

## **Danish Ice-Observations in Greenland History and Organization**

By Jens S. Fabricius

### **Abstract**

*The paper describes the development of the Danish ice service in the Greenland waters and the establishment of the Ice-central at Narssarsuaq. Further the article deals with the work and organization of the Ice-central and its prospects.*

### **Introduction**

Due to the severe ice-conditions around Greenland, the frequent storms and fog, even the strongest built ships with the most experienced navigators have run into difficulties causing loss of material and life.

The completely new and well-equipped ship "Hans Hedtoft" belonging to "Den kgl. grønlandske Handel" (the Royal Greenland Trade Department) was lost on the 30th January, 1959, on the return to Copenhagen from its maiden voyage to Greenland. South of Kap Farvel an iceberg caused a leakage to the ship. As it further was surrounded by polar ice (storis), and heavy storms and snow showers prevailed over the area, it was not possible to bring assistance. All the 95 persons on board were drowned as the ship went down – only one single lifebelt was found several weeks later on the Iceland coast.

This catastrophe caused arrangements in the Greenland waters similar to those caused by the Titanic-catastrophe in the waters of New Foundland in 1912. On 19th February, 1959, a commission was appointed by the Ministry of Greenland. The purpose of this commission was to investigate the problems related to the navigation during the whole year to and from Greenland and to the local navigation in the Greenland coastal waters. Furthermore, the commission should suggest improvements of the Greenland search

and rescue service. Vice-admiral, dr. phil. h.c. A. H. Vedel was appointed chairman, and the recommendations were available the 2nd September the same year.

Among others the report concluded that navigation during the winter months demanded an ice-patrol and information service to be established in Greenland. The reconnaissance-flights were suggested to be performed all the year round with Narssarsuaq in South Greenland as a base, and – in addition – Søndre Strømfjord, Kulusuk and Mestersvig should serve as bases during certain parts of the year.

#### **Former Ice Service in Greenland**

A new ice service would not have to commence from the very beginning. For many years Denmark was a pioneer country in collecting information of the ice in the Arctic waters.

Shortly after its establishment "Det Danske Meteorologiske Institut" (The Danish Meteorological Institute) started to collect information of the ice in the Greenland waters. The masters of the ships bound for Greenland were supplied with blank charts and asked to depict the ice-occurrences met with. The telegraph offices and other coastal stations kept diaries of observed ice. Based upon such material the institute started in 1890 to issue yearbooks of the ice-conditions in the Greenland waters.

The appearance of these reports gave rise to a resolution from the Seventh International Geographic Congress held in Berlin in 1899 declaring: "That the Danish Meteorological Institute of Copenhagen is the organization best adapted as a central office for the collection and preparation of information regarding the state of the ice in the northern seas."

Reports from ships of many nationalities rendered it possible to publish an annual report entitled: "The State of the Ice in the Arctic Seas". The first issue appeared in 1900, and successive issues were published until 1956, except for the years 1940-45.

After the Second World War the navigation increased and more ice observation stations on land gave improved records from Greenland waters, and these were supplemented by a new factor of importance, namely the data collected by the U.S. Air Force on ice reconnaissance flights.

In 1948 the Danish Meteorological Institute proposed the establishment of a telegraphic ice report service for Greenland with Angmagsalik as a broadcasting center, and on 15th February 1950 this ser-

vice became a reality. The main purpose was to give as recent information as possible to ships in the area and – besides – to give those concerned in Copenhagen a knowledge of the actual ice conditions.

The ice report was organized to comprise reports from land, sea and air. Ships and planes reported only occasionally, so most of the information came from stations on land with a changing – but always limited – visual range. Technically, it often proved difficult to include the flight reports from the U.S. Air Force, and the Danish ice reconnaissance was made off Mestersvig only. The latter was established owing to private initiative in 1956 because of exploitation of the existing lead ore. It was executed by the Royal Danish Air Force with ice observers from J. Lauritzen, the shipping company in charge of the transportation of the ore. A general ice reconnaissance in the Greenland seas was formerly considered beyond the economic possibilities, but on basis of the reports of the “Vedel Committee” the Ministry of Greenland started organizing an ice reconnaissance service from Narssarssuaq.

