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Evaluation of arctic ice-free land sites Kronprins Christian Land and Peary Land, North Greenland 1960

William E. Davies
Daniel B. Krinsley

May 1961

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GEOPHYSICS RESEARCH DIRECTORATE
AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
OFFICE OF AEROSPACE RESEARCH
UNITED STATES AIR FORCE
BEDFORD, MASSACHUSETTS

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EVALUATION OF ARCTIC ICE-FREE LAND SITES

KRONPRINS CHRISTIAN LAND AND PEARY LAND, NORTH GREENLAND
1960

William E. Davies*
Daniel B. Krinsley*

June 1961

Project 7628
Task 76284

*U.S. Geological Survey

Terrestrial Sciences Laboratory
GEOPHYSICS RESEARCH DIRECTORATE
AIR FORCE CAMBRIDGE RESEARCH LABORATORIES
AIR FORCE RESEARCH DIVISION (ARDC)
UNITED STATES AIR FORCE
Bedford, Massachusetts

FOREWORD

The field investigations of North Greenland sites in 1960 were undertaken by the U.S. Geological Survey for the Air Force Cambridge Research Laboratories in cooperation with the U.S. Army Transportation Environmental Operations Group who furnished helicopter support. The sites investigated are at Blaasø, Kap Renaissance, Herlufsholm Strand, Kap Wyckoff, Skagen, Kap Ole Chiewitz, Kap Morris Jesup, and Slusen-Midsommersø. Members of the party were: William E. Davies, U.S. Geological Survey, Leader; Daniel B. Krinsley, U.S. Geological Survey, geologist; Eigil Knuth, archeologist and Danish scientific representative.

ABSTRACT

This is a report of terrain investigations conducted in North Greenland, in June and July 1960, for the purpose of locating potential airfield sites. Eight sites were studied; all require a small amount of grading to make a 5000-ft (1500-m) runway. In addition the Brønlund Fjord airfield, site of a test landing on a natural surface in 1957, was re-examined and the the east half of the runway was found unusable at the time of visit because of late snow melt and poor drainage.

Scientific observations, as part of the program, showed that northern Peary Land was covered only by valley glaciers during the last glacial period and that an extensive marine invasion which deposited marine and related lacustrine silt occurred when the ice retreated about 6000 years ago. This was followed by a readvance of glaciers down major fjords and subsequent retreat to present ice fronts.

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1. INTRODUCTION

1.1 Operation

In 1951 a study of airfield sites in North Greenland was initiated by the U.S. Geological Survey. Based on the findings of this study Station Nord was established in northeastern Greenland. A number of sites in addition to the site at Nord were identified from aerial photographs. In August 1956 an attempt was made to field-check these sites using an amphibious aircraft (SA-16), but fog and stormy weather limited the work to a reconnaissance by air along Herlufsholm Strand and the north coast of Peary Land to Bliss Bugt. This work and subsequent investigations were a part of the Air Force Cambridge Research Laboratories' (AFCRL) Ice-Free Land Program. A projected field study in 1959 was canceled because of lack of aircraft support. However caches of food and fuel, totaling over 100,000 lbs, were air-dropped at nine points in northern and northeastern Greenland and were utilized in the field operations in 1960.

Field work in 1960 was done in June and July using two H-34 helicopters of the U.S. Army Transportation Environmental Operations Group (TREOG) as the primary means of transport. Operations were centered around Centrum Sø at the AFCRL camp from 14 June to 2 July (Fig. 1). During this period field checks were made of the area from Danmark Fjord, Ingolf Fjord, Rivieradal, and Blaasø to the ice cap at Kap George Cohn. On 2 July operations were extended along Norsemandal to Kap Renaissance and Nord; on 4-5 July the area around Kap Rasmussen and Herlufsholm Strand was investigated; and on 6 July the north coast of Peary Land to Kap Morris Jesup was covered. On 8 July operations were centered around Brønlund Fjord and Midsommersøer. Field work was completed on 11 July when the helicopters returned to the TREOG sledge train on the ice cap near Walcott Land. Return to Thule was by helicopter across the ice cap on 14 July.

1.2 Scientific Work

The main emphasis of investigations of sites for unprepared emergency airfields is on the study of unconsolidated surface deposits and related ground features. Since 1956 such studies in northern Greenland have yielded data on glacial geology and geomorphology. Although the scientific analysis of data and samples collected in this work is

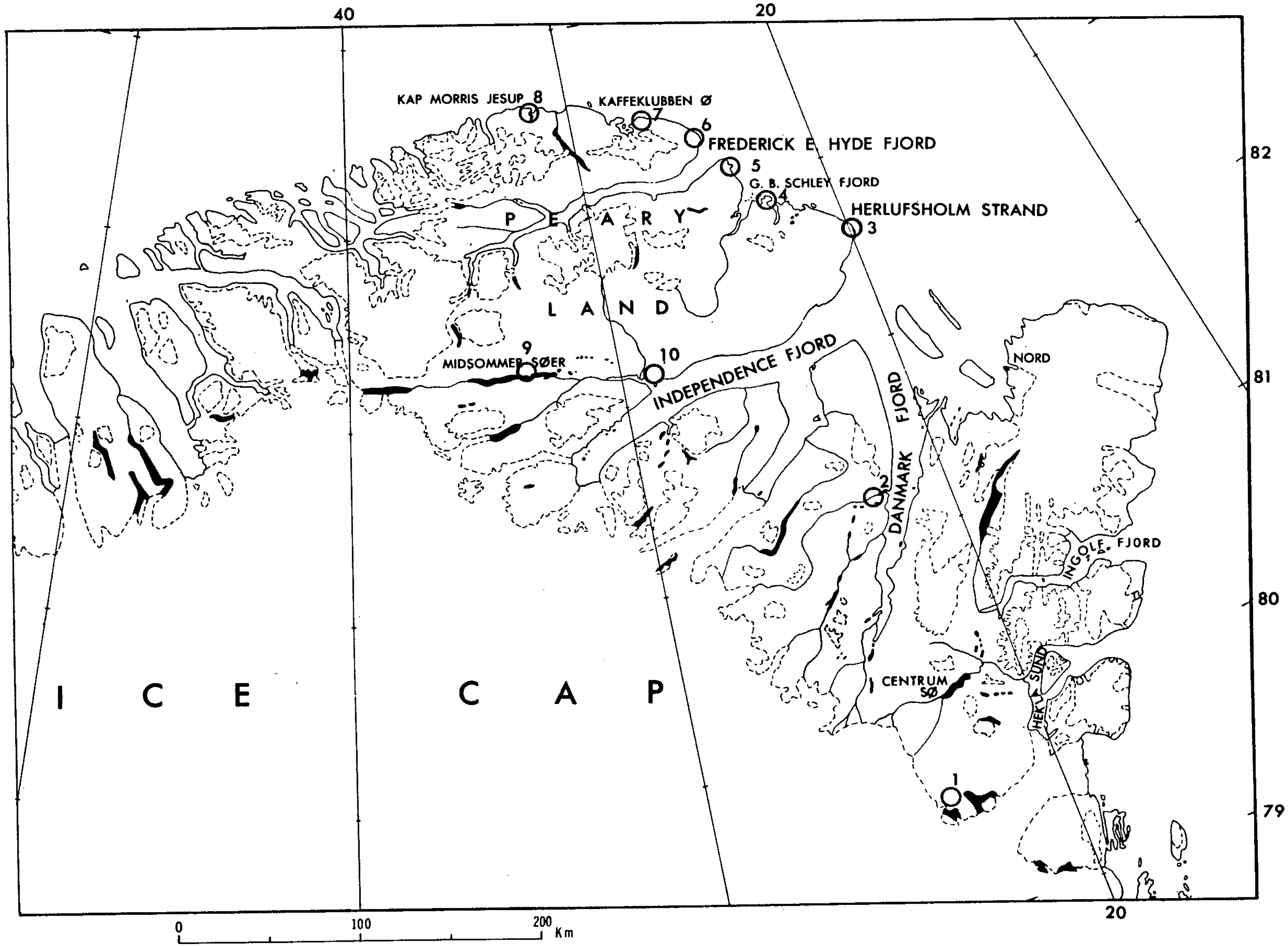

Figure 1. North Greenland. Sites studied are shown by circle and number. 1) Blaasø, 2) Kap Renaissance, 3) Herlufsholm Strand, 4) Kap Wyckoff, 5) Skagen, 6) Kap Ole Chiewitz, 7) Bliss Bugt, 8) Kap Morris Jesup, 9) Slusen-Midsommersøer, 10) Brønlund Fjord.

still underway the following outline of glacial sequence in northern Greenland has been established:

a. Wisconsin glaciation covered all of northeastern Greenland with a continental ice sheet centered in central Greenland. This ice sheet extended to the Independence Fjord area north of Mudder Bugt and across the plateau parallel and slightly inland from Independence Fjord. Other ice centers were near the head of J. P. Koch Fjord where the ice extended across the plateau between Independence Fjord and Frederick E. Hyde Fjord and down the latter fjord.

Peary Land, north of Frederick E. Hyde Fjord, was the source of a small ice cap with glaciation confined mainly to valley glaciers that extended to the sea at numerous points.

Along the coast from Herlufsholm Strand to Sand Fjord, 6 miles (10 km) west of Kap Morris Jesup, glacial and related deposits are on a bedrock bench. This bench is about 2 miles (3.2 km) wide at Kap Morris Jesup, and 4 miles (6.4 km) wide at Kap Ole Chiewitz and Herlufsholm Strand. It is a result of pre-Pleistocene planation. The overall slope is from northwest to southeast. At Kap Morris Jesup the bench is at an altitude of 335 ft (102 m); at Kap Ole Chiewitz, 240 ft (73 m); and at Kap Rasmussen, sea level or below.

b. Withdrawal of the ice sheet accompanied by marine submergence to a relative depth as much as 225 ft (68 m). During submergence marine silt was deposited in coastal areas, and lacustrine silt was deposited along major valleys that were occupied in part by stagnant tongues of ice. This submergence occurred about 5400 years ago, based on radiocarbon dating of shells. Following the deposition of the clay, extensive kame terraces were laid down in the valleys.

c. Readvance of ice tongues along major fjords. Radiocarbon dates indicate that this event occurred about 3700 years ago.

d. Retreat of glaciers to their present position.

Pebble counts made throughout Peary Land indicate that the area from Frederick E. Hyde Fjord to Sand Fjord was not covered by continental ice but only by valley glaciers.

Caves discovered and studied in an area 12 miles (20 km) north of Centrum Sø contained deposits older than the last glacial period. As such, these are the first interglacial deposits observed in northern Greenland.

Permafrost features in the form of polygons in bedrock were studied at Brønlund Fjord, and depth to permafrost was measured at points throughout Peary Land. These measurements indicate that the active zone is about 24 to 30 inches (60 to 75 cm) through most of the area.

1.3 Items of Interest

Cairns left by previous expeditions were examined at Kap Wyckoff and Kap Morris Jesup (Fig. 2); all were in good condition. Notes left in these cairns by Knuth and Fränkl were left undisturbed and additional notes were placed in the cairns by members of the party.

2. GEOLOGY

2.1 General

The rocks in North and Northeast Greenland can be divided into three distinct zones: (a) the flat-lying sedimentary rocks of the interior, (b) the folded rocks along the east coast, and (c) the folded rocks of the north coast of Peary Land.

2.2 Topography

The interior part of the area, primarily south of Frederick E. Hyde Fjord and west of Vandredalen, is a dissected plateau. The flat upland, at an altitude of 2000 to 3500 ft (610 to 1066 m), is cut into a series of mesa-like blocks by broad, flat-floored, glaciated valleys (Fig. 3). The coastline along fjords that cut into the plateau is steep; coastal flats are developed only were large rivers empty into the fjords.

The eastern coastal area consists of alpine mountains as much as 6000 ft (1830 m) in altitude (Fig. 4). The mountains are cut by numerous valley glaciers and the upland is cut into a series of sharp peaks. This mountain belt is 40 to 60 miles (64 to 96 km) wide, extending northwards to near Station Nord.

The mountain area in northern Peary Land covers a zone 20 to 45 miles (32 to 72 km) wide. Peaks rise to 6300 ft (1920 m) altitude. The mountains are cut by numerous valley glaciers; and the upland consists of ridges culminating at a few points in low peaks. In general the ridges are rounded with long smooth slopes.

Figure 2. Cairn at Kap Morris Jesup, 6 July 1960.

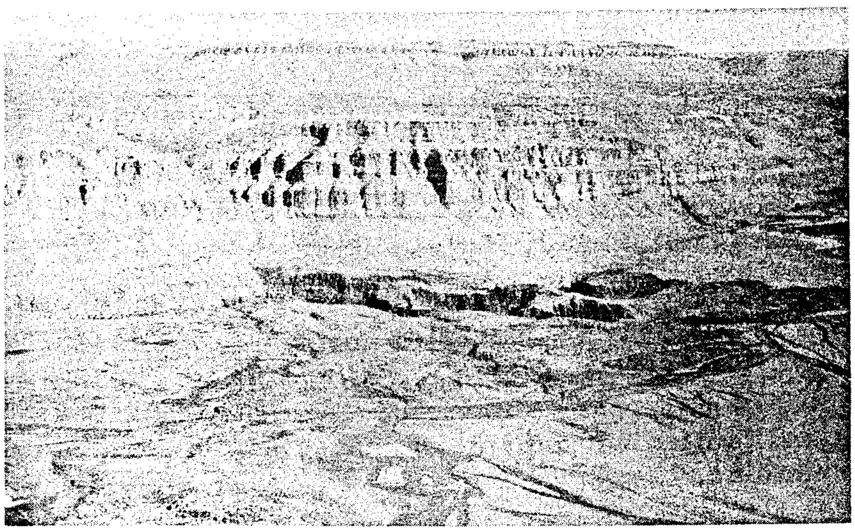

Figure 3. Dissected plateau, Wandel Dal, 4 miles (6.4 km) west of Midsommersøer, view northeast, 11 July 1960.

Figure 4. View north from Kap Ole Chiewitz showing the alpine mountains and coastal plain on the north side of Peary Land, 6 July 1960.

Along the coast of Peary Land and to a lesser extent along the east coast are areas of broad lowlands. The surface of the lowlands is flat to rolling and is interrupted by morainal ridges and raised beaches. Relief on the lowlands is 3 to 20 ft (1 to 6 m).

2.3 Bedrock Geology

The non-folded rocks that make up the area south of Frederick E. Hyde Fjord and west of Vandredalen consist of sandstones and quartzite at the base overlain by limestones. The sandstones and quartzite are late Precambrian in age and are estimated to be about 1300 ft (400 m) thick. The limestones are Cambrian to Silurian in age and are estimated to be over 3000 ft (915 m) thick. In the mountainous area bordering Herlufsholm Strand is a complex of rocks of Silurian, Carboniferous, and Cretaceous age. The rocks are faulted and slightly folded.

In northern Peary Land the mountains are formed of metamorphic and igneous rocks. The types of rocks include gneiss, schist, marble, and granite; and the type varies considerably from area to area. The rocks are intensely folded and the overall dip is to the south. These rocks are separated from less intensely folded rocks to the south by a fault along the south side of the eastern part of Frederick E. Hyde Fjord.

The east coast mountains also are formed of metamorphic and igneous rocks. Marble, gneiss, quartzite, and granite dominate. The rocks are folded and faulted but metamorphism is not as strong as in the Peary Land mountains.

2.4 Surficial Deposits

Unconsolidated glacial and alluvial materials mantle much of the bedrock of North and Northeast Greenland. Poorly sorted glacial till covers much of the upland. In the valleys there are extensive deposits of clay-silt and kame gravels. The clay-silt is present in the valley of Saefaxi Elv from Centrum Sø to Hekla Sund, south of Ingolf Fjord, the lower part of Zig-Zag Dal, and in Midsommer Dal. The silt is as much as 200 ft (60 m) in thickness and is gray to red in color. In coastal areas the clay-silt grades into a gray marine silt with shells.

Kame terraces are extensive in Wandel Dal and connecting valleys, and in Vandredalen where they overlie the clay-silt beds.

Glacial moraine in the form of complex ridges covers a large area north of Mudder Bugt, on Herlufsholm Strand, and on the coastal flat between Bliss Bugt and Constable Bugt. The moraine is mainly poorly sorted silty gravel.

Raised beaches are common along most of the coast of northern and northeastern Greenland. At least 14 levels have been measured as much as 300 ft (91 m) above present sea level. The beaches consist of well-sorted gravel in a sand matrix. Most of the beaches are of short length and narrow width. The largest raised beaches are at Nord, Brønlund Fjord, 7 miles (11 km) south of Skagen, K. Viborg, Kap Morris Jesup, Kap Wyckoff, and along Herlufsholm Strand.

