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WINTER ICE RECONNAISSANCE IN NARES STRAIT, 1971-72

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Winter ice reconnaissance in Nares Strait, 1971-72,
by Moira Dunbar. Dec. 1972.

page 3, line 1 - please insert the word "few" e.g.
"there were few grey patches"

E.A. Lang

E.A. Lang, Librarian
for Director General

ACKNOWLEDGEMENTS

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ABSTRACT

Following on the flights made in 1970-71 to determine the date of consolidation of the ice in Nares Strait (DREO TN 71-34), a further two flights were made in the winter of 1971-72. Radar scope photography was again used. A very different picture emerged, the ice consolidating much earlier than in the previous year, apparently largely as a result of a much lower incidence of strong winds.

RÉSUMÉ

Suivant les vols faits en 1970-71 pour déterminer la date de la consolidation de la glace dans le Détroit Nares (DREO TN 71-34), l'auteur a fait deux vols dans la même région pendant l'hiver 1971-72. La photographie du radar fut encore une fois utilisée. La glace s'est consolidée beaucoup plus tôt que l'année précédante, apparemment à cause d'une forte diminution de grand vents.

WINTER ICE RECONNAISSANCE IN NARES STRAIT, 1971-72

INTRODUCTION

In 1970-71 a series of six flights was made over Nares Strait to observe the winter ice conditions and to determine, if possible, at what date the ice became consolidated and ceased to move in the channel. Observations were by radar scope photography supplemented by visual observations. This work is reported in full in Dunbar (1971).

In 1971-72, with the cooperation of Canadian Forces Maritime Command, a second year of observations was undertaken. As in the first year, all flights were made in conjunction with Northern Patrol flights in Argus aircraft of 404, 405, and 415 squadrons, and the scope photography was undertaken by the air photo sections of CFB Greenwood and CFB Summerside.

It had been hoped to arrange a flight in November, a month earlier than the previous year, but this proved impossible. The first flight was set for 10 December, but had to be aborted because of aircraft unserviceabilities. Only two flights were actually made, on 9 January and 20 February. On the latter date the ice appeared to be so stable that no further observations were thought to be necessary.

On each flight Nares Strait (Fig. 1) was traversed twice, northbound and southbound, radar scope photography being carried out both ways. Exposures were made every minute through Smith Sound and Robeson Channel, and every two or three minutes the rest of the way. In addition, the writer made visual observations from the excellent nose position in the Argus on one traverse, taking notes by tape recorder.

The radar presentation of the ice is basically a black-and-white one, the black areas representing smooth areas and the white, rough. Thus, open polynyas, or very young ice, the presence of which can be taken as evidence that the ice is still in motion, showed up as black, while thicker ice appeared white. However, smooth patches of first-year ice usually looks black too, so that some visual observations were almost essential in correctly interpreting the radar.

Visual conditions were adequate on the first flight and very good on the second.

FLIGHT I

9 January 1972

Time: Northbound - 77°00N - 1745Z
82°30N - 1935Z

Southbound - 82°30N - 2000Z
77°00N - 2155Z

Flight altitude: 2,000 feet

Winds: Northbound - S at 5-15 knots
Southbound - N of 81°30 SSW at 30-35 knots, then light and variable to 79°00N; S of 70°00N, NNE at 10-20 knots.

Visibility: Fair, slight haze much of the time, no surface texture visible in ice. Overcast.

Observed conditions

Conditions in general were much more stable than anything observed in 1970-71 up to the middle of February. Dark patches were relatively few and most were grey, rather than black, indicating ice probably 10 cm thick and upwards.

Robeson Channel, Hall Basin: In general grey patches were few, small and rather light in colour. This was particularly true in the north part of Robeson Channel, which gave fairly consistently bright radar returns (Fig. 2). On the radar dark patches appeared at the southern entrance to Robeson Channel and on the east side of Hall Basin, but these were not confirmed visually; the latter was beyond the field of vision and the former probably was smooth ice thick enough to appear white (Figs. 3 and 5).

Kennedy Channel: North of Franklin Island conditions were much the same as Robeson Channel and Hall Basin, with only occasional grey patches. Immediately south of Franklin Island there was what appeared to be an open lead running diagonally across the channel from the island to the coast of Ellesmere Island. This appeared very strongly on the radar image (Fig. 7), where, however, there is no distinction between the open or near-open part on the north and the grey ice-covered part. From here to the south end of the channel grey patches made up about 3/10 of the cover and showed an E-W trend (i.e. parallel to the lead in Fig. 7).

Kane Basin: There were grey patches in this part of the strait, except for an area close to the entrance to Kennedy Channel, which was similar to the southern part of that channel.

Smith Sound: The ice edge forming the head of the North Water was continuous and apparently well consolidated (Fig. 9). A lead of about half a mile bordered it, and then progressing southward the usual banding of ice of increasing age. There were many openings, at first chiefly oriented across the channel. Around Cape Alexander this started to change to up-and-down channel, and south of the narrows it became more random. As usual there was some cloud over the open water but downward visibility remained quite good. There were no older floes among the young ice, which would have indicated that the ice bridge had only recently formed. The proportion of open water was about 3-5/10. At 77°00N, where observations ceased, the southern limit of the North Water had not yet been reached.

