# Third Indian Antarctic Expedition 1983-84

EXPEDITION ALBUM

# Third Indian Antarctic Expedition 1983-84

EXPEDITION ALBUM

PRINT NUMBER

298

PRINTED 400 NUMBERED ALBUMS ONLY

EDITED BY
PEKKA PERIVIITA

LAYOUT & COVER
PEKKA PERIVIITA

PHOTOGRAPHS BY
STIG MALMBERG
PEKKA PERIVIITA

PRINTED BY
JALKANEN KY
AHTARI FINLAND
1984

# Foreword

This Album has been published to present in words and pictures the Third Indian Antarctic Expedition. The expedition was quite an experience for everyone of its members. It was time for hard work and difficult conditions. It was time for blizzards and sunshine. It brought many pleasant memories, never to be forgotten. It brought many new friends.

The purpose of this Album is to collect all essential facts and the addresses of the expedition members in one place where they can be found also in the future.

The Album doesn't include the pictures of all the particulars happened but the main features are mentioned in the diary. The photographs are partly technically very poor because of the bad quality of the negatives. The films were developed mainly under rather difficult conditions during the expedition. However, I hope that this Album will bring You good feeling and pleasant memories. And don't forget to keep in touch with the friends you came to know during the expedition!

This is your personal copy of the Album. It is not available in extra copies. All Albums are numbered from 1 to 400 which is the total amount of the print.

Hereby I send my warmest thanks and appreciation for all the expedition members who participated in the work to achieve this Album. Also I like to thank WARTSILA Helsinki Shipyard for making the publishing of this album possible.