Areas of drifted sand occur at Kap Renaissance on the Sjaellands-sletten, on the Skjoldungelv west of Fyns Sø, and along Saefaxi Elv west of Centrum Sø. The drifted sand is fine-grained and generally forms a plain with scattered low dunes.

3. METEOROLOGY

3.1 General

Meteorological data in North Greenland are scarce. Systematic observations have been conducted at only one station -- Nord. Observations at Nord extend back to 1952. Observations were made at Brønlund Fjord from August 1948 to August 1950 by the Danish Peary Land Expedition (Eigil Knuth, Leader).

The climate of North Greenland is in two distinct zones. The coastal areas from Bliss Bugt southwards and the outer parts of Danmark and Independence Fjords are subhumid in type. The climate inland from this is arid.

The records (Table 1) from Station Nord typify the subhumid area while those from Brønlund Fjord are typical of the arid zone.

4. AIRFIELD SITES

4.1 Blaasø

The Blaasø site was identified by George E. Stoertz, U.S. Geological Survey, while examining aerial photographs for sites on the east coast of Greenland. On 14 June 1960, S. M. Needleman (AFCRL) and D. B. Krinsley (USGS) examined the site on the ground, conducted preliminary tests on bearing strengths, and determined soil profile by random sampling at scattered locations.

Map reference -- Greenland 1:250,000 AMS C501, sheet NT 25, 26, 27, 28-2, 1952.

Aerial photo reference -- USAF 7P14-M88-377 LT

Table 1. Comparison of Nord and Brønlund Fjord

	Nord	Brønlund Fjord
Annual absolute maximum temperature	61	64
Annual mean daily maximum temperature	9	8
Annual mean temperature (°F)	3	4
Annual mean daily minimum temperature	-3	1
Annual absolute minimum temperature	-60	-45
Annual mean precipitation (inches)	15.1	2.3
Annual mean number of days with precipitation	175	68
Annual mean days with snowfall*	n a	56
Annual mean relative humidity (percent)	83	72
Annual maximum wind speed and direction	S 36	W 65
Annual mean number of days with gales	n a	105
Annual mean number of clear days**	132	130
Annual mean number of cloudy days***	190	120
Annual mean number of days with fog	9	21

* Snowfall greater than a trace
** Cloud cover equal to or less than 3/10
*** Cloud cover equal to or greater than 8/10
n a Not available

Location -- Site is in a broad valley 6 miles (10 km) west of Blaasø. 79°35'N x 23°20'W (Fig. 5).

Landform -- The site is an extensive kame approximately subrectangular in plan and occupying an area of 3 square miles (8 square km). The kame is bounded by steep (60°) ice contact slopes containing kettle lakes or their related drainage 100 ft (30 m) below its surface. The site is 630 ft (184 m) above sea level. The Greenland Ice Cap and its glaciers border the site to the west and south. Blaasø is 6 miles (10 km) to the east, and a broad valley opens to the north. The surface of the kame is subdivided by frost cracks and locally by minor gullies as much as 30 ft (10 m) in width and 3 ft (1 m) in depth (Fig. 6).

Soil and drainage -- The surficial material (to 12 inches, 30 cm) is coarse pebble gravel with small cobbles and few fines. Below 12 inches (30 cm) there is coarse to medium sand. Drainage is excellent.

Dimensions and orientation -- There are two possible runway orientations. A 9000-ft (2743-m) runway is oriented N33°W, and a 8400-ft (2560-m) runway is oriented N70°E (Fig. 7).

Approaches -- Approach to the runway oriented N33°W is clear to the northwest but hills rise 1200 ft (365 m), 6000 ft (1828 m) southeast of the site. The approach to the runway oriented N70°E is clear to the northeast, but the Greenland Ice Cap rises 1200 ft (365 m), 6 miles (10 km) west of the site.

Engineering aspects -- Minor grading to fill frost cracks and small gullies on the 9000-ft (2743-m) runway site would require about 2000 cubic yards (1528 cubic meters) of material. A similar amount would be required on the 8400-ft (2560-m) runway site.

Construction materials -- Large quantities of sand and gravel for fill and other purposes are available at the site.

Water supply -- Large quantities of water are available at the site from late May to mid-September. Some of the deeper kettle ponds (more than 7 ft, 2 m, deep) are available for water during the winter.

Conclusions -- Site is well-suited for all light aircraft and special purpose heavy aircraft such as the C-130. Surfacing of the runways and other minimum stabilizing improvements would make the site suitable for large jet aircraft under emergency conditions.

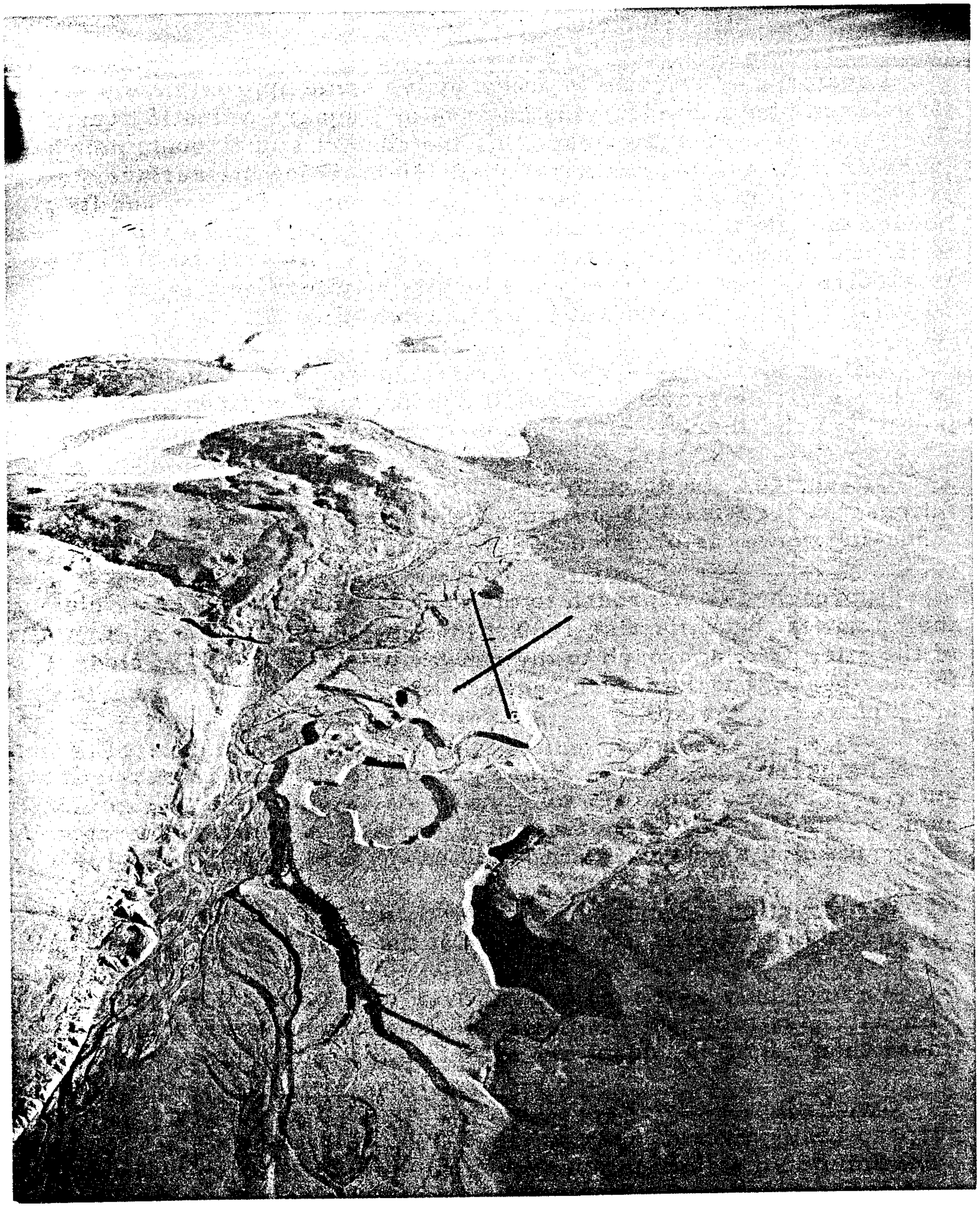

Figure 5. Blaasø site, view west.

Figure 6. Blaasø, view northwest, 14 June 1960.

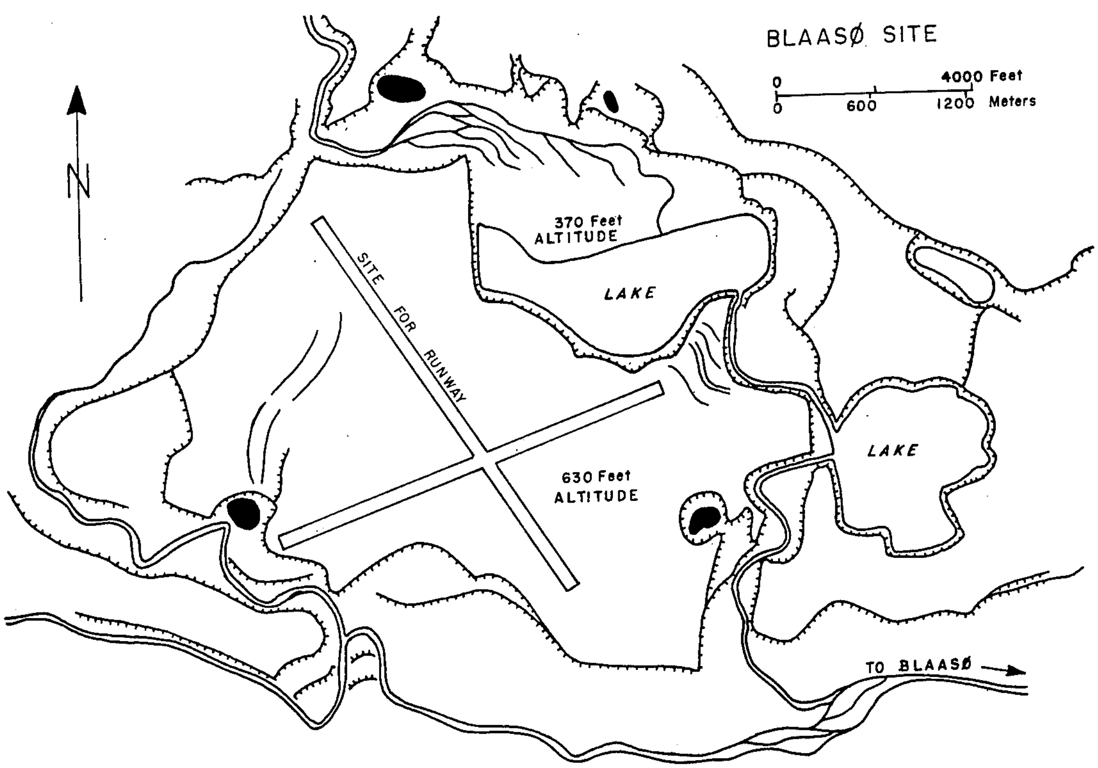

Figure 7. Map of Blaasø site.

4.2 Kap Renaissance

This site had been previously identified on aerial photos and its characteristics were determined by photogeologic methods.

Map reference -- Greenland 1:100,000 AMS C621, sheet E, 1952

Aerial photo reference -- USAF 7P13A-M60-260-265 LT, RT, VT
7P13A-M15-258-263 LT, 435-445 RT, V
7P13A-M17-521-530 RT

Location -- The site is on the Sjaellandssletten about 10 miles (17 km) WSW of Kap Renaissance. 81°14'00"N x 24°22'00"W (Fig. 8).

Landform -- The site is near the mouth of a broad valley (Zig-Zag Dal). The valley floor is 1.8 miles (3 km) wide and 3.6 miles (6 km) long. It is at an altitude of 75 to 150 ft (22 to 45 m). The site is bordered on the north and west by a dissected plateau 2400 ft (730 m) high (Fig. 9). The front of the plateau is a scarp in the upper half and a steep talus slope below. To the south and east the site is bounded by low rounded hills rising to a dissected plateau 3000 ft (915 m) high, 3 miles (5 km) south of the site.

The valley near the site is a sand flat with terraces of gravel bordering it. The sand flat is 90 to 120 ft (27 to 36 m) in altitude and is separated from the terraces by small gullies. The terraces are 100 ft (30 m) above the sand plain.

Soil and drainage -- The surface soil is a well-drained, poorly graded, coarse sand (Fig. 10). The upper 6 inches (15 cm) is dry and loose; below this it is damp but weak. At 20 inches (50 cm) the CBR is less than 3. The sand is about 3 to 8 ft (1 to 2 m) thick resting on clay-silt which is exposed in valleys and flats bordering the sand area.

Dimensions and orientation -- The best orientation for a runway is east-west. A length of 12,750 ft (3900 m) with minimum width of 600 ft (182 m) can be utilized without grading (Fig. 11).

Approaches -- With an orientation of N85°W, approach from the east would be via a valley 9000 ft (2750 m) wide, the floor of which is at the same altitude as the site. Approach from the west is marginal via Zig-Zag Dal. Nine miles (15 km) west of the site the approach line intersects the plateau face which rises steeply to 2700 ft (822 m).

Engineering aspects -- The site would require no grading. Stabilization and strengthening of the sand surface would be necessary to prevent excessive rutting. In addition, stabilization is necessary to control

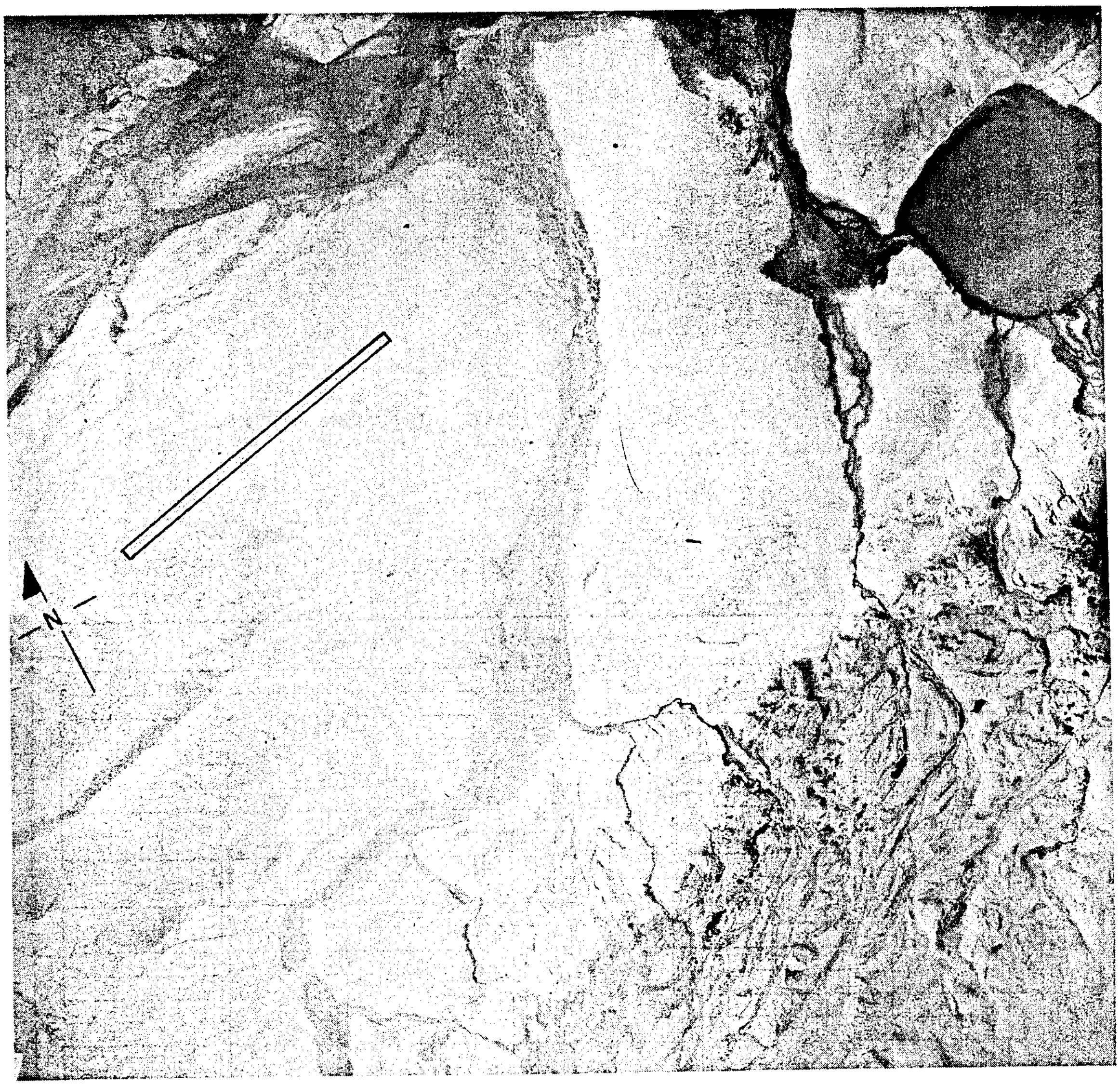

Figure 8. Kap Renaissance site.

