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REDAKSIONEEL — EDITORIAL

Weerkundige en wetenskaplike navorsingsbedrywighede van die Republiek in Antarktika het 'n nuwe belangstellingsveld vir Suid-Afrikaners geopen. Die rooi en bruin horisonne van die sand- en bossievlaktes en die bloues van die Boland en die see is aangevul met 'n nuwe horison—die witte van Antarktika.

Die verbreding van die einders getuig uit die vele navrae, veral van skoliere, oor lewe en gebeure van mens en dier om en op die Antarktiese vasteland. Hulle belangstelling word natuurlik gaande gehou deur die verspreiding van sesduisend eksemplare van die *Antarktiese Bulletin* op 'n keer deur die *Spectrum*, en deur die versoek van onderwysers om take oor Antarktika op te stel.

Ons hoop om wanneer ruimte dit toelaat in die toekoms meer gereeld gepaste artikels te publiseer om die skrywe van skooltake te vergemaklik. In hierdie uitgawe verskyn die eerste bydrae in dié rigting oor die honde en hul rol in Antarktika.

Moet tog net nie in die versoeking val om die Redakteur te versoek om 'n skooltaak oor die Antarktika haastig vir die indiwidu op te stel nie! Navrae van lesers, en veral skoliere, en kommentaar word verwelkom om te help met die keuse van bydrae wat in die smaak van alle lesers val. Beantwoording sal deur middel van die *Bulletin* plaasvind sodat die inligting tot nut van die breë leserskring kan wees.

Die Toepassing van Radio-aktiewe Isotope in Antarktika

A. M. VENTER, Leier SANAE IV, Wetenskaplike, Raad op Atoomkrag

Sedert die Internasionale Geofisiese Jaar (1957) is daar 'n voortdurende belangstelling in Antarktika. Sommige wetenskaplike probleme is reeds ontrafel. Die oplossing van veel meer moet nog gevind word. Die onherbergsaamheid, die lae temperature en gedurige wind op die Antarktiese plato bemoeilik dit.

Wanneer aan die vestiging van 'n basis gedink word oorheers twee aspekte die beplanning: (1) logistiese ondersteuning, en (2) kragvoorsiening.

Die belangrikste aspek van logistiese ondersteuning is die vervoer na Antarktika van groot hoeveelhede konvensionele koolwaterstofbrandstof teen 'n ontsettende hoë koste. Dan, met somerekspedisies na die binneland of na oorwinteringsbasisse daar, word die vervoer van brandstof, weens die gewig, weer feitlik die belangrikste oorweging. Die enigste doeltreffende manier om brandstof in Antarktika te vervoer is deur lugvervoer, wat die koste per gelling egter geweldig verhoog. Uit eie ondervinding weet ons dat op die Suid-Afrikaanse ekspedisies, waar van konvensionele vervoermetodes gebruik gemaak word, brandstof 'n groot deel van die beskikbare ruimte op sleë in beslag neem, ten koste van beweeglikheid, soms selfs veiligheid en wetenskaplike toerusting.

Gepaard met die probleem van brandstofvervoer gaan kragvoorsiening, eerstens vir die oorlewing van die ekspedisielede, en tweedens vir elektriese kragvoorsiening vir die uitvoering van wetenskaplike werk.

Een moontlike oplossing vir die probleem van kragvoorsiening is feitlik voor die hand liggend in die lig van geweldige tegnologiese vooruitgang op die gebied van kernkragreaktore. By McMurdo Sound en in Groenland is reeds kernkragsentrales met 'n sekere mate van sukses in gebruik. Die bedryfservaring met hierdie tipe reaktore is egter nog redelik beperk. Op hierdie stadium kan nog nie met sekerheid gesê word of die reaktore die toets in Antarktiese of Arktiese gebiede suksesvol sal deurstaan nie.

Kernkragsentrales los egter net 'n deel van die probleem op, aangesien uit die aard van die saak 'n reaktor nie maklik vervoer kan word nie, en derhalwe nie sondermeer vir kragopwekking by klein binnelandse basisse aangewend kan word nie.

Kernkragreaktore is by uitstek geskik vir groot kraglewering soos b.v. by McMurdo Sound. Die instandhouding van 'n reaktor, soos die herlaai van brandstof en die verwydering van radio-aktiewe afval, skep egter probleme wat nie maklik by 'n klein Antarktiese basis oorbrug kan word nie.