#### Narssarssuaq

The airfield N. (Lat. 61° 11' N and Long. 45° 25' W) was established by the Americans during the war as an intermediate landing place for flights between USA and Europe and equipped with a hospital for wounded from the invasion of France. Narssarssuaq represents one of the few possibilities for establishment of an airfield in South Greenland. It is placed on an alluvial plain near the inland ice at the head of Tunugdliarfik Fjord. This position far from the exterior coast means a comparatively dry, continental-like climate.

In 1958 Narssarssuaq (Blue West One) was evacuated by the Americans and taken over by the Danish state, and only a small Danish staff was left for operating the ionosphere, radiosonde and telegraph station.

In summer 1959 preparations were initiated to re-open the airfield, and in autumn the same year the first appropriations enabled a large-scale programme to start. On the 30th November 1959 the first Danish ice reconnaissance was made from Narssarssuaq.

Narssarssuaq was re-opened in order to facilitate ice reconnaissance and rescue service, but has also become of importance to the passenger traffic between south Greenland and Denmark, including an increasing number of tourists. The appearance of Narssarssuaq has changed year by year. The old wooden houses are removed to be

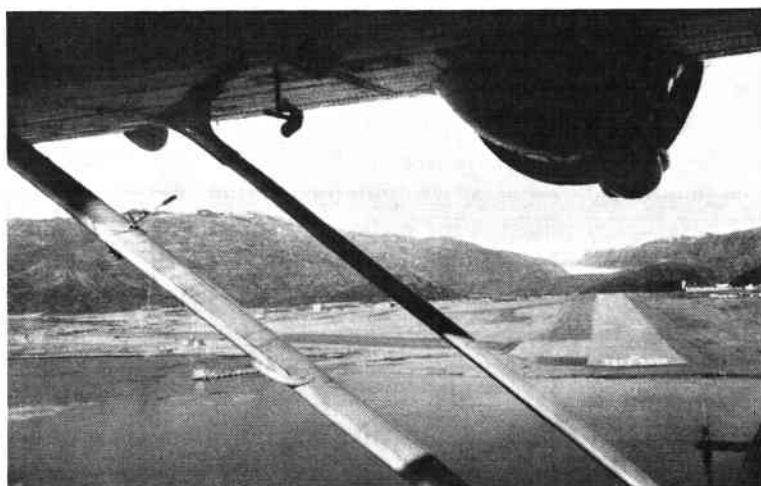


Fig. 1. The landing strip at Narssarssuaq seen from the blister of the Catalina. Over the strip an outlet glacier from the inland ice can be distinguished.

Photo: J. Fabricius.

*Fig. 1. Narssarssuaq landingsbane set fra Catalinaflyets blister. Gletcherudløbet fra indlandsisen skimtes over landingsbanen.*

used in towns and settlements. Only the concrete buildings and a few wooden houses will be left – but there will still be room for more than the present staff of 100 persons.

The night before 24th October 1963 the hangar was burnt down. The Icelandic DC-4 – chartered for ice reconnaissance – was destroyed together with 2 military Catalinas and a civil American plane. The reconnaissance planes were soon replaced, but a new hangar has not yet been erected. Provisionally, a sheltering wall (9 x 43 m) was built of available materials in December 1963, but is not giving enough shelter against the occasionally violent foehns.

#### **Aircrafts, Crews and Ice-Observers**

In autumn 1959 the Royal Danish Air Force stationed 2 Catalinas (PBY) with crews at Narssarssuaq, primarily for pilot service and ice-observations. The Catalina is wellsuited for this purpose, giving an excellent view through the two blisters placed on each side of the plane, combined with its powerful radio equipment. As the Air Force had difficulties in placing crews at disposal, a civil Canadian Catalina was used in the period from 12th November 1960 till 30th January 1961, at which time this aircraft was replaced by a DC-4 chartered from Icelandair. Because of the good experience

with the plane and the crews this charter with Icelandair is still in function.