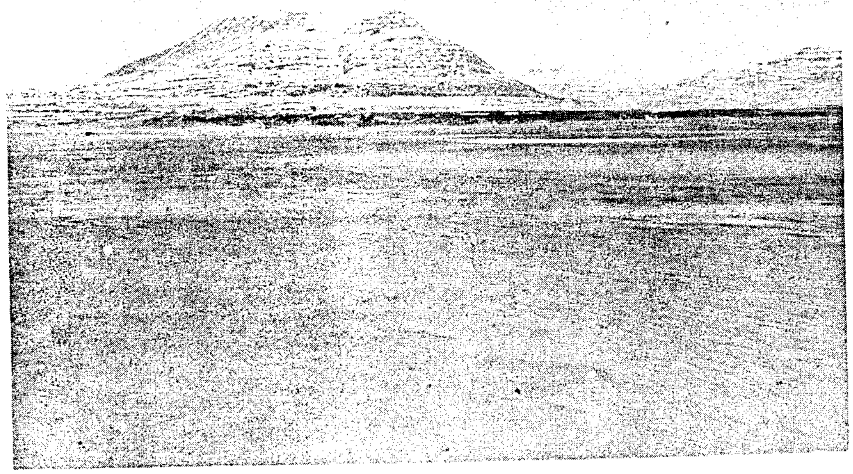

Figure 9. Kap Renaissance site, view west over Sjaellandssletten. 2 July 1960.

GRADATION CURVE — SAND
KAP RENAISSANCE

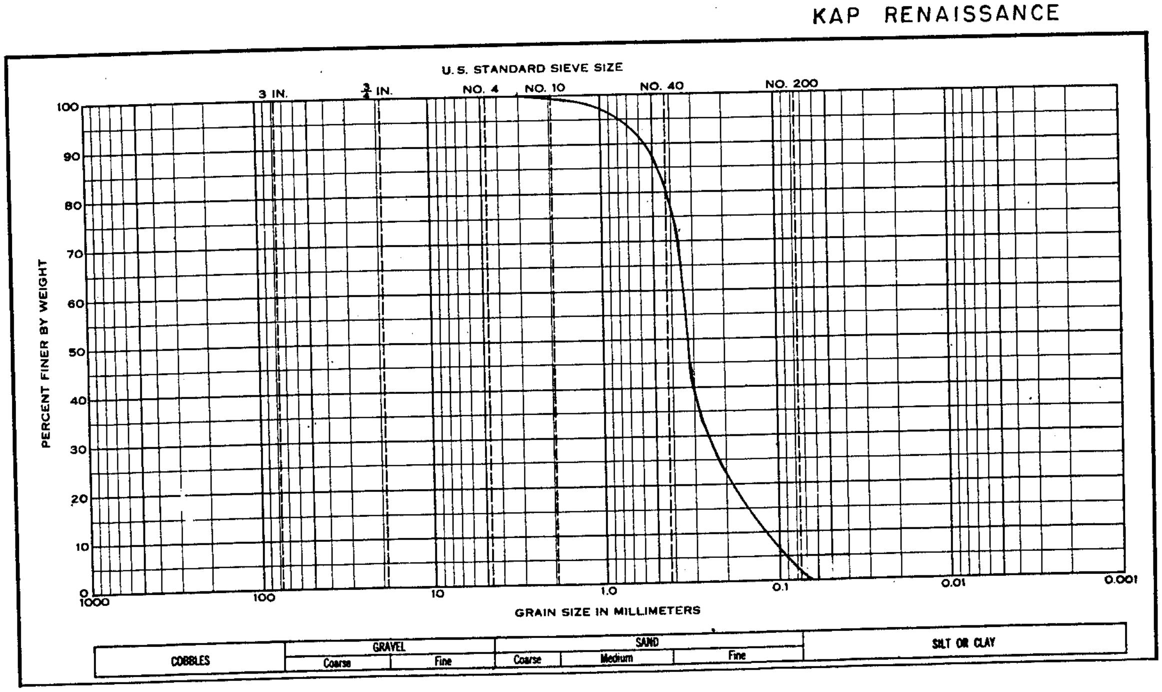

Figure 10. Kap Renaissance site, gradation curve, sand.

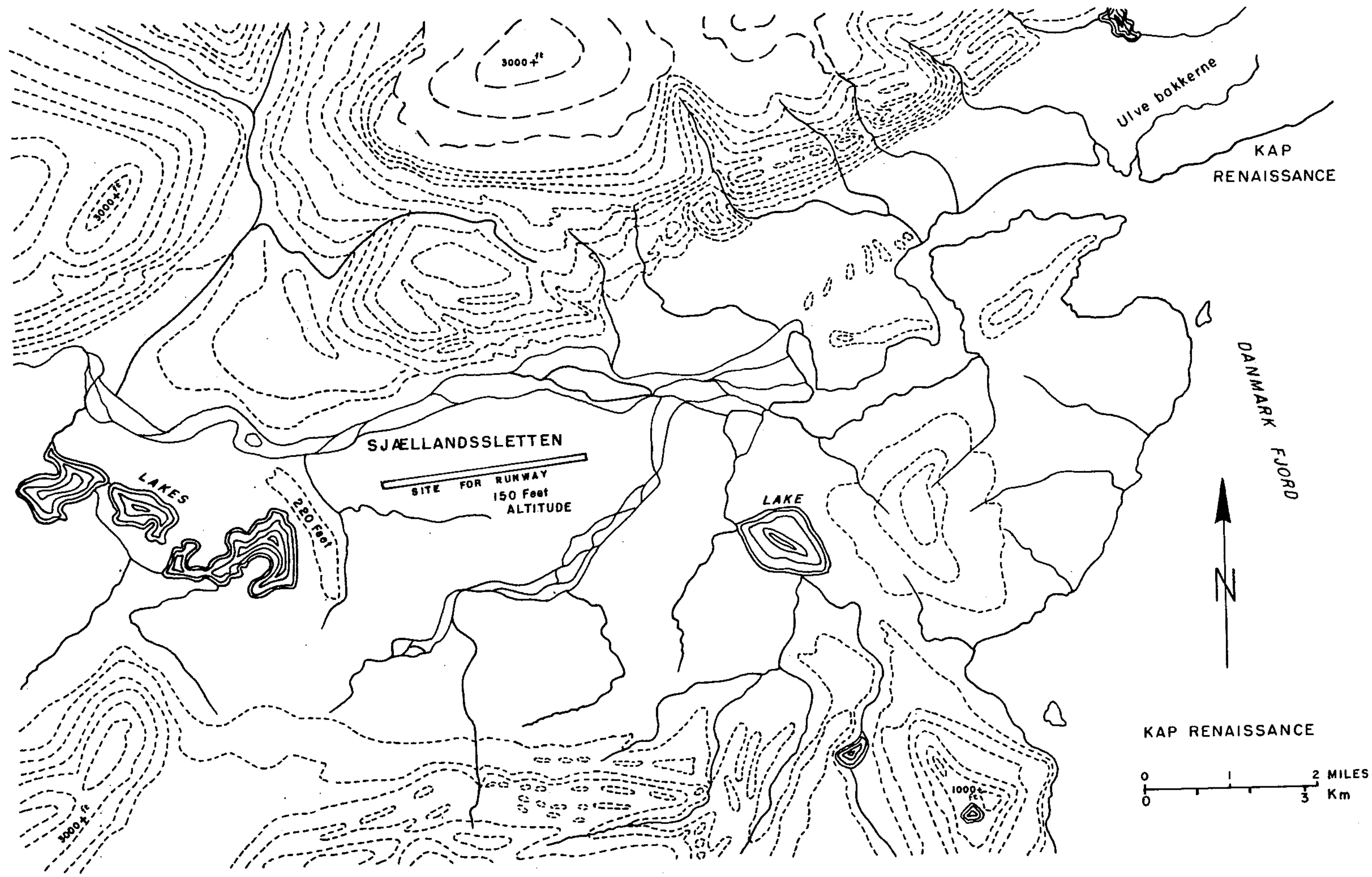

Figure 11. Map of Kap Renaissance site.

drifting sand which is common at the site. Silty clay for use as a binder is abundant adjacent to the sand flat.

Construction materials -- Sand for aggregate is available at the site. Diabase suitable for use as crushed stone is 1 mile (2 km) southwest of the site. Gravel for fill and aggregate is present in large quantities at the west end of the site.

Water supply -- Large quantities of water are available from a deep lake 3000 ft (914 m) west of the site. From June to October large quantities of water are available from the river on the north side of the site. This water, however, is muddy.

Access -- The site can be reached only by air or on foot. Danmark Fjord generally is free of ice in the vicinity of Kap Renaissance during August. Surface vessels, however, are blocked by heavy ice along the east coast of Greenland and cannot reach the open water in the fjord.

Conclusions -- Because of the low bearing strength of the sand, there is doubt that it will support heavy aircraft. If surfacing material is added to strengthen the sand, a long runway with fair to good approaches would be well-suited for use by all types of aircraft.

4.3 Herlufsholm Strand

This site was identified from aerial photography and its characteristics were based on photogeology studies.

Map reference -- Greenland 1:250,000 AMS C501, sheet NU 25, 26, 27, 28, 29, 30-6, 1957

Aerial photo reference -- USAF 7P13A-M16-479 LT, 477-478 VT

Location -- There are two sites, one 8 miles (13 km) northwest of Kap Eiler Rasmussen, the second on the coast 4 miles (6 km) north of Kap Eiler Rasmussen at Kølnaes (Figs. 12 and 13).

Landform -- The sites are on a coastal plain 6 to 8 miles (10 to 13 km) wide that extends 20 miles (32 km) northeast from Independence Fjord. The plain slopes gently from the Arctic Ocean southwards to the foot of the mountains where it is about 300 ft (91 m) high. Prominent terraces and moraines as much as 330 ft (100 m) in altitude occur over most of the strand. The site near Kølnaes is on a beach about 3 ft (1 m) above sea level. The other site is on a terrace at the base of the mountains.

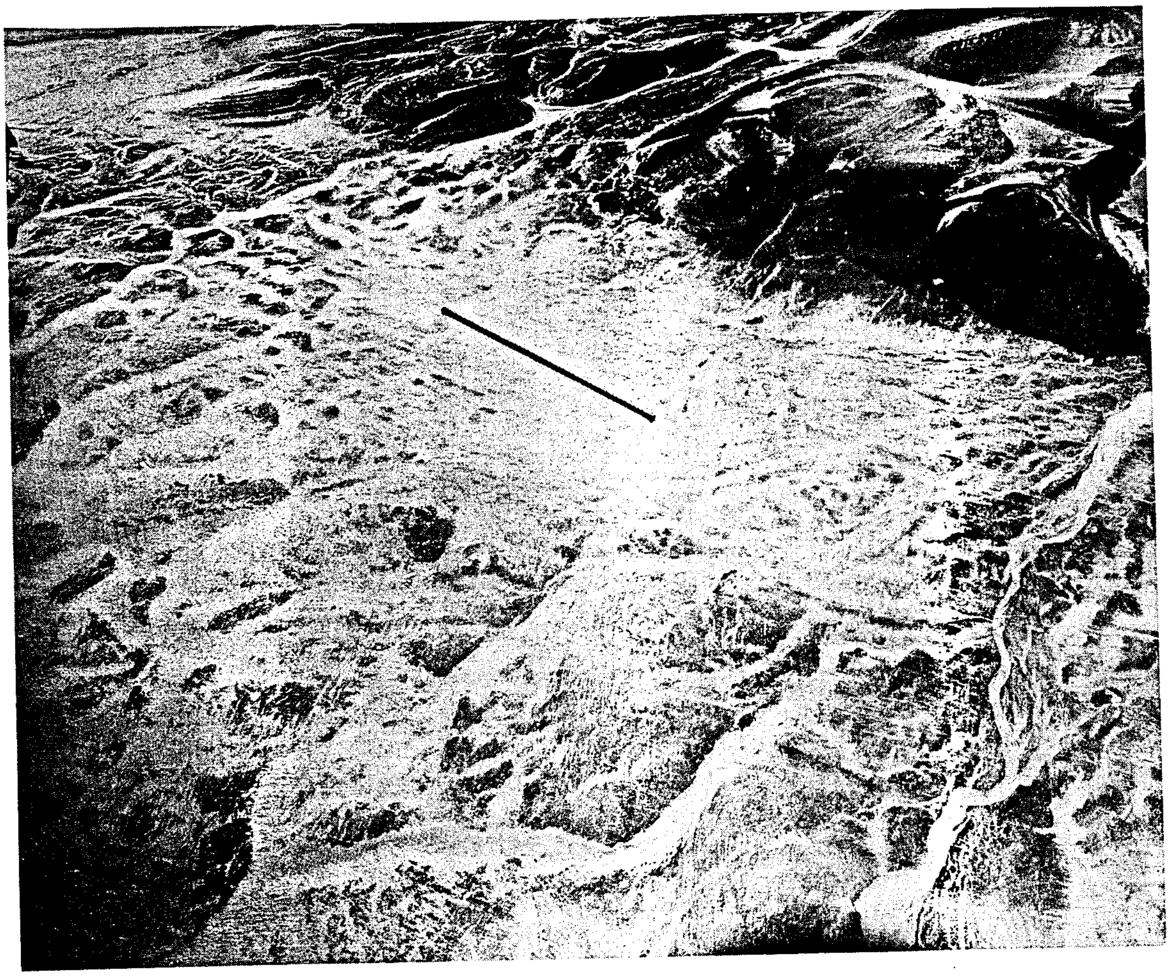

Figure 12. Herlufsholm Strand sites, view west.

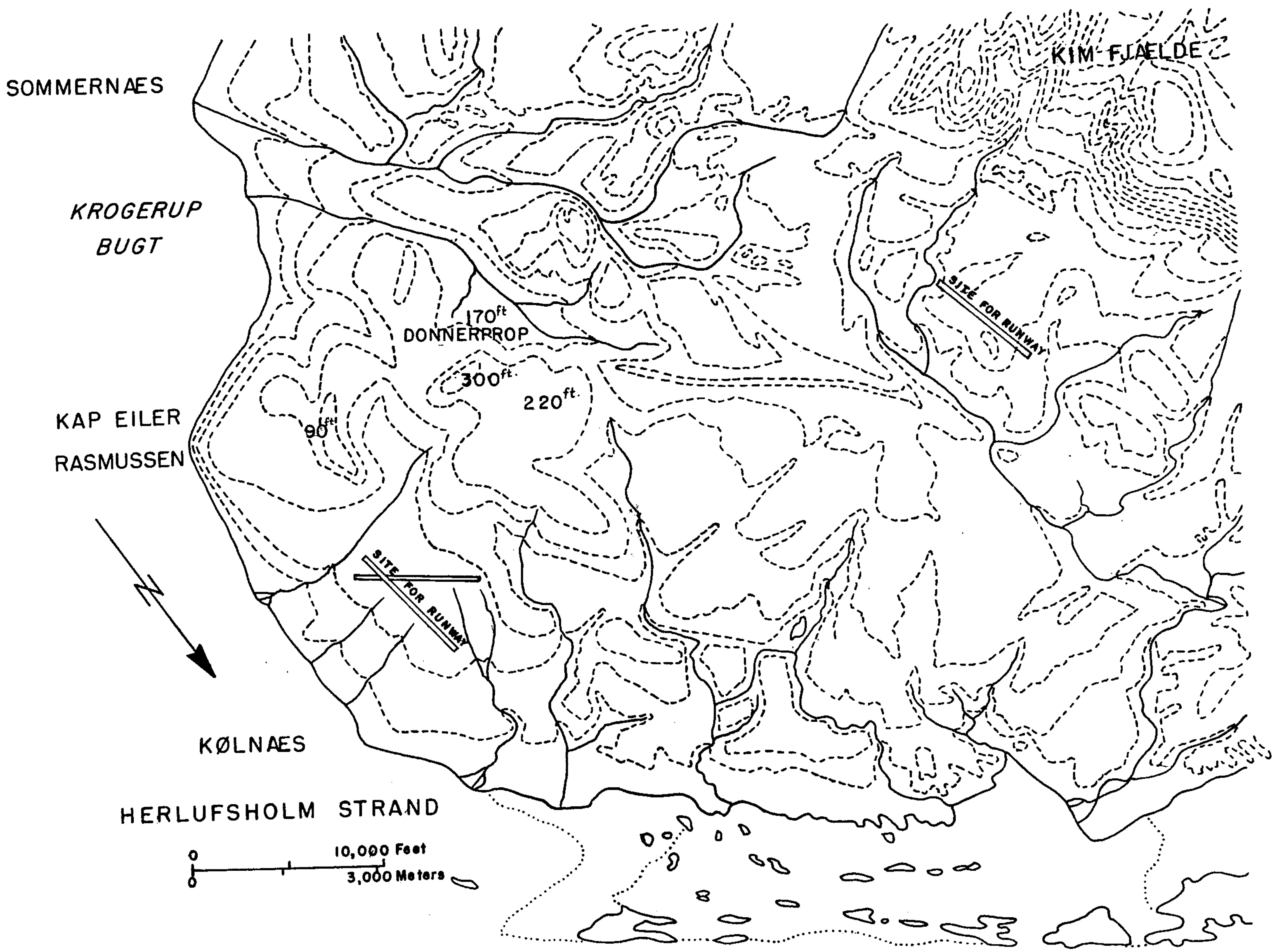

Figure 13. Map of sites at Herlufsholm Strand.