Ahtari, Finland July 11 1984

Pekka Periviita

DAKSHIN GANGOTRI STATION

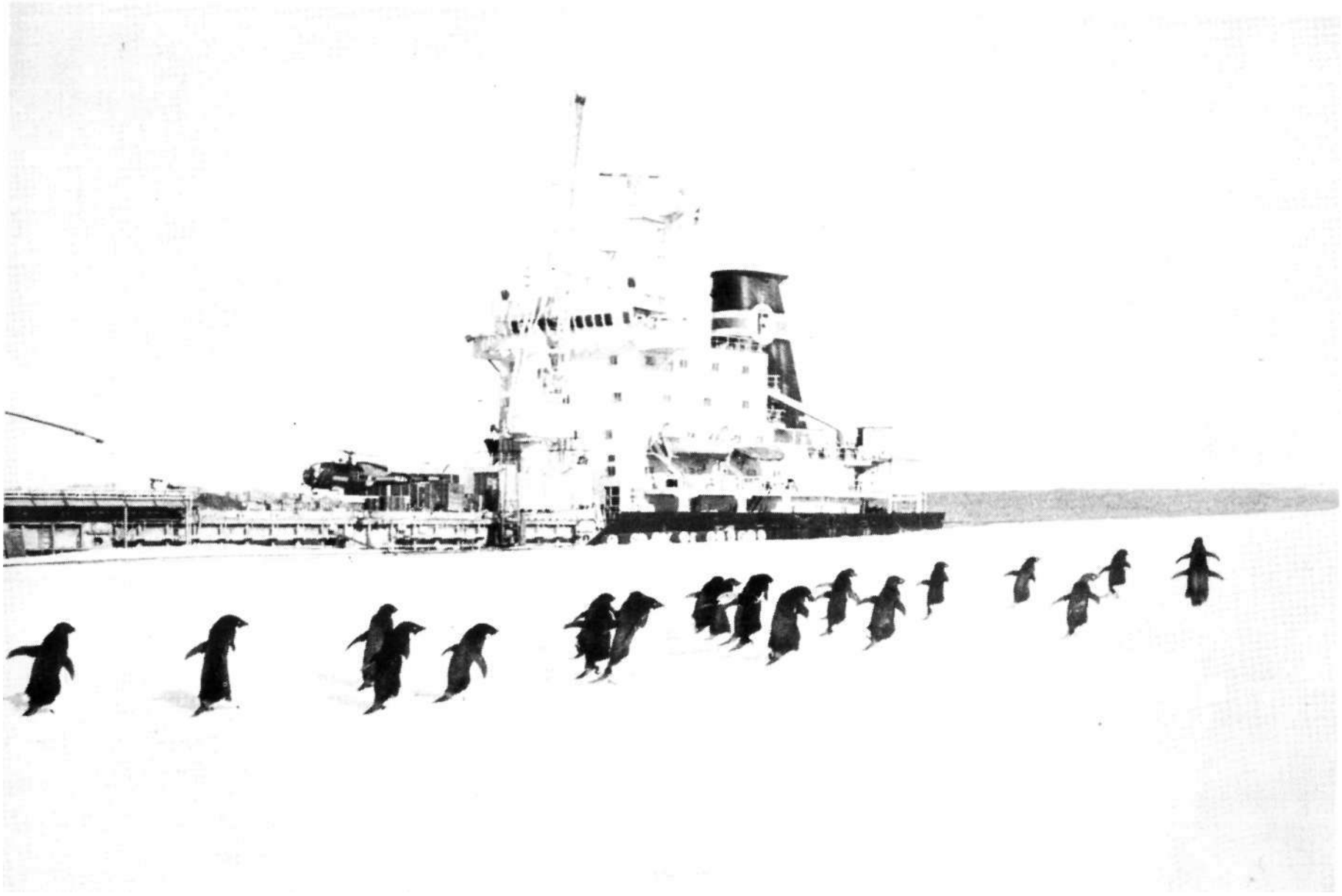
# DR QASIM

The Third Indian Scientific Expedition to Antarctica was able to achieve all the objectives set out for it including its main task of erecting a permanent building for the Indian Station. Thus, 'Dakshin Gangotri', a permanent station was built, named and commissioned within one summer season. Considerable scientific work and investigations were carried out in different disciplines of science during the period of stay of the team in Antarctica.

This was possible only because of the utmost cooperation shown by all the members of the team including the officers and crew of 'Finnpolaris' which carried the team to its destination.

I am very glad a commemorative album is being brought out on the various aspects of expedition. This will be very valuable possession for all members. I congratulate the authors for their very fine effort.

S.Z. Qasim
Secretary
Department of Ocean Development



MS FINNPOLARIS AND PENGUINS

# DR HARSH GUPTA

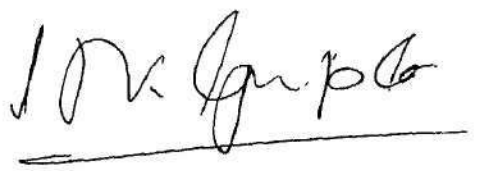
Having successfully laid down the foundation of scientific research in Antarctica during the maiden expedition in 1981-82, and having continued this effort during the 1982-83 expedition, the Department of Ocean Development, Government of India, decided to launch the third expedition during the Antarctic summer of 1983-84. To sustain continued scientific work during the winter months, it was decided to set up a Permanent Station during this expedition, and this major responsibility was given to the Indian Army Engineers. For other countries, which have established Permanent Stations in Antarctica, the construction job was handled by personnel in uniform. The logistic support, in terms of flying was provided by the Indian Air Force and the Indian Navy. There were fifteen scientists, including two lady members, drawn from some ten different Government Departments, Research Institutes and Universities. The scientific programme included studies in the field of meteorology, radiowave propagation, geology, geophysics, oceanography, marine biology, microbiology, upper atmosphere, chemistry and glaciology.

This expedition had a total strength of 83 members. The ship chartered for the expedition, M.S. Finnpolaris, from Finnlines of Finland is of 'Ice Class 1A Super'. It can cut upto 70 cm thick 'fast ice'. This 159 m long, 12.385 gross tonnage ship had been suitably modified for storing and operation of the helicopters, accommodation of 83 team members, etc. The ship had 28 officers/crew members.

The expedition left Goa on December 3, 1983 and returned on March 29, 1984. The stay at Antarctica was from December 26, 83 through March 1, 1984. Inspite of the severe weather condition, and several other problems, all the aims and objectives of the mission were successfully completed.

This document, aided with a few articles, is a pictorial depiction of the expedition. Photographs and addresses of the members of the expedition and officers/crew of the ship are useful for future contacts.

I would like to place on record, my appreciation and thanks to all who helped in successfully completing this prestigeous and ambitious project.



Harsh K. Gupta
Leader

CROSSING THE LINE CELEBRATIONS.

# Expedition Members

DR. K.J. MATHEW

Recidence: 29/1824, 'Abhilash', Chilavannoor, Kadavanthra. P.O. Cochin — 682020, Kerala State
Tel: 30544
Office: C.M.F.R. Institute (Annexe), S.T. Reddiar Buildings, Cochin-682035, Kerala State
Tel: 37192 Telex: 0885-435

DR. ASHUTOSH SINGH

Recidence: Post Office Box 4015, New Delhi 110 017

DR HARSH GUPTA

Director
Recidence: Karimparampil Blog. 2-2444 Pattom Trivandrum 695004
Tel: (0471) 68176
Office: Centre for Earth Science Studies, Sasta Mangalam, Trivandrum 695010
Tel: (0471) 68083/65937

DR. MADAN LAL

Sr. geologist
Recidence: B-VII-7, ONGC Colony, Dehradun (UP) 248195
Office: ONGC, KDM IPE Dehradun, UP (248195)