Intussen egter het die tegnologie van radio-aktiewe-isotoopkragbronne fenominale vooruitgang getoon en beskikbare resultate dui daarop dat aan die kragvereistes van 'n klein Antarktiese basis met so 'n kragbron wel voldoen kan word. Die koste laat egter nog veel te wense oor.

'n Isotoop, soos Co^{60}, Ce^{144} of Sr^{90}, word verseël in 'n houer wat dik genoeg is sodat al, of feitlik al, die α-partikels en γ-strale wat deur die isotoop afgegee word geabsorbeer word. Wanneer hierdie partikels of strale geabsorbeer word, word hitte vrygestel, wat, *via* 'n hitte-uitruiler, 'n turbine kan aandryf en sodoende elektriese krag kan opwek.

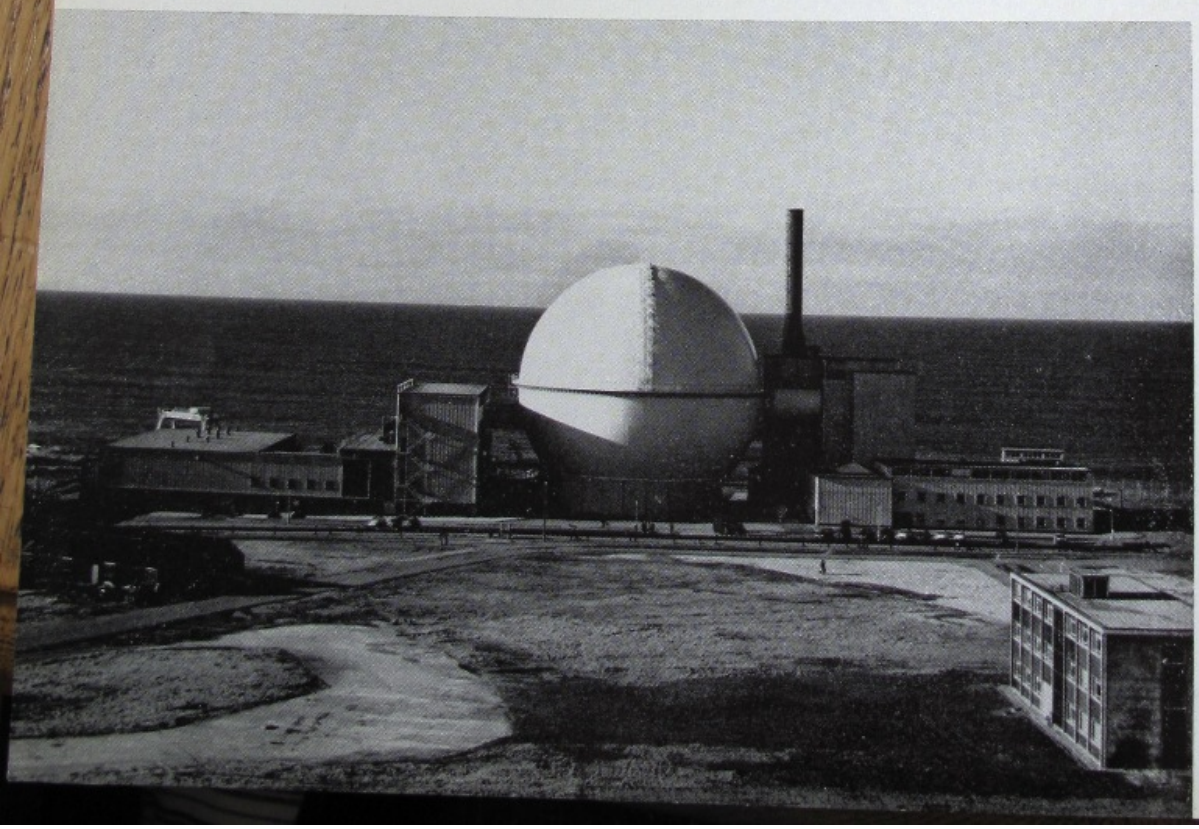
Laat ons nagaan wat die kragverbruik van 'n klein Antarktiese ekspedisie van 4 tot 5 man is. Toetse het getoon dat so min as 15 watt voldoende is vir 3 tot 12 maande vir 'n goedtoegeruste onbemande weerstasie. Die Amerikaanse vloot bereken die volgende: vir 'n 4 tot 5-man Antarktiese basis is 'n minimum van 10kW (elektries) en 10 kW (termies), d.w.s. gewone hitte-energie, nodig. Hierdie syfers verskil kennelik van basis tot basis afhangende van die omgewing en van die tipe wetenskaplike apparaat wat gebruik word. Vergelykbare syfers vir 'n 10-man navorsingskapsule op die seebodem is 10 tot 20 kW (e) plus 20 kW (termies).