On the northbound leg marked turbulence was encountered over the narrow part of Smith Sound, a common experience in the previous year, and the temperature outside the aircraft (at 2000 ft.) made a spectacular rise of 5°C as we reached the area of open water.

FLIGHT II

20 February 1972

Time: Northbound - 77°25N - 1702Z
82°30N - 1922Z

Southbound - 82°30N - 1922Z
77°25N - 2115Z

Flight altitude: 2,000 feet

Winds: N-NE throughout, 10-35 knots

Visibility: Good, except haze over Robeson Channel. Twilight on northbound leg.

Observed conditions

On this flight, to make the best use of light conditions, visual observations were made on the northbound leg instead of the southbound as usual. This gave very good visibility, high twilight over most of the track, but deteriorating somewhat north of Kennedy Channel. Ice cover was complete and without movement from north of Smith Sound and virtually no ice less than the order of a foot thick was seen. Examination of the photographs, which were particularly good, revealed that in all parts of the strait many of the same ice features could be identified on both

flights, showing that there had been no movement between the two. It was therefore decided that no further observations were necessary.

Robeson Channel: This was the only part of the strait where visual conditions were poor. Not only was the light failing but there was considerable haze. Visibility was limited to a small area directly under the aircraft, where a progression of multi-year floes and smooth ice, without much ridging,was seen (Fig. 4). The radar, however, as on the first flight, gave a bright return except in the south half of the channel, where there was an apparently large area of smooth ice (Fig. 4). This was also traceable in the photos from the previous flight (Fig. 3).

Hall Basin: On the west side of Hall Basin there was much smooth ice and also multi-year floes, but there was very little ridging in the first-year ice, a very different picture from the year before. On the radar an apparently smooth area appeared in the east part of the basin, as on the previous flight, but again it was out of visual range (Figs. 5, 6). Almost nil returns from Lady Franklin Bay suggested that the ice there might be smooth, and there was a marked bright line across the entrance to the bay as of a line of ridges (Fig. 6). This was not noticeable visually, possibly because the light was getting flat and haze beginning to appear.

Kennedy Channel: In the north part of the channel there was quite a lot of multi-year ice, including several floes about 3 miles across. Smooth first-year ice accounted for perhaps 4/10 of the cover, and there was relatively little ridging. The sastrugi in this area showed a very strong down-channel orientation; no secondary direction could be detected, not even an up-channel one, which must, however, prevail during up-channel winds.

Around Hans Island the ice was more like that of the previous season, about 4-5/10 multi-year floes with heavy ridging between them and very little smooth ice. There was, however, a strip of smooth ice extending most of the way between Hans Island and Franklin Island.

South of Franklin Island the open and grey patch observed in January was still easily identifiable, but now it was white and possibly about 30-60 cm thick (Figs. 7, 8). Quite close to the south shore of the island there was a patch which was still grey, and which was the thinnest ice seen on this flight north of the North Water. From here south there was a high proportion of smooth first-year ice, sometimes only one or two small multi-year floes being in sight. Ridges were few and small.

Kane Basin: In the extreme north of Kane Basin there was still up to 5-6/10 smooth ice, but this decreased southwards. Parts of our track were over the kind of ice seen last year, with very heavy ridging between the old floes and relatively small smooth areas, but in general it was smoother than last year. Near the head of the North Water the ice was smooth but appeared to be very solidly landfast. There were a number of patterns throughout Kane Basin that were identifiable also on 9 January photographs (Figs. 11-14).

Smith Sound: The North Water showed its usual form, the age of the ice graduating southward from the well delineated north edge, which was almost identical in form to that of 9 January (Fig. 11). One of the short-comings of the radar presentation is clearly illustrated here; all the ice being young and smooth, it did not show up at all, giving the impression that the area was completely open, or at least all the same. The amount of actual open water varied from about 2/10 to 6/10. Frost smoke covered most of the area but was not thick enough to seriously curtail visibility.

The superior light conditions made it possible to assess the southern limit of the North Water, which was considered to be about 77°00N. This rather arbitrary line was not the limit of openings in the ice, as this would be impossible to identify, but was the point at which the predominant age category ceased to be grey-white and became first-year.

A strong down-channel wind was reflected in the streaks of shuga and frost smoke and in the waves on the open water, which were surprisingly well developed considering the small size of the water areas. There were even white caps. The wind changed from N to NE, or straight down channel, as we approached the narrows at 78°00N, and rose from 4 to 25 knots, dropping back to 13-15 knots in Kane Basin.