The DC-4 has a crew of 5 or 6 men and one ice-observer. He is placed in one of the pilot seats rendering him the best view and from where he can take advantage of the radar to determine position and ice boundaries, especially in cloudy weather. A DC-4 with room for 68 passengers might seem rather big for this purpose, but the 4 engines increase the security on the often long flights under difficult conditions in the desolate regions. Further comes that the effectivity of the ice reconnaissance has improved considerably with this plane, which can take off and land under more unfavourable wind conditions than a lighter one.

Practically all ice-observations from Narssarsuaq are now carried out by the DC-4. However, Catalinas are still stationed at Narssarsuaq as a valuable back up for the DC-4 in case of technical defects or overhauling of the plane and replacement of the crew in Reykjavik.

The ice-observers have all passed a mate's examination and are experienced navigators in Greenland seas. They are recruited from The Royal Greenland Trade Department and are normally stationed at Narssarsuaq for a period of 24 to 30 months. The senior, however, being the leader of the Ice-central, contracts for a longer period.

At the Narssarsuaq station there must always be one observer to answer cable inquiries, and holidays and further education at the Ice-central makes it necessary to have one leader and two observers stationed at Narssarsuaq. Houses for the observers with families are placed at disposal.

A mate is preferred as an ice-observer due to his knowledge of the strength and ability of the ships. His knowledge has a special importance as far as ice-piloting is concerned, although the responsibility in full lies upon the master of the ship, and the guidance of the ice-observer is advisory only.

#### **Observation Areas and Reconnaissance Frequency**

The main operating area is the seas around Kap Farvel, i.e. the distance Frederikshåb-Kap Farvel-Tingmiarmiut. The principal task is to survey the extension of the polar ice. If this makes its way north of Frederikshåb the reconnaissance flights will be extended in order to cover the whole area of polar ice along the west coast.



Fig. 2. The ice-recco plane "Solfaxi" on the beach after a successful landing on the ice of Jørgen Brønlund Fjord. ( $82^{\circ}11'N$  and  $30^{\circ}30'W$ ). Photo. J. Fabricius.

Fig. 2. Isreccomaskinen "Solfaxi" på stranden efter vellykket landing på isen i Jørgen Brønlunds Fjord ( $82^{\circ}11'N$  og  $30^{\circ}30'W$ ).

Once or twice a month the reconnaissance flights are extended to comprise the east coast northwards to Angmagssalik as well.

Normally, two flights a week are made in the main area, but this number may be increased in difficult periods and reduced to once a week in autumn when the polar ice has disappeared.

During the last few years a monthly reconnaissance of the west coast has been undertaken from November to June of the so-called "Vestis" i.e. the ice created in the Baffin Bay. This reconnaissance starts from Sdr. Strømfjord and expands to Umanak or even to Upernavik.

The reconnaissance from Mestersvig is the responsibility of "Iscentral Mestersvig" and is now done – after the closing down of the lead mine – for the Royal Greenland Trade Department for the sake of the navigation of Scoresbysund and the meteorological stations Daneborg and Danmarkshavn. From July until medio October a military Catalina is stationed at Mestervig with two ice-observers from the shipping company J. Lauritzen. The "Iscentral Mestervig" is working in close co-operation with the Danish Meteorological Institute and with "Iscentral Narsarsuaq" which in difficult periods assists in making reconnaissance from Mestersvig, and the plane from Narsarsuaq has sometimes reached as far as Station Nord on these flights on the east coast.