Verskillende radio-aktiewe isotope kan vandag kunsmatig vervaardig word óf direk óf as 'n neweprodukt in kernkragreaktore. Een van die ernstigste probleme, so ver dit isotoopkragbronne aangaan, is egter om groot hoeveelhede van 'n spesifieke isotoop teen 'n redelike koste te bekom. Verder is daar ander beperkings: die isotoop moet b.v. 'n lang halfleeftyd hê, die vervalbestraling moet maklik kan afgeskerm word, die isotoop moet redelik lig wees en sy chemiese vorm moet nie-korroderend wees en moet by hoë temperature (in die orde van 500 sentigrade) chemies stabiel wees.

Een van die belowendste ontwerpe wat in die VSA ontwikkel is, is die sogenaamde Rise-enjin (Radio-isotope Submersible Engine), wat 'n kraglewering van 12 kW het. Die brandstof wat gebruik word is Ce^{144}. Die eenheid weeg 3,220 lb. en die algehele doeltreffendheid is 26.7 persent. Die verwagte leeftyd van die brandstof is egter net 6 maande. Dit is egter ook moontlik om Co^{60} i.p.v. Ce^{144} te gebruik, wat die leeftyd na ongeveer een jaar sal verleng. Co^{60} vereis egter 'n baie swaarder afskerming. Gevolglik is 'n generator met Co^{60} baie swaarder as dié van een met Ce^{144}. Die prys van Co^{60} is ook ongeveer vyfmaal hoër as dié van Ce^{144}. 'n Ander moontlike kragbron is Sr^{90}, wat weens sy lang halfleeftyd by uitstek geskik behoort te wees. In **Tabel I** word 'n paar van die belangrikste isotope en hulle verskillende eienskappe gegee.

TABEL I
VERSKEIE BELANGRIKE EIENSKAPPE VAN SOMMIGE RADIO-ISOTOPE

	Co^{60}	Sr^{90}	Cs^{137}	Ce^{144}	Pu^{238}	Po^{210}
Halfleeftyd (jr) ..	5·27	27·7	26·6	0·78	86·4	0·38
Watts/gram	2·9	0·3	0·074	2·7	0·39	140
Tipe straling	γ en β	β en x	γ, β en x	γ, β en x	α en n	α
Afskerming	swaar	swaar	swaar	swaar	lig	lig
Jaarlikse beskikbaarheid (kW): tans ..	7,500	90	48	800	15	9,400
1970-80	7,500	650	620	4,200	60	9,400
Prys: R/watt: tans	19	21	19	14	1,150	560
minimum 1970-80	7	14	19	1·4	380	7



Exterior view of the experimental fast breeder reactor at Dounreay, Northern Scotland, which has operated successfully and produced electricity for the last three years.

Photo: United Kingdom Atomic Energy Authority (1966).

'n Mens moet dus weer die koste van 'n konvensionele kragbron vergelyk met dié van 'n isotoopkragbron. Koolwaterstofbrandstowwe is algemeen en in groot hoeveelhede beskikbaar. Konvensionele kragopwekkers is beskikbaar en het reeds hulle pratktiese aanwending in Antarktika en Arktika bewys. Verder moet ook in gedagte gehou word dat, selfs al sou 'n basis met 'n isotoopkragbron toegerus word, dit oor een of ander konvensionele kragopwekker sal moet beskik, ingeval van 'n onherstelbare fout in die isotoopkragbron. Indien laasgenoemde egter foutloos en doeltreffend vir die periode van aflos tot aflos sou gewerk het, sou dit beteken dat konvensionele brandstof die daaropvolgende jaar nie teen koste hoef meegeneem te word na die basis nie.

