NORSK POLARINSTITUTT
RAPPORTSERIE
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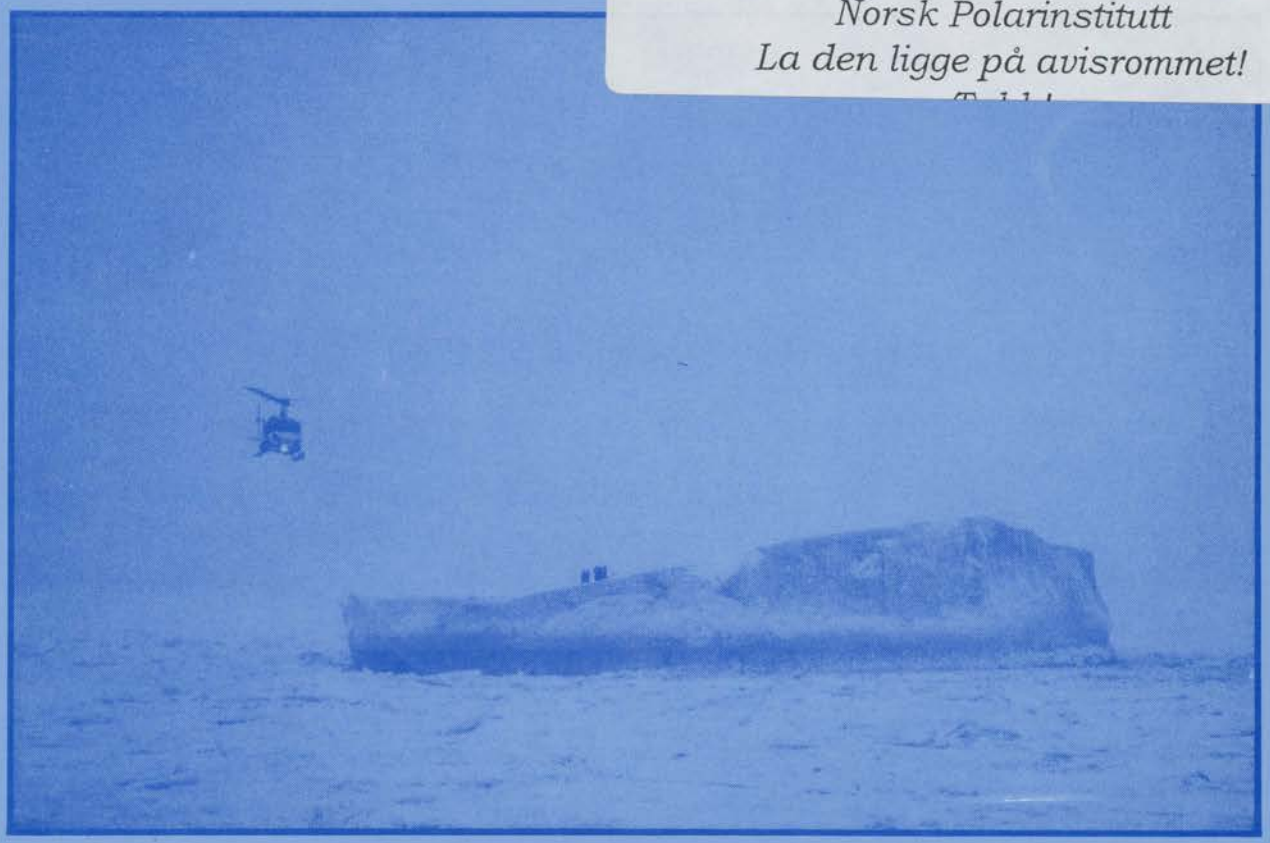
HANS JENSEN and TORGNY VINJE:

IDAP 89
LANCE DEPLOYMENT

VOLUME 1
CRUISE REPORT



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REPORT

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EXTRACT

The ice fields between Bjørnøya and Hopen were investigated.

Altogether 6 icebergs were located from LANCE while 85 were spotted from the helicopter reconnaissance flights covering most of the Spitsbergenbanken. Nine icebergs were instrumented with ARGOS positioning buoys for drift tracking.

Most of the area of operation was covered with ice floes 20-500 m of medium to thick winter ice.
Multi-year ice was observed in concentrations between 0 and 4/10. The total concentration was between 90 and 100 percent along the sailing route.

3 INDEXING TERMS: NORWEGIAN	3 INDEXING TERMS: ENGLISH
Miljø	Environment
Isfjell	Iceberg
Barentshavet	Barents Sea

Page

1. INTRODUCTION

The activities under IDAP 1989 R/V LANCE Deployment Project were carried out according to guidelines from the Ice Data Acquisition Program Committee (IDAP) of Operatørkomite Nord through MOBIL Exploration Norway Inc. The Institutes responsible for the activities were Norsk Polarinstitutt (NP) and Norsk Hydroteknisk Laboratorium (NHL) on a fifty/fifty basis.

The intent of the expedition was to map the distribution and sizes of icebergs on the Spitsbergenbanken and to deploy 10 Argos positioning and temperature recording buoys on selected icebergs. A description of the ice fields in the area should also be made. Bottom topography measurements of multi-year ice floes should be made on an opportunity basis as well as thikness measurements of icebergs and sea ice using a continuous wave radar.

The field work was carried out by the altogether 16 expedition members listed in APPENDIX A, and fifteen crew members from the ship owner, the Norwegian Hydrographic Office. The captain of LANCE was Jan Jansen. A Bell 212 helicopter was hired from A/S Lufttransport to take care of the field operations and surveys. The pilot was Knut Hustad.

We started from Tromsø 7 April 1400 and returned ten days later. That leaves about 7 day for carrying out the investigation programme on Spitsbergenbanken.

Sub-surface mapping of icebergs using the scanning sonar was planned on an oportunity basis. This had to be left out because of very strong drift of the ice between the ship and the grounded icebergs. To carry out such measuremets a safe passage for the sonar head and the cabel through the drifting ice is necessary, e.g., by using a sylindrical lever attached to the side of the ship.

A comparatively small number of icebergs were encountered on Spitsbergenbanken this year. The icebergs were also relatively small and one buoy was therefore returned for a later deployment further north. Otherwice all planned operations were carried out.

2. SURVEY AREA

2.1 Track of vessel.

The survey area comprised the major part of the Spitsbergenbanken. LANCE operated in the outer ice margin (Fig.2.1) and the rest of the area was surveyed by the Helicopter (Figs.2.2 - 2.11).

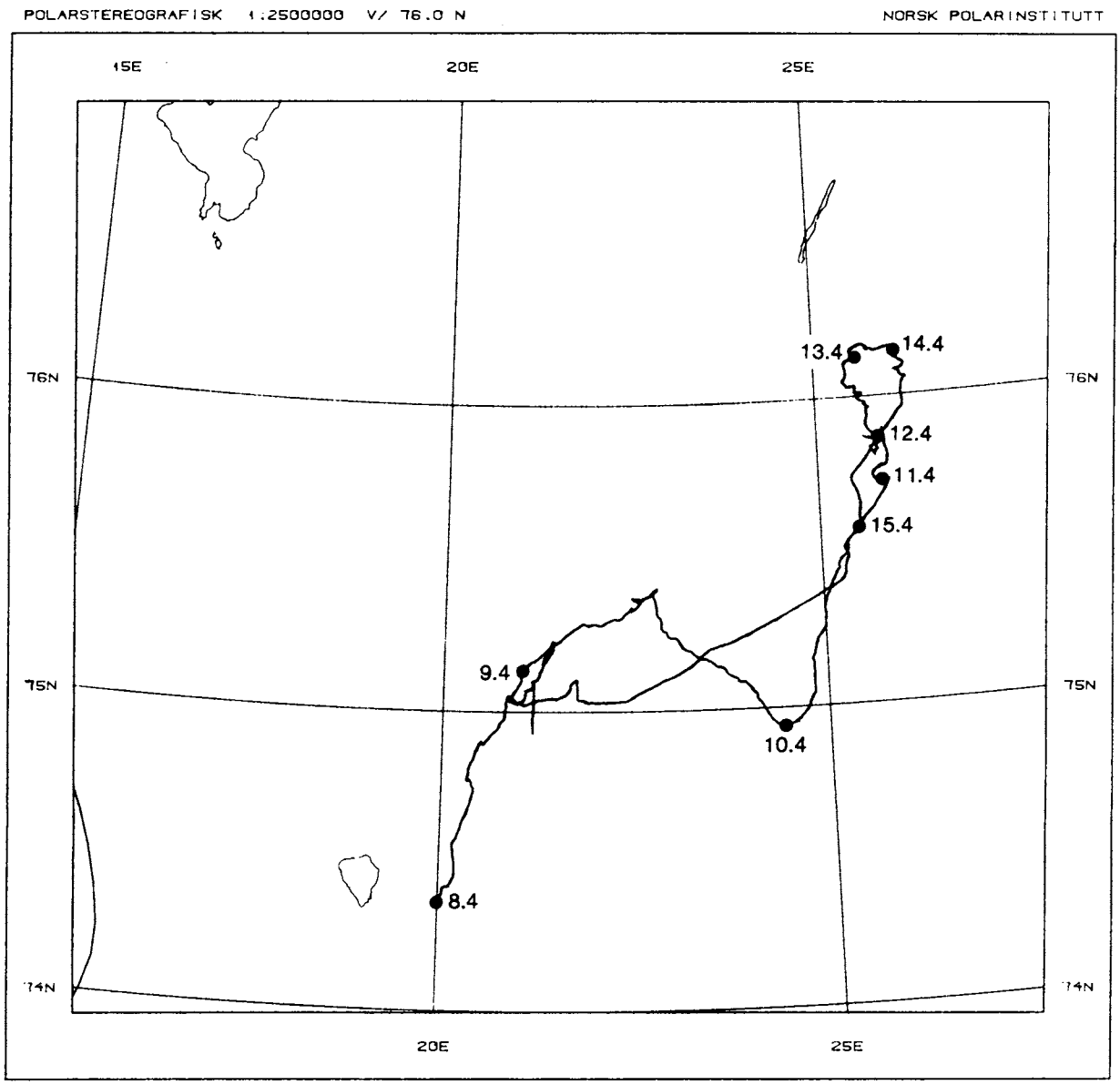

Fig. 2.1

Track of R/V LANCE during IDAP 1989 operations. The midnight position of the ship is noted along the track.

2.2. Tracks of helicopter missions.

During the expedition 21 helicopter missions were carried out, refer Table 2.2. In Figs 2.2-2.11 all ice reconnaissance missions and two deployment missions are plotted. The other missions were either short or did not increase the area covered by the expedition.

Table 2.2. Helicopter missions

Mission #	Date	Main objective/achievement
1	04.08	Ferry to Bjørnøya
2	04.08	Ice reconnaissance
3	04.09	Ice reconnaissance (Interrupted)
4	04.09	Deployed PTT 3336 on Iceberg #7, temperature profiling, CW radar measurements
5	04.09	Ice reconnaissance
6	04.09	Deployed PTT 3337 on Iceberg #8
7	04.10	Ice reconnaissance
8	04.10	Ice reconnaissance
9	04.10	Deployed PTT 3339 on Iceberg #9
10	04.11	Rec. for navigation
11	04.12	Deployed PTT 3340
12	04.12	Ferry to Hopen
13	04.12	Ferry to Hopen
14	04.13	Deployed PTT 3341 and PTT 1787 on Icebergs #11 and #12 respectively
15	04.13	Ice reconnaissance to Stonebreen (Interrupted)
16	04.13	Radar profiling Iceberg #11
17	04.14	Ice reconnaissance to Stonebreen, started the deployment of PTT 1788 on Iceberg #13
18	04.14	Comleted deployment of PTT 1788 and deployed PTT 1789 on Iceberg #14 (Interrupted)
19	04.15	Radar profiling Iceberg #13, completed the deployment of PTT 1789 on Iceberg #14.
20	04.15	Ice reconnaissance
21	04.15	Deployed PTT 1790 on Iceberg #17

