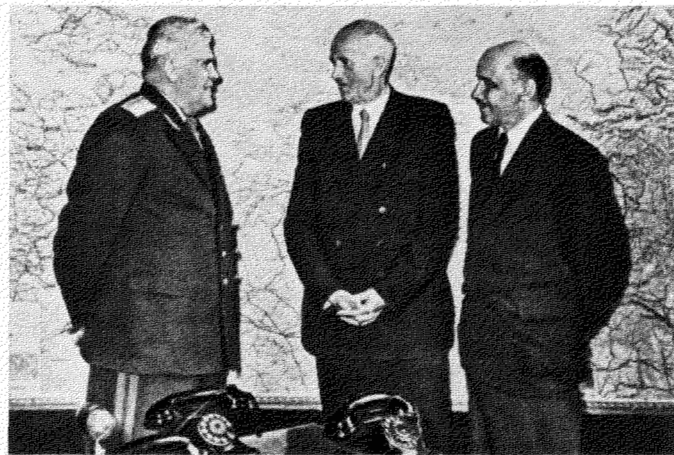


FIG. 5. Nagurskiy (centre) with Vodop'yanov (left) and Chukhnovskiy (right) in Moscow, 1956.

first landings at the airstrips at both Mys Chelyuskina and Dikson in 1943 (Belov, 1969). All were delighted at being able to meet the man who had preceded even their earliest flights by a decade.

At a special reception at the headquarters of *Glavsevmorput* (Chief Administration of the Northern Sea Route) at which he was guest of honour, Nagurskiy learned that ten years previously a Soviet weather and research station on Zemlya Aleksandry, the most westerly island of Zemlya Frantsa Iosifa, had been named after him. From Moscow Nagurskiy went to Leningrad, where he was again given a warm welcome by the arctic and aviation communities. A poignant moment came when he was introduced to Vera Valer'yanovnaya Sedova, the widow of Leytenant Georgiy Yakov'levich Sedov. His triumphant tour of the USSR was completed with a visit to Odessa.

ALEKSANDROV'S CONTEMPORANEOUS ACTIVITIES

Also in the summer of 1914, while Nagurskiy was making aviation history in the skies above Novaya Zemlya, at the other end of the Russian Arctic an attempt was being made by another Russian pilot to use his aircraft in support of a different arctic expedition, also mounted by the Russian Imperial Navy. The pilot was Captain Second-Class D.N. Aleksandrov, who with an Henri Farman floatplane (Fig. 6) and accompanied by a mechanic, Sr. Lt. A.G. Firdarov, had been attached to the icebreaker *Taymyr*. Along with her sistership *Vaygach*, *Taymyr* was engaged in a long-term survey of the arctic coast of Siberia in an operation known as the Arctic Ocean Hydrographic Expedition 1910–1915 (Starokadomskiy, 1976). During each of the navigation seasons between 1910 and 1913 the two icebreakers had pushed progressively farther west along the arctic coast from Bering Strait, carrying out careful surveys and sounding traverses, and returning to Vladivostok each winter. But in 1914 the intention was to complete the through passage to Arkhangel'sk.

The two icebreakers sailed from Vladivostok on 7 June 1914 and reached Bukhta Emma in Chukotka on 28 July. Here with

the assistance of a party of seamen, Aleksandrov and Firdarov ferried their aircraft ashore and assembled it on the beach (Fig. 4) under conditions almost identical to those with which Nagurskiy had to cope on Novaya Zemlya. By the morning of 2 August the plane was ready to fly (Fig. 6). The weather was clear and calm and the sea mirror-smooth. Aleksandrov took off successfully but set the plane down again almost immediately. On the second attempt part of the rudder assembly broke; the damage was sufficiently serious that Aleksandrov could not repair it in the field, and hence the plane was towed ashore and disassembled.