COMPARISON WITH 1970-71

Conditions observed differed from those of 1970-71 in two ways: The date of consolidation of the pack was much earlier, and the resulting ice cover was much less deformed. A comparison of the dates of consolidation is given in Table I, showing a difference for the North Water that could be as much as a month but might be as little as a week, and for the rest of the channel a much greater difference. It is unlikely that movement ceased this year very long before 9 January, as the newest ice at that time still appeared to be fairly thin; and the previous year nearly all the strait was shorefast on 1 March. Therefore the difference was probably not more than two months, which is, however, a pretty wide gap. The difference in topography follows naturally from the difference in date inasmuch as the heavy ridging in 1970-71 was a function of the amount of movement and refreezing in the pack.

TABLE I

DATES OF CONSOLIDATION OF ICE IN NARES STRAIT

	1970-71	1971-72
Head of North Water	Late January	Before 9 Jan.
Rest of strait	Early March	Before 9 Jan.

The reason for these differences does not seem far to seek. An examination of the weather charts over the period of observations in 1970-71 revealed almost continuously stormy conditions. By contrast in 1971-72 the area was much calmer, and this alone would enable the ice to grow undisturbed

to a viable thickness. Table II is reprinted from Dunbar (1971) for comparison with Table III. The two are not completely compatible, as the data from 1970-71 were taken from daily surface synoptic charts and those for 1971-72 from daily 1000-mb charts. However, as the 1000-mb charts tend to give higher rather than lower winds than the surface charts, the contrast in wind speeds between the two years remains highly significant. Too much emphasis should not be placed on the first four columns, as these figures are much influenced by interpretation, and this was done by different individuals in the two years involved. The relationships between the two figures in each column, however, should have some validity, and it is significant that most of these relationships remain the same in both years; a greater preponderance of down-channel winds in the southern half of the channel and a lower incidence of "other winds" and calms.

LATER OBSERVATIONS

In mid April and again in early June a party from DREO made several landings in a Twin Otter on the ice of Robeson Channel to install and remove current meters. They found most of the ice to be extremely rough, very much as it had been the year before. A reconnaissance flight in early July, before break-up, confirmed that this was certainly true of the north half of the channel, but that south of Wrangel Bay there was a large area of remarkably smooth first-year ice, showing exactly the configuration of the large black patch in Figs. 3 and 4. The ice in the north part of the channel, which was not clearly seen visually on either flight, may have been rough all along, and indeed the radar image is quite consistent with a very rough condition (Fig. 2). On the other hand it may also have remained in motion until a later date than the rest of the channel as it did in 1970-71.

The line of bright returns across the entrance to Lady Franklin Bay (Fig. 6) was also clearly identifiable in July as a line of ridges (Fig. 15).

CONCLUSIONS

The second year of observations showed a very different and much earlier season than the first, indicating that there is probably a wide variation in date of ice consolidation, and that this variation is largely dependent on weather conditions. Which of the two years may be considered the more "normal" is debatable. Historical records seem to favour the first (Dunbar 1971), but they are too incomplete to be sure. A study of the weather records would be of interest. In the meantime it would be worthwhile to continue to monitor ice conditions in the strait.

Reference

Dunbar, Moira 1971. Winter ice reconnaissance in Nares Strait, 1970-71. DREO Technical Note 71-34.

TABLE II

Wind Data for Nares Strait (2000-ft level)
1 December 1970 to 1 March 1971

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	% of daily winds with down-channel component	% of daily winds with up-channel component	% of other winds	% of calm days	Average wind speed (knots)		% 20 kn. and over		% 50 kn. and over	
					Down-chan. (Col. 1)	Up-chan. (Col. 2)	Down-chan.	Up-chan.	Down-chan.	Up-chan.
North part of channel (N of c80°N)	45	28	4	22	24	23	59	63	4	4
South part of channel (S of c80°N)	74	15	1	10	30	23	71	62	13	0

From: DUNBAR 1971

TABLE III

Wind Data for Nares Strait (1000 mb charts)
28 November 1971 to 26 February 1972

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	% of daily winds with down-channel component	% of daily winds with up-channel component	% of other winds	% of calm days	Average wind speed (knots)		% 20 kn. and over		% 50 kn. and over	
					Down-chan. (col.1)	Up-chan. (col.2)	Down-chan.	Up-chan.	Down-chan.	Up-chan.
North part of channel (N of c80°N)	46	20	21	12	11	10	19	11	0	0
South part of channel (S of c80°N)	57	21	14	8	13	10	19	10	0	0