Vir 'n 4 tot 5-man Antarktiese basis kom die aanvanklike koste vir konvensionele kragvoorsiening op ongeveer R47,000 vir die eerste jaar te staan. Hierdie uitgawe is net vir kragopwekking (10 kW e) en nie vir hitte nie. Dit sluit in twee 10 kW (e) generators, twee verhitters, twee 10,000-gelling opgaartenks en ook die koste en aflewering van die brandstof. Die koste van die vervoer en lewer van die brandstof is gebaseer op die tarief van lugvervoer vanaf McMurdo Sound na die basis en bedra net sowat 54 persent van die werklike koste. Indien die Ce^{144} isotoopkragbron onder dieselfde toestande vir 'n jaar gebruik word beloop die koste ongeveer R200,000, d.w.s. meer as vierkeer so veel as vir konvensionele brandstof. In hierdie geval beloop die koste van die 10 kW Ce-isotoop alleen 68 persent van die totale uitgawe. Die totale koste van R200,000 sluit in die gedeeltelike vervanging van die isotoopbron, asook 'n sekere hoeveelheid konvensionele brandstof vir noodkragvoorsiening. Uit die voorgaande is dit dus duidelik dat die koste van isotoopkragbronne op hierdie stadium nog nie teen dié van konvensionele kragbronne kan opweeg nie.

Die verwagte koste van Ce^{144} sal egter teen die begin van 1970 daal na R1.4/w, wat dus beteken dat dié isotoopvoorraad vir 10 kW R14,000 sal kos teenoor die huidige prys van R136,000. Bereken op hierdie basis sal die koste van R200,000, wat hierbo genoem is, daal na R46,000, wat goedkoper, alhoewel weinig, is as die R47,000 vir konvensionele kragopwekking, maar dit skakel vervoerprobleme, veral op die Antarktiese vasteland, uit.

Wat betref die personeel vir die instandhouding van 'n kraginstallasie, weet ons uit ondervinding dat die gewone elektriese generators redelik eenvoudig en duursaam is, maar dat sekere herstelwerk van tyd tot tyd nogtans steeds nodig is. By 'n oorwinteringsbasis en by selfs net 'n somerbais op 'n afgeleë plek in Antarktika is dit dus noodsaaklik dat een van die personeellede by so 'n basis 'n ervare werktuigkundige moet wees. In die geval van 'n isotoopkragbron met 'n doeltreffende energie- omsettingsisteem, is geen of geringe aandag nodig. In die geval van Ce^{144} kan b.v. 'n deel van die isotoopbrandstof na ses maande, d.w.s. aan die einde van 'n somerekspedisie, vervang word. In die geval van 'n oorwinteringsekspedisie kan Co^{60} gebruik word wat eers na 'n jaar vervang moet word. Dit skyn dus dat wanneer van isotoopbronne gebruik gemaak word, die instandhoudingspersoneel nie self lede van so 'n ekspedisie hoef te wees nie.

Ons kan opsom deur te sê dat die huidige hoë koste van isotoopkragbronne nie kan vergelyk met konvensionele brandstofkragbronne nie. Die feit dat eersgenoemde 'n ligte en kompakte eenheid is, met geen of geringe instandhouding, te same met die verwagte daling in die koste van radio-aktiewe isotope in die vroeë sewentiger jare, kan meebring dat hierdie metode van kragvoorsiening heelwaarskynlik nog 'n groot rol in 'n plek soos Antarktika sal speel, en moontlik heeltemal konvensionele kragbronne kan vervang.

Ten slotte wil ek net 'n ander baie interessante toepassing van radio-aktiewe isotope in Antarktika noem. Die omsetting van hitte na elektrisiteit kan m.b.v. termokoppels verkry word, deur die bekende *Seebeck-effek*. Generators wat op hierdie prinsiep werk is reeds in Engeland ontwikkel en die kraglewering wissel tussen 5 en 10 watt. Hierdie termo-elektriese omsetters behoort vir klein onbemande weerstasies in Antarktika of op Bouvet-eiland geskik te wees.

SUMMARY

An important aspect of logistical support of Antarctic expeditions is the transport of large quantities of conventional carbon hydrogen fuel to and on the Antarctic continent. Besides being costly and cumbersome, it may affect the scope, safety and equipping of sledging parties. With these problems goes the supply of electric power for comfort and for the running of scientific apparatus.

One obvious method to solve power supply is with atomic power stations, which have already been installed at McMurdo Sound and in Greenland. At this stage it cannot be said yet that it will continuously be successful. Atomic power stations are primarily intended for large bases.