The remainder of the voyage must have been extremely frustrating for Aleksandrov and Firdarov. The two icebreakers successfully negotiated Proliv Vil'kitskogo, but in mid-September they became icebound off Mys Mogilniy on the west coast of Poluostrov Taymyr and were forced to winter. During March 1915 Aleksandrov, who by now had abandoned any hope that his machine would fly again, decided to try to operate it as an aerosled without any significant modification; presumably the idea was to simply taxi across the sea ice and the snow-covered land surface. This idea was less than successful; the plane managed to crawl only a few tens of metres across the sea ice before several of the major struts supporting the wings broke from the jolting. Undaunted, Aleksandrov and Firdarov removed the engine from the plane and mounted it on a solidly built sledge to produce what was almost certainly the world's first aerosled. It was a complete success. Pulling a sledge at speeds of up to 40 kph on firm, level snow, the aerosled was used to support a field party, which completed a survey of Zaliv Gafnera between 1 and 11 June 1915 (Starokadomskiy, 1976; Pinkhenson, 1962). Dr. Starokadomskiy, A.M. Larov and N.I. Yevgenov not only mapped this inlet for the first time but also carried out geological and zoological investigations.

Later that spring Aleksandrov played an important role in another, very different phase of the expedition. B.A. Vil'kit-skogo, captain of *Taymyr* and leader of the expedition, was faced with a difficult decision. In the event that the ice did not break up to free the ships, he did not have sufficient provisions on hand to last for a second wintering. Fortunately, however, he was in wireless contact with Otto Sverdrup in *Eclipse*,

wintering off Mys Vil'da, and through him with Petrograd. As a precautionary measure it was decided to evacuate half the crews of *Taymyr* and *Vaygach* overland to *Eclipse* and thence to Gol'chikha on the Yenisey. The pilot, Aleksandrov, was chosen to lead this party, largely because he was suffering from a nervous disorder and it was not advisable that he remain for a second wintering. Accompanied by a sledge party from *Eclipse* led by Sverdrup himself (Sverdrup, 1928), Aleksandrov and his group left *Taymyr* on the morning of 19 May; they reached *Eclipse* on the 22nd and were very hospitably treated by the Norwegians. Two months later they set off on the second leg of the overland trip; escorted by N. Begichev and 650 reindeer to haul supplies and equipment, they set off westward. Covering about 20 km per day, Aleksandrov and his group reached Gol'chikha on 19 August.

As it turned out *Taymyr* and *Vaygach* got free of the ice with relative ease and were able to head west to Dikson and Arkhangel'sk. From Dikson *Vaygach* was sent south to Gol'chikha to recover the overland party. They boarded her on 5 September and by the 6th she was back at Dikson, where Aleksandrov and the others of the group belonging to *Taymyr* transferred back to their own ship.

While far from being as successful as Nagurskiy's arctic operations, Aleksandrov's contribution is in its own way quite significant. From his persistence and innovation emerged what was almost certainly the first operational aerosled. And while the overland trek from Mys Mogilniy to Gol'chikha must have seemed rather humiliating to Aleksandrov, in that it represented a tundra journey of close to 1000 km, it was in its own right quite an impressive achievement.

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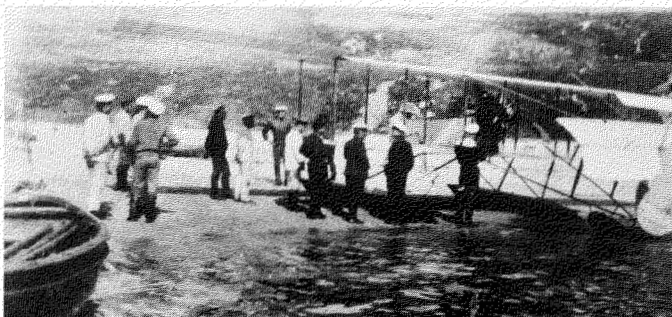


FIG. 6. Aleksandrov's Henri Farman ready for its first test flight; apart from being fitted with a rotary engine, having its stabilizer mounted much higher, and a single rather than double rudder, this machine was basically the same as Nagurskiy's Maurice Farman.

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