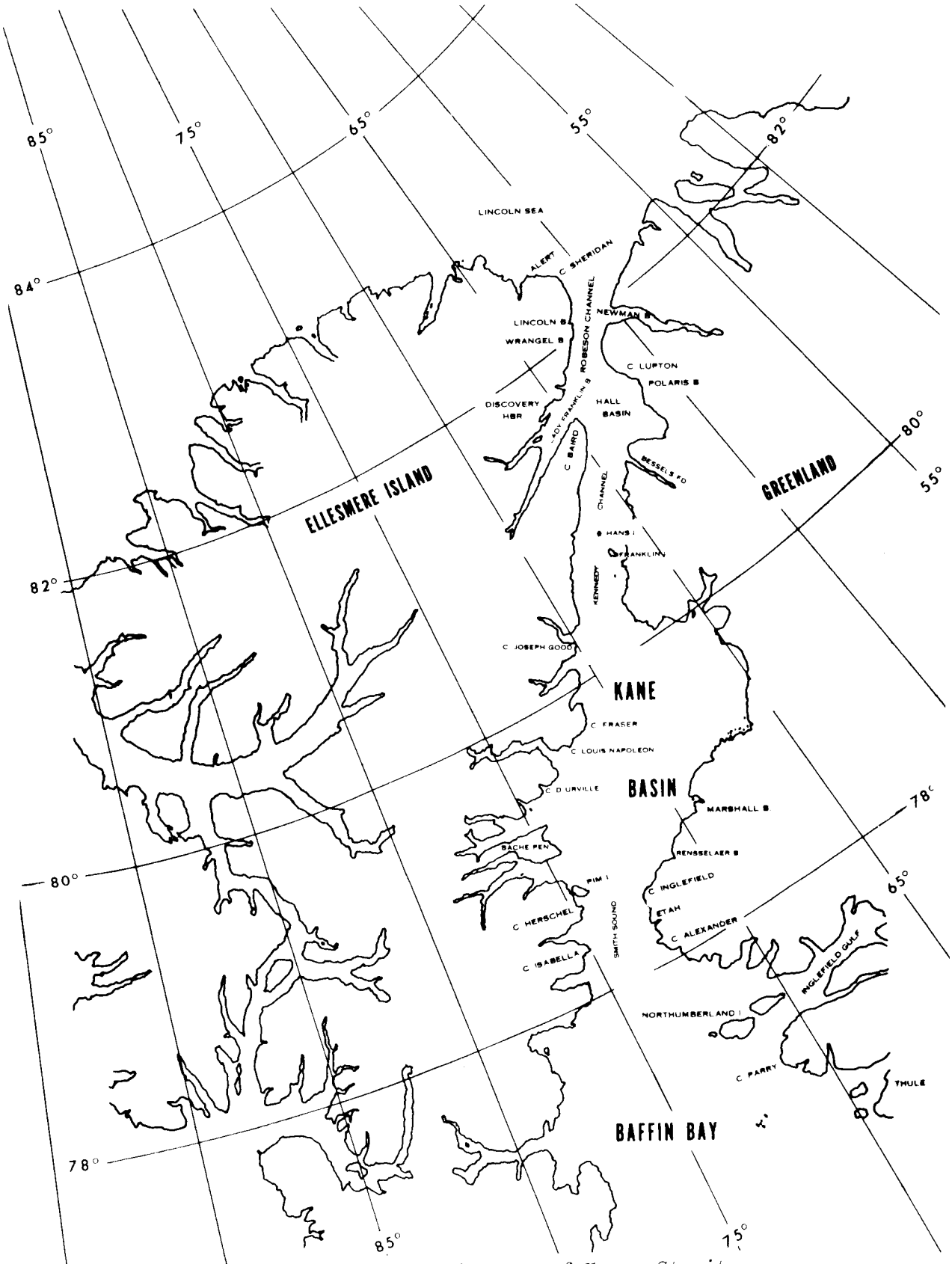

Fig. 1. Location map of Nares Strait.