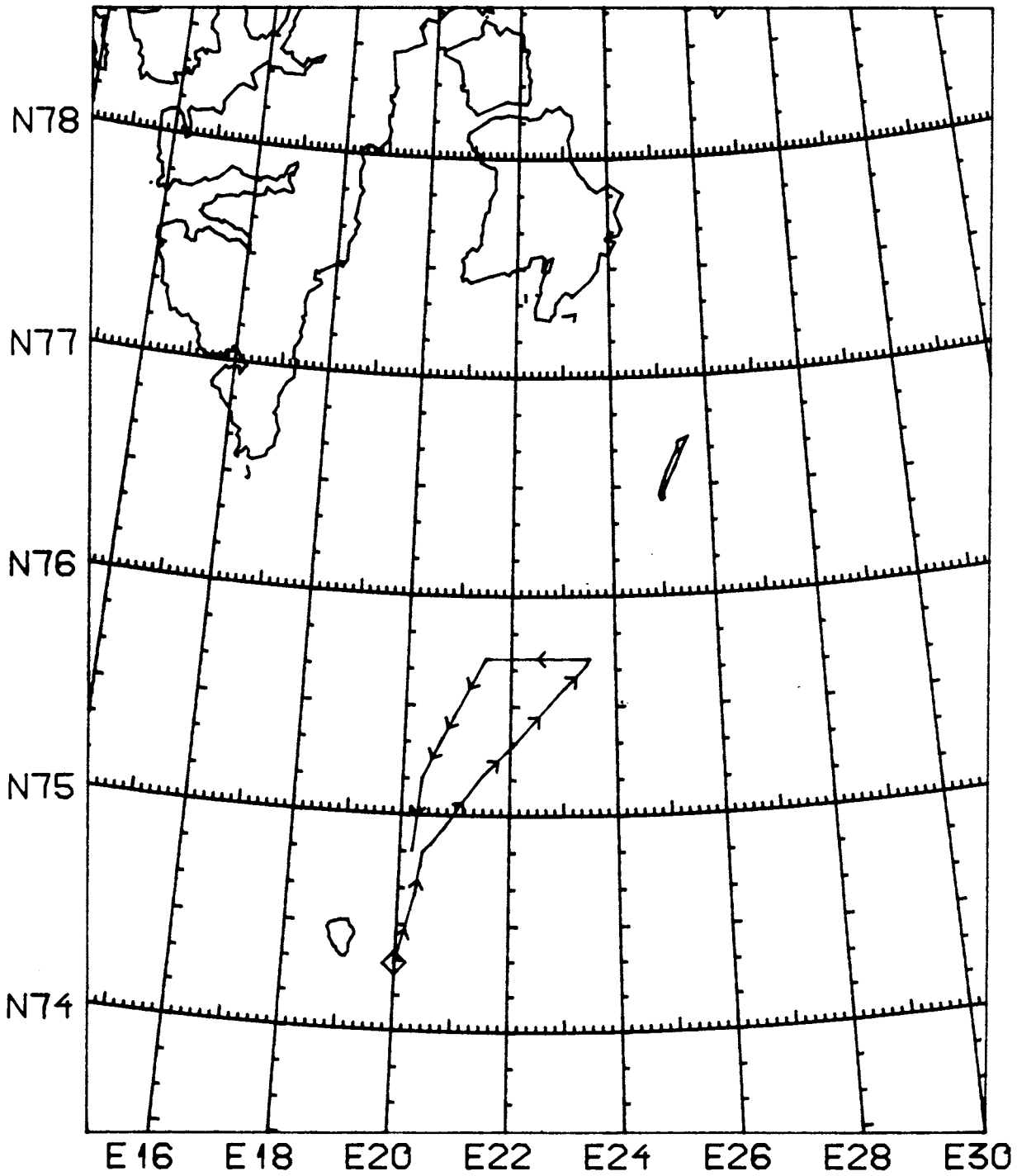

Fig. 2.2. Helicopter mission 2, 8 March 1989

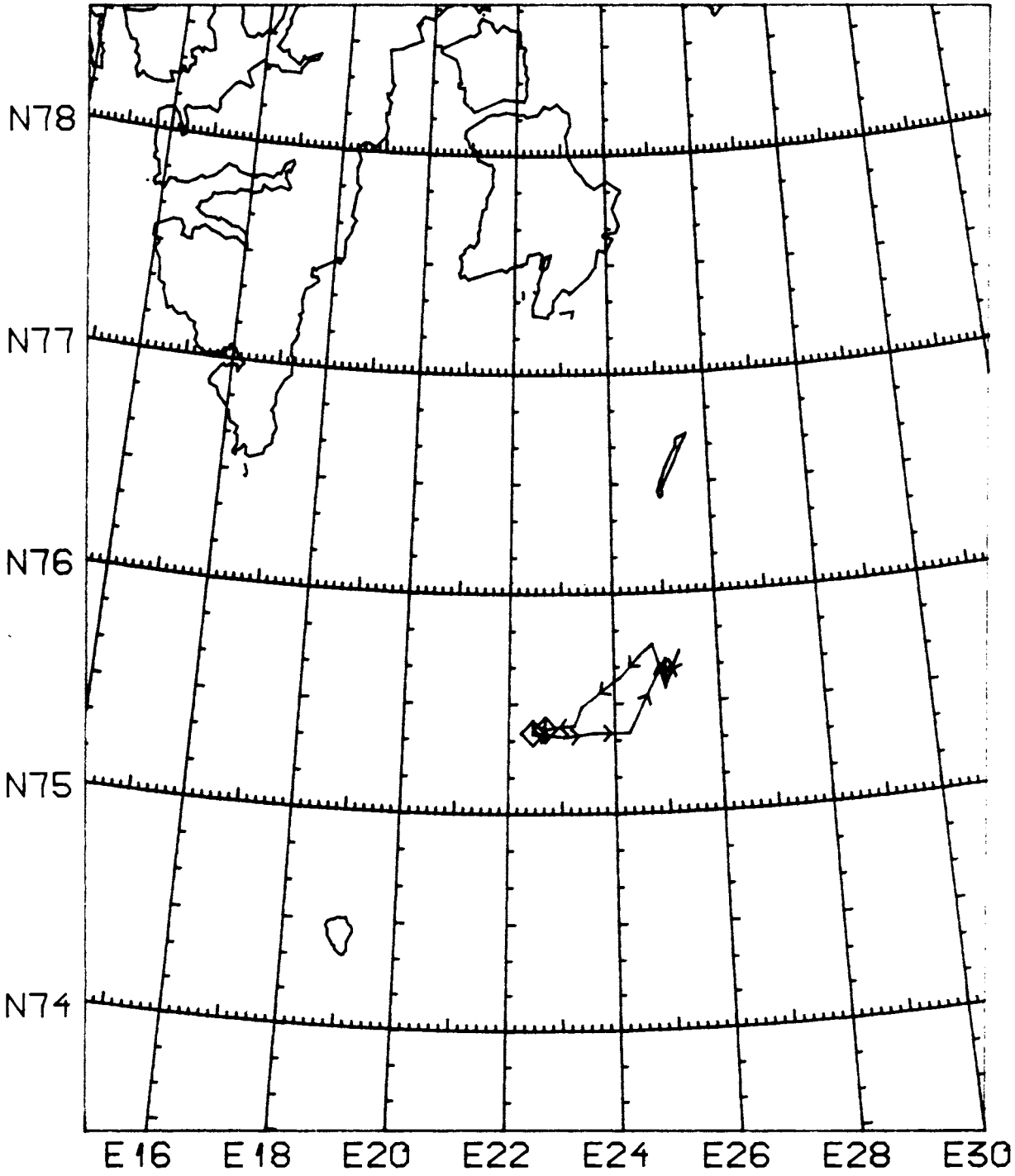

Fig. 2.3. Helicopter mission 3, 9 March 1989

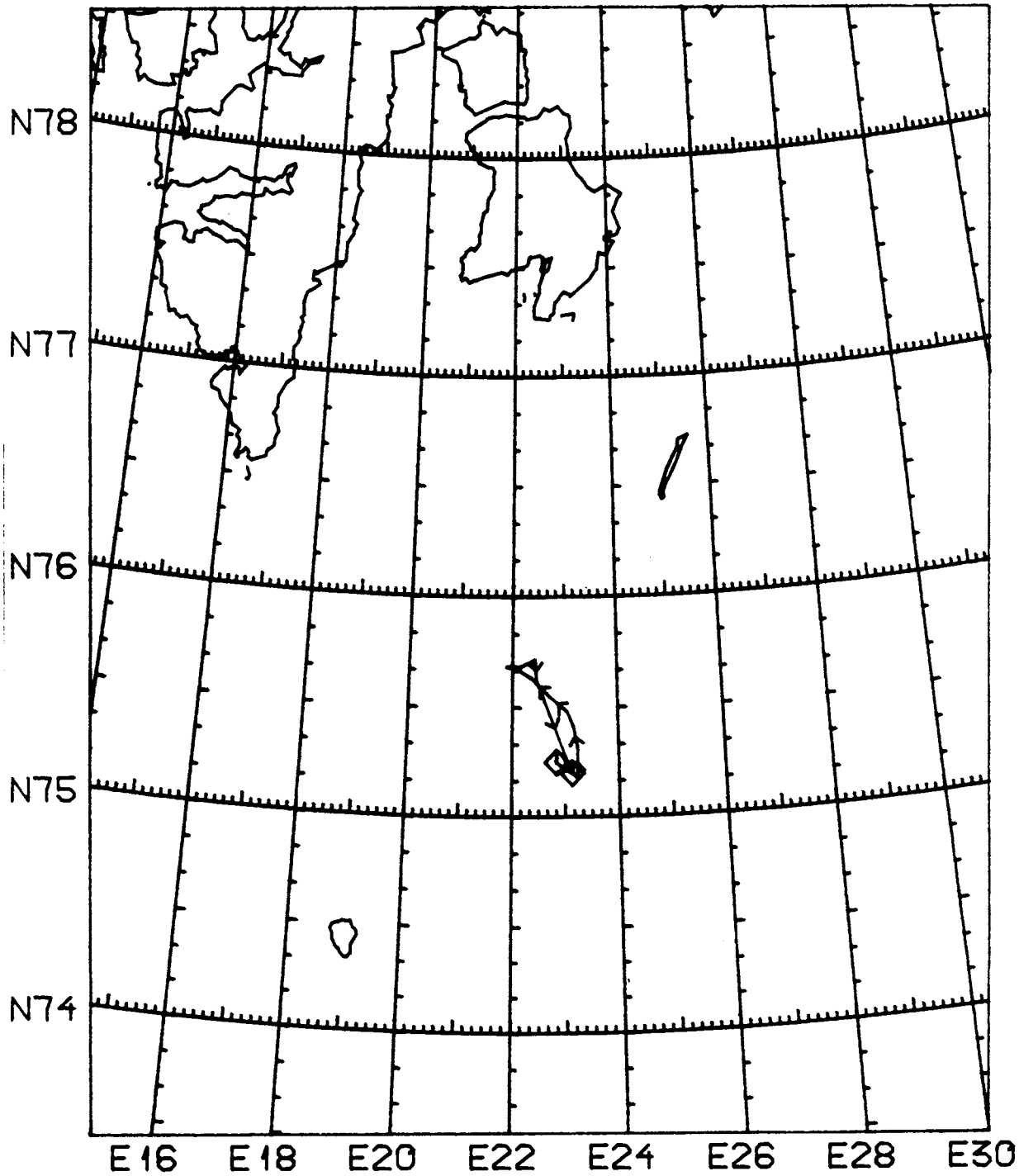

Fig. 2.4. Helicopter mission 5, 9 March 1989

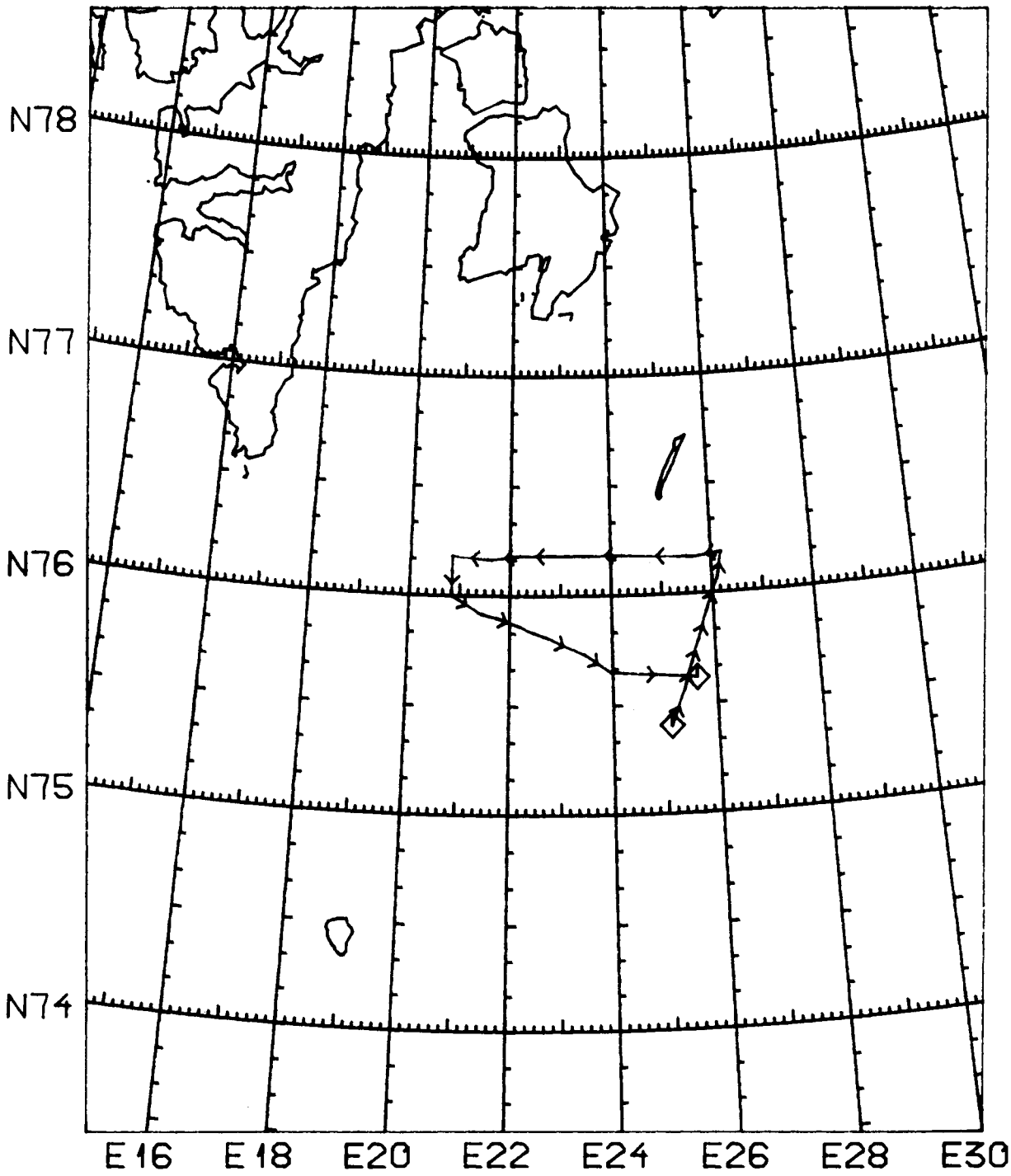

Fig. 2.5. Helicopter mission 7, 10 March 1989

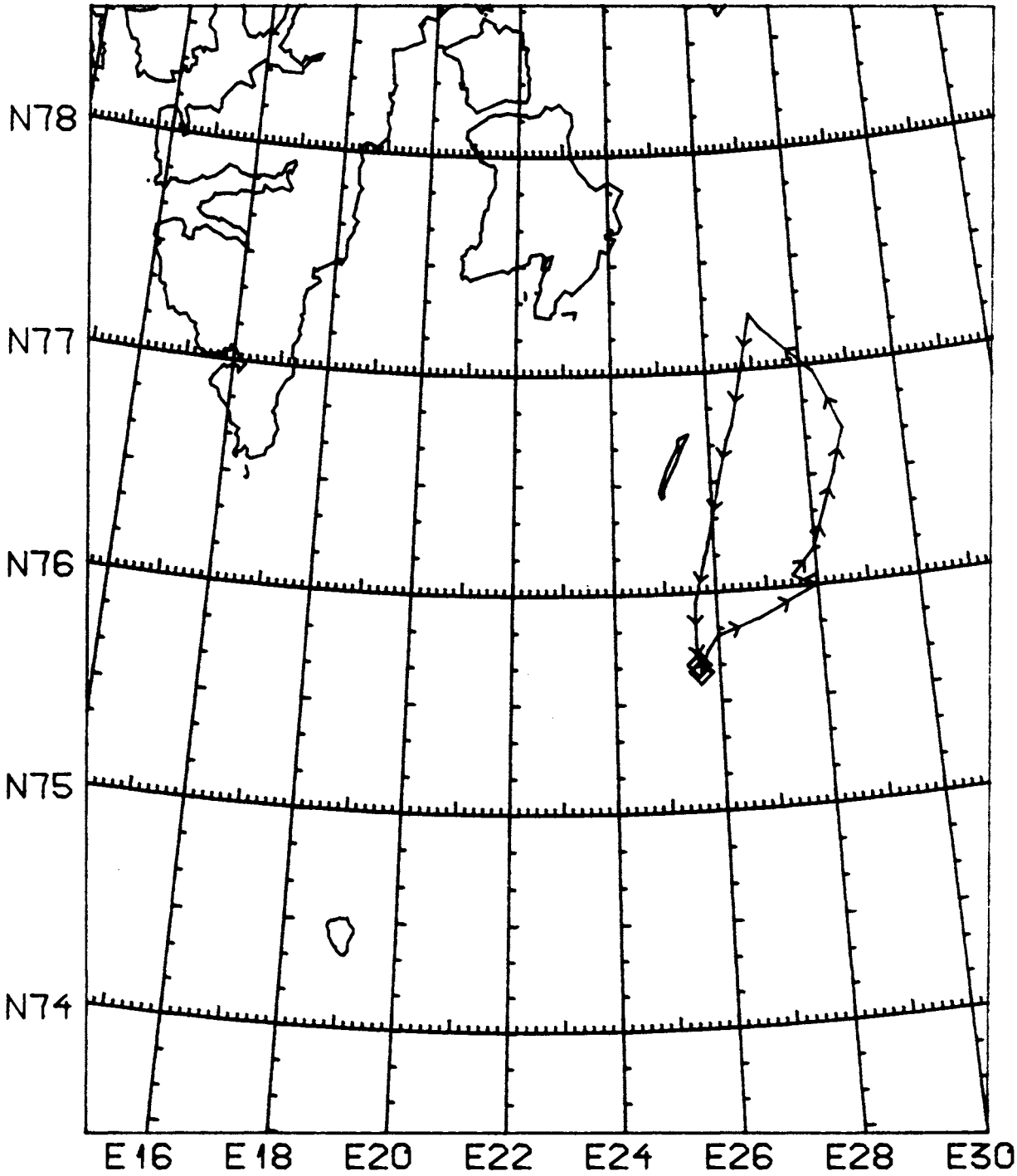

Fig. 2.6. Helicopter mission 8, 10 March 1989

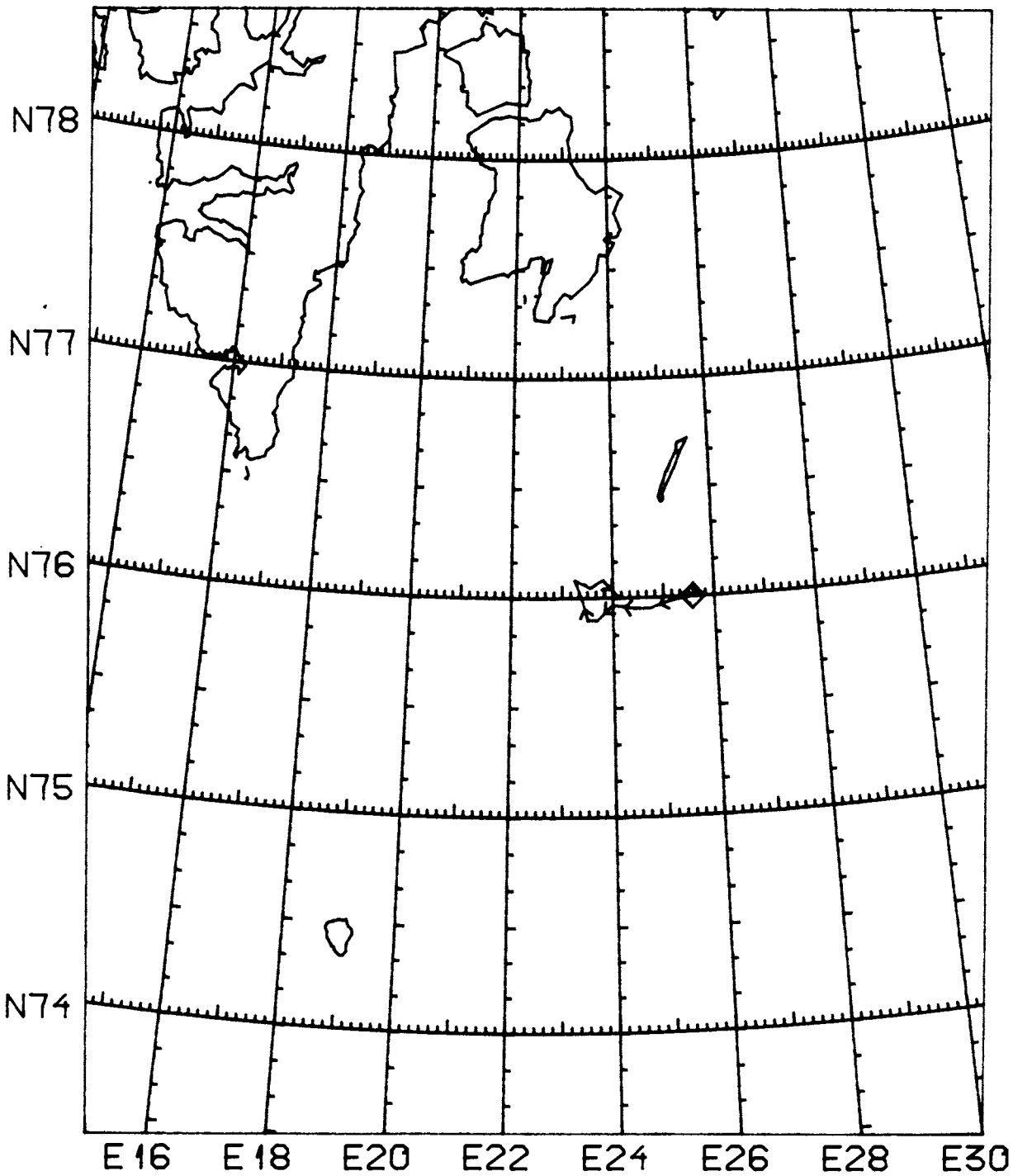

Fig. 2.7. Helicopter mission 11, 12 March 1989

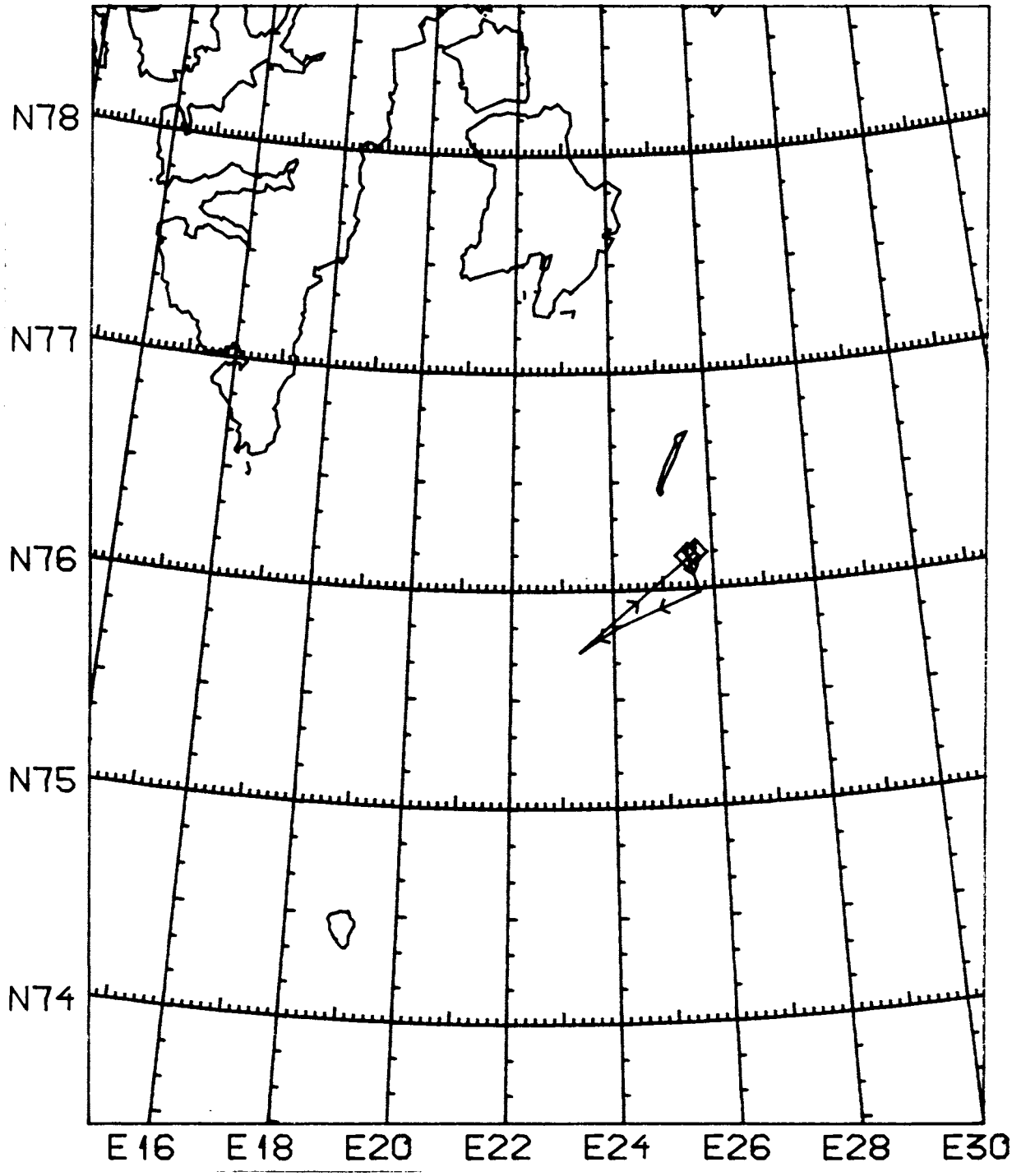

Fig. 2.8. Helicopter mission 14, 13 March 1989

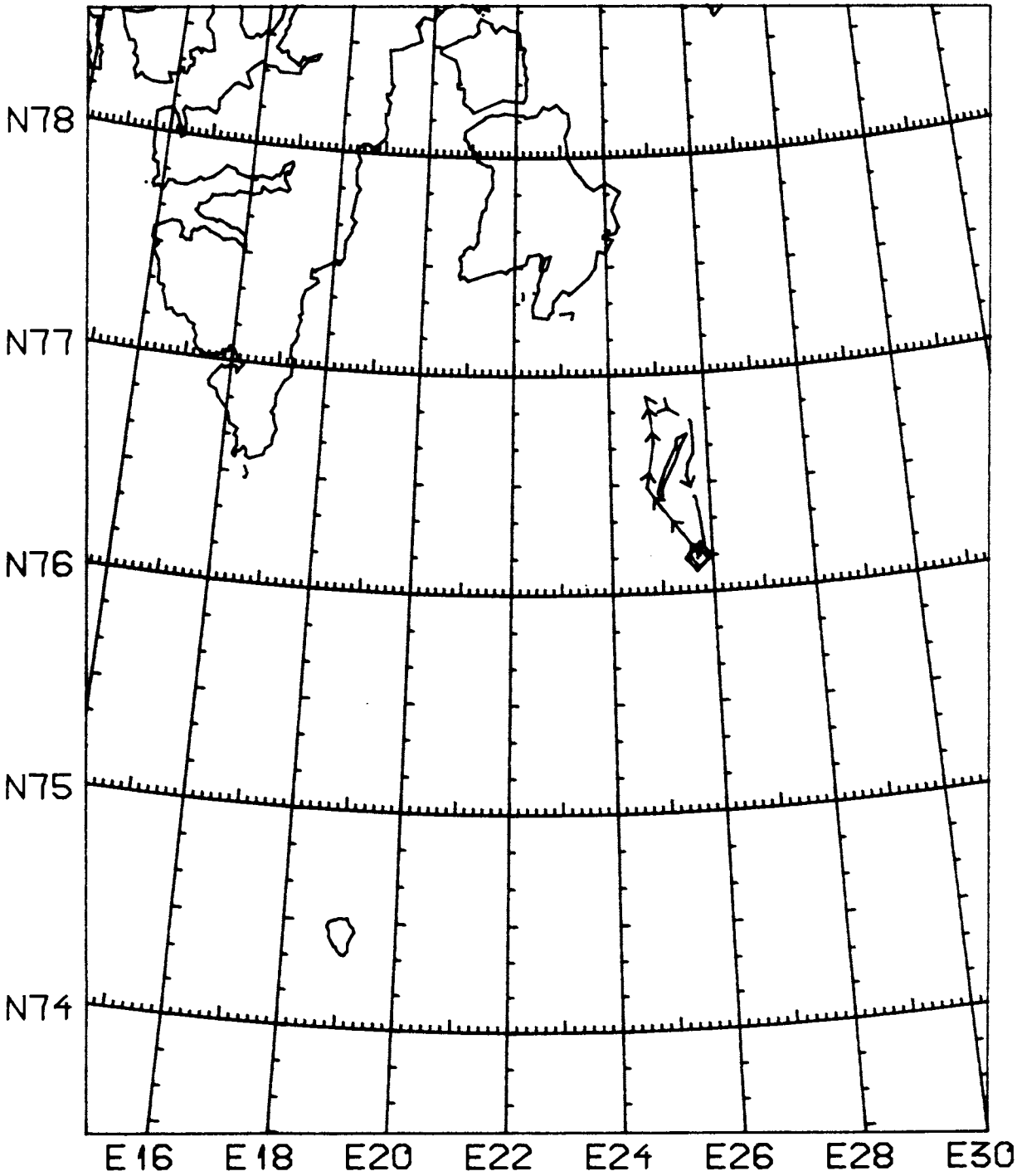

Fig. 2.9. Helicopter mission 15, 13 March 1989

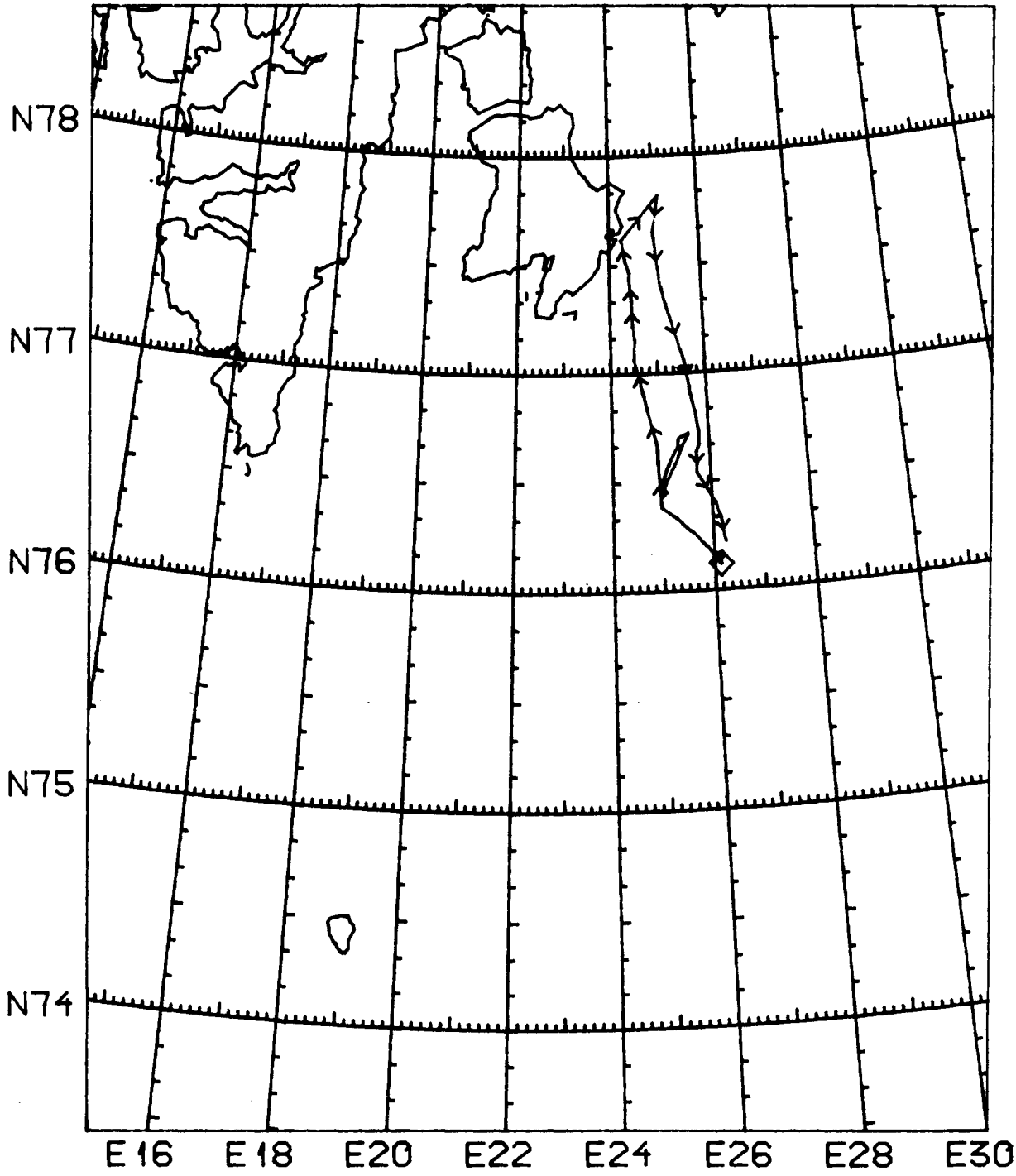

Fig. 2.10. Helicopter mission 17, 14 March 1989

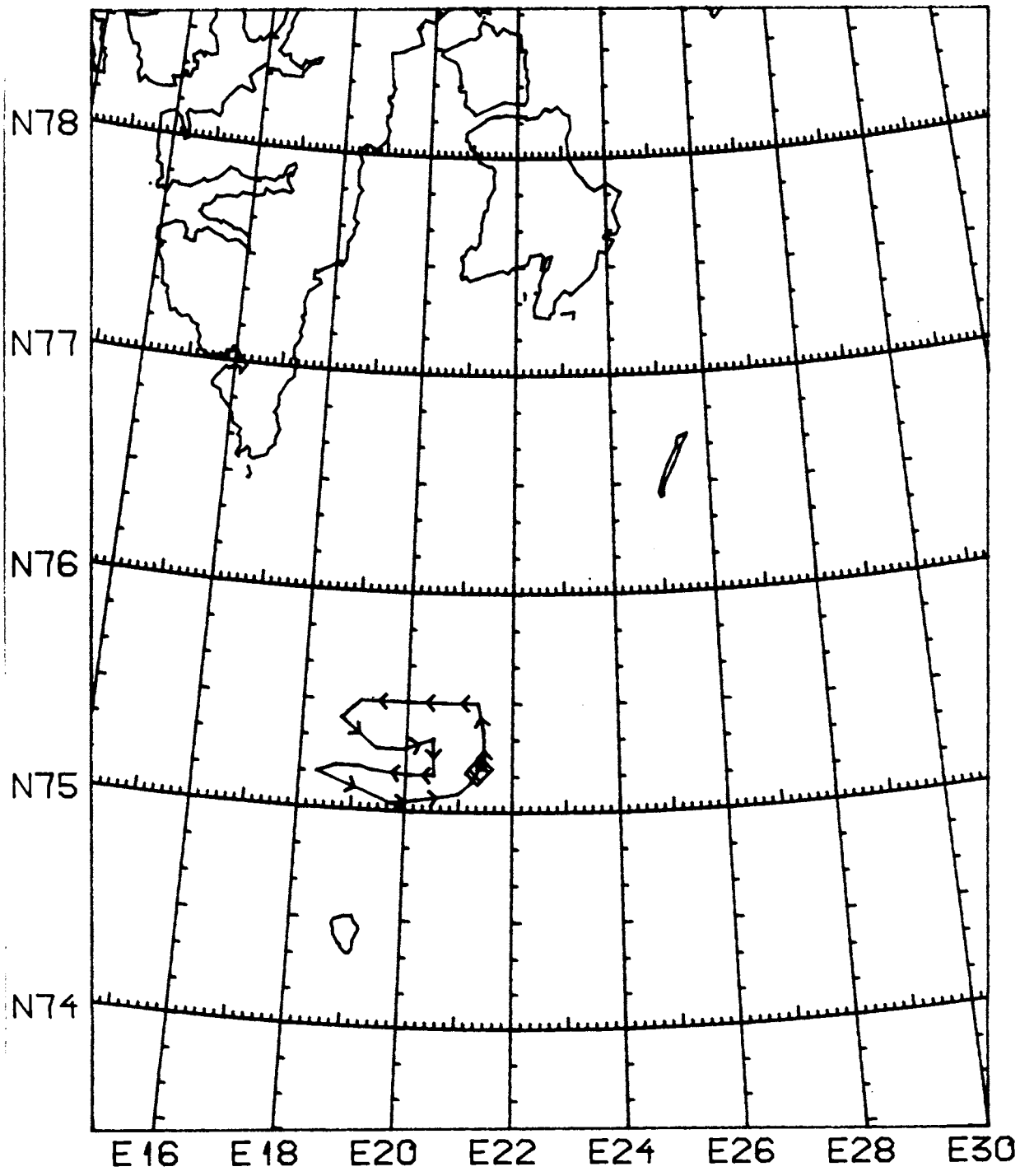

Fig. 2.11. Helicopter mission 20, 15 March 1989

3. ICE CONDITIONS

Preceding ice conditions.

Large quantities of multiyear ice was observed from LANCE between Kong Karls Land and Kvitøya towards the end of the melting season in September 1988 (NP Rapportserie Nr.49). This ice had drifted in from the Arctic Ocean due to persistent NW drift over a larger area during the previous months and was trapped in the Barents Sea when the refreezing started towards the end of September that year.

Ice conditions during the cruise.

Detailed observations were made along the ship's track and on some of the helicopter missions. As we operated fairly close to the outer ice margin the ice fields consisted of broken ice with floe sizes varying between 20 and 500 m mainly. The smaller floes were observed when crossing the ice edge. In all areas grey-white ice (15-30 cm) was observed between the larger floes consisting mainly of medium to thick winter-ice. The multi-year ice observed last year further north was now fairly well distributed with maximum concentrations of 3/10 at about 75^0 10'N - 21^0 40'E and 4/10 at about 76^0N - 26^0E. Large, 1000-2000 m floes consisting of a mixture of multi-year and medium to thick winter-ice were observed at $75^0$44'N-$25^0$00 E and near the northern tip of Hopen. Large wind and current induced openings were observed on both sides of this island, otherwice the total concentration varied between 7 and 9/10 along the ships track.

Weathered ridges were observed in a small amount with a coverage less than 1/10, otherwice the occurence of hummocks was quite common. Altogether ten rubble piles (floebergs), about 8 m high and 30 x 10 m in horizontal extension, were observed near $76^0$04'N and $25^0$50'E.

3.1. Use of scanning sonar.

Altogether four scanning surveys of the ice bottom topography were made. The areas mapped covered about 5000 m^2 and consisted of a mixture of multi-year and first-year ice.