### **The Execution of the Ice Reconnaissance and the Issue of Ice Reports**

The leader of the ice-central plans the time and the route of the flights in co-operation with the pilot on the basis of previous reconnoissances, reports received from stations on land as well as from ships, the positions of ships, and the flight meteorologists' briefing of the weather situation in the area.

The observed ice is plotted on a chart 1:1.000.000 (Lambert's conical projection) based upon the Ice Plotting Sheets of the U.S. Navy Hydrographic Office. Before autumn 1962, however, charts 1:1.500.000 were used. The signatures are the same as those used in Canadian and American ice observation charts.

The ice chart is drawn up based on the navigator's determination of the position, supplemented by the local knowledge of the ice observer and the radar determination of the distance. Beyond this the observer has only his binoculars. The observations will inevitably be stamped subjective by the individual observer, f. inst. in determining sizes of the floes and by marking boundaries of regions with different concentrations of ice. New observers start by joining an experienced observer on his flights, which should ensure as uniform a description of the ice as possible.

It should be noticed that the result of the reconnoissance flights is very much dependent on the weather conditions. In cloudy weather, with clouds hanging low or in case of fog, it is only possible to survey the extension of ice by means of radar, but the concentration of ice can mostly not be observed.

Before a ship is piloted through the ice, radio contact between plane and ship is made over the emergency frequency 2182 kc/s whereupon the correspondance takes place over a frequency agreed upon.

For other ships aerial ice reports are issued in plain English. These reports are transmitted to Angmagssalik Radio, which includes them in the daily ice report broadcasting. The aerial ice reconnoissance reports are also telegraphed from Narssarsuaq to Prins Christians Sund, Julianehåb, Grønnedal and Frederikshåb from where the reports will be transmitted upon request. The reports include information on:

- 1) Date of Ice-recco
- 2) Route or observation area
- 3) Position of the edge of the Storis or the Vestis