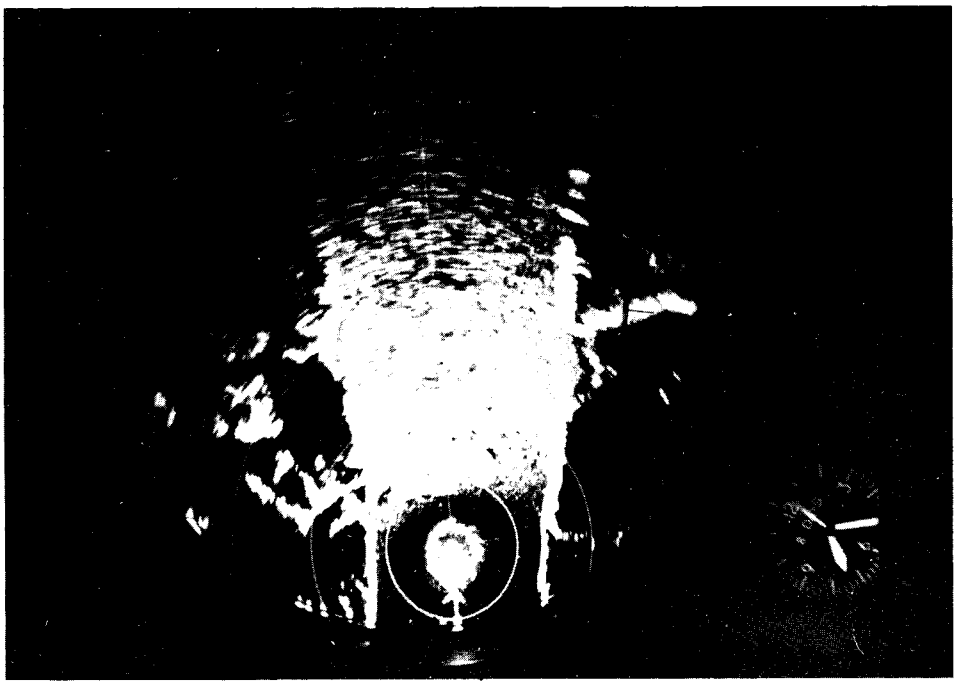

Fig. 2. Robeson Channel on 9 January, aircraft heading up-channel, showing a generally bright return which probably indicates a rough ice surface with few smooth patches. Lincoln Bay is at the third range ring on the left, Newman Bay opposite, with what appears to be a ridge across its entrance.

Note: All radar photos are oriented with the northern end of the strait at the top.

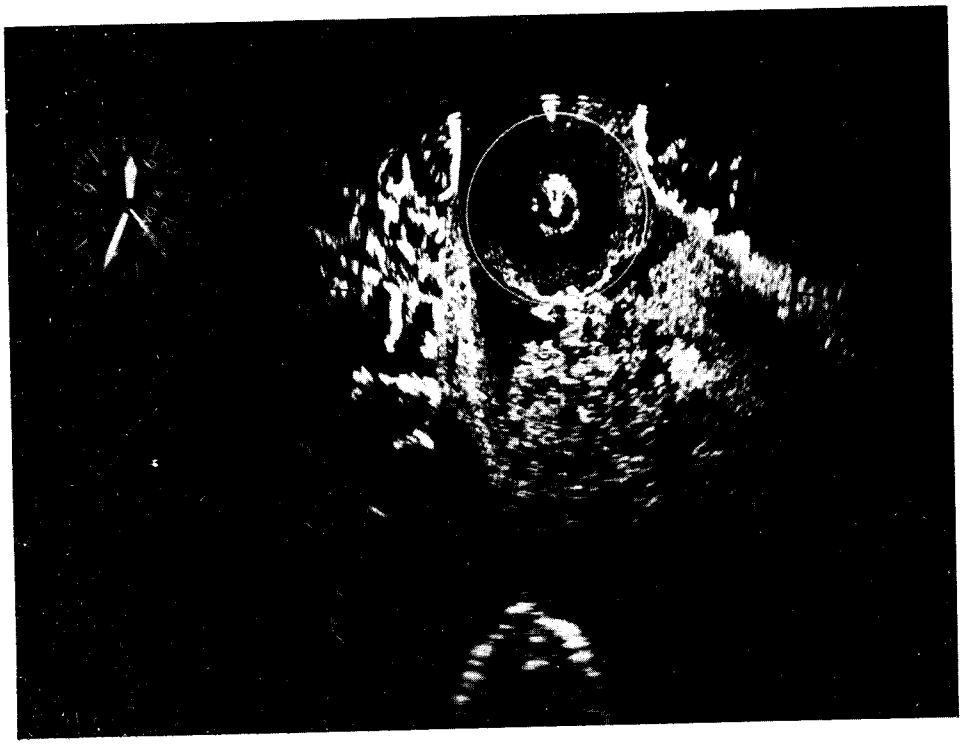

Fig. 3. Hall Basin on 9 January, heading down-channel, with Cape Baird at the bottom and Lady Franklin Bay to the left of it. Note the expanse of apparently smooth ice at the south end of Robeson Channel and the more mottled appearance of the Hall Basin returns, indicating more smooth patches than in Fig. 2.

Note: All radar photos are oriented with the northern end of the strait at the top.

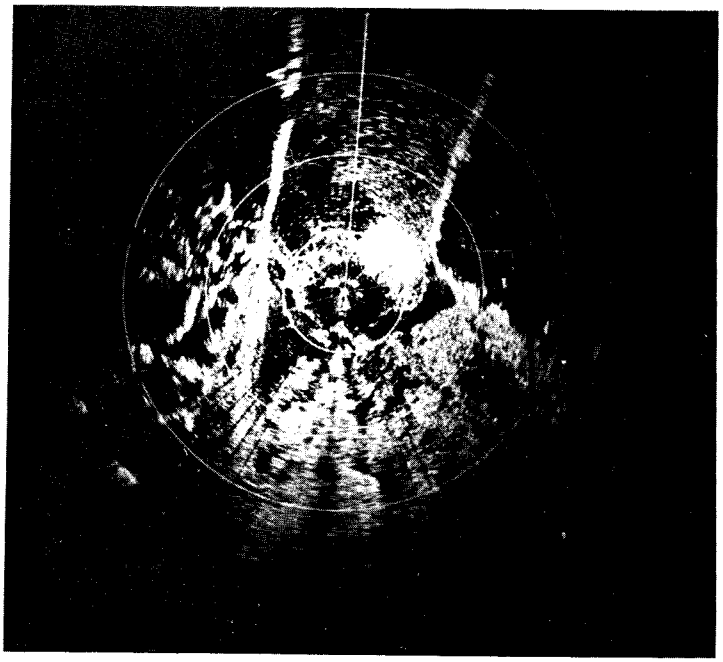

Fig. 4. Hall Basin on 20 February, heading up-channel, showing the same smooth area at the south end of Robeson Channel as Fig. 3. The same patterns can also be traced in the ice of Hall Basin, with the exception of the area right behind the aircraft, where the returns are distorted by the aircraft itself.