4. ICEBERG OBSERVATIONS

Most icebergs were observed from the helicopter, and these icebergs were given numbers from H1 to H85. These numbers are referred in the flight reports, Appendix A.

Some icebergs were observed from the vessel. These bergs were given an identification number starting at #1. After the expedition the two lists of icebergs were compared and the final list of icebergs is presented in Table 4.1. Multiple observations of icebergs are removed from the list, hence the total number of icebergs observed during the expedition is 91.

4.1 Use of timegated synthetic pulse radar.

A timegated synthetic pulse radar system operating at frequencies 320-370 MHz was used. The system was pulled on a sledge over the iceberg surface making cross-sections in different directions. Three icebergs were mapped:

Iceberg # 7 : Two profiles showing ice thicknesses of 45-55 m.

Iceberg # 12: Three profiles showing ice thicknesses of 70-90 m.

Iceberg # 14: Three profiles showing ice thickness of 45 m.

The radar system worked according to specification during the whole measurement campaign.

Table 4.1. Iceberg observations.

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ICEBERG OBSERVATIONS

Page 1 of 2

ICEBERG #	HELICOPTER OBSERVED ICEBERGS	POSITION N	POSITION E	MISSION #	Max. height (m)	Max. length (m)	Max. width (m)	Shape	Remarks
1	H1	74°52'	20°35'	2	8	120	60		
2	H2	75°04'	20°49'	Vessel	10	100	60	Tab	Tilted, H_{min}=2 m
3		75°03'	20°52'	Vessel	12	80	60	Tab	Tilted, H_{min}=6 m
4		75°02'	20°56'	Vessel	9	200		Tab	H_{min}=3 m
5	H3	75°13'	21°24'	Vessel	20	50	30	Tab	
6	H4	75°13'	21°26'	2.20	9	80	30	Tab	
7		75°24'	22°26'	Vessel		130	110		PTT 3336,CW-rad.
8	H10	75°11'	23°14'	6	11	60-70	45-50		PTT 3337
9	H14	75°43'	22°26'	9	12	150	90	Sloping	PTT 3339
10		75°57'	24°43'	11	5	80	55		PTT 3340
11	H6	75°43'	23°26'	14	18	150	100	Tab	PTT 3341,CW-rad.
12	H7	75°42'	23°30'	14	18	180	160	Tab	PTT 1787
13	H38	76°40'	25°48'	8,15,17	14	65	60	Tab	PTT 1788
14	H78	76°41'	25°08'	18	14	65	45		PTT 1789
15		75°06'	21°44'	Vessel	15	70	50		
16		75°06'	21°12'	Vessel	13	65	40		H_{min}=2 m
17	H81	75°11'	18°50'	20	7	65	50		PTT 1790
18	H5	75°35'	22°40'	2		150-200			
19	H8	75°42'	23°31'	2,9					
20	H9	75°40	23°31'	2,9					
21	H11	75°38'	22°21'	5	15	40	20		
22	H12	75°41'	21°56'	5					
23	H13	75°41'	21°53'	5					
24	H15	76°04'	26°07'	7					Small
25	H16	76°00'	25°38'	7					
26	H17	76°11'	23°42'	7					Small
27	H18	76°06'	23°28'	7					
28	H19	76°06'	23°28'	7					
29	H20	76°06'	23°28'	7					
30	H21	76°06'	23°28'	7					
31	H22	76°06'	23°28'	7					
32	H23	76°31'	22°52'	7					
33	H24	76°31'	22°10'	7					
34	H25	76°21'	20°50'	7					
35	H26	76°07'	20°00'	7					
36	H27	76°01'	20°15'	7		~100			
37	H28	75°54'	21°26'	7		~ 90	60-70		
38	H29	75°52'	21°44'	7		50			
39	H30	75°57'	22°55'	7					
40	H31	75°55'	23°18'	7					
