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Proposed Site for Indian Research Station in Weddell Sea Area — Antarctica

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Introduction

The Indian Scientific Expeditions to Antarctica have been launched regularly since 1981. Two permanent stations have been established till date at Dakshin Gangotri and Maitri for conducting year long scientific activities. The studies mainly include Earth Sciences, Meteorology, Marine Biology and problems related to logistic support. With the experience in Dronning Maud Land, DOD has now planned to enhance the scope and activity in Antarctica. The First Weddell Sea Expedition launched with 21 member team on board 'Polarbjorn' was a step in this direction. The main objective of this expedition was to recce Filchner Ice Shelf, Berkner Island and surrounding area with a view to select a site for establishing a Permanent Station either at Berkner or at a suitable place in nearby location. The new station would facilitate exploration in the Weddell Sea area and Trans Antarctic Mountains. The route selected was via Mauritius to refuel the ship and to get additional supplies. The journey upto Mauritius was good except for two days, just before reaching Mauritius, when the ship had to pass through a cyclone affected zone. The journey from Mauritius upto Berkner had many anxious moments especially while passing through "roaring forties" and the cyclone zones. A few members were affected by sea sickness, mostly because of heavy rocking and rolling of the small ship.

Site Selection for Station

The following sites were reced and are recommended for the new Station:

- (a) INDIA - I : At $78^{\circ} 15'S$ Lat and $40^{\circ}W$ Long. This is on Filchner Ice Shelf approximately 60 kms east of Berkner.
- (b) INDIA - II : South of Roberts Inlet at $79^{\circ} 18'S$ Lat & $43^{\circ} 30'W$ Long, along the eastern side of the Berkner Island. This site will be effective for further exploration in the Trans-Antarctic Mountains.
- (c) INDIA - III : On or near the Littlewood Nunataks at $77^{\circ} 53'S$ Lat & $34^{\circ} 10'W$ Long, approximately 10 kms away from Belgrano II Station. Argentina has put two refuge huts at this location which are not being used by them at present.

Station on Filchner Ice Shelf (India-I)

During First Weddell Sea Expedition, it was feasible to reach very near $78^{\circ}15'S$ Lat, where a temporary camp/refuge hut was established along with POL dump of 22 barrels. The area around camp was recce by SKIDOO and by air. The main points of interest noted were:

- (a) The Filchner Ice Shelf has high banks with overhangs along the front and is not easily approachable by ship.
- (b) The ice shelf edges are heavily crevassed inwards upto a distance of 10 to 15 m and the approach to ice shelf is difficult.
- (c) All activity of logistic movement will have to be done by helicopters.
- (d) The approach from Filchner Ice Shelf to Berkner Island requires detailed recce on vehicles to negotiate such area.

Argentina, U.K. and Russia had earlier located their stations on Filchner Ice Shelf. This, coupled with our experience of this year, indicates that a station can be established on this shelf. The station of Filchner Ice Shelf would work as base for establishment of a permanent station at Berkner Island. As the ice shelf along the front is mostly crevassed, a suitable site by going inside 15 to 20 kms, will have to be recce. The station could be like Dobson Hut system which was provided earlier near Dakshin Gangotri. This mainly includes a timber footing and an open container carrying frame which could be ready to use or in a frame construction. The superstructure of the station could be based on mini-construction or a



Fig. 1. Refuge hut at India-I, Filchner Shelf, $78^{\circ} 15'S$: $40^{\circ} W$, Weddell Sea.

modular structure. Such a station would accommodate 6 to 8 personnel with adequate logistic support and storage area to support the main station of Berkner.

As already reported a refuge hut (Fig.1) was erected on the shelf by the expedition members. This knock-down hut supplied by HIALTECH had large number of components and hundreds of nut bolt connections which made the construction difficult and timetaking.

Station at Berkner Island (India -II)

Berkner Island was reced along its northern and eastern sides near its confluence with Ice Shelf. Three areas have been reced for the purpose of establishing a station:

- (i) Northern tip
- (ii) McCarthy's inlet
- (iii) Roberts inlet

Berkner Island is roughly 350 km X 150 km and is capped by polar ice. The edge of Berkner and adjoining ice shelf could be clearly seen from air. The slopes from Berkner to Filchner are steep initially and gentle after half way and mostly flat with little slopes on the tip. There are two main rises along the length of Berkner, approximately at south-west tip of Berkner.

The average snow-fall and accumulation of drift snow on the Berkner island is considerably high. An experimental study of snow accumulation conducted by the Geological Survey team for ten days revealed an accumulation rate of 3 cm per day during the period of observation in the month of January, 1990.