Note: All radar photos are oriented with the northern end of the strait at the top.

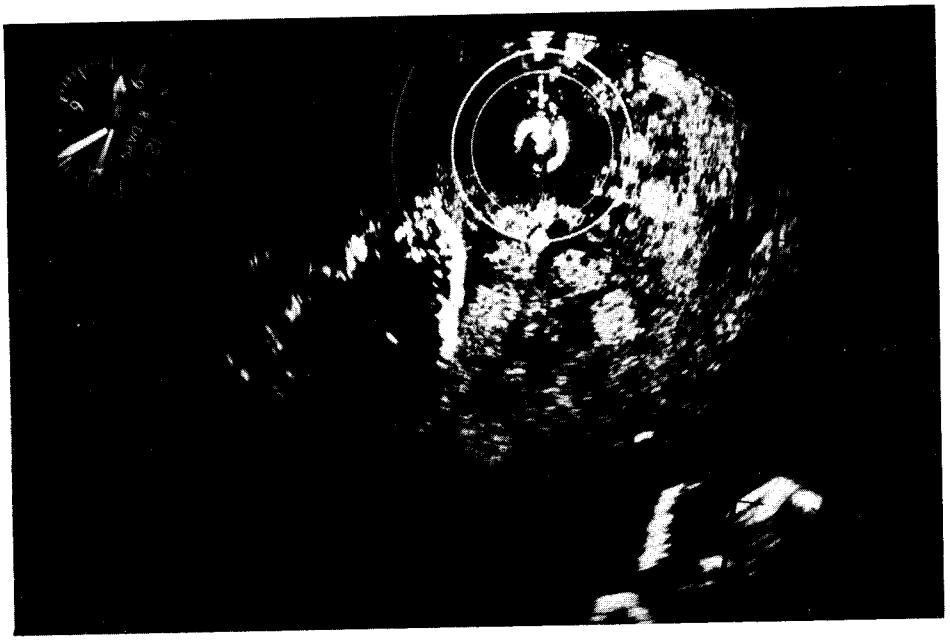

Fig. 5. Southern Hall Basin on 9 January, heading down-channel, with Cape Baird at upper left. Bessels Fiord lower right. Compare this with Fig. 6.

Note: All radar photos are oriented with the northern end of the strait at the top.

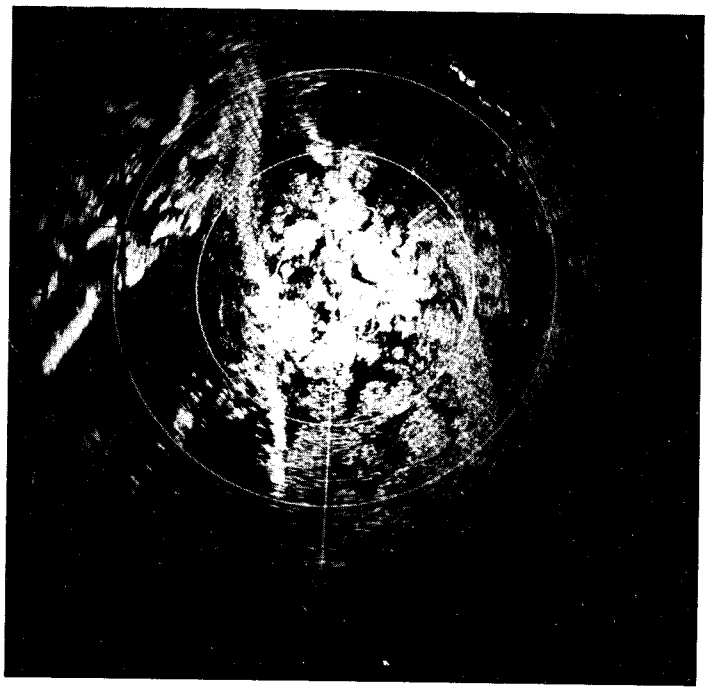

Fig. 6. Southern Hall Basin on 20 February, heading down-channel. Note the line of bright returns running from Cape Baird, at lower left, across the entrance to Lady Franklin Bay. Also the smooth (dark) area on the extreme right. This, and the ice pattern, are exactly the same in Fig. 5.

Note: All radar photos are oriented with the northern end of the strait at the top.

Fig. 7. Southern Kennedy Channel on 9 January, heading down-channel. Franklin Island is at about four o'clock from the aircraft position, touching the first (double) range ring. Note the dark area south and west of the island, which represents an open lead and smooth young ice. The dark area to the east is the radar shadow of the island (cf Fig. 8).