Soil and drainage -- (a) Kølnaes site. The soil is of angular cobble and pebble gravel in a matrix of coarse sand. At the time of visit (4 July) the soil was frozen at a depth of 6 inches (15 cm). Soil was wet and soft in places.

(b) Kim Fjaelde site. This site was covered by deep snow and the soil was not examined in detail. It is probably similar to that at Kølnaes but contains more silt.

Dimensions and orientation -- (a) Kølnaes site. The runway can be 10,500 ft (3200 m) long, 3000 ft (914 m) wide, and oriented north-south; second runway, 5100 ft (1554 m) long, oriented northwest-southeast (Fig. 13).

(b) Kim Fjaelde site. This runway can be 4950 ft (1500 m) long, 180 ft (55 m) wide, and oriented north-south.

Approaches -- (a) Kølnaes site. The approach is clear in all directions.

(b) Kim Fjaelde site. The approach is clear except from the west where mountains 1800 ft (548 m) high are 1.2 miles (2 km) from site.

Engineering aspects -- (a) Kølnaes site. Grading of about 10,000 cubic yards (7645 cubic meters) is necessary to remove shallow gullies and low mounds. Second runway requires moderate grading.

(b) Kim Fjaelde site. No data are available on the extent of grading.

Construction materials -- Sand and gravel are available at both sites; and sandstone for crushed rock is available at Kim Fjaelde site.

Water supply -- Small quantities are available from small ponds at both sites.

Access -- The sites can be reached only by air or on foot.

Conclusions -- The sites were examined at a time when snow cover was heavy. It appears that both sites are poorly suited because of wet soil and microrelief features.

4.4 Kap Wyckoff

The site was identified and originally described from photogeology work. At the time of field examination (5 and 7 July 1960) 6 inches (15 cm) of snow covered the area.

Map reference -- Greenland 1:100,000 AMS C501, sheet NU 25, 26, 27, 28, 29, 30-6, 1952

Aerial photo reference -- USAF 7P13A-M16-495 LT

Location -- At Kap Wyckoff, Peary Land. 82°54'N x 24°00'00"W (Fig. 14).

Landform -- The site is on the flat upland of the promontory that forms Kap Wyckoff. The promontory is 3 miles (5 km) long and 2 miles (3.2 km) wide. To the south and west are mountains rising 2340 ft (713 m) above the site. The flat upland is at an altitude of 226 ft (69 m) (Fig. 16).

Soil and drainage -- Tightly packed, angular fragments of limestone with maximum dimension of 6 inches (15 cm) form the soil. Matrix between the fragments consists of small pebbles and very small amounts of sand.

Dimensions and orientation -- Two runways are possible, one oriented N10°W with 5100 ft (1554 m) length; the other oriented N80°W with 5400 ft (1649 m) length (Fig. 15).

Approaches -- Approaches from the north, east, and south are clear. Mountains rising 750 ft (229 m) above the site, 7 miles (11 km) from the site, hinder approach from the west and southwest. From the southeast, approach is blocked by a mountain 7 miles (11 km) from the site that rises 2340 ft (713 m) above the site.

Engineering aspects -- Grading of about 34,000 cubic yards (25,800 cubic meters) would be necessary to smooth out several rises, each about 12 inches (30 cm) high, that cross the site. Permanently frozen ground is about 2 feet (60 cm) below the surface at maximum thaw.

Construction materials -- Moderate quantities of material for fill are available at the site. Permanently frozen ground prevents removal of more than 2 ft (30 cm) (deep) of material in borrow areas. Limestone for crushing is available in north side of site.

Water supply -- Small quantities of water are available during summer from shallow ponds at the site.

Access -- The site can be reached generally by air or on foot only. The summer offshore lead extending from Nordostundingen reaches Kap Wyckoff, and ice breakers might reach the site in late summer. The water is shallow off Kap Wyckoff and ships probably would have to anchor about 1.2 miles (2 km) offshore.

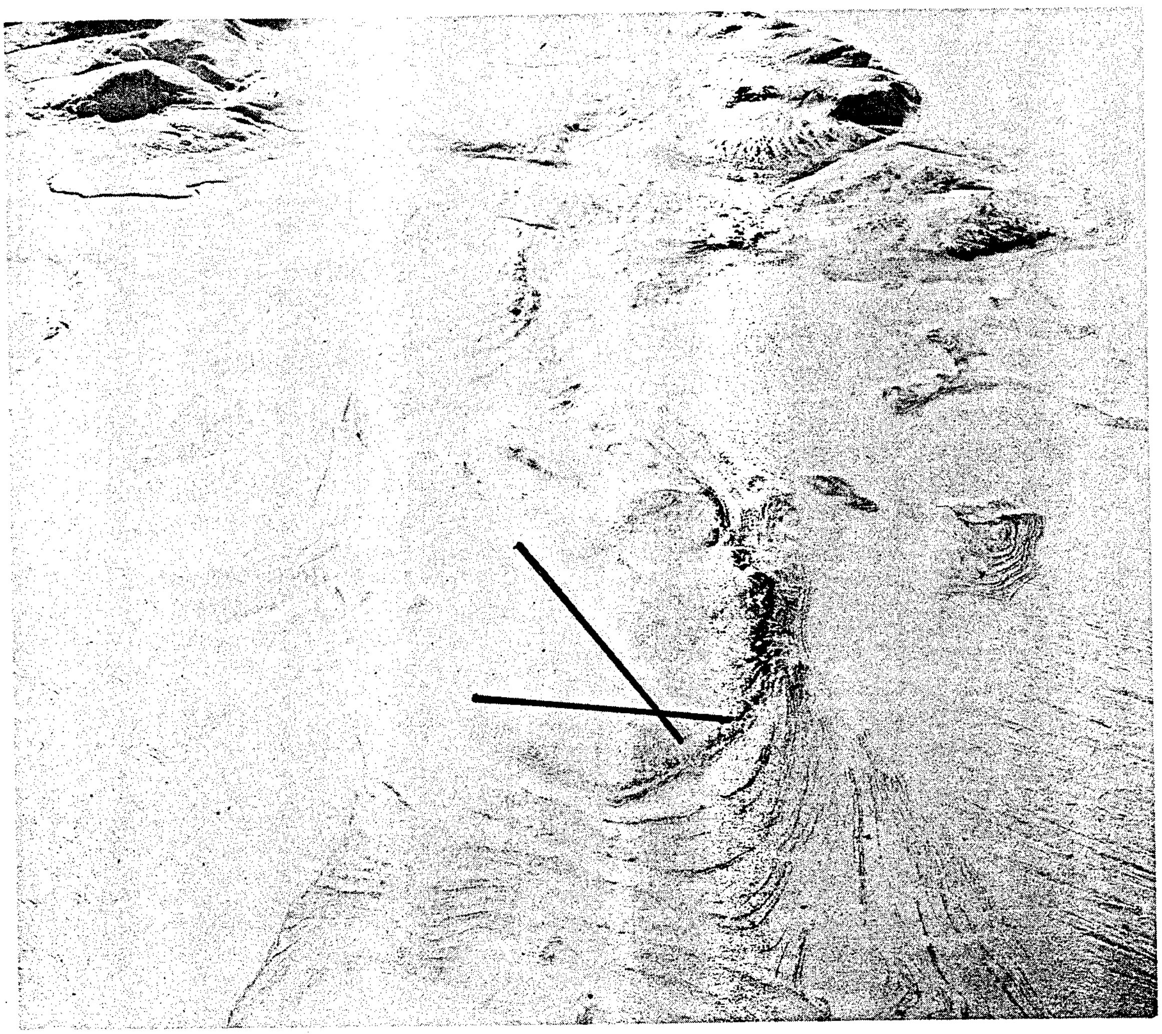

Figure 14. Kap Wyckoff, view west.

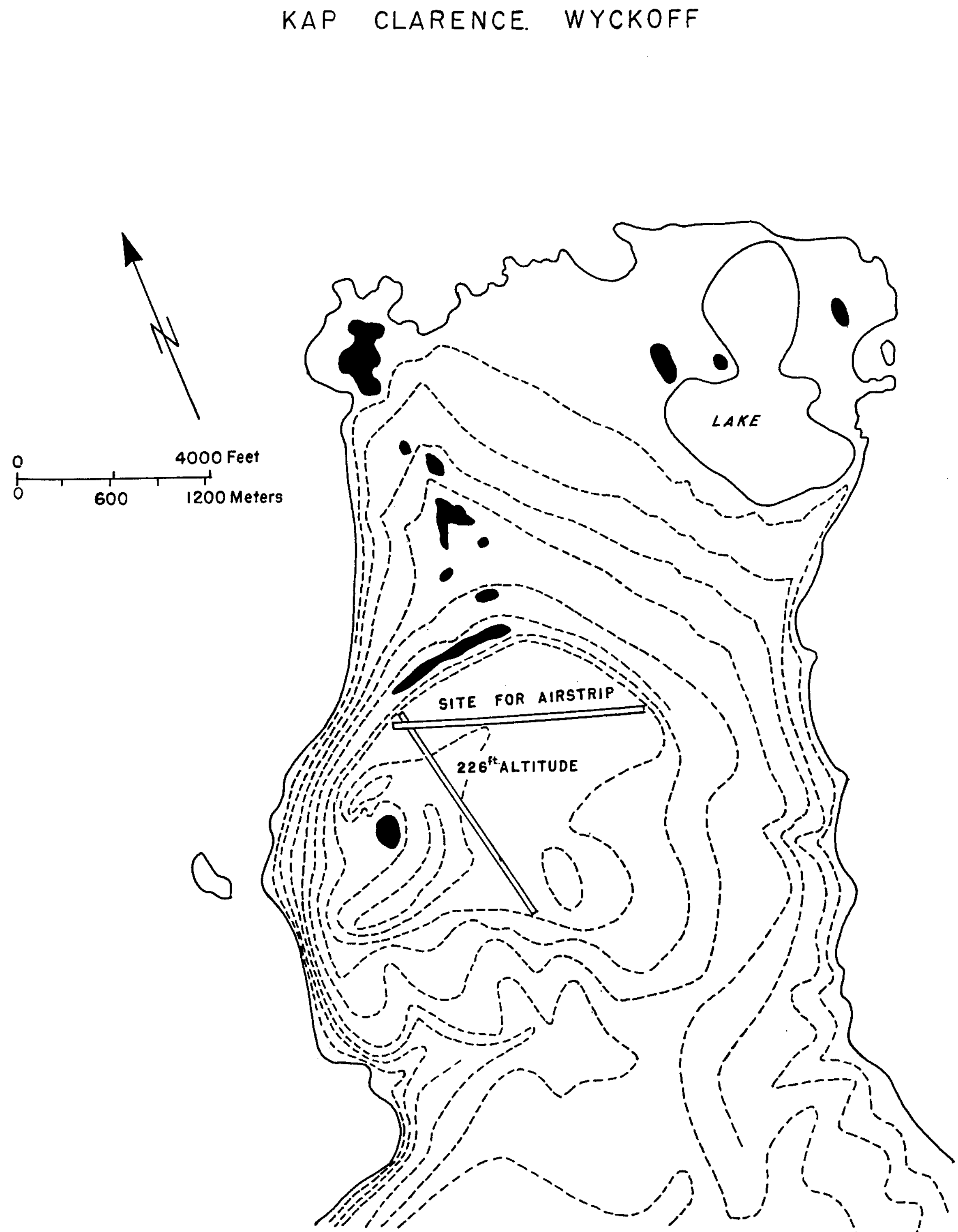

Figure 15. Map of Kap Wyckoff site.

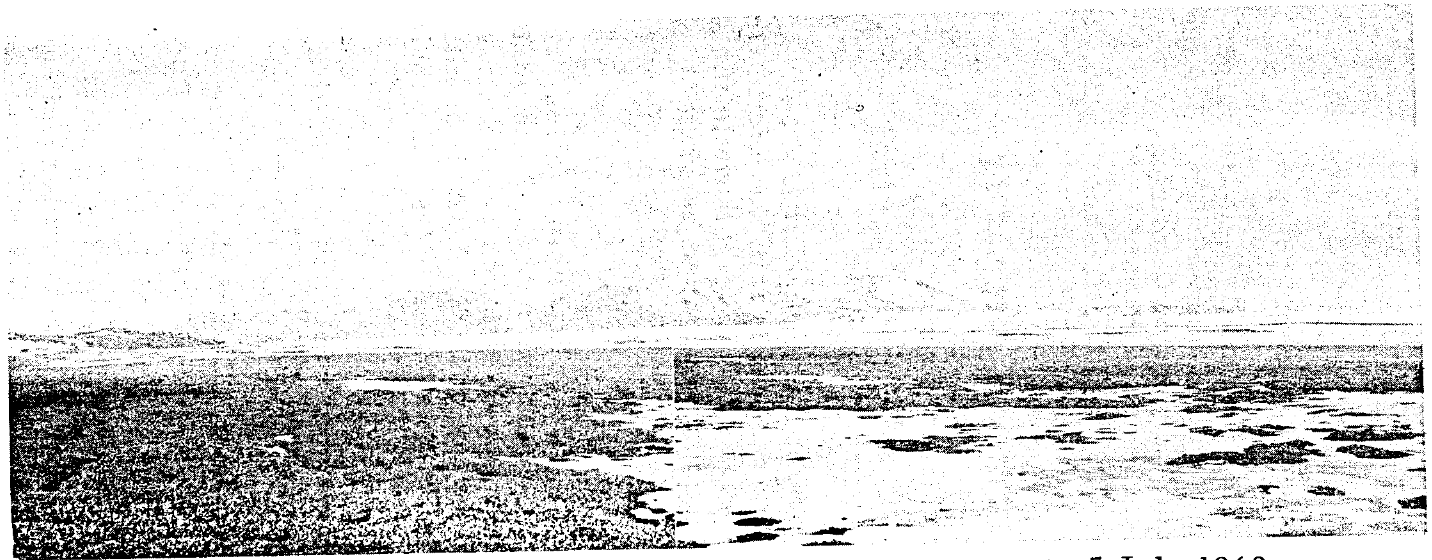

Figure 16. Panorama of Kap Wyckoff site, view west, 5 July 1960.

Figure 17. Skagen site, view southwest, 5 July 1960.

Conclusions -- The size of the site and the good approaches are a distinct advantage. The moderate grading required and the long period of snow cover detracts a little. In general this site is the best one north of Nord.

4.5 Skagen

Examination of aerial photos indicated that an airfield site might exist at Skagen but that it would probably be less than 5000 ft (1524 m) long. For this reason it was not included in previous listings.

Map reference -- Greenland 1:250,000 AMS C501, sheet Nu 25, 26, 27, 28, 29, 30-1, 1957

Aerial photo reference -- USAF 7P13A-M16-506, 507 VT

Location -- Site is on the summit of a low promontory 3 miles (5 km) south of Kap Flagler. 83°06'30"N x 24°50'00"W. Altitude of site is 80 ft (24 m).

Landform -- Skagen is a rounded promontory, 4500 ft (1371 m) wide and 7500 ft (2286 m) long, extending eastwards into the Arctic Ocean. The summit, at an altitude of 80 ft (24 m), is flat (Fig. 17) while the sides of the promontory are cut by two prominent raised beaches at 40 ft (12 m) and 55 ft (17 m). The beaches are in the form of benches 30 to 200 ft (9 to 60 m) wide.

Soil and drainage -- The soil is angular to subangular cobbles, as much as 2 inches (5 cm) in size, of gray-brown quartzite. Some pebbles of black limestone are present. A few boulders as much as 18 inches (0.5 m) in size occur at several places on the upland. A small quantity of coarse sand and silt form the matrix between the cobbles and pebbles. Drainage is good.

