

## **SOME EXPERIMENTS WITH THE USE OF A HELICOPTER FOR SPECIAL SURVEY JOBS**

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During the winter of 1966-67 the President of the "Expédition Glaciologique Internationale au Groenland" (E.G.I.G.) asked the Royal Danish Hydrographic Office whether it would be possible during the 1967 survey season to take soundings as close as possible along the fronts of certain glaciers in Greenland in order to obtain profiles of the fjord bottoms, the reason being that E.G.I.G. was of the opinion that by so doing it would be possible to make an estimate of the amount of ice produced yearly by these glaciers, the horizontal movement being already known.

The glaciers specified were situated in the Umanak district and the Disko Bugt area. Knowing that as a rule it may be difficult if not dangerous to get close to the glacier fronts on account of falling ice masses and the presence of icebergs and growlers floating in the water near the front, usually milling around madly, all thought of using any kind of survey vessel had to be given up.

Instead it was decided to try to solve the problem by using the Alouette helicopter with which the survey ship is supplied to take spot soundings between the floating ice. Towing the transducer was considered out of the question.

Very little time was available for experiments in home waters, which moreover are very shallow compared to Greenland waters, so the helicopter was fitted with a 24 volt Atlas Nerius echo sounder working on a frequency of 13 kc/s, theoretically able to measure down to 1 000 metres.

The transducer was hung on a thin wire to which the cable connecting it with the recorder was tied, and a float (balloon) to carry it at the right depth was attached to it, all this weighing about 30 kilos.

In order to get as near to the glacier fronts as possible it was originally planned to have the transducer hung 90 metres beneath the helicopter as this, it was thought, would generally allow the aircraft to fly just above the upper edge of the glacier front.

However, experiments made over open water showed that with this length of wire both wire and the connecting cable became severely tangled when being hauled in, this having to be done by means of a loosely installed

handwinch. Moreover the helicopter pilots advised strongly against flying too close to the glacier where turbulences of some strength may occur.

The 90 metres wire was consequently discarded, and a length of 30 metres decided upon, mainly because it would thus be possible to use the helicopter's proper lifting cable which is 30 metres long and which can be hauled in electrically. This was important as the soundings had to be taken whenever there was room between the bergs and growlers and the transducer consequently had to be lifted clear of the ice when moving from one place to another. The helicopter hovered while sounding, positioning being done by means of two theodolites placed on trig points ashore, timed by radio from the helicopter (fig. 1). The echosounder was, as mentioned, theoretically able to measure depths up to 1 000 metres, but on arrival in Greenland it became evident that owing to loss of power in the connecting cable only depths up to about 500 metres could be measured.

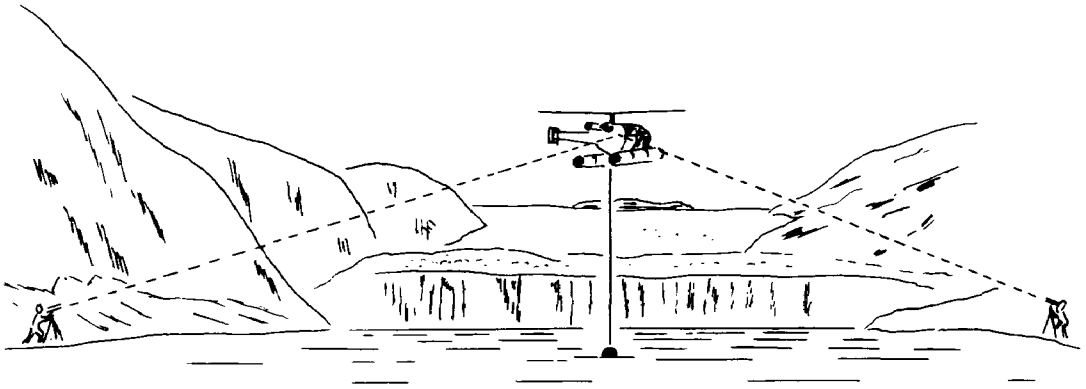


FIGURE 1

The surveys were conducted between Aug. 17th and 27th, the first glacier chosen being "Store Gletcher" at the head of Qarajaq Isfjord, East of Umanak.

This fjord was so full of ice that it was impossible to get any nearer than 10 miles with the survey ship, at which place the depth was 900 metres, and as the general depth in the long Icefjords in this district is about 1 000 metres the helicopter soundings gave no results.

Near the front of this glacier very strong eddies were observed, caused by the outflow of fresh water from under the glacier, which would make it as impossible to take soundings as when backing ship. Similar conditions were observed at the fronts of other glaciers where the water at times appeared to be boiling.

In Karrats Isfjord it was possible to get within a mile of the front of Brinks Isbrae and a regular sounding line showing depths of about 800 metres was run by the survey ship. The height of the glacier front was measured by the helicopter to be 120 metres.

At the Eqip Sermia at the head of Atâ Sound, Disko Bugt, the depth proved to be much shallower than in the icefjords further North, and the

helicopter here successfully spot-sounded in front of the glacier finding depths between 30 and 110 metres.

The experiences gained through these experiments show clearly that for future surveys of this kind steps will have to be taken to reduce loss of power in the connecting cable by using the proper type of cable and transducer, and by flying at fairly low altitude. Further, an echosounder able to penetrate the "boiling" water in front of the glaciers, if such exists, would be desirable.

Apart from the sounding experiments at the glacier fronts a number of height determinations were made by the helicopter at the request of the Danish Geodetic Institute in the inaccessible area around Karrats Isfjord. Some 41 heights between 500 and 2 000 metres were determined in one day with fine clear weather by placing a precision barometer in the helicopter from which a series of readings were noted, as were readings from the altimeter while the helicopter hovered immediately above each mountain-top. At the same time readings from a similar precision barometer were noted in the survey ship.



The helicopter was flown with reduced pressure in the pontoons which allowed it to rise to a maximum of 2 000 metres.