Note: All radar photos are oriented with the northern end of the strait at the top.

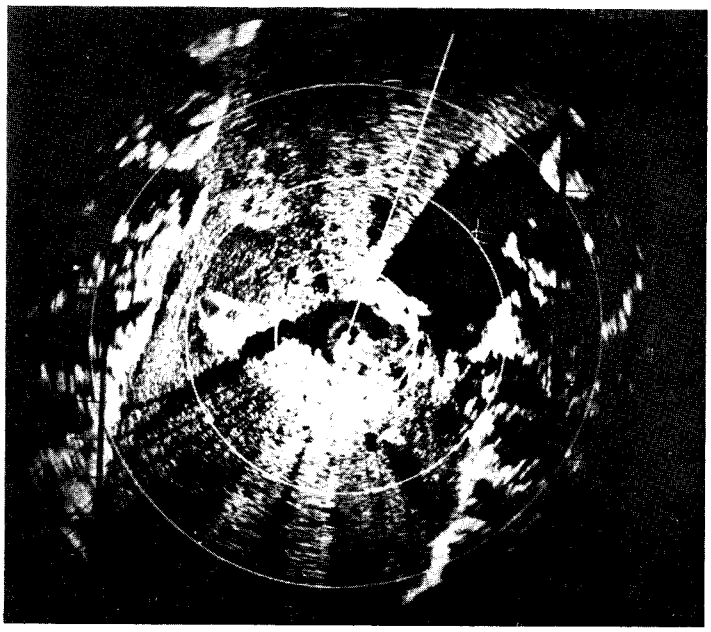

Fig. 8. Southern Kennedy Channel on 20 February, heading up-channel. The same dark area south and west of Franklin Island is apparent but the radar shadow is now up-channel from the island. Note also the similarity of the ice pattern between the lead and Ellesmere Island.

Note: All radar photos are oriented with the northern end of the strait at the top.

Fig. 9. The head of the North Water on 9 January, heading up-channel. Note the fast-ice edge on the left side of the channel, which runs from Pim Island south to Cape Isabella (extreme bottom). The dark area immediately northwest of Pim Island is its radar shadow. The next ridge north of Pim Island is the south coast of Bache Peninsula, and at the extreme top left the coast of Kane Basin around Cape D'Urville. The dark area in Smith Sound, as shown in Figs. 9-12, is actually largely covered with young ice of various ages (see text).

Note: All radar photos are oriented with the northern end of the strait at the top.

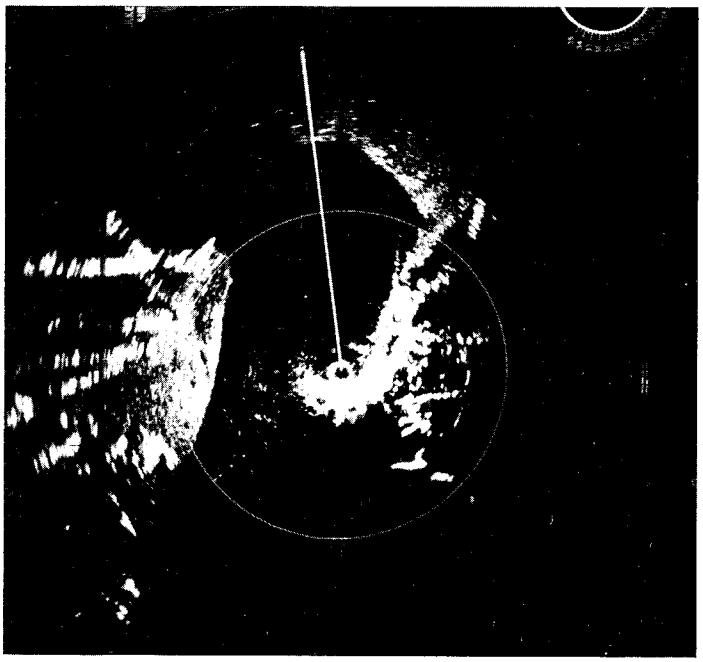

Fig. 10. The North Water in Smith Sound on 20 February, heading up-channel, showing the same fast-ice edge as Fig. 9.

Note: All radar photos are oriented with the northern end of the strait at the top.

Fig. 11. The head of the North Water on 20 February, heading down-channel, showing almost exactly the same shape as in Fig. 9. The shadow of Pim Island is now on the south side.

Note: All radar photos are oriented with the northern end of the strait at the top.

Fig. 12. The head of the North Water and southern Kane Basin on 9 January, heading up-channel. A comparison of the ice pattern between this and Fig. 11 will reveal many identical features.

Note: All radar photos are oriented with the northern end of the strait at the top.