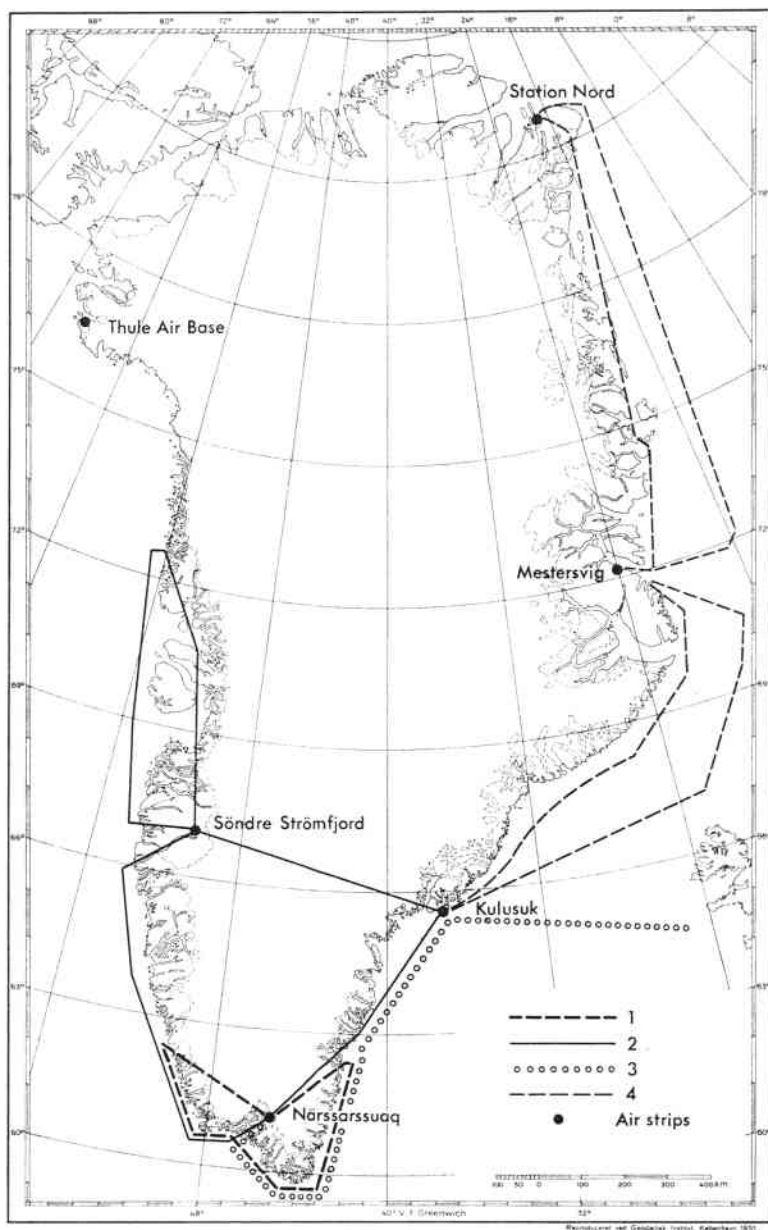


Fig. 3. Ice-central Narssarssuaq's flight-tracks. 1. normal ice recco. 2. "Vestis" recco. 3. track to Reykjavik. 4. tracks at assistance to "Iscentral Mestersvig".

Fig. 3. Iscentral Narssarssuaqs flyveruter. 1. normal rekognoscering. 2. vestis rekognoscering. 3. rute til Reykjavik. 4. ruter ved assistance til Iscentral Mestersvig.



- 4) Concentration of ice-floes in tenths
- 5) Leads, shore leads, winter ice
- 6) Icebergs (many or few).

Besides these aerial reports, which are made immediately after the landing of the plane, a redrawn ice chart in facsimile is issued when the reconnaissance has covered the Kap Farvel area. Ice-charts have been broadcasted from Narssarsuaq since January 1961. The low power of only 1 kW of the transmitter in addition to the poor aerial conditions renders the reception very bad although it has improved in the course of years. The charts are broadcasted at 6970 kHz every day at 1200 GMT and at 2200 GMT.

The redrawn ice charts are sent to the Danish Meteorological Institute for further studies.

#### **Rescue Service**

All the Danish ships in Greenland seas are now under an effective position control, of which also foreign ships may take advantage.

Ships under the control service sailing to or from Greenland and being north of 57°N within a distance of 250 miles from the Greenland coast have to report position, course, speed, route and destination to Grønlands Kommando, Grønnedal, or other authority referred to from Grønnedal. These reports must be given twice a day – in the area between 40°W and 50°W even four times a day – supplemented by a short ice report (Efterretninger for Søfarende, nr. 31, 1962, XI 1190 and 1191). From Grønlands Kommando the reports of position are transmitted to the Ice-central Narssarsuaq, but the control is assigned to Grønlands Kommando.

In 1960 – when this control was only prescribed ships sailing for The Royal Greenland Trade Department a position report from m.s. HANNE S. failed to appear. In the last cable, received 29th April, the ship had reported a gale in the position 58°N 44°W. A search by planes and ships was effected, but unfortunately in vain. Presumably HANNE S. went down in a gale, as no ice was observed in the area.

The planes of the Ice-central have luckily been able to give assistance in searches with successful results, and have also carried patients from Narssarsuaq to Reykjavik or Copenhagen. With a view to its participation in the rescue work the DC-4 is – like the military Catalinas – equipped with a Sarah-receiver to localize victims of accidents equipped with Sarah-transmitters.



Fig. 4. Ice island. Presumably part of Arlis II observed 2nd September 1965 on  $60^{\circ}16'30''N$  and  $43^{\circ}03'W$ . Photo: J. Fabricius.

*Fig. 4. Isø. Antagelig del af Arlis II observeret 2. september 1965 på  $60^{\circ}16'30''N$  og  $43^{\circ}03'W$ .*

#### Duties of Transport

Once a month the DC-4 plane has to leave for Reykjavik for overhauling and replacement of the crew. In order to take advantage of these flights the plane conveys passengers for The Royal Greenland Trade Department – in summer every fortnight. The plane has also been used for special transport duties in Greenland including mail drops, especially to the isolated weather and loran stations in East Greenland.