Dimension and orientation -- On the summit there is a site for a runway strip 3600 ft (1100 m) long and oriented N10°E (Fig. 18).

Approaches -- Approaches are clear from all directions. The closest obstruction is 6 miles (10 km) southeast of the site where mountains rise to about 3000 ft (914 m).

Engineering aspects -- Grading of 2000 cubic yards (1530 cubic meters) of material will be necessary to remove frost mounds and depressions. Mounds are about 12 inches (30 cm) high and 10 ft (3 m) in diameter. Occasional depressions are 3 ft (1 m) wide, 10 to 20 ft (3 to 6 m) long, and 12 inches (30 cm) deep.

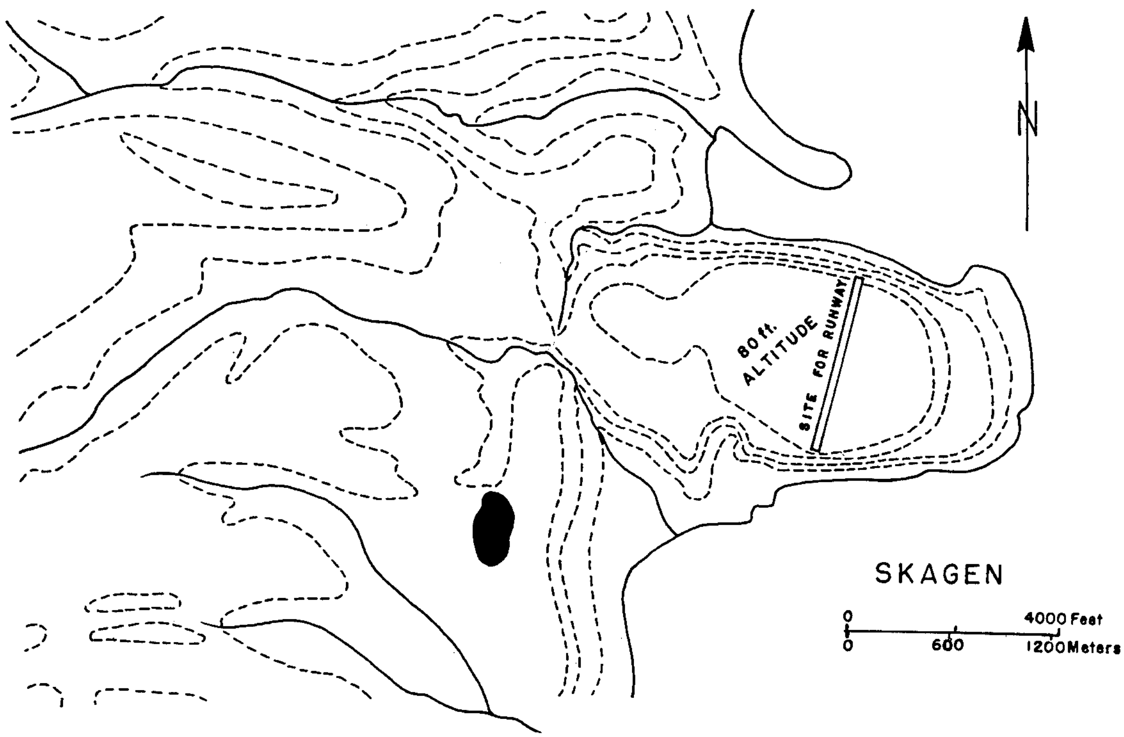

Figure 18. Map of Skagen site.

Construction materials -- Cobbles and pebbles for fill are abundant at the site. Sand is available from a river delta on the north side of the site; and clay and silt are available in large quantities along the southwest edge of the site.

Water supply -- From early June to early September large quantities of water are available from streams on the north and southwest sides of the site. In winter, snow and sea ice are the only sources of water available.

Access -- Site is accessible by air only. The annual offshore lead off the coast of Peary Land is 2 to 6 miles (3 to 9 km) east of the site and generally has its northern terminus opposite the site.

Conclusions -- This site does not have length enough for a long runway. It would be suitable for a runway for light planes or special cargo aircraft. In addition to this site there are two sites on the summits of long hills trending east-west about 3 miles (5 km) west of Skagen. These sites would provide runways of the same length and construction effort as the Skagen site. With heavier grading these sites could be extended to 5000 ft (1524 m) long.

4.6 Kap Ole Chiewitz

The site was discovered during a helicopter reconnaissance in 1960.

Map reference -- Greenland 1:250,000 AMS C501, sheet NU 25, 26, 27, 28, 29, 30-1, 1957

Aerial photo reference -- Geodaetisk Institut (Denmark) 548A-S 153
USAF 7P13A-M16-516 RT

Location -- Site is on the north side of Frihed-Rådet Elv, 2 miles (3 km) west of Kap Ole Chiewitz. 83°16'00"N x 26°00'00"W.

Landform -- The site is on a broad river terrace about 7 ft (2 m) above the Frihed-Rådet Elv. The terrace is 3600 ft (1100 m) long northwest-southeast and 2000 ft (610 m) wide northeast-southwest. It is 155 ft (47 m) above sea level. On the northeast and east the site is bounded by morainal ridges rising to 215 ft (65 m); to the northwest the terrace grades into the wide outwash plain that forms the north side of Peary Land. The surface of the terrace is locally pitted with shallow frost depressions as much as 24 inches (60 cm) in diameter and 6 inches (15 cm) in depth (Fig. 19).

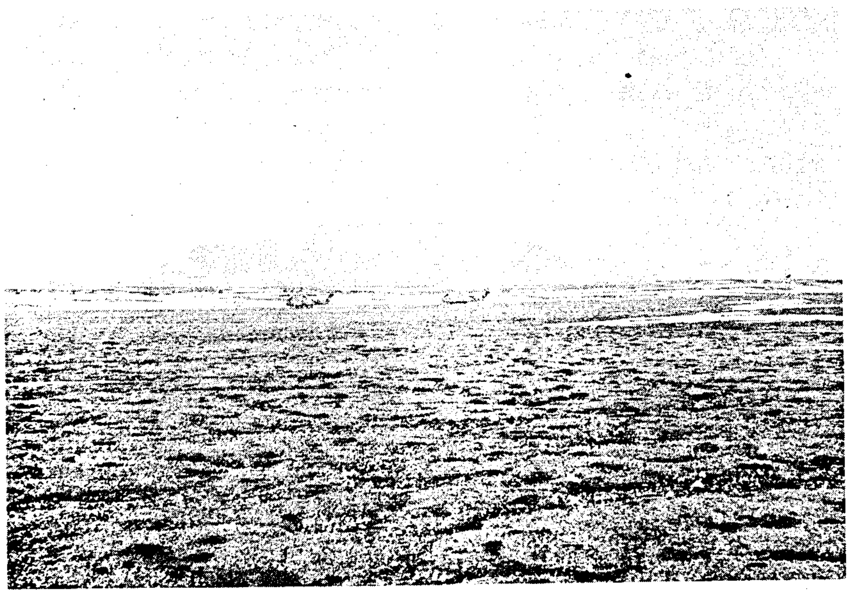

Figure 19. Kap Ole Chiewitz site, view WNW, 6 July 1960.

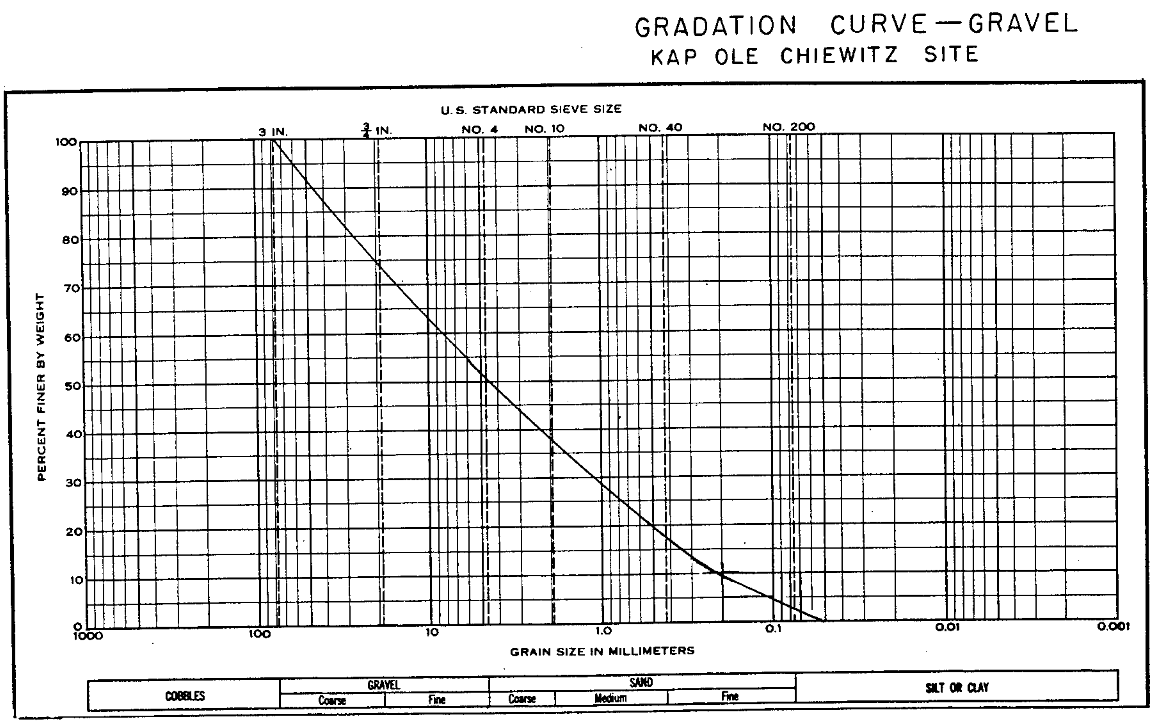

Figure 20. Kap Ole Chiewitz site, gradation curve, gravel.

Soil and drainage -- The soil along the site for a runway is densely-packed gravel in a matrix of silty sand. The gravel is composed of pebbles as much as 2 inches (5 cm) in size (Fig. 20). Drainage is good.

Dimensions and orientation -- The best runway orientation is N60°W, with a length of 3600 ft (1100 m) (Fig. 21).

Approaches -- Approaches to a runway oriented N60°W are clear from the northwest and southeast. Mountains rise 3500 ft (1066 m), 9 miles (15 km) west of the site.

Engineering aspects -- Grading to fill the small isolated pits on the runway site would require about 1000 cubic feet (765 cubic meters) of soil.

Construction materials -- Gravel for fill is available from morainal hills bordering the site. Sand is available from the Frihed-Rådet Elv at the site.

Water supply -- Large quantities of water are available from Frihed-Rådet Elv from late May to mid-September.

Conclusions -- Site is well-suited for light aircraft and special purpose aircraft such as a C-130. Extension of the runway beyond 3600 ft (1066 m) would involve extensive grading.

4.7 Bliss Bugt

This site had been previously identified on aerial photos and its characteristics were determined by photogeologic methods. In 1956 it was examined from low-flying aircraft. In 1960 the site was visited but 3 ft (1 m) of snow covered the area and detailed investigations could not be made.

Map reference -- Greenland 1:250,000 AMS C501, sheet NU 25, 26, 27, 28, 29, 30-6, 1957

Aerial photo reference -- Geodaetisk Institut (Denmark) 548A-S 1554
USAF 7P13A-M15-541 VT

Location -- On the northeast corner of Bliss Bugt, 2 miles (3 km) east of Kap J. P. Koch (Figs. 22 and 23).

4.8 Kap Morris Jesup

The possibility of a site at this point was recognized from examination of reconnaissance aerial photography made in 1956. However

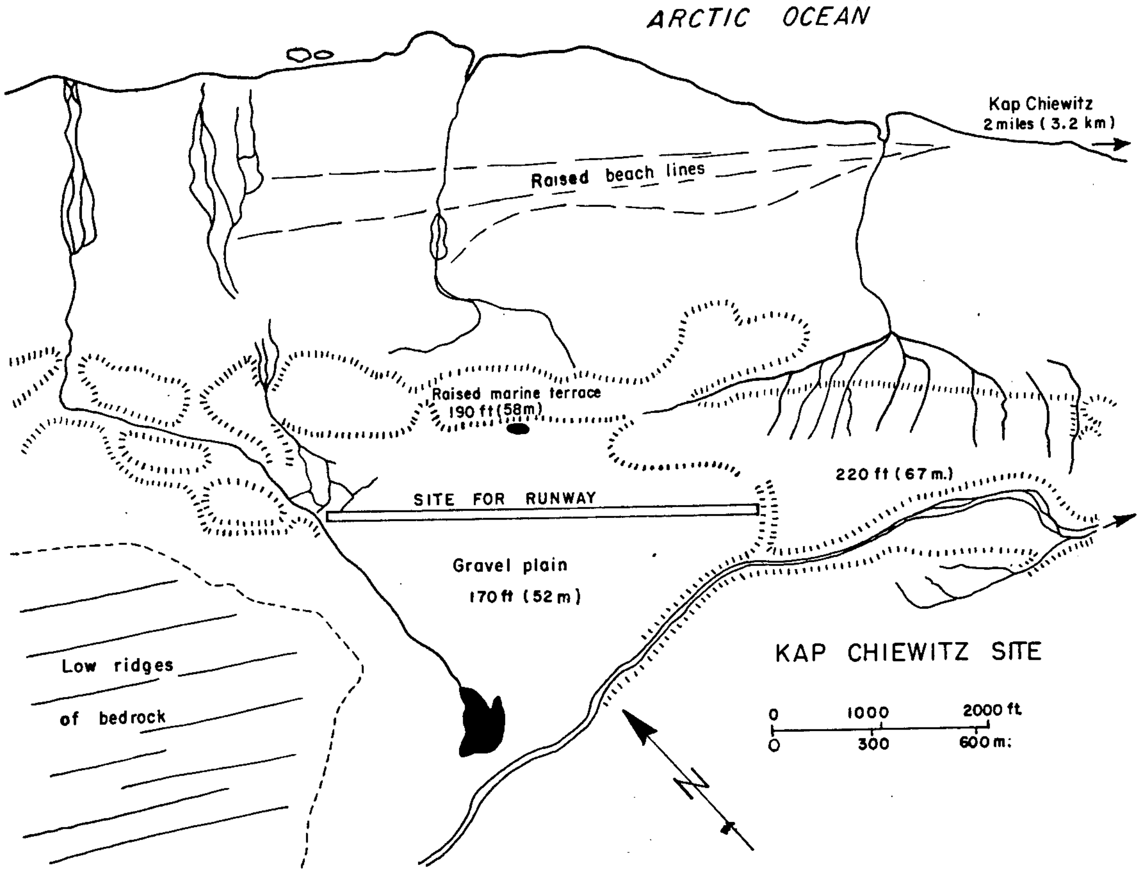

Figure 21. Map of Kap Ole Chiewitz site.

Figure 22. Air view looking SW over Bliss Bugt site, 19 August 1956.

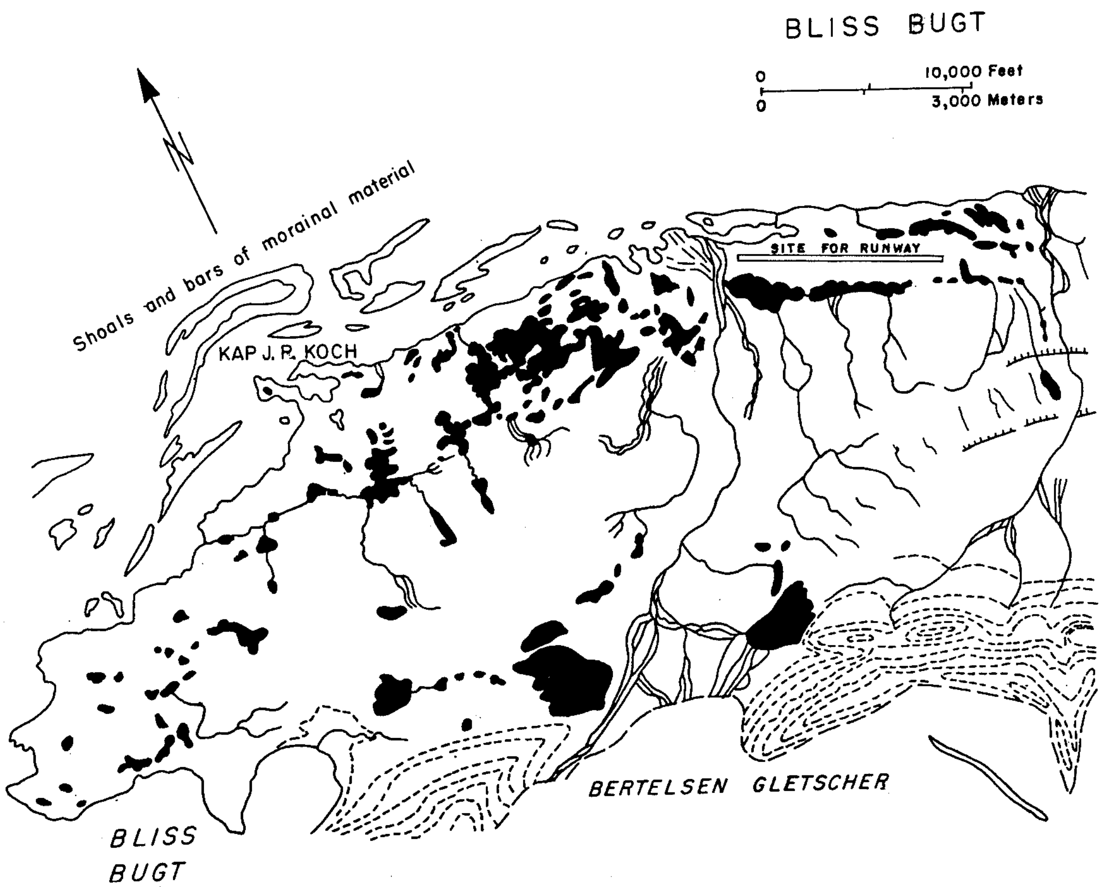

Figure 23. Map of Bliss Bugt site.

the area for a potential site was poorly shown on the photographs and very little detail could be obtained from studies of the photos.