It would be more challenging to establish a permanent station on Berkner which may have constant logistic problems. However, with meticulous planning and dedication it should be feasible to establish a good station on Berkner. As there are no rock exposures on Berkner, the station has to be on ice. The site selected south of Roberts Inlet 79° 18' S Lat and 43° 30'W long is almost at the centre of the Berkner Island. The movement upto the site from the northern tip of Berkner could be on snow vehicles. A fuel dump can be created at the site for operating helicopters upto Dufek Massif and the main station can give logistic support and facilities for laboratory work. For a station at Berkner, one has to be prepared to meet the eventuality of the ship (Ice breaker) not reaching the vicinity of the Filchner Ice Shelf. Under such circumstances, the station should be self-sufficient with proper stocking even for a period of 2 years.

The main considerations for a station on Berkner are :

- (a) Berkner Island, the largest ice rise in Antarctica will be available for detailed study.
- (b) Movement over Berkner with snow vehicle is easy and the entire area could be easily explored. The POL dumps at various locations will be essential to cover the distance upto Trans-Antarctic Ranges.
- (c) Exploration of Trans-Antarctic Ranges, with station on Berkner, will be ideal.
- (d) Even though, some nations have tried to carry out work on Berkner, there is no permanent presence. Belgrano III at northern tip was abandoned in 1987 due to logistic problems.

- (e) With little hardship initially, Berkner location will prove an ideal place for future explorations.
- (f) Easier to prepare a skiway for an aircraft to land.

The ice breaker selected for future expeditions to Berkner should have carrying capacity of minimum 2 MI-8 and 2 *Cheetah* helicopters. It would be difficult to execute the construction of a hut with the help of only the *Cheetah* helicopters. A minimum of three to four snow vehicles with articulate type sledges, six to eight snow scooters with sledges, a small and medium crane mounted on track vehicles with adequate fuel storage would be essential. For easing the approaches on ice shelf and the routes to Berkner, light weight dozers, approximately 2 to 3 nos, will be required.

A Light Weight Aerial Cableway 200 M to 250 M with carrying capacity of 75 kg on one hook and 150 kg on two hooks will be a good support and help in case of crossing crevassed areas.

Availability of a fixed wing aircraft in nearby vicinity, as is available in Filchner Station of West Germany is a must for logistic support and emergency evacuation. In case our own fixed wing's support is available, that would be ideal.

Station on Nunataks (India - III)

Establishing a station, near Belgrano II, on rocks - Littlewood Nunataks ($77^{\circ} 53'S$ Lat; $34^{\circ} 10' W$ Long) would be ideal. A suitable site is available for a small station on these rocks where two small huts have been erected by Argentina (Fig.2). Since sufficient place is available at the present location of Belgrano II, Argentinian may spare the site selected by us. However, DOD may have to approach for obtaining clearance and willingness to allow Indian permanent station in this area. With the past experience of Argentina in Weddell Sea area, we can be benefited with their co-operation. A thought could also be given for launching a joint programme for exploration in this area.

Ships (Icebreaker Class) have been able to reach almost every year to Belgrano II, thus the logistic support is assured. The shifting of stores is considerably easy as the distance involved will be only 5 to 8 kms from ice shelf.

The construction of station in this area will not pose any major problems as this will be similar to Maitri Station, and could be on stilts with modular structure based on sandwiched panels with central electric heating, power supply and allied facilities.

Alternatively, ready to use aluminium light weight containers (size 10 ft x 10 ft) within the carrying capacity of MI-8 helicopter could be planned. As most of the facilities could be built-in, the site work will be minimum. The station could be established in about 8 to 10 days time and a small detachment of 5 to 6 persons could be left to complete the work, who could remain through one winter or come back alongwith the main expedition. The main expedition for exploration of Berkner and Filchner Ice Shelf could also be launched simultaneously.

A layout based on mini containers/modular construction to establish a 6 men station at Littlewood Nunataks (INDIA-III) is proposed. This facility could be increased/reduced depending on final requirement. Once this station is established, effort could be made to

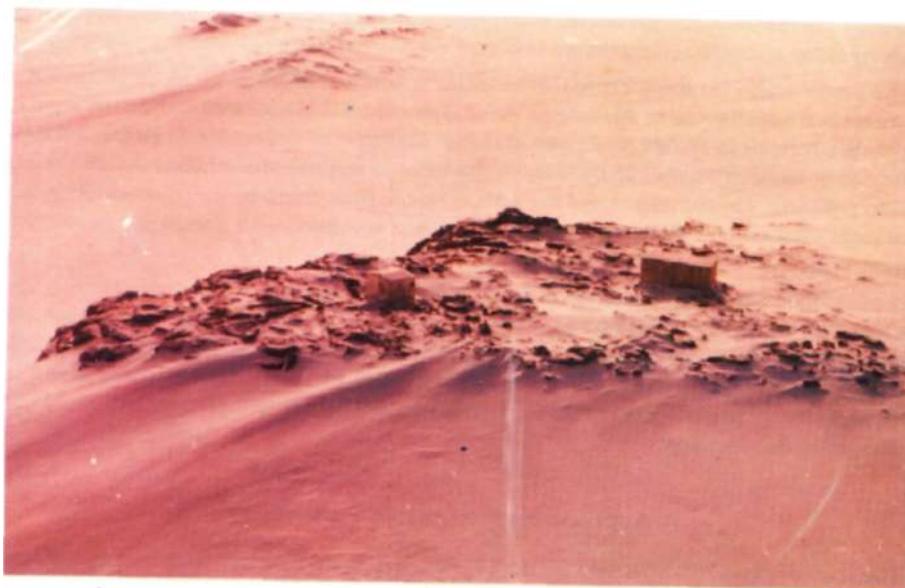


Fig.2. Site for Indian Station (India-III), Littlewood Nunatak, $77^{\circ} 53'5''S$: $34^{\circ}10'W$ (Two refuge huts built by Argentina).