41	H32	75°37'	24°25	7					Small
42	H33	75°34'	24°40'	7					Small
43	H34	76°11'	27°27'	8				Tab	Low
44	H35	76°21'	28°00'	8					Small
45	H36	76°30'	28°10'	8	4	40-50			Small
46	H37	76°41'	27°09'	8					

Table 4.1 (continued)

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ICEBERG OBSERVATIONS

Page 2 of 2

ICEBERG #	HELICOPTER OBSERVED ICEBERGS	POSITION N	POSITION E	MISSION #	Max. height (m)	Max. length (m)	Max. width (m)	Shape	Remarks
47	H39	76°41'	25°35'	8,15	25	100	50		
48	H40	76°32'	26°25'	8					Small
49	H41	76°40'	25°30'	8,15	15	60	50	Dome	
50	H42	76°38'	25°25'	8,15		60	50	Sloping	
51	H43	76°11'	25°51'	8	15	80	30		
52	H44	76°13'	25°53'	8,15	5	30	15		Small
53	H45	76°09'	25°48'	8,15		20	20		Small
54	H46	76°05'	25°55'	8,15	6-8	40	30	Dome	Small
55	H47	75°53'	25°35'	8					
56	H48	75°57'	23°38'	11					Small
57	H49	75°59'	23°30'	11					Small
58	H50	76°37'	24°51'	15,17		50	20		
59	H51	76°42'	24°53'	15	10-12	80		Tab	
60	H52	76°47'	25°41'	15	5-6	80	50		
61	H53	76°46'	25°42'	15					
62	H54	76°19'	25°46'	15,17	6	40	15		
63	H55	76°23'	24°59'	17					
64	H56	76°40'	24°56'	17,18					
65	H57	76°40'	24°56'	17,18					
66	H58	77°26'	24°26'	17	4	50		Sloping	H_{min} = 2 m
67	H59	77°28'	24°26'	17	3-4	60-70			Small, tilted
68	H60	77°28'	24°26'	17	3-4	60-70			Small, tilted
69	H61	77°28'	24°26'	17	3-4	60-70			Small, tilted
70	H62	77°31'	24°21'	17					
71	H63	76°35'	25°35'	15		50	40	Sloping	
72	H64	76°35'	25°35'	15					
73	H65	77°39'	24°18'	17					
74	H66	77°39'	24°18'	17					
75	H67	77°39'	24°18'	17					
76	H68	77°49'	25°06'	17	15-20			Tab	
77	H69	77°49'	25°06'	17	15-20			Tab	
78	H70	77°47'	24°55'	17					
79	H71	77°47'	24°43'	17					
80	H72	77°45'	24°35'	17					
81	H73	77°42'	24°35'	17					
81	H74	77°42'	24°40'	17					
83	H75	77°49'	25°07'	17					
84	H76	77°49'	25°07'	17					
85	H77	77°49'	25°07'	17					
86	H79	75°22'	21°27'	20	10	50	30		
87	H80	75°20'	20°31'	20	15	50	50		
88	H82	75°12'	18°45'	20	6	40	30		
89	H83	75°12'	18°45'	20	4	40	30		BB
90	H84	75°12'	18°41'	20	8	30	20	Tab	
91	H85	75°02'	19°46'	20	15	70	70		

APPENDIX A: HELICOPTER MISSIONS

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HELICOPTER FLIGHTS

Date: 1989-04-08	Mission No. 1	Page 1 of 1

Attendees: Mellbye, Mørland, Kleiven, Hamran

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1540	74°19'	19°59'	-	90		Take off Lance. Heading for Bjørnøya radiost.
						No icebergs observed. Open water close to the station.
1630						Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 2

Date: 1989-04-08

Start: 1730	WP1	LANCE	N74°23'	E20°04'	
	WP2		N74°50'	E20°25'	27 nm
2 ICEBERGS	WP3		N75°43'	E23°30'	70 nm
	WP4		N75°43'	E21°30'	30 nm
	WP5		N75°00'	E20°00'	49 nm
	WP6		LANCE		15 nm
					191 nm

- Try to locate the 2 icebergs observed 6 April from fixed wing aircraft.

- In case low visibility, turn SW before WP4.