Map reference -- Greenland 1:250,000 AMS C501, sheet NU 25, 26, 27, 28, 29, 30-1, 1957

Aerial photo reference -- No mapping showing details of site are available.

Location -- Site is on the west side of the stream which flows into the delta at Kap Morris Jesup. The site is 3000 ft (914 m) south of the cape.

Landform -- Kap Morris Jesup is on a broad fan-shaped delta about 2400 ft (731 m) north-south and 12,000 ft (3657 m) east-west. On the south side of the delta are a series of raised beaches cut into two parts by the north-flowing stream that enters the Arctic Ocean at Kap Morris Jesup (Fig. 24).

Soil and drainage -- At the site the soil is compact gravel made up of rounded pebbles and cobbles, maximum diameter 3 inches (7.5 cm). Matrix is coarse sand (Fig. 25). Drainage is good.

Dimensions and orientation -- On the 80-ft (24-m) terrace there is a site for a runway 2800 ft (853 m) long, oriented N45°W (Fig. 26).

Approaches -- Approach from the northwest is clear (over the Arctic Ocean). To the southwest the land rises to a bench at an altitude of 330 ft (100 m), 7500 ft (2286 m) from the site. About 2.5 miles (4 km) south of the site there are mountains that rise to about 3000 ft (914 m).

Engineering aspects -- Grading, to remove small depressions, would involve about 1000 cubic yards (765 cubic meters) of materials.

Construction materials -- Sand and gravel are abundant at the site and from the delta to the north of the site. Rubble is available in large quantities from the rock bench to the south and southwest of the site.

Water supply -- Large quantities of water are available from late June to early September from the stream along the east side of the site. At other times snow or sea ice are the only sources of water.

Access -- The site is accessible only by aircraft.

Conclusion -- The site is well-suited for a short runway for light aircraft in support of a meteorological or similar station.

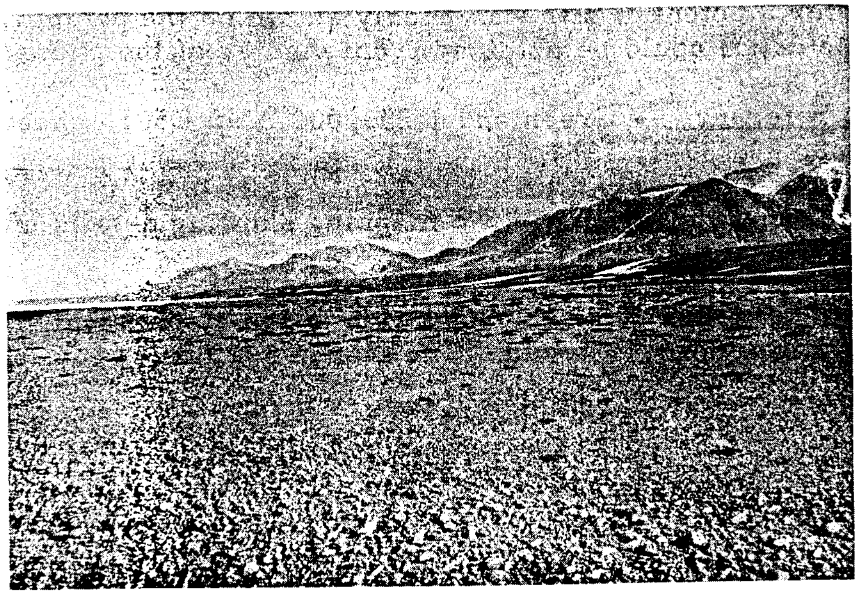

Figure 24. Kap Morris Jesup site, view southeast, 6 July 1960.

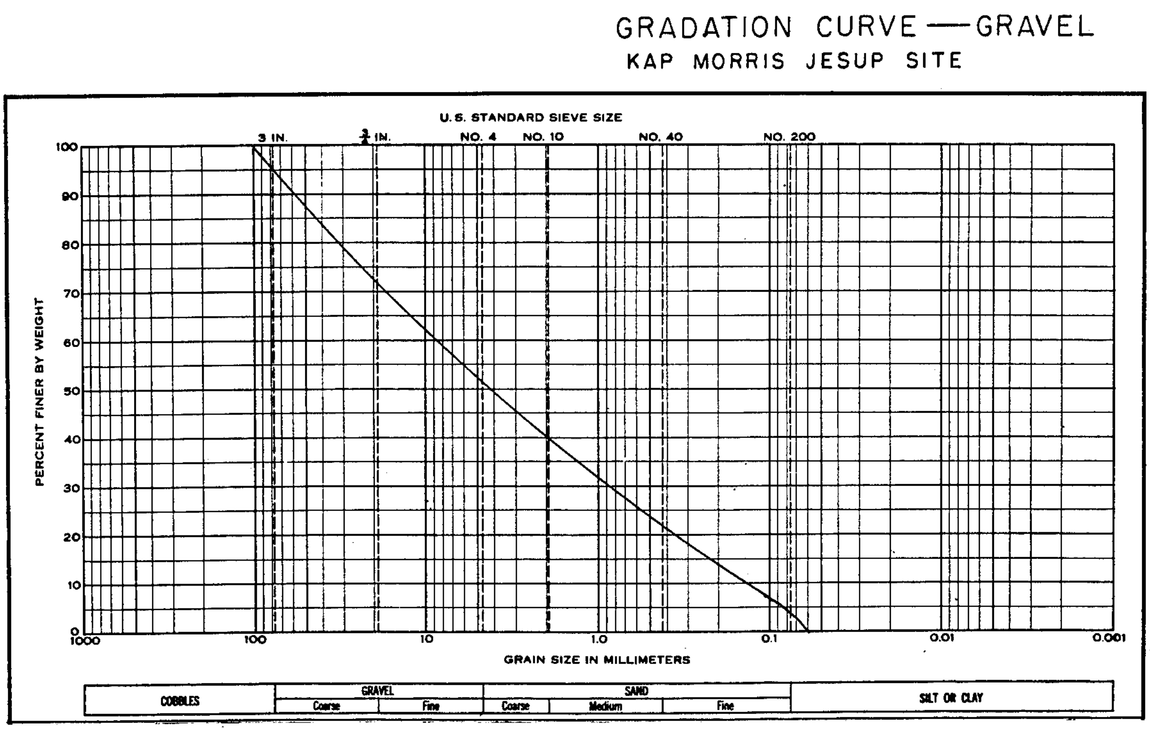

Figure 25. Kap Morris Jesup site, gradation curve, gravel.

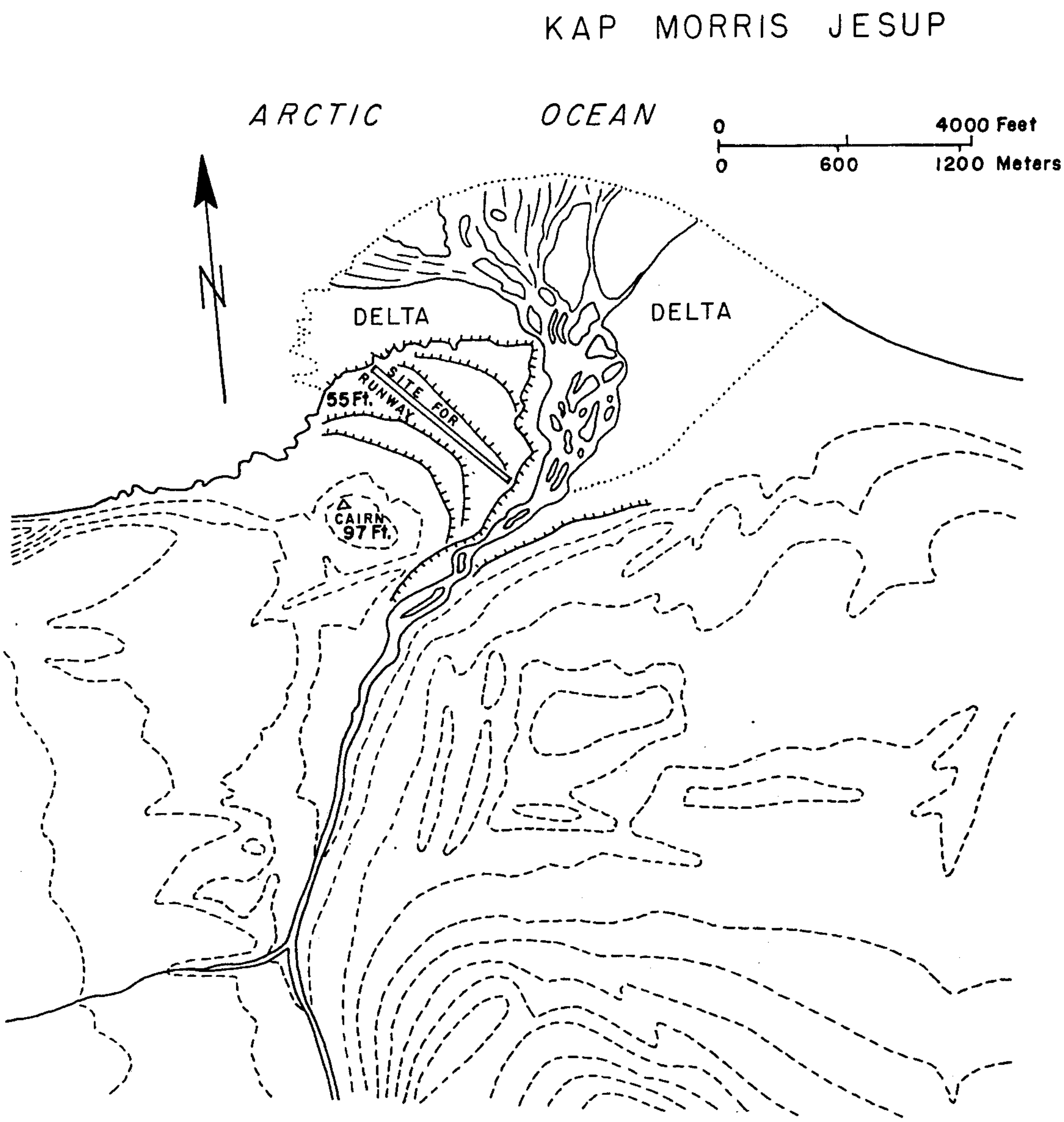

Figure 26. Map of Kap Morris Jesup site.

4.9 Slusen-Midsommersø

This site was recognized from aerial photos in 1952 but was not included in previous listings because it is shorter than 5000 ft (1524 m).

Map reference -- Greenland 1:250,000 AMS C501, sheet NU 25, 26, 27, 28, 29, 30-5, 1957

Aerial photo reference -- Geodaetisk Institut (Denmark) 548C-N 04265

Location -- The Slusen site is on the north side of the river channel that connects Nedre Midsommersø and Øvre Midsommersø. 82°15'N x 33°48'W. Altitude of site 620 ft (189 m) (Fig. 27).

Landform -- At Slusen the river channel is bounded on the north and south by terraces. The upper broad terrace is 23 ft (7 m) above the level of Midsommersø (Fig. 28). It is 4500 ft (1371 m) long east-west and about 3000 ft (914 m) wide. To the north this terrace grades into a kame terrace that is 90 ft (27 m) above the level of the lake. This kame terrace is 750 ft (228 m) wide and ends at the base of a third terrace which is 900 ft (274 m) wide and ends on the north at an outcrop of diabase. The terrace surfaces have numerous frost mounds and polygon trenches with relief as much as 3 ft (1 m) in height.

Soil and drainage -- The terrace soil is gravel formed of pebbles and cobbles as much as 4 inches (10 cm) in size. Coarse sand is mixed with the gravel.

Dimensions and orientation -- The best site for an airstrip is on the 23-ft (7-m) terrace 30 to 1600 ft (10 to 183 m) from Slusen, oriented in an east-west direction. A runway 3000 ft (914 m) long could be made with minimum grading; and with moderate grading a runway 4500 ft (1371 m) long could be made (Fig. 29).

Approaches -- Approaches from the east and west are clear via the lowland of Midsommersø. On the north and south the plateau rises to 2400 ft (731 m), 1.5 to 2 miles (2.4 to 3.2 km) from the site.

Engineering aspects -- Grading of about 40,000 cubic yards (30,600 cubic meters) would be necessary to remove microrelief features on a 3000-ft (914-m) strip. 80,000 cubic yards (61,200 cubic meters) of grading would be necessary for a 4500-ft (1371-m) runway.

Construction materials -- Large quantities of sand and gravel are available at the site. Limestone and diabase for crushed stone are available 1 mile (1.6 km) north of the site.

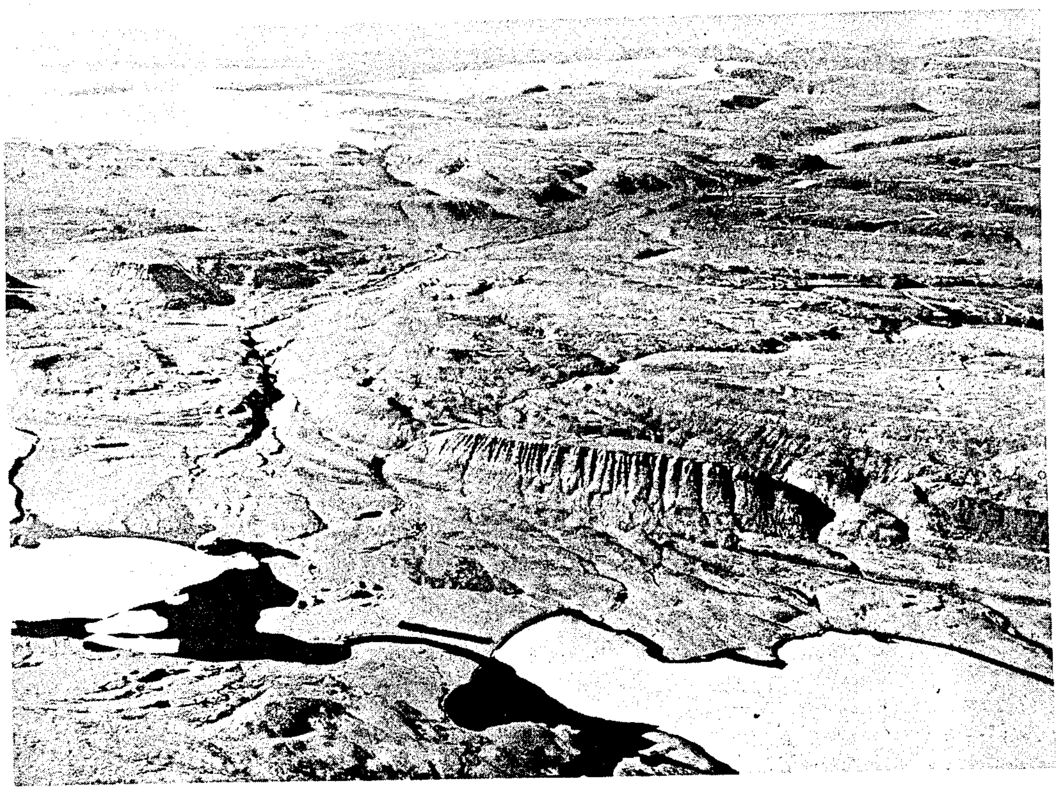

Figure 27. Slusen site, view northwest. Geodaetisk Institut (Denmark) all rights reserved.