Ice reconnaissance is also made during these flights and the combination of several tasks contributes to reduce the heavy expense involved. The primary duties, ice- and rescue service, must of course not be neglected for transport. When the plane is needed for ice- and rescue service other tasks will be postponed.

#### Organization

The maintenance of Narssarsuaq has demanded a close co-operation between many authorities. The necessary grants are applied for by the Ministry of Greenland, but the book-keeping and the responsibility for the various duties have now gradually been placed within the jurisdiction of the authorities to which they naturally belong. Therefore, the Ice-central is under the auspices of the Danish Meteorological Institute, whereas other duties are assigned to the

Aviation Department, The Royal Greenland Trade Department, The Greenland Technical Organization etc.

In connection with the extension of the ice-service in Greenland the author became attached to the Nautical Department of the Danish Meteorological Institute in March 1959, and Hans H. Valeur, M. Sc. in August 1961.

Among other things the Nautical Department gives information to ships bound for Greenland. They are furnished with blank ice-charts for the registration of ice occurrences en route, as well as with ice-charts drawn out according to the latest telegraphic reports.

When the final organization has been established, the Ice-central at Narssarssuaq should cover the following duties:

1. Ice reconnaissance.
2. Radio collection of ice observations from all sources available: recco-planes, other planes, ships and stations along the coast.
3. Issue of a general ice-report for the entire Greenland to replace the present CQ-report from Angmagssalik.
4. Ice-reports to ships on request.
5. Effectuation of ice-piloting.

The work of the office in Copenhagen should lie within the below frame:

1. Ice-information service to interested in Denmark and abroad.
2. Scientific research on ice-observations.
3. Instruction of ice-observers for ice-recco planes, other planes, ships and coastal stations.

#### **The Efficiency of the Ice-Service**

The question naturally arises whether the ice-service in Greenland is actually working satisfactorily. Rather often the reports from Narssarssuaq via the coast stations contain telegraphic errors. An effective transmission of ice-charts in facsimile would eliminate this source of error and be a significant resource of security. The majority of the bigger ships navigating the seas of Greenland are already equipped with facsimile receivers. Furthermore a powerful radio station would enable the ice-central to establish a direct contact with a far greater number of ships than now possible.

The destruction of the hangar at Narssarssuaq has caused the inconvenience that the planes can not always take off promptly

for search or ice-reconnaissance, as they have to be cleaned of possible snow and ice.

The somewhat uncertain future of Narssarssuaq has caused that the Ice-central has not been fully developed as a central for collection of ice-observations and therefore it is not yet able to issue collective reports on the ice conditions of Greenland. The airfield has proved to be much better suited for the purpose than presumed, and the ice-recco plane has been able to take off all the year round except for a few days. The fact that the airfield is placed near the main operating area of the ice-reconnaissance has contributed largely to the regular flights that have actually been effected.

It is criticized from part of the ships that the reconnaissances do not take place frequently enough. However, an intensification to f. inst. daily flights, weather permitting, would involve heavy costs and presumably not increase the efficiency correspondingly in view of the fact that the concentrations of ice might change in the course of a few hours. On the other hand, an extended ice-piloting service, perhaps with smaller planes or helicopters, would definitely increase the security of ships navigating in the ice-covered seas. Generally, it might be said, however, that the shipping companies and the ships are satisfied with the efficiency of the ice-piloting and the ice-reconnaissance service.

It has to be admitted that good results have been obtained with the present organization of the ice-service in Greenland, though improvements are still needed in several fields.

How efficient the ice-service may ever be there is no guarantee against shipwrecks, although the security margin has been enlarged in the capricious and dangerous seas around Greenland. Further the increased knowledge of the ice-conditions should mean improved surveys, statistics and forecasts.