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HELICOPTER FLIGHTS

Date: 1989-04-08	Mission No. 2	Page 1 of 3

Attendees: Bjerke, Kjelås, Løset, Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1748	74°19'	19°59'	800			Take off Lance. Video tape started immediately after take off. Passed over Lance at 800' → top - bottom screen: 120 m Planned track: WP1, WP2, WP3, WP4, WP5
1750				90	6	Broken FYI. Floes < 20 m, uniform size of the floes. The bright spots on the video are MYI floes typically 20 - 30 m across.
1753	74°38'	20°18'		90	6	The ice edge to the E, but also to the W.
	74°46'	20°23'	800	90	6	
1758	WP2			90	7	Still mainly small floes of FYI.
1801	74°52'	20°33'				IB estimated to 120 x 60 x 8 m. H1 Some MYI floes to the E.
1805	74°56'	20°46'	800	90	6	Broken FYI on both sides. Floe diameter < 20 m.
1810						Visibility < 2 km IB 20 x 15 x 7 m H2
1815	75°11'	21°29'	500			2 IB 1) 90 x 30 x 15, α = 5° H3 2) 80 x 30 x 10, α = 5° H4 Both are tabular bergs, most probably grounded. No special lead formation or polynyas behind the bergs.
1820			500		7-8	Visibility on both sides: 5 - 10 km The visibility is improving and we start climbing to 800 ft.
1823	75°19'	22°02'	800		6	Some openings on both sides, 10 - 20 cm snow cover on the ice.
1830			800		8	FYI Floes: L ≈ 20 m MYI Leads

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HELICOPTER FLIGHTS

Date: 1989-04-08	Mission No. 2	Page 2 of 3

Attendees: Bjerke, Kjelås, Løset, Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1838	75°35'	23°01'				1 IB 90° on port, about 5 km H5 L ≈ 150 - 200 m
1840	75°41'	23°26'	800			WP3 2 IB, same as observed on the fixed wing aircraft ice rec. 1) 100 x 60 x 10 H6 2) 130 x 80 x 15 both tabular H7
1845			800		7	Floes < 20 m 1 BB 30°W Patches of fog.
1854	75°43'	23°31'			8	WP3 FYI L ≈ 50 m 1 IB 2 km, (PS) H8 1 IB 5 km, (PS) H9
1903	75°43'	21°30'				WP4 Between WPs 3 and 4; some floes L ~ 100 m, else L < 20 m.
1905					6	Visibility 3 km on both sides. Small ice floes.
1910						Visibility ~ 1.5 km
1912						Visibility ~ 500 m
1915	75°27'	20°55'	500			Visibility < 50 m, dive to get the ice surface within sight.
1918	75°21'	20°42'			7	Only FYI, small floes. 1 BB Visibility: 1 - 2 km
1920			700			The brash ice between the floes turns into light brown again (algae) as on the way north-south of this latitude approx.
1928					6-7	
1930	75°10'	20°21'	800 1000		7	FYI L ~ 10 - 15 m Visibility: Good
1935			800		7	Visibility: 5 km

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HELICOPTER FLIGHTS

Date: 1989-04-08	Mission No. 2	Page 3 of 3

Attendees: Bjerke, Kjelås, Løset, Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1940						BB 1 km (PS) BB
1940			1000 900		8-9	WP5 Some MYI floes with ridges on top.
1946	74°50'	20°13'	800			Ice edge underneath. Relatively sharp edge.
1950						Landed on Lance.

Sum up:

	1801	74°52' 20°33'	1 IB 120 x 60 x 8 m		H1
Interpolated	1810	75°03' 20°05'	1 IB 20 x 15 x 7 m		H2
	1815	75°11'	1 IB 90 x 30 x 15 m		H3
		21°29'	1 IB 80 x 30 x 10 m		H4
		75°38'			
Interpolated	1838	22°40'	1 IB L ≈ 150 - 200 m		H5
WP3	1840	75°41'	1 IB 100 x 60 x 10	Tab.	H6
		23°26'	1 IB 130 x 80 x 15		H7
Interpolated	1854	75°42' 23°31'	1 IB		H8
		75°40' 23°31'	1 IB		H9

FLIGHT PLAN

HELICOPTER MISSION # 3

Date: 1989-04-09

Start: 1115	WP1	N75°24'	E22°26'	
	WP2	N75°24'	E25°00'	37 nm
	WP3	N76°00'	E25°00'	36 nm
	WP4	N76°00'	E21°00'	58 nm
	WP5	WP1		42 nm
				173 nm

Objective: Ice reconnaissance

IDAP 89

HELICOPTER FLIGHTS No iceberg obs.

Date: 1989-04-09	Mission No. 3	Page 1 of 1

Attendees: T. Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1115	75°22'	22°27'				Take off Lance.
1120	75°21'	23°03'	300	90	7	Medium to thin FYI. Floe size 20 - 50 m. Vis.: 5 km
1125	75°22'	23°35'	300	90	7	3/10 floes 20 - 50 m 4/10 floes 200 - 500 m
1130	75°22'	24°17'	300	90	8	5/10 floes 20 - 50 m 3/10 floes 200 - 500 m
1135			600	90	7	7/10 floes 20 - 50 m Ice border 5 nm to the south
1140	WP2 75°24'	25°00'	600	90	9	5/10 floes 20 - 50 m 3/10 floes 100 - 500 m
1145	75°35'	25°00'	500	90	9	7/10 floes 200 - 1000 m 2/10 floes 20 - 100 m
1150	75°44'	25°16'	500	90	9	8/10 floes 200 - 2000 m 1/10 floes 20 - 50 m
	75°34'	24°59'				Return to Lance due to low visibility. Vis.: 500 m
1155	75°46'	24°45'			8	6/10 floes 200 - 1000 m 2/10 floes 20 - 50 m Vis.: 500 m
1200	75°43'	24°30'			9	Vis.: 500 m
1205	75°37'	24°07'			6	Vis.: 500 m
1210					8	Vis.: 100 m
1215	75°29'	23°22'	300		7	Vis.: 50 m (horizontal)
1220	75°24'	23°14'			8	Vis.: 50 m
1225	75°23'	22°41'			6	Vis.: 3 km Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 4

Date: 1989-04-09

Start: 1000

WP1 LANCE N75°24' E22°26'
WP2 ICEBERG STATION #1 ON IB #7
a few hundred metres from the vessel

OBJECTIVE: Deploy PTT 3336
Temperature profiling
CW radar measurements

IDAP 89

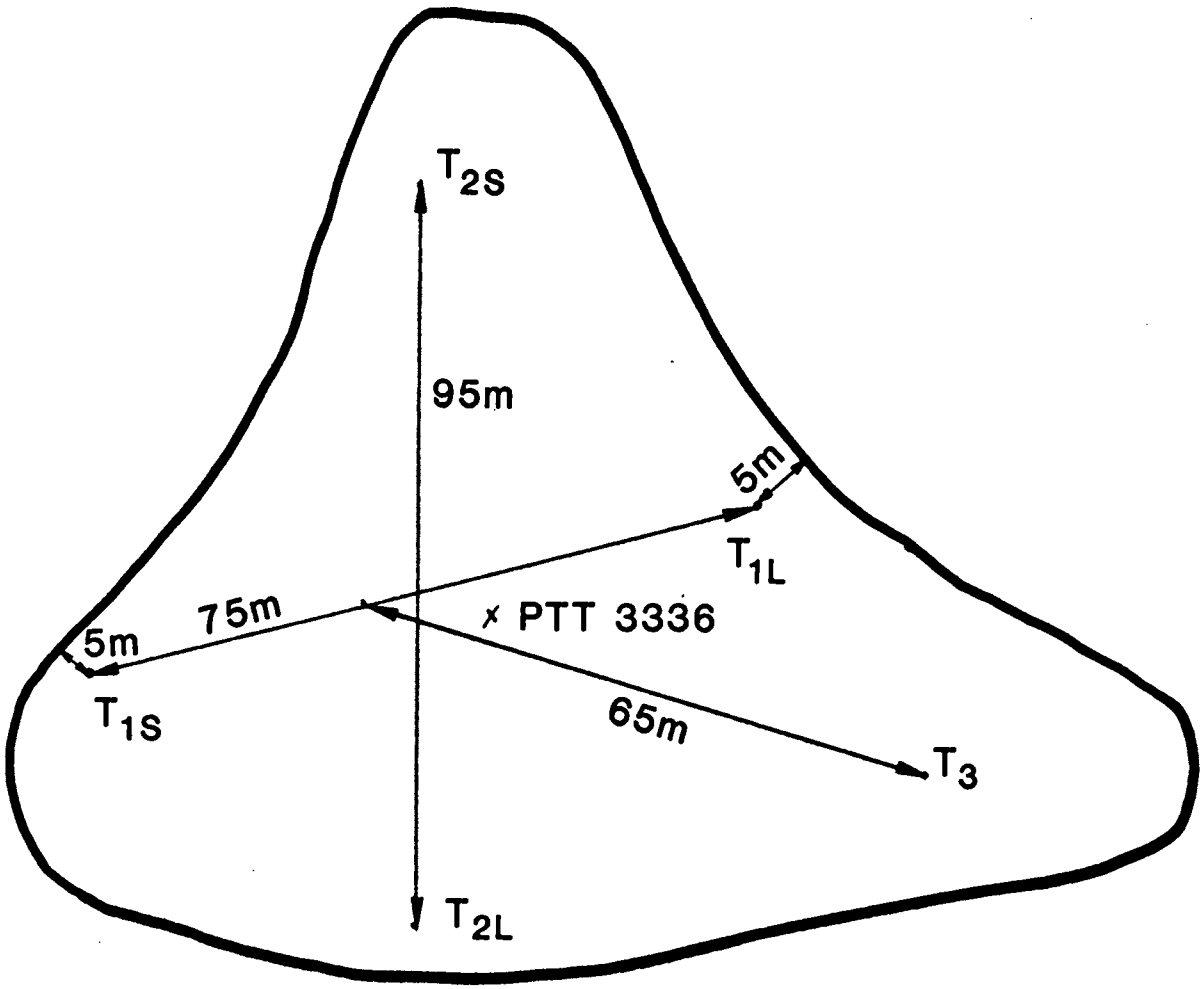
HELICOPTER FLIGHTS

Date: 1989-04-09	Mission No. 4	Page 1 of 1

Attendees: Hamran, Erlingsson, Mellbye, Mørland, Kleiven, Grant, Løset, Jensen, Spring, Kjelås

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1010	75°24'	22°26'				Landed on IB #7 close to the LANCE
1310	75°24'	22°46'				Landed on Lance.
			30 min stabilizing			D(cm) T(°C) 10 - 5.35 87 - 8.7 190 -10.25 210 -11.35
						The iceberg is grounded, 1 knt ice drift speed by. Tidal marks on the berg. Some big blocks of sea ice on the berg.

ICEBERG # 7



FLIGHT PLAN

HELICOPTER MISSION # 5

Date: 1989-04-09

Start: 1815

WP1	LANCE	N75°16' E22°49'	
WP2	2 ICEBERGS at	N75°38' E22°55'	22 nm
WP3	2 ICEBERGS at	N75°43' E23°30'	10 nm
WP4		N76°00' E24°30'	22 nm
WP5		N76°00' E22°30'	30 nm
WP6		N75°35' E22°00'	26 nm
WP7		LANCE	23 nm
			133 nm

Objective: Ice reconnaissance

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-09	Mission No. 5	Page 1 of 2

Attendees: H. Jensen, W. Spring, C. Grant, E. Mellbye

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1816	75°15'	22°50'	1200			Take off Lance
1818						Flight track over Lance for video scale.
1823			700 Descending			Flying 117°
1825	75°11'	23°14'	1200			IB ~ rectangular 60 - 70 x 30 m H10 Circling for various views Freeboard ~ 15 m. Free floating Will deploy buoy on this iceberg tonight.
1830						Starting to WP2
1836	75°19'	23°14'	1300			Vis.: 10 nm S Low cloud to E. Broken ice on W side of track.
1840	75°25'	23°09'	1250			Large floes to E. More broken to W Vis. as before.
1844	75°29'	23°02'	600			Descending due to low clouds.
1846			600			Poss. IB sighted ahead + 2 IB to the west.
1848						Turning to the west.
1849	75°33'	22°42'	600			
1851					7-8	4 IB in view: 2 PS, 1 ahead, 1 SB Visibility to the NE poor, low cloud

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-09	Mission No. 5	Page 2 of 2

Attendees: H. Jensen, W. Spring, C. Grant, E. Mellbye

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1856	75°38'	22°21'	600		8	IB H11 40 m x 20 m, 20 nm S of WP5 Freeboard 15 m Irreg. shape ridge on SB side of IB
1857			600			Turning to the west for next IB. Visibility worsened, 5 km
1859	75°40'	22°08'	600		8	
1900	75°41'	22°01'	500		7-8	Descending due to low cloud cover.
1901	75°41'	21°56'	500			IB H12 Ready to break up; lots of holes from melting.
1902	75°41'	21°53'	500			IB, V notch in middle H13 Now heading east to pick up previous IB (SB) (observed 1651)
1905	75°41'	22°09'	500			Vis. poor 3 - 5 km Heading for IB straight ahead.
1908	75°43'	22°26'	300		7-8	IB, Vis. very poor esp. to the E H14 15 m on E, 2 - 3 m on W rubble on low side
1909						Heading for Lance
1912	75°37'	22°28'	700		7-8	Passed BB on SB side. 0.3 nm
1928	75°12'	23°08'				Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 6

Date: 1989-04-09

Start: 1930

WP1	LANCE	N75°09'	E23°23'
WP2	ICEBERG #8	N75°11'	E23°14'
WP6	LANCE		

Objective: DEPLOYMENT OF PTT 3337

IDAP 89 HELICOPTER FLIGHTS		
Date: 1989-04-09	Mission No. 6	Page 2 of 2
Attendees: Løset, Kleiven, Rasmussen, Dalsgård		

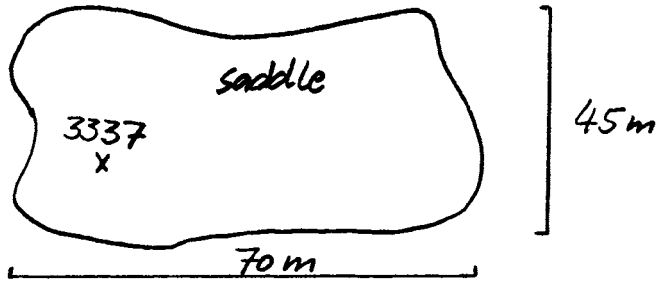
Iceberg Station # 2 (IB #8) seems to be free floating for two reasons:

1) No tidal marks on the IB walls.

2) Ice drifting only very slowly by (5 - 10 cm) and no wakes were observed behind the IB.

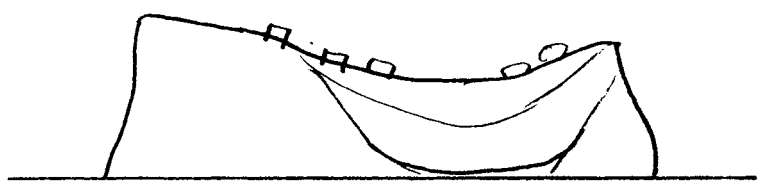
The ice was brittle and clear, snow ice only for the 10 cm on top.
The IB had two (elevated) tops.
The PTT was deployed on one of them, only about 10 m from the steep edge.

Top view:



Side view:

The blocks were weathered so they had not been thrown onboard recently.



IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-09	Mission No. 6	Page 1 of 2

Attendees: Løset, Kleiven, Rasmussen, Dalsgaard

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
						Iceberg Station #2 IB #8 Buoy deployment PTT 3337 No temp. readings, no CW radar
1935						Take off Weathered IB
1949	75°11'	23°14'				Landed on IB # 8 (H10). Helicopter went back to Lance.
2025	75°05'	23°53'				Landed on Lance.
						Dimensions: L = 60 - 70 m W = 45 - 50 m H = 11 m (max point)
						Tubing: Levelled the ice. 3 - 5 cm snow on the ice Free floating IB. No tidal marks.

FLIGHT PLAN

HELICOPTER MISSION # 7

Date: 1989-04-10

Start: 0900	WP1	LANCE	N75°17'	E25°00'	
	WP2		N76°10'	E26°15'	57 nm
	WP3		N76°10'	E20°50'	91 nm
	WP4		N76°00'	E20°50'	10 nm
	WP5		N75°43'	E23°30'	45 nm
	WP6		LANCE		35 nm
					238 nm

Back at about 1200.
Buoy at 1.30 PM.