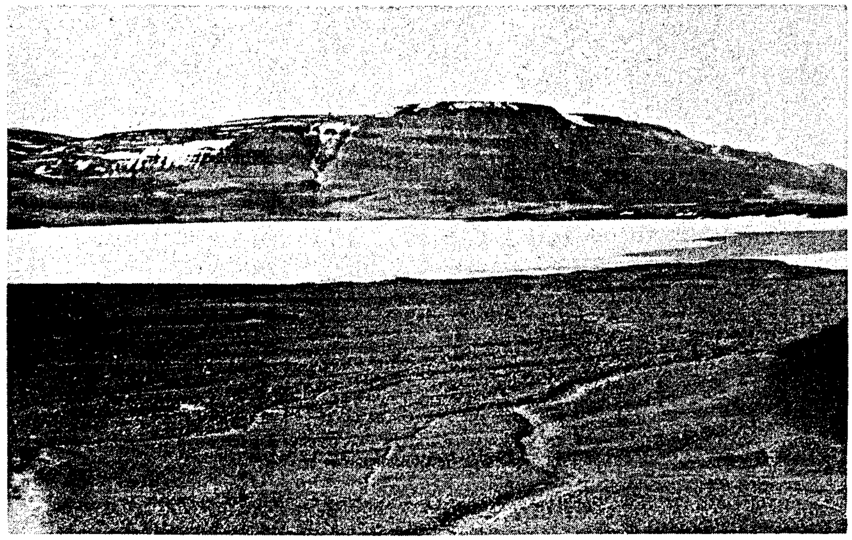

Figure 28. View west at west end of Slusen site, 10 July 1960.

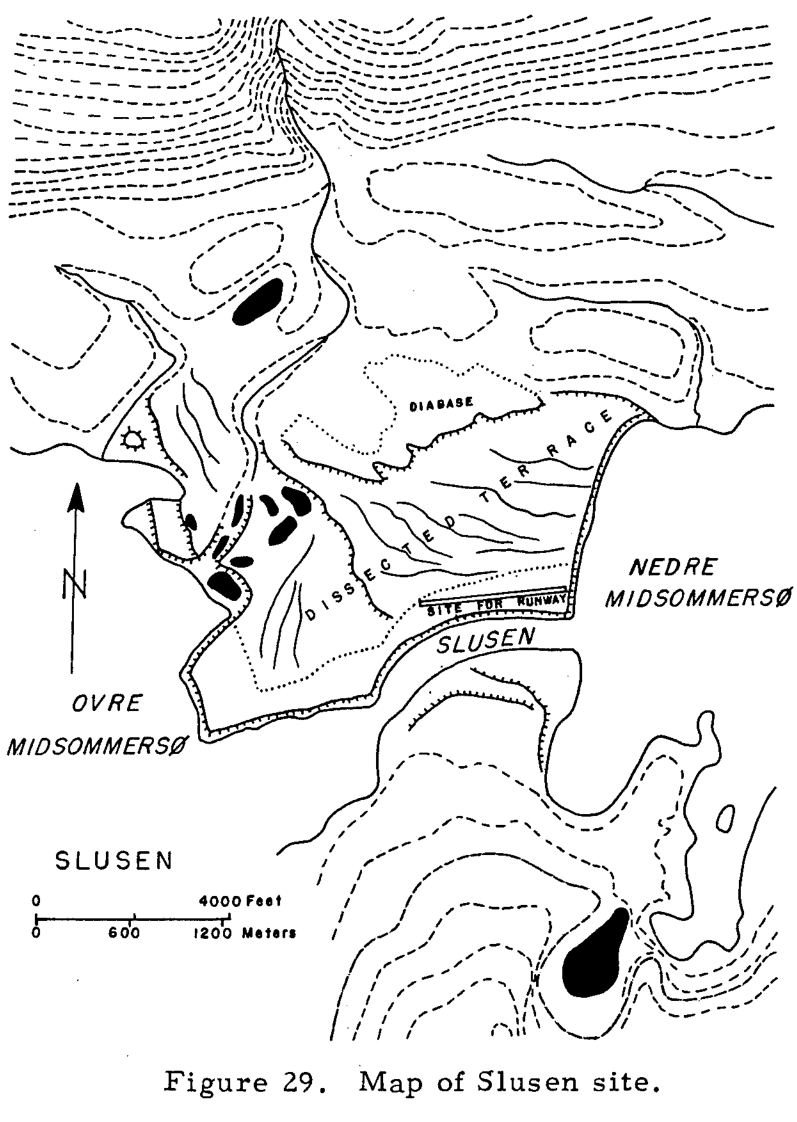

Figure 29. Map of Slusen site.

Water supply -- Enormous supplies of potable water are available year round from Midsommersø.

Access -- This site can be reached by air-landing on the lake ice from December to May and by amphibious aircraft landing on the lake from late June through early September. The site can be reached overland from Brønlund Fjord by track vehicles along Midsommer Elv and the north shore of Midsommersø.

Conclusions -- The site is within 40 miles (64 km) of the Brønlund Fjord airstrip. Because of the grading required and the proximity to a tested airstrip it would be of little value except for support of a scientific or other station on Midsommersø.

4.10 Brønlund Fjord

The airfield site at Brønlund Fjord was field-checked in 1956 and tested by landing of a C-124 aircraft on 16 August 1957. The site was checked 8 July 1960 to see what effect the landing had on the soil and to check conditions immediately after the snow melt.

Map reference -- Jørgen Brønlund Fjord, 1:20,000, Area D, AMS (US), 1952.

Aerial photo reference -- USAF 7P13A-M12-294 RT
Geodaetisk Institut (Denmark) 625-06817, 06769

Previous reports -- Davies, W.E., and Stoertz, G.E., 1957, Contributions to the geomorphology of Northeast Greenland: U.S. Geol. Survey for Air Force Cambridge Research Center, 25 p. (U)

Stoertz, George, and Needleman, Stanley, 1957, Report on Operation Groundhog, 1957: U.S. Geol. Survey for Air Force Cambridge Research Center, 40 p. (U)

Location -- The airstrip is on the northeast side of Brønlund Fjord at its junction with Independence Fjord. 82°08'N x 29°52'W. Altitude of the site is 10 ft (3 m).

Condition of runway -- The runway at Brønlund Fjord is on the floor of a former lagoon. The soil is a hardpacked clay-silt. The runway is 5000 ft (1524 m) long, oriented N35°W. On 8 July 1960 the west half of the runway was dry and strong with soil strengths as high as 25 (CBR) 1/ The east half had several wet areas where drainage from

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1/ Equivalent.

Table 2. Soil Strength, Brønlund Fjord Airstrip

Soil Strength (CBR equivalent)

STATION 0 at SE end of airstrip		1-in depth	3-in depth	6-in depth	12-in depth
150 ft -	north	12	15	15	15
	center	4	4	3	3
	south	3	0.8	1.5	2
610	north	4	7	12	4
	center	4	6	15	4
	south	1.5	7	12	7
730	north	0.8	4	3	3
	center	3	9	15	3
	south	1.5	9	7	4
1160	north	0.3	0.8	1.5	1.5
	center	0.3	0.8	1.5	1.5
	south	0.3	0.8	1.5	1.5
1390	north	20+	20+	20+	20+
	center	20+	20+	20+	20+
	south	20+	20+	20+	20+
1510	north	0.8	0.5	2.5	3
	center	0.8	0.5	2.5	3
	south	0.8	0.5	2.5	3
1620	north	1.5	9	10	9
	center	1.5	9	10	9
	south	1.5	9	10	9
1730	north	20+	20+	20+	20+
	center	9	4	2.5	2.5
	south	0.3	0.5	2.5	1.5
1840	north	0	0	0.3	0.3
	center	0	0	0.3	0.3
	south	0	0	0.3	0.3
2060	north	6	9	4	6
	center	6	9	4	6
	south	6	9	4	6
2280	north	0	0.3	2.5	3
	center	3	2	4	3
	south	13	20+	20+	20+
2500	north	9	7	3	20+
	center	0	0.3	2.5	3
	south	0	0.3	2.5	3

Table 2. (continued)

STATION 0 at SE end of airstrip		1-in depth	3-in depth	6-in depth	12-in depth
2740 ft -	north	20+	20+	20+	20+
	center	0	4	4	3
	south	20+	20+	20+	20+
2800	north	20+	20+	20+	20+
	center	4	7	3	4
	south	20+	20+	20+	20+
2920	north	20+	20+	20+	20+
	center	20+	20+	20+	20+
	south	20+	20+	20+	20+
3280	north	20+	20+	20+	20+
	center	3	3	4	3
	south	20+	20+	20+	20+
3570	north	1	2.5	4	1.5
	center	9	2	3	7
	south	20+	20+	20+	20+
3990	north	20+	20+	20+	20+
	center	20+	20+	20+	20+
	south	20+	20+	20+	20+
4880	north	20+	20+	20+	20+
	center	8	3	3	3
	south	20+	20+	20+	20+
5000	north	20+	20+	20+	20+
(NW end	center	2.5	2.5	2.5	2.5
of air-strip)	south	20+	20+	20+	20+

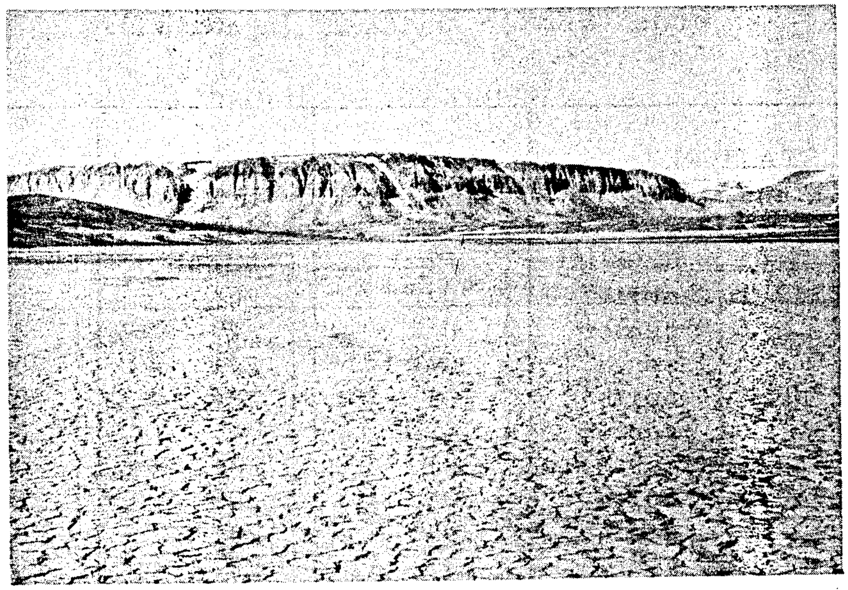

Figure 30. View northwest, 2000 feet (609 m) from southeast end of Brønlund Fjord site. Dark areas are wet soils. 8 July 1960.

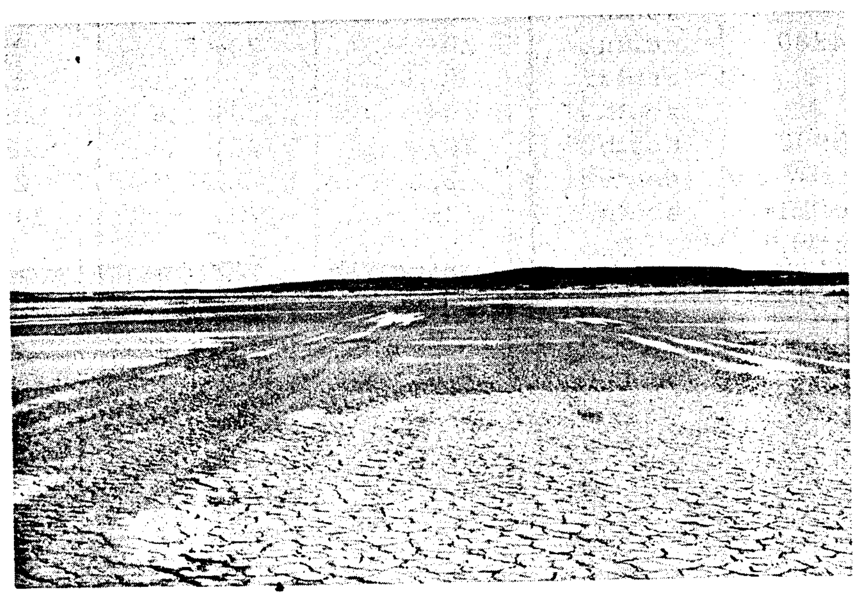

Figure 31. View southeast, 2000 feet (609 m) from southeast end of Brønlund Fjord site. Dark areas are wet soils, 8 July 1960.

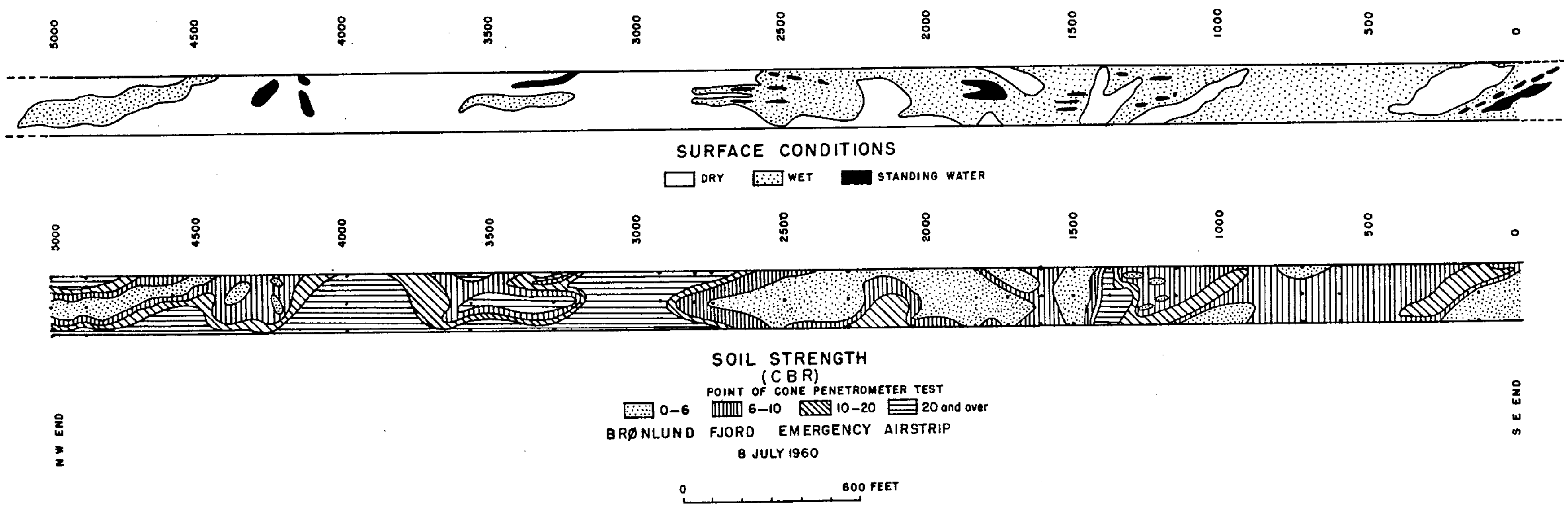

Figure 32. Plan of runway at Brønlund Fjord showing strength of soil and surface conditions.

the south crossed the site and in places where wheel ruts were made by the test aircraft (Figs. 30 and 31). In the wet areas, soil strength was very low (CBR 0 to 6). Detailed CBR readings were made along the runway at intervals of about 500 ft (152 m) (Fig. 32 and Table 2).

Conclusions -- The east half of the runway at Brønlund Fjord is not safe for use in its present condition from early June to mid-July. Shallow ditches parallel to the runway to divert drainage from the hills to the south would probably make the runway suitable for 12-month capability except for a period of a week or two in early June.

5. LOGISTIC SUPPORT

5.1 Introduction

Preparations for the helicopter reconnaissance of Peary Land were initiated in the Summer of 1959 with the dropping of fuel and supplies at selected sites. The material to be airdropped was assembled and prepared at Thule Air Base between 18 and 20 June 1959.