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## **RESUMÉ**

Danske isobservationer ved Grønland. Historie og organisation.

Dansk istjeneste ved Grønland var allerede før 1959, når bortses fra de kostbare isrekognosceringsflyvninger, vidt udbygget og anerkendt. Danske isrekognosceringsflyvninger udførtes kun ved Mestersvig af hensyn til blymalmtransporterne. Forliset af m/s Hans Hedtoft d. 30. januar 1959 ved Kap Farvel førte, på grundlag af „Vedeludvalgets“ betænkning, til etableringen af en iscentral i Narssarssuaq, hvorfra isrekognosceringer er foretaget siden november samme år.

Flyvningerne udføres nu hovedsageligt med et fra Icelandair chartret

DC-4 fly, medens danske militære Catalinafly står til rådighed som reserve. Isobservatorerne er styrmænd udlånt fra Den kgl. grønlandske Handel. Observationsområdet er primært Kap Farvel området, hvor der flyves ca. 2 gange ugentligt. En til to gange månedligt rekognosceres på østkysten til Angmagssalik. Fra november til juni rekognosceres vestkysten en gang månedligt nordpå til Umanak eller Upernavik. Ved Mestersvig assisterer Iscentralen Narssarssuaq efter behov, og der rekognosceres iblandt til Station Nord.

Isobservatøren sidder i et af pilotsæderne og indtegner isforekomsterne på kort i målestokken 1:1.000.000. Fra flyet foretages – ved radiokontakt – direkte islodsning. Efter landing sendes ismeldinger i klart sprog på engelsk til en række kyststationer, hvorfra skibene modtager meldingerne på anmodning. Meldingerne indeholder oplysninger om observationsrådets udstrækning, drivisens grænser og koncentrationer (i tiendedele), render, landvand, fastis og isbjerge. Pr. faksimile er der derudover udsendt iskort siden januar 1961. Iscentralens virksomhed er vejledende og fritager ikke den enkelte skibsfører for ansvaret.

Iscentralens fly deltager i redningstjenesten; desuden udføres passagertransporter til og fra Reykjavik, når maskinen skal til eftersyn eller besætningsudskiftning, samt postdrop ved øde vejr- og loranstationer i Østgrønland. Disse opgaver kombineres med isrekognosceringer. De primære opgaver, is- og redningstjeneste, må dog ikke kompromitteres af transportopgaver.

Driften af Narssarssuaq har krævet et nært samarbejde mellem mange instanser. Bevillinger koordineres og søges af Ministeriet for Grønland. Iscentralen Narssarssuaq er underlagt Meteorologisk Institut fra hvis nautiske afdeling information om isforholdene ved Grønland videregives til interesserede i Danmark og i udlandet, og hvor den videre bearbejdelse af materialet foretages.

Oprettelsen af Iscentralen Narssarssuaq har givet skibsfarten ved Grønland en øget sikkerhed. Stort set er der fra rederiernes og skibenes side tilfredshed med islodsningernes og isrekognosceringernes effektivitet. Det øgede kendskab, der er skabt til isforholdene igennem de udførte rekognosceringer, skulle give løfte om bedre oversigter, statistikker og prognoser.

Narssarssuaq har vist sig velegnet som base for isrekognosceringerne. Det føles som et savn, at hangaren, der nedbrændte oktober 1963, ikke er erstattet, idet eftersøgnings- og redningsflyvninger nu ikke kan startes uden længere tids klargøring og opvarmning af flyene. Ligeledes synes en udbygning af radiostationen påkrævet, således at Iscentralen direkte kan kontakte et større antal skibe, end det nu er tilfældet, og faksimileudsendelserne af iskort forbedres.

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## LITTERATUR

Betænkning afgivet af Det af Ministeriet for Grønland under 19. februar 1959 nedsatte Udvalg vedrørende Besejling af Grønland. Betænkning nr. 227. København 1959.

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