Objective: Ice reconnaissance

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 7	Page 1 of 3

Attendees: W. Spring, M. Mørland, B. Erlingsson, A. Kjelås

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
0900	75°24'	25°07'				Take off Lance.
0905			1200	90	8	Mainly FYI, some SYI,
0910	75°34'	25°23'	1200		9	FYI: 5/10, SYI: 4/10
0915	75°41'	25°32'	1200			Several BB 1 mile away (PS).
0920	75°47'	25°41'	1200	90		
0926	75°55'	25°52'	1200	90		2 BB 2 miles (PS) 2 BB 4 miles (PS)
0930			1200			refreezing + opening FYI mainly floes < 20 m SYI floes < 40 m
0932						1 BB 3 miles (PS)
0935	76°04'	26°07'				1 small IB on track passing the IB, circle around and cross over. H15 Two small/one BB 40 m long
0941	76°11'	26°13'	1300			WP2
0944	76°10'	25°57'				Contacted Hopen Radio
0946	76°10'	25°38'			9	1 IB 10 miles S H16 floes up to 200 m with openings, FYI Newly frozen 2-4/10
0957	76°11'	24°13'	1200			High visibility, see Hopen right BB 10 miles (SB)
1002	76°11'	23°34'	1300	90		IB (SB), small H17 Contacted Hopen Radio

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 7	Page 2 of 3

Attendees: W. Spring, M. Mørland, B. Erlingsson, A. Kjelås

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1004	76°11'	23°28'	1250	90	8-9	Cluster of 5 IB H18-22 5 nm to the S
1006	76°11'	23°09'				1 BB N
1009	76°11'	22°52'	1300	90		1 IB 20 miles N H23
1015	76°11'	22°11'	1250			1 IB 20 miles N H24
1019					8	7/10 SYI 20 - 40 m
1020	76°10'	21°37'				Contacted Hopen Radio
1028	76°11'	20°50'	1200	90		WP3. IB 10 miles N H25
1032	76°07'	20°50'				IB + BB 10 miles (SB) H26
1035	76°00'	20°50'				IB 5 - 10 miles off to (SB). H27 large ~ 100 m WP4. BB
1039			1300	90		2 BB (SB)
1040	75°55'	21°26'	200			IB pictures taken H28 60 - 70 wide, ~ 90 m long
1042			300 - 400		9	Continue 300 ft. after request from W. Spring SYI ice mostly up to 1 km
1045	75°54'	21°44'	400			Contacted Hopen Radio. H29 IB (SB) 50 m BB 2 m
1050	75°52'	22°08'	400			Big IB (SB) 15 miles off H12 or H13

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 7	Page 3 of 3

Attendees: W. Spring, M. Mørland, B. Erlingsson, A. Kjelås

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1053	75°50' 75°49'	22°27' 22°39'	400			IB (SB) > 100 m H14 IB 10 miles off (PS) H30 IB 15 miles (SB) < 100 m H5 or H11
1056						IB 10 miles (PS) H31
1105	75°44'	23°27'	800			WP5 2 big IB H6, H7 Flying across and around.
1110	75°44'	23°27'	900			Continued, BB 10 nm (SB) rest of heavy ridges SYI (SB)
1115	75°39'	23°58'				22 nm from Lance small IB/BB 5 nm (PS) H32
1119						Small BB 10 nm (SB) One seal! BB 5 nm (SB)/small IB H33
1128						4 BB (SB) 5 nm
1134	75°37'	25°38'				Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 8

Date: 1989-04-10

Start: 1400	WP1	LANCE	N75°34'	E25°28'	
	WP2		N76°10'	E28°00'	53 nm
	WP3		N76°50'	E29°00'	43 nm
	WP4		N77°15'	E27°00'	38 nm
	WP5		N76°45'	E26°30'	30 nm
	WP6		N75°57'	E25°35'	50 nm
	WP7	LANCE			22 nm
					236 nm

Back on LANCE about 1700
Possible buoy deployment at 1900

Objective: Ice reconnaissance

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 8	Page 1 of 4

Attendees: S. Løset, W. Spring, P.E. Bjerke, S. Rasmussen

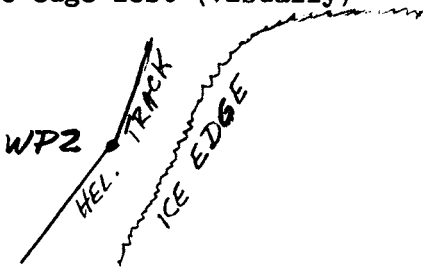
Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1400	75°38'	25°39'				Take off Lance.
1409	75°44'	25°48'	1000	90		BB
1412						Large floe composed of smaller floes, some MYI 30-40 m ice edge further (SB) side, 25 nm.
1415	75°48'	26°00'	1000	90		New ice formed.
1417						BB H = 4 m, L = 30 m (PS)
1418			1000	90	9	1-2/10 MYI, 30-40 m across. Visibility to the ice edge (SB)
1421	75°52'	26°49'	1000	90	7-8	Broken ice ridges on (SB) side, observed on small floes.
1426			1000	90		3 medium size BB 2 m height ice edge like drawing
1429	76°00'	28°00'	1000	90	8	Ice conc. Excluding new frozen ice.
1432	76°03'	27°32'	1000	90		22-25 nm to ice edge (SB). Ice condition as previously reported.
1434			1000	90		One small BB 4 nm (SB)
1436			1000	90	7-8	Mainly FYI. Floes 40 - 100 m across.
1438	76°10'	28°00'	1000	90		1 low tabular IB H34 7 miles (PS), BB 5 miles (PS)

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 8	Page 2 of 4

Attendees: S. Løset, W. Spring, P.E. Bjerke, S. Rasmussen

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1442			1000	90	10	Ice conc. Including new ice. BB, small (SB)
1444			1000	90	2 1	1 BB, 2 miles (PS) 2/10 young ice (SB) 1/10 MYI, some up to 100 m (SB)
1448	76°21'	28°16'	1000	90		IB (small), 4 miles (PS) H35 Bay of open water passed (SB) Ice edge lost (visually) 
1452			1000	90	10	Floes 2 km dia. FYI 2/10 young ice > 1/10 MYI
1454	76°30'	28°31'	1000	90	10	Floes up to 1 km dia. 2/10 young ice > 1/10 MYI Small IB 4 miles (PS) H36 H = 4 m 40 - 50 m long
1458			1000	90		New ice large area (SB) Small BB 1 nm (SB)
1502	76°42'	28°47'	1000	90	10	Solid ice cover (SB)
1507			1000	90		Visibility 20 - 30 km Small BB 1 naut. m (SB)
1509			1000	90	10	2/10 young ice > 1/10 MYI
1511			1000	90		FYI is larger 1 growler (SB) 3 ridges 6-7 m, 1-2 m height (SB)

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 8	Page 3 of 4

Attendees: S. Løset, W. Spring, P.E. Bjerke, S. Rasmussen

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1517	76°58'	28°16'	1000	90	10	Solid ice cover, flat (PS).Hard snow cover est. to be 0.2-0.3 m thick (SB
1526			1000	90	10	Solid ice cover, flat new ice
1530	77°11'	27°14'	1000	90		Just position (comm. with Hopen) and time.
1532	WP4		1000	90	10	Solid ice cover (FYI) 2-3/10 young ice, all flat ice outside temperature -23°C
1539			1000	90	10	Solid FYI Visibility 30 km
1543	76°58'	26°43'	1000	90		Large area with new refrozen ice
1549			1000	90	10	FYI, flat (SB) 1/10 young ice. Some pieces of MYI 1.5 m freeboard. Flat on top.
1552	WP5		1000	90	10	Hopen seen at 2 o'clock. Probably not visible from ice surface due to some mist. Solid new ice 1/10 Young ice No MYI
1555	76°41'	26°22'	1000	90		1 IB 10 miles (PS) H37 Few blocks of MYI (SB)
1559			1000	90		1 IB near Hopen (SB) H39 Another south of 1st H38 reported. Near Hopen.
1601	76°32'	26°12'	1000	90		Small IB 3 miles (PS) H40
1606			1000	90		1 km south of the last two Hopen IB, another two was observed. H41, H42 Level ice 3/10 young ice Some MYI in old refrozen leads

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 8	Page 4 of 4

Attendees: S. Løset, W. Spring, P.E. Bjerke, S. Rasmussen

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1610			1000	90		Solid ice with large distinct floes (SB)
1614	76°13'	25°53'	1000			1 small IB 1 nm away (PS), just passed it H44
1616	76°11'	25°51'	1000	90		IB 80 x 30 m, H = 15 m H43 4 others (PS)
1617	76°09'	25°48'	1000	90	1-2	1 IB in front of helicopter H45 1 IB at 11 o'clock H46 MYI (SB)
1618	76°09'	25°48'	1000	90		1 BB (SB) 1 small IB, 2 nm (PS) H46 Heavy MYI (PS)
1624	WP6		1000	90		Small IB 2 o'clock (SB) IB somewhat NW of WP6 H16
1626	75°53'	25°35'	1000	90		3 separate IB (SB) H45, H46, H47 Possible 4th IB (SB)
1628			1000	90		Lots of open water/new ice from Hopen southwards (following helitrack)
1629			1000	90	10	3/10 new ice 2 BB (SB), 5 o'clock, 1 nm
1633	75°46'	25°34'	1000	90		Approx. end of open water/new ice one BB (SB)
1638	75°40'	25°37'	helideck			Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 9

Date: 1989-04-10

Start: 1900	WP1	LANCE	N75°39'	E26°01'	
	WP2	ICEBERG # H14	N75°43'	E22°26'	53 nm
	WP3	LANCE			53 nm
					106 nm

Back at LANCE 2045
Meeting at 2115

Objective: Deploy PTT 3339 on Iceberg #H14

IDAP 89

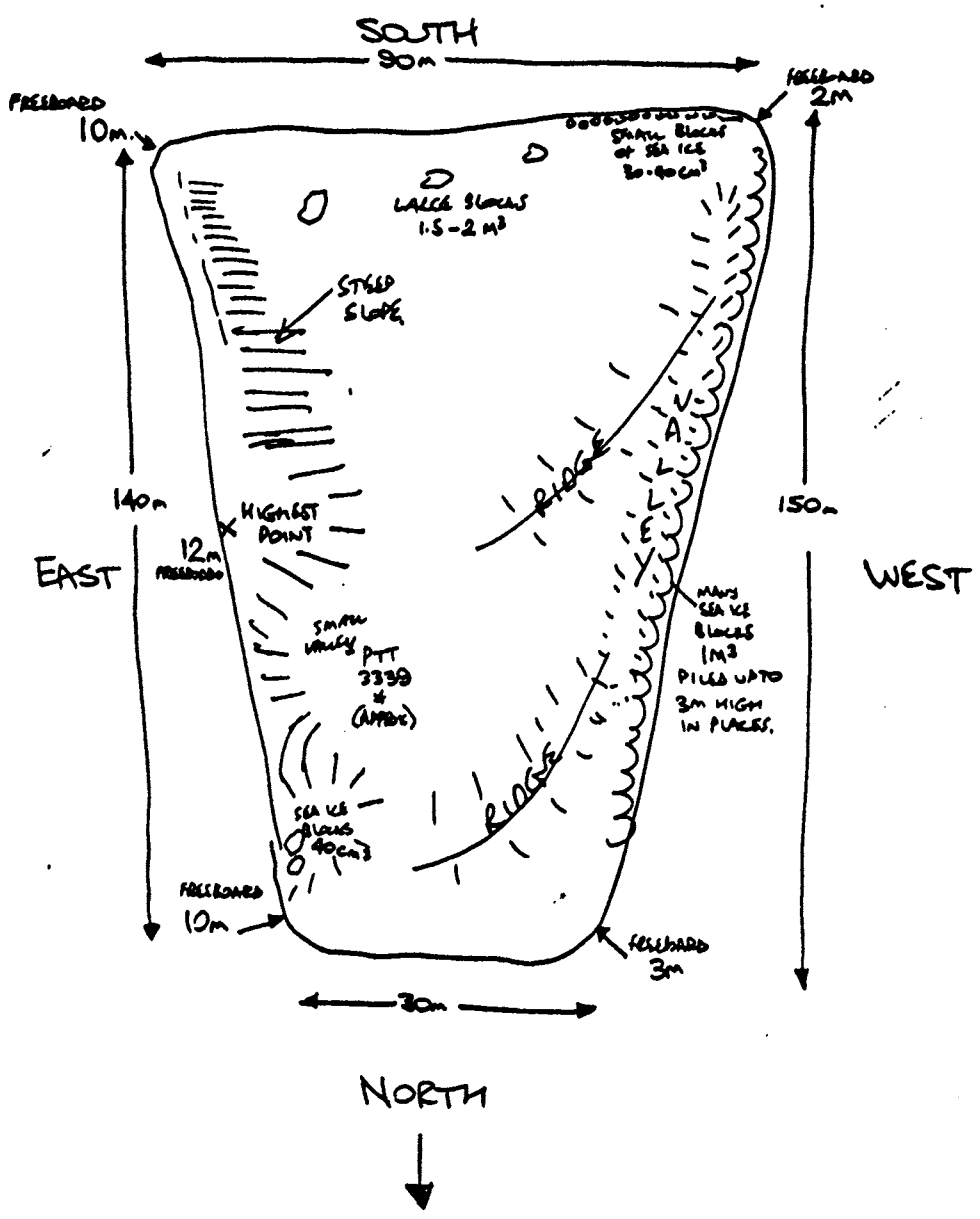
HELICOPTER FLIGHTS

Date: 1989-04-10	Mission No. 9	Page 1 of 1

Attendees: H. Jensen, C. Grant, E. Mellbye, G. Kleiven

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1900	75°43'	25°46'				Take off Lance. Climb to 900 ft. Heading west
1910	75°43'	25°00'	1000		8-9	Heading west. Small IB to (SB) (BB?) L = 60 m; 1 1/2 nm away tabular
1913					8-9	Small IB - at least 8 miles at 4 o'clock (SB)
1915	75°43'	24°26'	1000			BB under flight path.
1918						Hopen visible at 4 o'clock. Good vis.
1920	75°43'	23°53'	1000			Pair of IB in sight ahead.
1922	75°43'	23°40'	1000			Passing 2 IB which are on (PS) side. 17.8 nm to go. (PS) one circular ~ 50 m H8 Closer one - half moon 30 x 20 m H9
1930	75°43'	22°52'	1000	90	8-9	Heading west; good vis. all around Possible IB around 4 o'clock, flat
1933						2 IB from yesterday out to SW Circling target IB for landing site.
1935	75°43'	22°26'				Landing on IB #9 H14 Deployed PTT 3339
2018						Take off IB #9 Circling for recording video
2021						Heading for Lance
2031	75°42'	23°32'	1000	90		2 IB on flight track H8, H9
2057	75°44'	25°47'				Landed on Lance

ICEBERG # 9


SOUTH
90m
FREEBOARD
10m
FREEBOARD
2M
SMALL BLOCKS OF SEA ICE
LARGE BLOCKS
1.5 - 2 M³
STEEP SLOPE
140m
HIGHEST POINT
12m
EAST
SMALL VALLEY
PTT
3339
(APPROX)
SEA ICE BLOCKS
40cm³
FREEBOARD
10m
150m
WEST
MANY SEA ICE BLOCKS
1M³
PILED UPTO
3m HIGH
IN PLACES.
FREEBOARD
3m
30m
NORTH

FLIGHT PLAN

HELICOPTER MISSION # 10

Date: 1989-04-11

Objective: ICE REC. FOR NAVIGATION

FLIGHT PLAN

HELICOPTER MISSION # 11

Date: 1989-04-12

Start: 0845	WP1	LANCE	N76°00' E25°35'	
	WP2	ICEBERG # H31	N75°55' E23°18'	35 nm
	WP3	ICEBERG # H30	N75°57' E22°55'	5 nm
		Deployment on the better one		
	WP4	5 ICEBERGS	N76°05' E23°35'	11 nm
		Consider buoy candidates		
	WP5	LANCE		28 nm
				79 nm

Fuel for 2 hours
Back at 1045

Objective: Deploy PTT 3340

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-12	Mission No. 11	Page 1 of 1

Attendees: H. Jensen, W. Spring, L. Dalsgaard, M. Mørland

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
0855	76°00'	25°35'			9	Take off
0900	75°59'	25°09'	350	90	10	Visibility 7 - 8 nm.
0905	75°57'	24°43'				IB #10, 50 x 50 m, FYI on top of IB Freeboard 5 - 7 m
0908	75°57'	24°27'			9	Closed floes
0914	75°58'	24°00'			10	Closed floes 2-3/10 MYI
0917	75°54'	23°41'				Small IB 3 nm (SB) H48 rubble on top
0919	75°54'	23°30'				Small IB 5 nm to (SB) H49
0927	76°00'	23°23'			7	Closed floes with some large channels
0944	76°05'	23°15'				Small IB 6 - 7 nm (SB) H49
0948	76°03'	23°34'				BB 2 m freeboard
0952	76°05'	23°49'				Several BB
1000	76°00'	24°09'				Small BB 2 - 3 m freeboard 40 m long rubble on top
						Visibility 3 nm around Lance on arrival.
						Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 12

Date: 1989-04-12
Start: 1230

WP1	LANCE		
WP2	HOPEN RADIO	N76°30' E25°04'	31 nm
WP5	LANCE		31 nm
			62 nm

30 min stop at Hopen.
Back at Lance 1430.