On the other hand the technology of radio-active isotope methods of generating power have advanced satisfactorily. Results so far obtained indicate that the power needs of small Antarctic bases can satisfactorily be met from these sources. Isotopes Co^{60}, Ce^{144} and Sr^{90} are discussed. The Rise (Radio-isotope Submersible Engine) engine, developed in the United States, can deliver 12 kW. It makes use of Ce^{144} as fuel. The unit weighs 3,220 lb., with an overall efficiency of 26.7 per cent. The expected life of the fuel though is only six months. Using a Unit with Co^{60} the continuous life will be extended to 12 months. This isotope, however, needs heavier shielding and therefore the unit will weigh much more. Furthermore, the price of Co^{60} is about five times that of Ce^{144}. Perhaps another suitable isotope will be Sr^{90}.

Considering expense, the cost of supplying 10 kW (energy) with the conventional type of carbon hydrogen fuel for a 4-5 man base amounts to R47,000 for the first year. The cost of a power unit, using Ce^{144} as fuel, will be about R200,000. It is expected that the price of Ce^{144} would have decreased by 1970 to R1.4/watt, which will decrease the overall cost of this unit to R46,000. Although only slightly cheaper than the conventional type of engine for generating electricity, it will in addition minimize transport problems.

By and large radio-isotope power units promise to play a major role in the foreseeable future at small and isolated bases.

In conclusion mention is made of the application of the principle of converting heat to electricity by means of thermo-couples (the Seebeck effect). One type of unit has already been developed in Britain and can deliver 5 to 10 watt. This type should be suitable for small unmanned stations in Antarctica and on Bouvet Island.

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THE HUSKY—FRIEND AND FIGHTER

by A. le R. VAN DER MERWE, SANAE I

Towards the end of 1959, South Africa sent its first Scientific Expedition to Antractica, and I was Medical Officer to this group.

We sailed from Cape Town on board the *Polarbjorn*, a 486 ton Norwegian sealer, on the evening of Thursday, 3rd December. Having fought our way through heavy pack ice, we arrived, 36 days later, at the ice-front.

Offloading of stores started immediately, and for weeks after the *Polarbjorn* had departed, we transported 165 tons of supplies by sledge from the depot at the icefront to our base, 22 miles inland. To transport 165 tons of supplies at the rate of 4 tons approximately per trip took us until the end of February.

Our team, consisting of ten members (the leader, four meteorologists, a radio operator, a radio technician, a geologist, a diesel mechanic and myself) took over the Norwegian base. A boat would, if it could get through the ice, relieve us a year later.

All heavy transportation was done by crawler tractors. The petrol-driven Canadian muskeg with its very wide rubber tracts, was the most comfortable and the fastest. The diesel tractor was a much slower vehicle and during the hottest part of the day it used to dig itself into the soft snow, which caused us to arrive late at our destination on many occasions. The lowering of temperatures during the night hardened the surface and made it more suitable for travel, but the diesoline used to cool to a jelly-like consistency making the tractor inoperative. Many a time this freezing of the diesoline made us unhitch and abandon one of the loaded sledges until a later date.

Temperatures of 20 degrees Centrigrade below freezing point were frequent during these trips between the ice-front and our base. It was during these trips that Chris, our mechanic, met with many heartbreaking experiences with the jelly-like diesoline. Naturally, both he and the stalled tractor became the butt of our good-natured "insults" until he hit on the idea of running the tractor on illuminating paraffin which does not turn into jelly until temperatures of well below minus 30° Centigrade are experienced.

With the husky-drawn sledge, however, there were no fuel problems. This mode of travel is most reliable, has no starting troubles and needs no spare parts.

Huskies tread lightly on the snow and over hidden crevasses. These latter are sensed by the leader dog who immediately veers the team away from the danger area, hauling the sledge and its load to safety.

The Norwegian Expedition which we replaced, left behind for our use a team of ten huskies. Some were of the original pack brought from Greenland; the others were born out of them in Antarctica, a year to a year-and-a-half previously. One died of diabetes before the sledging trips started.

The remaining nine proved themselves worthy pioneers, hauling scientific equipment and personnel into the unknown mountainous interior of Queen Maud Land.

A well-bred husky weighs between 70 and 100 lb. In Antarctica, the dragload for a good dog is equal to his own weight. For some weeks before their arduous trips began, they were put on a mixture of vitamins which gave them so much vitality and endurance that they hauled between the nine of them, a load of well over 1,000 lb. Whilst resting at base, each received 5 lb. of seal meat, the blubber and skin on alternate days.