From 21 through 27 June successful flights were made each day to 11 drop sites and to Station Nord. Two flights were made to Brønlund Fjord on 21 June, and a total of 16 pallets of supplies were dropped. Because of a maximum estimated loss of 7 pallets during the initial drop, an additional drop was planned for 23 June. Ten pallets of supplies were successfully dropped at the Centrum Sø site on 22 June. During 23 June, 2 pallets were dropped at Romer Sø ; 6 pallets were dropped at Kap Renaissance; and 3 pallets were dropped at Brønlund Fjord. One parachute with barrels of petroleum products failed to open at Kap Renaissance. Seven pallets were dropped at the Constable Bugt site on 24 June. During 25 June, 5 pallets were dropped at the Kap Rasmussen site, and 5 pallets were dropped at the Bliss Bugt site. On 26 June, 2 pallets were dropped at Victoria Fjord*; 1 pallet was dropped at J. P. Koch Fjord*; 2 pallets were dropped at Frederick E. Hyde Fjord; and 1 pallet was dropped at the Kap Ludovika site. Fuel and rations were landed at Nord on 27 June, and the C-130 aircraft departed Thule on 28 June for Boston. All of the cache sites were identified on aerial photographs and large scale maps.

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*Victoria Fjord and J. P. Koch Fjord sites were established so that helicopters could be flown along the coast from Thule to Peary Land; this plan was abandoned in favor of direct flight across the ice cap in 1960.

5.2 Itinerary of Airdrop Operations

The following members of the scientific party arrived at Thule Air Base on 17 June and participated in the Airdrop Operations: Mr. S. M. Needleman, Project Leader, AFCRL, Lt. Col. R. H. Wilson, USAF, Mr. D. B. Krinsley, Capt. S. W. Klick, USAF, Mr. D. Craven, and A1/c E. Whitney, USAF.

From 18 through 20 June, aviation fuel, food, camping equipment, and scientific instruments were assembled, inventoried, and packed on pallets for airdrop. Capt. T.D.N. Douthit, USAF, and Mr. H. Strong assisted in base liaison and movement of material.

On 21 June two airdrops were made at Brønlund Fjord. The first was in moderately clear weather with some isolated clouds at 5000 ft (1524 m). After two low-altitude passes the drop was made from an altitude of 2000 ft (609 m). Ten pallets containing 4 drums of aviation gas each were discharged, but due to inadequate spacing of the trip lines, only 3 parachutes opened. The drop landed at position 82°08'N, 31°14'W.

The second drop of 6 pallets, containing food and equipment, was made from 2000 ft (609 m) in clear weather. All parachutes opened and the supplies landed at position 82°08'N, 31°14'W. Following this drop 2 pallets were dropped successfully in clear weather with surface winds of at least 20 knots at the tractor train (U.S. Army Transportation Environmental Research Group) rendezvous near Nyeboe Land. It was necessary for the drop to be retrieved by speeding weasels.

On 22 June, in clear weather with a surface wind of 10 knots from the south, 10 pallets containing fuel, food, and equipment were dropped from 2000 ft (609 m), after one pass, at Centrum Sø. All landed successfully at position 80°08'N, 23°02'W.

On the following day, after one pass, 2 pallets containing fuel and rations were dropped at Romer Sø, Kronprins Christian Land, from 2000 ft (609 m) in clear weather with a surface wind of 15 knots from the south. Both pallets landed successfully at position 81°01'N, 20°35'W. The aircraft then went to the mouth of Zig-Zag Dal, Kap Renaissance, where one drop of 6 pallets was made from 2000 ft (609 m), after one pass, in clear weather with very little surface wind. Five pallets landed successfully at position 81°13'N, 24°14'W. One parachute containing aviation fuel failed to open. To complete this mission 3 pallets of aviation fuel were dropped from 2000 ft (609 m), after one pass, at Brønlund Fjord, in slight overcast with a surface wind of 15 knots from the southeast. All pallets landed successfully at position 82°08'N, 31°14'W.

On 24 June after one pass, 7 pallets containing food, fuel, and equipment were dropped from 2000 ft (609 m) at Constable Bugt in overcast with surface wind of 40 knots from the north. All parachutes were blown against the east slope of the valley and came to rest at position 83°31'30"N, 32°30'W. After this drop was completed the aircraft went to Ward Hunt Island (Canada) and, after 2 passes, 3 pallets containing fuel and equipment were successfully dropped from 2000 ft (609 m) in overcast with slight surface wind.

On 25 June, after observation and one pass, 5 pallets containing food, fuel, and equipment were dropped at Kap Rasmussen from 2000 ft (609 m) in slight overcast with light surface wind from the south. All parachutes opened and the materials came to rest at position 82°33'30"N, 23°21'W. The flight was continued to Bliss Bugt where in slight overcast with an estimated head wind of 65 knots from the north, after observation and one pass, 6 pallets containing food, fuel, and equipment were dropped from 2000 ft (609 m). All parachutes opened and were blown against the north-facing slope of the adjacent hills; they came to rest at position 83°24'30"N, 28°40'W.

On 26 June at Victoria Fjord, after observation and one pass, 2 pallets containing fuel and rations were dropped from 2000 ft (609 m) in clear weather and a slight surface wind blowing to the northwest. Both parachutes opened and the materials came to rest at position 81°40'N, 46°11'W. Continuing on to J. P. Koch Fjord, after observation and one pass, 1 pallet containing fuel and rations was dropped from 2000 ft (609 m) in overcast with a 20-knot surface wind to the northwest. The pallet landed successfully at position 82°21'N, 40°43'W.

The C-130 departed J. P. Koch Fjord in overcast and entered low clouds at 2500 ft (762 m). Because of the presence of 6000-ft (1828-m) peaks, the lack of visibility, and difficulty with radar, the planned drop at Frederick E. Hyde Fjord was about to be abandoned when an opening appeared above the fjord near the cache site. After observation and one pass 1 pallet was dropped from 2000 ft (609 m). The pallet landed successfully at position 83°02'30"N, 29°21'W. On the return flight to Thule, after one pass, 1 pallet containing fuel and rations was dropped from 2000 ft (609 m) in overcast with a surface wind of 20 knots from the northeast at Kap Ludovika. The pallet landed successfully at position 82°00'N, 24°30'W.

On 20 June 1960, 23 barrels of aviation gasoline and 1 barrel of oil were parachute-dropped at Depot Bugt (83°05'N, 27°45'W). This drop was intended as a supplement to the existing one at Citronen Fjord but, because of misidentification of the site, it landed at Depot Bugt. On the same flight 15 barrels of aviation gasoline and 1 barrel of oil were parachute-dropped at Brønlund Fjord.

5.3 Description of Cache Sites

5.3.1 Victoria Fjord, 81°40'N, 46°11'W. Site is located on an outwash plain south of Victoria Fjord and east of the southern tip of the eastern lake in Wulff Land. Pallets were resting on gravel, beneath a 500-ft (152-m) slope, adjacent to several small lakes. The site was clear of snow, dry, and protected from the wind by the adjacent hill. Estimated altitude of the site is 400 ft (122 m).

5.3.2 J. P. Koch Fjord, 82°21'N, 40°43'W. Site is on an outwash plain 1.2 miles (2 km) east of the snout of J. P. Koch Glacier at the head of J. P. Koch Fjord. Pallet was resting on sand and gravel south of the major stream at an estimated altitude of 100 ft (30 m). Site was clear of snow but wet and exposed to off-glacier wind.

5.3.3 Constable Bugt, 83°31'30"N, 32°30'W. Site is 3 miles (5 km) south of Constable Bugt at the east slope of the valley containing a lake separated in two by a glacier (Dobbelts, tentative name). It is at an estimated altitude of 500 ft (152 m). Pallets were resting on coarse broken rock adjacent to the slope. Site was clear of snow, dry, but exposed to strong winds from the north.

5.3.4 Bliss Bugt, 83°24'30"N, 28°40'W. Site is 0.6 mile (1 km) east of the snout of Berthelsen Glacier and 4 miles (7 km) south of the coast, adjacent to a northwest-facing slope. Pallets were resting on coarse broken rock at an estimated altitude of 500 ft (152 m). Site was clear of snow, dry, but exposed to strong winds from the north.

5.3.5 Frederick E. Hyde Fjord, 83°02'30"N, 29°21'W. Site is at Citronen Fjord on a dissected river terrace along the east side of the valley about 50 ft (15 m) above the stream and 0.6 mile (1 km) south of the fjord re-entrant. Pallet was resting on sand and gravel at an altitude of approximately 100 ft (30 m). Site was free of snow, dry, and subjected to slight wind from the fjord.

5.3.6 Depot Bugt, 83°05'N, 27°45'W. Site is on a series of raised marine terraces. Six pallets were resting on shingle gravel at an altitude of 75 to 125 ft (22 to 38 m). Site was free of snow, dry, and protected from wind.

5.3.7 Kap Rasmussen, 82°33'30"N, 23°21'W. Site is on a slope 8 miles (14 km) northwest of Mudder Bugt, between the two central tributaries of the stream which empties into the northern part of Mudder Bugt. Pallets were resting on coarse gravel at an estimated altitude of 1200 ft (365 m). Site was free of snow, dry, and not subjected to strong winds.

5.3.8 Brønlund Fjord, 82°08'N, 31°14'W. Site is 1.3 miles (2 km) north of Kap Harold Moltke, at the mouth of Brønlund Fjord. Nine pallets were scattered along a 0.6-mile (1-km) strip northeast of the clay flat, and 3 pallets were at the southwest corner of the flat. All pallets were resting on marine clay at altitudes of from 25 to 75 ft (7.6 to 22.8 m). Site was free of snow, slightly wet, and exposed to moderate wind from the southeast.

5.3.9 Kap Ludovika, 82°N, 24°30'W. Site is on the southeast shore of a small embayment along the northwest coast of Kap Renaissance. Pallet was resting on coarse rock and beach gravel at an altitude of 10 ft (3 m). Site was partly covered by snow, dry, and exposed to strong wind from the northeast.

5.3.10 Kap Renaissance, 81°13'N, 24°14'W. Site is 8 miles (14 km) west of Danmark Fjord on the south shore of a lake at the entrance to Zig-Zag Dal (Sjaellandssletten). Five pallets were resting on gravel at an estimated altitude of 200 ft (60 m). Site was clear of snow, dry, and subjected to slight wind from the east.

5.3.11 Nord, 81°43'N, 17°51'W. Installation is on raised marine beaches on Prinsesse Dagmar Halvø. Supplies consisted of rations, fuel, and equipment landed by C-130.

5.3.12 Romer Sø, 81°01'N, 20°35'W. Site is 1.3 miles (2 km) west of Romer Sø on the north slope of the major valley west of the lake. Two pallets were resting on coarse broken rock at an estimated altitude of 500 ft (152 m). Site was partly covered with snow, dry, and subjected to slight wind from the east.

5.3.13 Centrum Sø, 80°08'N, 23°03'W. Site is on a raised lake terrace at the west end of Centrum Sø. Ten pallets were resting on pea gravel at an estimated altitude of 380 ft (115 m). Site was free of snow, slightly wet, and subjected to slight wind from the east.

5.4 Recovery of Parachute-Dropped Supplies

The parachute drop sites, except at Centrum Sø and Brønlund Fjord, were scouted from the air by helicopter during recovery operations. Krinsley had participated in all the parachute drop missions and was familiar with the landmarks at each site. In most cases the parachute drops were spotted within 5 minutes or less of scouting. The parachute drops at Kap Renaissance and Kap Rasmussen, however, required 30 minutes of scouting before they were located. In the case of the former, low overcast and poor light made it difficult to distinguish the pallets and parachutes. In the latter case many small similar hills and valleys along with color of the soil and the presence of large boulders made the pallets difficult to find. At most drop sites the parachutes were of little use in spotting the drop because they were green-brown camouflaged ones and blended with the soil color and pattern. In addition the parachutes after landing generally were rolled into tight cylinders by the wind.

Centrum Sø. All fuel, food, and supplies parachute-dropped on 22 June 1959 were inspected on the ground on 7 May 1960. There was 100 percent recovery of all items.

Kap Renaissance. Six pallets (14 barrels of aviation gasoline; food; and equipment) were parachute-dropped on 23 June 1959. On 2 July 1960 the site was inspected on the ground. One pallet containing 4 barrels of aviation gasoline was damaged and the gasoline lost. All other fuel, food, and equipment were recovered.

Kap Rasmussen. Five pallets (18 barrels of aviation gasoline; 1 barrel of oil; food; and equipment) were parachute-dropped on 25 June 1959. On 4 July 1960 the site was inspected on the ground. One pallet containing 4 barrels of aviation gasoline was damaged and the contents lost. All other fuel, food, and equipment were recovered.

Depot Bugt. All fuel parachute-dropped on 20 June 1960 was recovered on 5 July1960.

Bliss Bugt. Six pallets (16 barrels of aviation gasoline; 1 barrel of white gasoline; 1 barrel of oil; food; and equipment) were parachute-dropped on 25 June 1959. On 6 July 1960 the site was inspected from the air at 500 ft (152 m). The pallets were not observed but the presence of a parachute nearby suggested that the parachute drop came to rest in a ravine that was then covered with at least 10 ft (3 m) of snow. Because of the limitations of time no further attempt was made to recover the cache.

Constable Bugt. Seven pallets (20 barrels of aviation gasoline; 1 barrel of oil; 2 barrels of white gasoline; food; and equipment) were parachute-dropped on 24 June 1959. On 6 July 1960 the site was inspected on the ground. All the pallets were damaged in landing and the barrels were torn loose and scattered on the hillside. Six barrels of aviation gasoline leaked and were empty. The remaining barrels were assembled by rolling to a flat area where the helicopters could land. In rolling the barrels, rust and sediment were stirred up and the gasoline could not be used. The white gasoline, oil, food, and equipment were recovered and recached.

Brønlund Fjord. Sixteen pallets (67 barrels of aviation gasoline; 2 barrels of white gasoline; 3 barrels of oil; food; and equipment) were parachute-dropped on 21 June 1959. Twenty-eight barrels of aviation gasoline were damaged and the contents lost, due to unopened parachutes resulting from inadequate spacing of the trip lines. Some food was also lost because of parachutes dragging along the ground (Fig. 33), but all equipment (radio, generator) was recovered when the site was visited on the ground on 9 July 1960. All fuel parachute-dropped on 20 June 1960 was recovered on 9 July 1960.

The caches parachute-dropped in 1959 at Victoria Fjord, J. P. Koch Fjord, Kap Ludovika, Romer Sø, and Citronen Fjord (F. E. Hyde Fjord) were not visited in 1960.

5.5 Recommendations for Future Parachute Drop Operations

a. Drops should not be made with a surface wind greater than 20 knots.

b. Parachutes used in arctic areas (with strong winds) must be automatically detachable from the pallets on landing.

c. Parachutes and pallets should be marked with both orange and white panels for either snow or land conditions. Camouflage parachutes should not be used.

Figure 33. Condition of airdropped material, Brønlund Fjord, 9 July 1960. Airdrop was made in 1959.

6. CONCLUSIONS

a. The reconnaissance has shown that North Greenland was not covered by a continental ice cap during the last glacial stage.

b. Most unprepared sites in North Greenland are not suitable for long natural airfields. However, minor grading would make it possible to develop many airstrips 5000 ft (1524 m) long capable of supporting heavy aircraft.

c. Numerous sites are available for runways as much as 2000 ft (609 m) long that without grading can support light aircraft.

d. Soils are strong enough at all sites to support heavy aircraft except for a two-week period during the melt season in late May or June.

e. Permafrost conditions in North Greenland do not impose severe restrictions on construction. Ice wedges and lenses do not appear to be well-developed; and, if natural surfaces are not extensively altered, frost action is at a minimum.

f. Helicopters are well-suited for field work in North Greenland. Large helicopters can be used with the same versatility as small ones, but the cost in fuel is relatively high and logistics increase.

g. Preseason airdrops of supplies to form caches by experienced crews is practicable and no serious problems exist in recovery of the airdropped material.

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EVALUATION OF ARCTIC ICE-FREE LAND SITES KRONPRINS CHRISTIAN LAND AND PEARY LAND N. GREENLAND, 1960 - by W. E. Davis and D. B. Krinsley, May 1961. pp. incl. illus. and tables. (AF Surveys in Geophysics No. 135; AFCRL 469) Unclassified Report

A report of terrain investigations conducted in N. Greenland in June-July '60 to locate potential air-field sites. Eight sites were studied; all require a small amount of grading to make a 5000 ft runway. Also, the Bronlund Fjord airfield, site of a natural-surface test landing in '57, was re-examined; the runway's eastern half was found unusable at the time because of late snow melt and poor drainage.

Scientific observations, as part of the program, showed that northern Peary Land was covered only by valley glaciers during the last glacial period and that an extensive marine invasion, depositing marine and related lacustrine silt, occurred when the ice retreated about 6000 yrs ago. This was followed by a readvance of glaciers down major fjords and subsequent retreat to present ice fronts.

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Terrain - N. Greenland
Landing Fields - N. Greenland
Glaciers - N. Greenland

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