Personnel: T. Vinje
A. Kjelaas
C. Grant
P.E. Bjerke
L. Dalsgaard

FLIGHT PLAN

HELICOPTER MISSION # 13

Date: 1989-04-12

Another flight to Hopen
Start at 1435
30 min stop at Hopen
Back at Lance 1640

Personnel: G. Kleiven
E. Mellbye
M. Mørland
S.E. Hamran
B. Erlingsson

FLIGHT PLAN

HELICOPTER MISSION # 14

Date: 1989-04-13
Start: 0900

WP1	LANCE	N76°09' E25°31'	
WP2	ICEBERG #11, #12	N75°43' E23°30'	42 nm
	Deployment of 2 buoys		
WP3	LANCE	N76°09' E25°31'	42 nm
			84 nm

Back at Lance 1100

Objective: Buoy deployment PTT 3341 and PTT 1787 on Icebergs #11 and #12.

IDAP 89

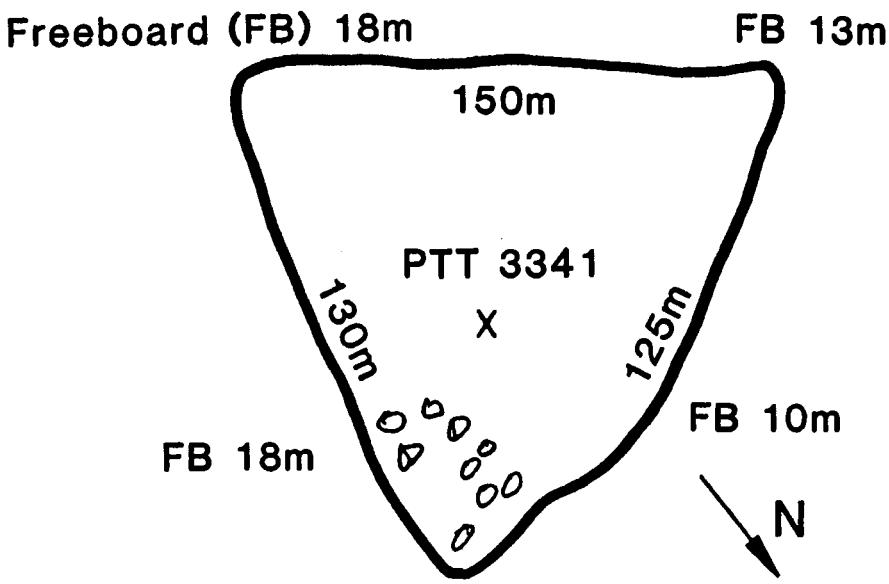
HELICOPTER FLIGHTS

Date: 1989-04-13	Mission No. 14	Page 1 of 1

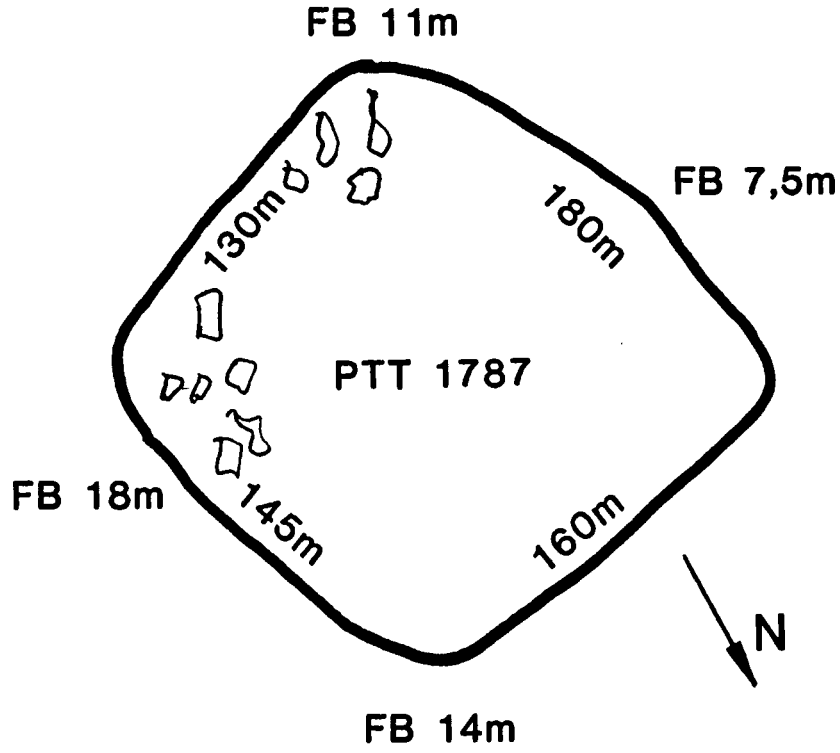
Attendees: S. Løset, W. Spring, A. Kjelaas, S. Rasmussen

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
0919	76°09'	25°30'				Take off Lance
0920			450	90	9-10	FYI, 40-50 m & 100-150 m size (both sides) grey ice with snow on top
0923					8	FYI, some large floes up to 200 m. Portion of open water with slush ice.
0928	75°59'	25°44'	450	90	9	> 1/10 MYI Visibility > 1 nm
0932					8-9	Few leads 30-40 m across. Some young ice. BB approx. 40 m long (SB)
0935						One BB
0937	75°50'	24°08'	600	90		Starting video camera
0943					8-9	1 BB, some MYI
0953	75°43'	23°20'				IB #12, deployed PTT 1787 Take off 2nd IB
1110	75°43'	23°20'				1st IB #11, deployed PTT 3341, 85 m water depth
1136	76°10'	25°40'				Landed on Lance.

ICEBERG # 11



ICEBERG # 12



FLIGHT PLAN

HELICOPTER MISSION # 15

Date: 1989-04-13

Start: 1315	WP1	LANCE	N76°10'	E25°44'	
	WP2	S.TIP HOPEN	N76°26'	E24°55'	21 nm
	WP3	PTT 3056	N77°39'	E24°17'	74 nm
	WP4	STONEPYNTEN	N77°56'	E24°30'	17 nm
	WP5	N.TIP HOPEN	N76°43'	E25°35'	72 nm
	WP6	LANCE			34 nm
					218 nm

Back at 1615

Objective: 1. Observe PTT 3056 from last year
2. Ice reconnaissance to Stonebreen

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-13	Mission No. 15	Page 1 of 3

Attendees: T. Vinje, S. Løset, E. Mellbye, C. Grant

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1329	76°10'	25°45'			8-9	MYI with small open water patches (Air temp. +2°C) Take off Lance, heading for WP2
1334	76°16'	25°26'	450	90	9	BB (2) (SB) 3/10 grey ice, 6/10 floes 50-100 m 6/10 med. thick FYI. Vis. 1 km
1336			300	85	9	Ice cond. same as above on both sides.
1340	76°23'	25°03'	300	85	9	Solid ice to Hopen snow covered 4 BB - (SB)
1341			300	80	10	Solid ice - relatively leveled 3 BB
1342			250	75		Vis. 1 nm. Hopen in sight Big floe 4-5 nm (PS) consists of thick FYI.
1345	76°29'	24°44'	250	80	9	Flying with w. coast of Hopen in sight. Large areas of open water - Polynya to shore. 1 BB (SB), 2 BB (PS). 2/10 new ice, 3/10 floe size 20-50 m 4/10 large floes up to 1 km
1348						Floes (SB) less than 50 m 1 small BB (SB)
1350	76°37'	24°51'	600	85		End of Polynya (SB), SB: 9/10, PS: 8/10 4/10 floes 20-100 m (PS) 4/10 floes 200-500 m (PS) 1 IB, 50 x 20 m H50
1352	76°41'	24°54'	450	85	8-9	IB, L = 80 m, FB = 10 - 12 m H51 2 km away - tabular (PS) Ice blocks on top SB: 4/10 grey ice, 3-4/10 FYI Pos. BB (SB)

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-13	Mission No. 15	Page 2 of 3

Attendees: T. Vinje, S. Løset, E. Mellbye, C. Grant

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1355	76°47'	24°52'	500	85		PS: 1 big floe 2 km long SB: scattered MYI (but < 1/10) PS: 8/10, 3/10 grey to grey-white 6/10 floes 50-500 m, mostly thick winter ice (SB) - large floe ~ 3 km circular
1400	76°54'	24°46'	550	85		2 parallel leads S→N (SB) 600 - 700 m appr. PS: 9/10, 4/10 floes, 50-100 m. 5/10 floes, 200-500 m, leads NE↔SW
1401			500		9	Omega stopped functioning. Clouds too heavy, returning to Lance. 1 polar bear track!
1404			550			Heading for WP5 just N of Hopen (course SE'wards)
1409	Near north top of Hopen		550			SB: 8/10, 5/10 grey ice, 3/10 FYI 3 floes up to 1 km, visibility ~ 2km
1411	76°47'	25°41'	600			Slightly north of Hopen, large polynya, 1 IB (SB) 80x50 m, FB 5-6 m 1 BB (PS) H52
1413	76°46'	25°42'				1 IB (SB) H53
1415	76°42'	25°43'	200			IB (PS) 1 - 2 km away, H38 200 m long, H 20-30 m, 2 pieces?
1418	76°38'	25°43'	200			1 IB (PS), irreg. 100x50x25 m FB H39 2 IB (SB) 60x50: 1 dome 15 m H41 1 sloping H42
1422	76°35'	25°35'	200			2 IB (SB): 1 sloping H63, H64 ~ 1 km away 40x50 m
1425	76°32'	25°33'	200		8-9	1 BB (SB)
1426	S tip of Hopen				10	1 BB (PS) 90° out. SB 10/10 - snow on FYI, solid PS: similar

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-13	Mission No. 15	Page 3 of 3

Attendees: T. Vinje, S. Løset, E. Mellbye, C. Grant

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1429	76°26'	25°41'			10	Solid FYI
1430	76°26'	25°43'				Lead N of Hopen 10 km wide Solid ice finished, heavily ridged Many polar bear tracks!
1433	76°22'	25°46'	200	85	8-9	1 BB 90° (PS)
1435	76°19'	25°48'	250			1 IB (SB) 40x15x6 m 500 m out H54 another IB (SB) 30x15x5 m H44?
1437	76°15'	25°50'	200			1 small IB 5 km to (PS) H45? 20x20 m Thick MYI floe.
1442	76°13'	25°51'	250	85	8-9	1 IB (SB) 3 nm N of Lance H46? Domeshaped 30x40x6-8 m blocks on top
1445	76°09'	25°42'				Landing on Lance
						Positions uncertain after Omega stopped funcitoning.

FLIGHT PLAN

HELICOPTER MISSION # 16

Date: 1989-04-13

Start: 1530	WP1	LANCE	N76°09' E25°45'	
	WP2	ICEBERG #12	N75°43' E23°30'	42 nm
	WP3	LANCE	N76°09' E25°45'	42 nm
				84 nm

Back at LANCE 1745

Objective: Radar profiling of icebergs

Personnel: H. Jensen
S.E. Hamran
B. Erlingsson

FLIGHT PLAN

HELICOPTER MISSION # 17

BUOY DEPLOYMENT / ICE RECONNAISSANCE TO STONEBREEN

Date: 1989-04-14

Start: 0900	WP1	LANCE	N76°08'	E26°07'	
	WP2	S. HOPEN	N76°26'	E24°55'	26 nm
	WP3	PTT 3056	N77°39'	E24°17'	74 nm
	WP4	STONEPYNTEN	N77°56'	E24°30'	17 nm
	WP5	PTT 3056	N77°39'	E24°17'	17 nm
	WP6	ICEBERG W. HOPEN	N76°41'	E24°54'	60 nm
	WP7	S. HOPEN	N76°26'	E24°55'	14 nm
	WP8	LANCE	N76°08'	E26°07'	26 nm
					234 nm

Back at Lance 1100

Objective: BUOY DEPLOYMENT / ICE RECONNAISSANCE TO STONEBREEN

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-14	Mission No. 17	Page 1 of 3

Attendees: B. Erlingsson, S. Løset, W. Spring

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
0917	76°07'	26°08'		90		Take off, BB 5 km off Lance north, Heading 305°
0922	76°12'	25°52'	400	90		Camera on
0925	76°16'	25°36'	400	90		One small IB, 1-2 km west H54 newly frozen fingerrafted ice
0927	76°17'	25°30'	400	90	8	5/10 SYI, 3/10 FYI 1/10 newly frozen fingerrafted ice
0930	76°20'	25°17'	800 for a while	90	9	7/10 FYI, 2/10 slush Floe diam. 20-40 m (> 100 m evident)
0935	76°23'	24°59'	600	90	10	L=10-20 m, severly broken, refrozen 6/10 refrozen new ice 1/10 slush, 3/10 refrozen SYI IB spotted to east H55
0942	76°35'	24°56'	600			Small IB 1 km west H50
0943	76°38'	24°56'				
0944	76°40'	24°56'	600			2 IB. Buoy candidates. H56, H57
0945	76°40'	24°56'	700	90	10	Ridged SYI. visibility poor
0952	76°50'	24°45'	700			Improving visibility
0954	76°54'	24°41'	800		8	1/10 FYI 3/10 newly frozen fingerrafted ice, coherent clusters 1- 2 km 4/10 SYI, large floes, slush
1000	77°04'	24°30'	800	99	10	Large coherent FYI floes 1-2 km, openings in between. Open areas with heavily broken ice in between. 1-3/10 grey newly frozen fingerrafted ice.