During the summer, the huskies were chained out-of-doors to pegs firmly implanted in the snow. In winter, they were kept in an ice tunnel under the snow to protect them against the extremes of wind and cold. Here, in the underground tunnel, they were tied firmly apart because the slightest chance one might get to reach the tail or paw of a neighbour would set off a vicious fight. When one got loose, which occasionally did happen, he would roam through the pack, select an opponent, and the two would then have a furious set-to, all the others barking and whining in applause. Some were good friends though, and one would attack his mate only during a general skirmish. In such a brawl, the nearest was attacked, whether friend or foe.

Huskies are kind and loving to man. Like lap dogs, they like to be stroked and patted. They would strain on their chains to get near to you in order to nuzzle their noses into the warmth of your arm pit.

These dogs are inspanned in tandem, the leader right in front at the end of a 40-foot drag line. One on each side of him, each on its short rope or chain: the others followed in pairs at 8-foot intervals. To prevent the dogs from getting too close to each other during inspanning, the line was kept tight by fixing the back of the sledge and the end of the drag line with steel pegs onto the snow.

When everything was ready, the pegs were removed and the person at the brake of the sledge shouts, "trek!" One or two of the huskies would then look around to see if the command was really in earnest, and then with a series of severe jerks they would be off at a fast run. Very often, they regard the removal of the pegs as a sign for a scrap.

Allow me to quote from my diary:
"Wednesday, 3rd August, 1960.

Today was an historical one. Three major events occurred, viz. Vic's birthday; the first inspanning of the dogs since our arrival here, and our efforts to teach them Afrikaans terminology. I went outside with the intention of taking some photos, but many hands were necessary to maintain order.

I happened to be holding on to the brace of the leader dog, Oscar, when Hannes le Grange shouted, "trek!" and I released the brace. Oscar took the line of least resistance, shot back into the pack and started the rowdiest dog-fight imaginable. After considerable effort, this bundle of misguided energy was disentangled and dragged apart, and soon they set off like old-timers.

The two high-spirited imps at the rear, I like best; they are as friendly and mischievous as two small children. They could never be mean, and were great friends—these two, Knoll and Flap. Bamsie and Buster were immediately in front of them, then Leeu and Hiena, and then Oscar with Jonas and Turr.

Oscar's misdemeanour, however, caused him to forfeit his position of honour as squadron leader and also the position which tired least. Buster was promoted."

Above: A well-bred husky weighs between 70 and 100 lbs.

Right: Seals were shot along the way for dogmeat.

Every command has to be shouted, except one—"Hokaai!" (stop!). Even the slightest whisper of that word would bring the team to a dead stop. Their eagerness to relax was as natural as it is in humans.

Dogs do not strain at a drag rope, but start off at full force and pace, and should the sledge gliders be frozen to the snow and not move, then the whole team would stare back as if to say, "What's up? Foolish to forget the brake!"

Once started, they maintain a steady pace for 20-30 minutes after which they willingly respond to the whisper, "Hokaai". Then during the following ten minutes' rest, there are no fights, no arguments. Some pant, some dig with their front paws into the snow to loosen small pieces with which to quench their thirst. Then off again, and with 20-30 minute running periods they cover 20-30 miles per day.

Whilst on a trip, the huskies are left in the evenings still hitched to the drag rope, with a steel peg at each end to keep it taut. This last measure not only helps to keep the peace, but helps the driver to keep his dogs, for they love to run back home, and would leave you stranded many miles from base. Each dog is fed a cake of pummican and then lies down for his hours of rest. They lie with their backs to the wind which causes the snow to bank against their backs, and this snow owing to the air it contains forms a warm blanket insulating them against the blizzards.

Often, only two black holes will indicate the position of a husky's nose. He lies very quietly, and is not fed again until the storm has abated, because to break the snow-blanket would do more harm than the hunger. However, his wonderful ability to go into temporary hibernation until nature befriends him again saves his life during prolonged storm periods. He seems to like the cold, and never shivers. The colder it gets, the quieter he becomes, thus using his energy for higher internal combustion.

Despite the savage traits which they show on occasions, their love for man and their willingness to pull great loads in Nature's most rugged territory outweigh all their shortcomings. Owing to their reliability and the real company they afford, they will ever remain the Rolls-Royce of Antarctica.

During the summer the huskies were chained out-of-doors, and each received 5 lbs. of seal meat on alternate days.

After a strenuous haul there were no fights.