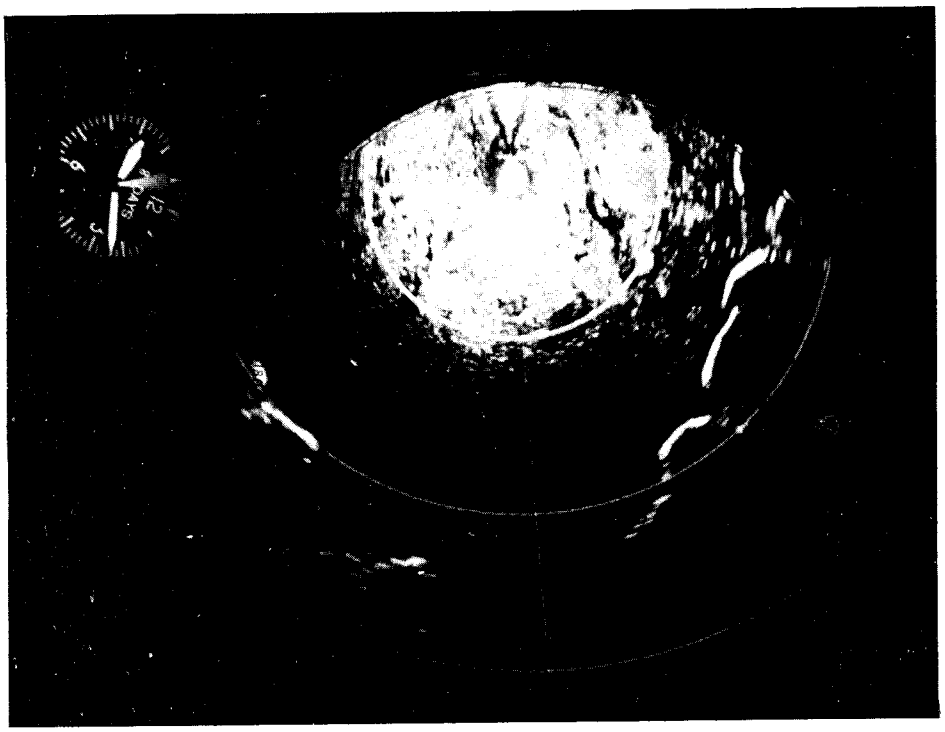

Fig. 13. Southern Kane Basin on 9 January, heading down-channel. Coast of Bache Peninsula on the second range ring at left, Marshall Bay extreme right. For comparison with Fig. 14.

Note: All radar photos are oriented with the northern end of the strait at the top.

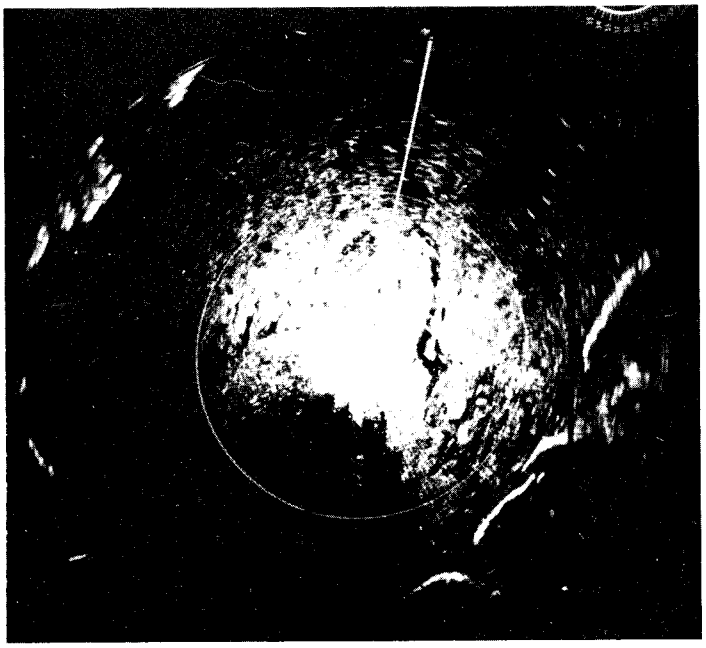

Fig. 14. Southern Kane Basin on 20 February, heading up-channel. Marshall Bay at right, Cape Louis Napoleon extreme top left. Bache Peninsula and Pim Island just starting to paint at lower left. The same features can be identified both to left and right of the aircraft in this and Fig. 13, especially the dark area to the right.

Note: All radar photos are oriented with the northern end of the strait at the top.

Fig. 15. Looking north-east across the entrance to Lady Franklin Bay on 13 July, showing the line of ridges ending at Cape Beechey. This is in exactly the same position as the line of bright returns in Fig. 6.

Note: All radar photos are oriented with the northern end of the strait at the top.

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13. ABSTRACT

Following on the flights made in 1970-71 to determine the date of consolidation of the ice in Nares Strait (DREO TN 71-34), a further two flights were made in the winter of 1971-72. Radar scope photography was again used. A very different picture emerged, the ice consolidating much earlier than in the previous year, apparently largely as a result of a much lower incidence of strong winds.

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14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a document and could be helpful in cataloging the document. Key words should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context.