connect the station of Filchner Ice Shelf, and proposed site near Roberts inlet of Berkner with a land route, so that the snow vehicles can easily operate in this area. The approximate distance between each station would be 100 km. With a detailed recce a proper route marking is feasible.

Simultaneous activity by sub-groups for establishing the route to Berkner, exploration of Berkner and establishing the station on Filchner Ice Shelf will have to be planned meticulously and coordinated for independent execution. Since the clear days are limited and pulling out of the ship is mostly dictated by ice movement and weather, it is, therefore, more important to plan the logistic support even upto sub-groups. The layout plan given for the station INDIA-III could be suitably modified and used for this area. The water supply would be based only on snow melt.

Type of Structures

The first Indian Permanent Station, Dakshin Gangotri which was on ice shelf was made of special plywood. It could be effectively used till it got completely buried under snow in about 6 years time when it had to be abandoned.

The Halley Bay Stations of U.K. i.e. Halley I, II, III & IV all of which had a life span of seven to eight years, were built from same material. The new station under construction is based on jack-up platform system. The entire station has to be lifted using mechanical jacks. The expected life of the station is around 10 to 12 years. The station is 16-18 km inside ice

shelf edge. Since the accommodation is exposed, the claustrophobic feeling of buried structure is avoided and maintenance would be easy.

The construction on ice shelf has to be either a surface which is going to be buried, a resistant shell structure as in the case of West German Neumayer Station or in the form of jack-up platform as in Halley V. Proposed Indian Station on Filchner Ice Shelf i.e. INDIA-I or the one at Berkner Island (INDIA-II) would have to be either based on resistant shell or jack-up platform. On the other hand the station on the rock could be like the second Indian Permanent Station — Maitri based on adjustable columns with sandwich panel wall construction.

If containers could be moved to such location, container based accommodation would also be appropriate as it would be easy to construct on a raised platform, like Dobson Hut constructed at DG, by carrying the container modules by helicopter. These modules would be light weight aluminium or fibre glass which could be easily carried under-slung by helicopters for a distance of 5 to 6 kms. A small station for six to eight persons could thus be planned at this location.

Appreciation for Logistic Support

The journey upto 70° S Lat and 20° to 22° W Long could be easily managed by ice class ships. However, for movement inside the Weddell Sea area, it is essential to have an ice breaker with latest equipment on board for manoeuvering through thick sea ice and iceberg zones.

It is understood that the Belgrano III Station which was established in 1986-87 along the northern tip of the Berkner island could not be maintained due to logistic problems, and has been presently abandoned. However, to the west of Berkner, the German Field Station (Filchner) is normally manned in summer with the help of Fixed Wing Aircraft and the ice breaker "Polar Stern".

With the modern facilities to monitor ice condition, which is available throughout the year from Satellite and with improved onboard ship equipment, it could be feasible to reach the Filchner Ice Shelf (i.e. around 78° S Lat & 40° W Long) every year for a limited period. However, the movement of icebergs in this area, especially larger size icebergs which sometimes get anchored to the ground, may pose some problem of restricted manoeuverability. It is, therefore, essential that the movement upto Filchner Ice Shelf should have flexibility even for movement by air. In case of any emergency, the station could be stocked or the personnel evacuated depending upon the site conditions and the logistic support.

The working period available during the months of January and February for any task in this area would be much restricted, may be 25 to 30 days including bad weather days. In such a situation, brisk operation would be extremely essential. Hence, while planning a compact station, the stores which could be moved in shortest possible time and construction to be completed by well trained men in minimum period is essential. This would always be guiding factor in any future station in this area.

The Filchner Ice Shelf, Berkner Island, sea side ice shelf edges are mostly crevasse affected areas. It may be almost impossible to reach the ship upto the ice shelf due to the overhung ice and high banks of the shelf. It may be essential even to artificially create an

approach to the Filchner Ice Shelf. This may involve blasting or the overhung portion or ice and creating a small approach to the ice shelf by dozing or by explosive blasting. A similar approach to ice shelf has been made at Halley Bay Station.

The station planned at Filchner shelf would have to be kept sufficiently inside from ice shelf face, to ensure that the station would not move out in sea in the form of an iceberg before the expiry of the desired life. Halley V has been kept approx. 16 to 18 km inside ice shelf edge.