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-14	Mission No. 17	Page 2 of 3

Attendees: B. Erlingsson, S. Løset, W. Spring

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1004	77°09'	24°32'	800		8	Edgeøya coming up. Large floes 100 m - 1.5 km up to 2 km.
1006	77°13'	24°29'	800	100 ground	10	Refrozen FYI in big floes 0.5-2 km MYI 1/10, freeboard 2-3 m
1011	77°20'	24°28'	800		9	SYI floes frozen together 50 km east of Edgeøya, 2/10 MYI open coastal polynya 20-30 miles
1015	77°26'	24°26'	800			sloping IB H58 L = 50 m, H_{max} = 4 m, H_{min} = 2 m
1016	77°28'	24°26'	800			3 small IB tilted H59, H60, H61 3-4 m FB, 60-70 m range Broken ice and IB in the open water severly broken
	77°31'	24°21'	800			IB H62
1024	77°37'	24°16'				3 IB spotted H65, H66, H67 between the barrier and the islands
1044	77°45'	24°35'				5 IB at Ryke Yse-øyene H70-74
1045	77°49'	25°07'	400			Buoy not found, turned into reconnaissance flight. 3 IB at the islands and the barrier H75, H76, H77
1047	77°46'	24°58'	400			2 IB 2 km off the shelf H68, H69 tabular, high, freeboard 15-20 m
1055	77°39'	24°59'	400	80	8-9	FB 2-3 m large, sloping BB with FYI piled up on them
1102	77°24'	25°07'	400	80	8-9	4/10 newly frozen fingerrafted ice 4/10 refrozen FYI 1/10 MYI 20-30 m
1105	77°19'	25°13'	400		9	7/10 refrozen FYI 2/10 newly frozen fingerrafted ice, grey ice

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-14	Mission No. 17	Page 3 of 3

Attendees: B. Erlingsson, S. Løset, W. Spring

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1110	77°19'	25°13'	400		9	Large floes 0.5 - 2 km Refrozen ridged FYI with large ridges (BB) 2-3 m
1115	77°03'	25°34'	400		9	FYI floe 1- 2 km wide refrozen FYI, grey ice Polar bear tracks
1120	76°56'	25°39'	400			MYI in the leads Visibility ~ 25 km (SB)
1123	76°54'	25°40'	400		8	BB + small IB MYI in the leads grey 4/10 newly frozen fingerrafted ice
1125	76°49'	25°45'	400			Open water large lead > 10 km wide passes south Visib. best on east side of Hopen
1126	76°44'	25°48'	400			BB 0 - 3 m freeboard broken ice field 4/10 FYI 10 - 20 m 4/10 slush grey ice
	76°40'	25°48'	400			IB #13, tabular, deployed PTT 1788, FB 13 - 18 m, 60 x 80 m^2
1200	76°38'	25°44'	600			Cluster of 3 IB: 2 tilted/sloping 1 tabular
1201	76°32'	25°44'	600			Visibility poor
1205	76°24'	26°04'	1000			Big lead ahead
1210	76°20'	26°10'	800		8	6/10 Newly frozen fingerrafted ice, ice, thin ice, open water. 2/10 FYI
1215	76°13'	26°15'	600 400		9	Visibility poor 1/10 grey ice (FYI) 8/10 FYI

FLIGHT PLAN

HELICOPTER MISSION # 18

Date: 1989-04-14

START WHEN VISIBILITY IMPROVES

WP1	LANCE	N76°07'	E26°09'	
WP2	ICEBERG E. HOPEN	N76°40'	E25°48'	34 nm
	FINISH DEPLOYMENT			
WP3	ICEBERG W. HOPEN	N76°40'	E24°56'	13 nm
WP4	S. HOPEN	N76°26'	E24°55'	13 nm
WP5	LANCE	N76°07'	E26°09'	27 nm
				87 nm

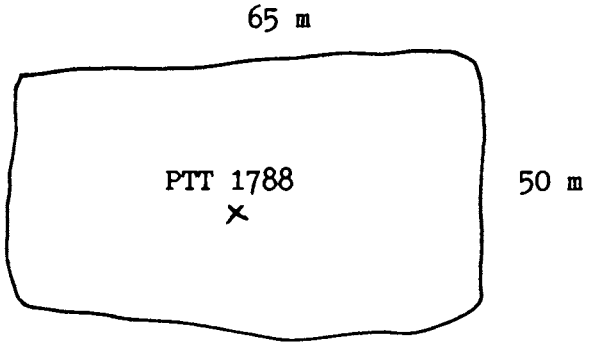
Objective: 1. DEPLOY BUOY W OF HOPEN
2. FINISH DEPLOYMENT E OF HOPEN

Personnel: H. Jensen
T. Vinje
P.E. Bjerke
L. Dalsgaard

I C E B E R G # 13

Horizontal, hard glossy surface.

Freeboard 14 m.



IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-14	Mission No. 18	Page 1 of 1

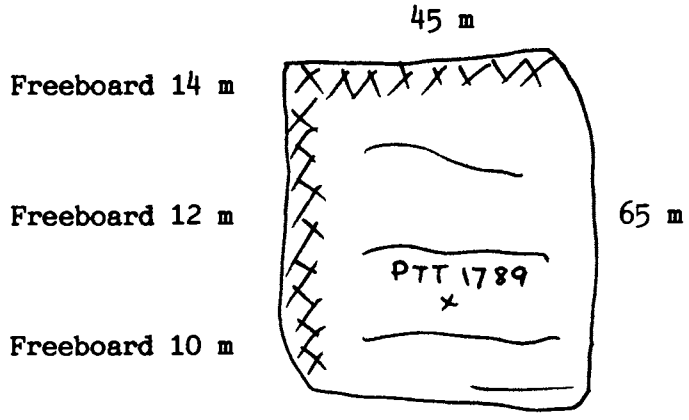
Attendees: H. Jensen, T. Vinje, P.E. Bjerke

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1458	76°28'	28°21'	350			
1500						Small IB (SB) towards Hopen Radio.
1500						Several small IB in the landfast ice Flying along the edge of the land-fast ice east of Hopen.
	76°40'	25°48'				Finish deployment of PTT 1788 before going W of Hopen.
1530	76°41'	25°08'	1000			Passing IB, 80 x 30 m, before the target IB H78
1540	76°40'	24°56'	500			On the target IB. The iceberg is divided into two pieces. H56, H57 Chose the largest one, but reconsidered due to lots of cracks.
1542	76°41'	25°08'				Returning to IB (passed at 1530).
1620						Heading for Lance. PTT 1789 is not deployed, due to technical problems.

I C E B E R # 14

Sloping, hard glossy surface with 2-3 m high ridges of sea ice along the eastern and northern rims.

Numerous refrozen cracks.



FLIGHT PLAN

HELICOPTER MISSION # 19

SAME ICEBERGS AS MISSION #18.

Date: 1989-04-14

Objective: 1. RADAR PROFILING ICEBERG #13
2. DEPLOYMENT BUOY ON ICEBERG #14

Personnel: H. Jensen
S. Løset
B. Erlingsson
S.E. Hamran

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1724						Take off Lance. Goes to Iceberg #13 NE of Hopen to radar profile.
1752	76°40'	25°48'				Left Hamran and Erlingsson on Iceberg #13.
1800	76°41'	25°08'				On Iceberg #14 to install PTT 1789.
1845	76°41'	25°08'				Finished deployment.
1855	76°40'	25°48'				Hamran and Erlingsson on board. Go back to Lance.

FLIGHT PLAN

HELICOPTER MISSION # 20

Date: 1989-04-15

Start: 1300	WP1	LANCE	N75°12' E21°24'	
	WP2		N75°00' E18°20'	44 nm
	WP3		N75°10' E18°20'	10 nm
	WP4		N75°10' E20°30'	33 nm
	WP5		N75°20' E20°30'	10 nm
	WP6		N75°20' E18°35'	29 nm
	WP7		N75°30' E19°05'	13 nm
	WP8		N75°30' E21°40'	40 nm
	WP9	LANCE		23 nm
				202 nm

Objective: Ice reconnaissance

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-15	Mission No. 20	Page 1 of 3

Attendees: T. Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1306	75°12'	21°24'	600	90		Take off Lance. Visibility 10 km
1316	75°12'	21°29'	600	90	9	2 IB 30 x 40 m Tabular #5, H3 20 x 20 m Wavy surface #6, H4 5/10 < 10 m across, 4/10 grease ice Medium FYI
1324	75°22'	21°27'	600	90	9	1 IB 50 x 30 x 10 m H79
1329					9	WP8, Sunshine
1330	75°30'	21°20'			9	5/10 < 20 m 4/10 ice cakes Medium FYI
1335	75°30'	20°43'			7	4/10 < 20 m 3/10 ice cakes
1340	75°30'	20°00'			3	3/10 < 20 m
1345	75°30'	19°48			6	4/10 Medium FYI, 20 - 100 m 1/10 MY 50 m 1/10 ice cakes
1350					8	4/10 Medium FYI, 20 - 100 m 1/10 MY 50 m 3/10 ice cakes
1355	75°30'	19°06'	600	90		BB 10 x 5 m WP7
1358	75°28'	18°57'	600	90	4	Ice cakes
1400	75°25'	18°44'				Ice edge
1403					0	No ice
1409						Ice edge

IDAP 89

HELICOPTER FLIGHTS

Date: 1989-04-15	Mission No. 20	Page 2 of 3

Attendees: T. Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1412	75°17'	19°27'			9	8/10 medium FYI of which 4/10 20 - 50 m, 4/10 ice cakes 1/10 MY 50 m
1415	75°17'	19°43'			9	1 BB 30 x 30 m FB: 0 - 5 m
1417	75°17'	19°58'	600	90	9	6/10 medium FYI 20 - 50 m 1/10 MY 50 m 3/10 thin W
1421	75°20'	20°31'	600	90	9	1 IB 50 x 50 m FB: 15 m H80
1422	75°20'	20°30'	600	90	9	WP5
1427	75°10'	20°32'	600	90	9	6/10 thin W 3/10 medium FYI 20 - 50 m WP4
1430	75°10'	20°06'	600	90	9	8/10 thin W < 20 m 1/10 ice cakes medium FYI
1435			600	90	9	As above
1438	75°11'	19°22'			9	1 BB 20 x 20 x 3 m
1440	75°12'	19°07'			9	6/10 medium to thick FYI < 50 m 1/10 MYI 3/10 ice cakes
	75°12'	18°49'			9	1 triangular tabular IB H81 65 m sides FB: 5 - 7 m, IB #17 Later: Buoy 1790 deployed here
			600	90	9	1 IB 40 x 30 x 6 m H82 1 BB 40 x 30 x 4 m H83
1445	75°12'	18°41'	600	90	9	1 tabular IB 20 x 30 x 8 m H84 Ice edge

IDAP 89

HELICOPTER FLIGHTS

Date: 1988-04-14	Mission No. 20	Page 3 of 3

Attendees: T. Vinje

Time (loc	POSITION N	POSITION E	Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
1450	75°10'	18°20'	600	90	0	No ice
1500	75°02'	19°46'	600	90		IB 70 x 70 x 15 m H85 Ice edge
1505	75°03'	20°12'	600	90	9	4/10 medium FYI < 20 m 5/10 ice cakes
1515	75°05'	20°59'	600	90	9	3 tabular, tilting IB 70 x 70 x 7 m IB #2,3,4
	75°08'	21°13'	600	90	9	1 tabular IB, tilting 50 x 50 x 12 m, IB #16
1520	75°11'	21°20'			9	Landed on Lance.

FLIGHT PLAN

HELICOPTER MISSION # 21

Date: 1989-04-15

Start: 1615	WP1	LANCE	N75°13' E21°25'	
	WP2	ICEBERG	N75°12' E18°45	
		TABULAR BERG 70 x 70 m freeboard 12 m		41 nm
		TRIANGULAR		
	WP3	LANCE	N75°13' E21°25'	41 nm
				82 nm

Back at LANCE 1735

Objective: Buoy deployment

IDAP 89

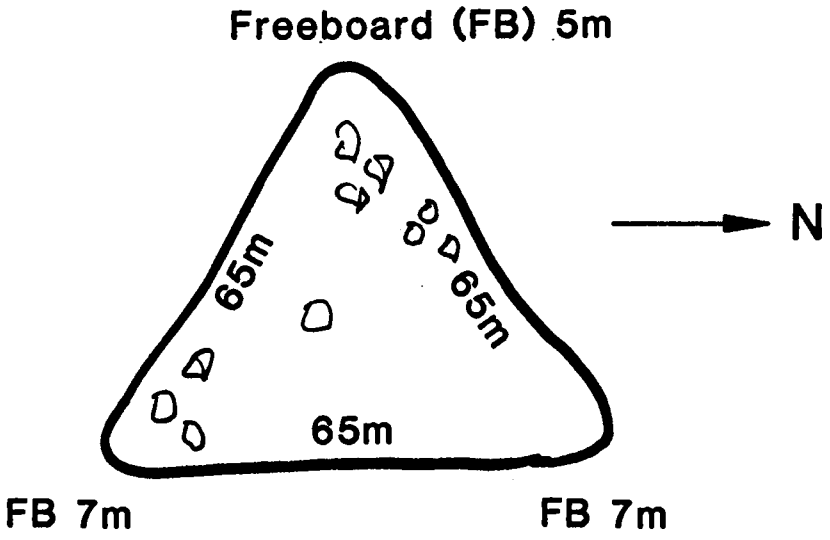
HELICOPTER FLIGHTS

Date: 1989-04-15	Mission No. 21	Page 1 of 1

Attendees: B. Erlingsson, A. Kjelaas, S. Rasmussen, E. Mellbye

Time (loc	POSITION		Altitude (feet)	Speed (knt)	Ice conc #/10	Remarks
	N	E				
1613	75°12'	21°12'	350	90	9	Take off Lance
1640	75°11'	18°50'	350	90	9	Landed on IB #17 Deployed PTT 1790
1705			350	90	9	Take off IB #17 Circled and took photos.
1730	74°56'	21°20'	350	90	9	Landed on Lance.

ICEBERG # 17



A P P E N D I X B

Expedition members

R/V LANCE DEPLOYMENT SURVEY 7 - 17 APRIL 1989

EXPEDITION MEMBERS

NAME	COMPANY/INSTITUTION	PROFESSION
Amundsen, Arild	Lufttransport A/S	Flight Engineer
Bjerke, Per Erik	STATOIL	Oceanographer
Dalsgaard, Leif	Norwegian Petroleum Directorate	Civil Engineer
Erlingsson, Bjørn	NP	Scientist
Grant, Colin	BP Petroleum Development Ltd.	Oceanographer
Hamran, Svein-Erik	NTNF (The Royal Norwegian Council for Scientific and Industrial Research)	
Hustad, Knut	Lufttransport A/S	Pilot
Jensen, Hans	NHL	Research Engineer
Kjelaas, Anton G.	Saga Petroleum	
Kleiven, Gudmund	Norsk Hydro A/S	Marine Technology
Løset, Sveinung	NHL	Research Engineer
Mellbye, Ellinor	STATOIL	Civil Engineer
Mørland, Morten	Norsk Hydro A/S	Marine Technology
Rasmussen, Stein R.	Elf Aquitaine Norge A/S	Structural Engineer
Spring, Walter	Mobil Research & Dev. Corp.	Arctic Engineer
Vinje, Torgny	NP	Scientist