DR. A.K. HANJURA

Scientist
Recidence: 30-B, LIG flats, Phase III, Ashok Vihar, Delhi - 110 052
Office: Time and Frequency Section, National Physical Laboratory, Hillside Road, New Delhi 110012

DR. ADITI PANT

Recidence: National Institute of Oceanography, Dona Paula Goa 403004
Office: Inst. Dn, NIO, Dona Paula, Goa 403004
Tel: 4612 Telex: 194216 NIO
Telex: 194216 NIO IN,
Satcom: 00583-1640102 MVTT

DR. A.K. BAKHSHI

Recidence: C-139, Old Moti Nagar, New Delhi -110015
Office: Chemistry Department, ARSD

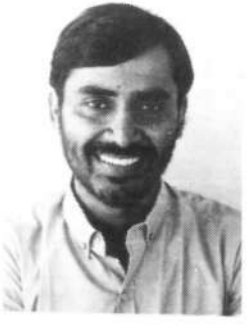
ARSD College (University of Delhi) Dhaula Kuar, New Delhi

S.W.A. NAQVI

Scientist 'B'
Recidence: NIO Hostel, Dona Paula, Goa 403004
Office: National Institute of Oceanography, Dona Paula, Goa 403004
Tel: 3291

DR. SUDIPTASENGUPTA

Recidence: 52. Ballygunge Place, Calcutta — 700019
Tel: 41-2069
Office: Dept. of Geological Sciences, Jadavpur University, Calcutta 700019



DR. L.S. RATHORE

Meteorologist
Recidence: 1/7 I.M.D. Colony, Pashan, Pune — 411008
Office: Division of Agricultural — Meteorology, India Meteorological Deptt. Pune — 411 005
Tel: 55221/248

M.R. NAYAK

Scientist
Recidence: C5, N.I.O. Qrs, Dona Paula Goa 403 004
Office: Inst. Dn, N.I.O., Dona Paula,
Paula, Goa 403 004
Tel: 4612
Telex: 194216 NIO IN
Satcom: 00583-1640102 MVTT

**M. MANOHARAN**

Scientist —BI
Recidence: No: 566, Gabrals House, Behind St. Peter's Church Caranzalem, Goa 403 002
Office: N.I.O. Dona Paula, Goa 403 004 Tel: 3291, 5988

**CAPT. H.C. LOHUMI**

Recidence: E-247 CME, Pune - 411 031

Office: F E/M, CME, Pune - 411 031 Tel: 54213 ext 258

**NB/SUBP.L. DWIVEDI**

2(1) Para Field Workshop, Coy EME, c/o 56 APO

**R.K.SINGH**

Geologist, Sr.
Recidence: B-365, Indra Nagar Lucknow Tel: 73478

Office: Glaciology Division Geological Survey of India l-C. Gokhale Marg Lucknow Tel: 48117 Telex: 244

**CAPT. ANIL HARNAL**

Recidence: 63/7 Rajpur Road, Dehradun Tel: 25819
Office: 113 Engr Regt c/o 56 APO Tel: Jodhpur Army Exch ext 393

**HAVMAJ. (TECH)MALKHAN SINGH**

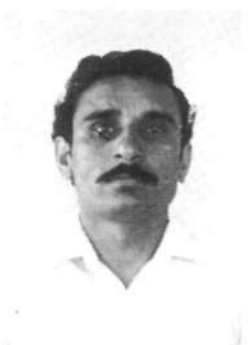
'A' Coy 3 PL, 3 Advance Base Wksp c/o 56 APO

**J ITU VARTAK**

Cameraman
Recidence: Shirgaon, Tl. Palghar, Distt. Thane (W.R) Maharashtra 401 407
Office: Films Division 24 - Pedder Road Bombay - 400 026 Tel: 361461

**CAPT. AJITPATIL**

Recidence: 1218, Wrangler Parantape Road, Shivajinagar Pune
Office: TRG BN-1, Beg & Centre Kirkee Pune



**HAV. SHIV KUMAR**

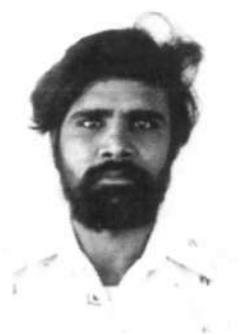
2 Training Bn. B.E.G.E' Centre, Roorkee

**MAJ. P.K. NAIR**

Recidence: E-254 D, CME, Pune - 411 031
Office: F Combat, CME, Pune - 31 Tel. 54213 Ext 257

**CAPT. A.T. PARNAIK**

413 (I) Engr Sqn c/o 56 Apo



**HAV. D. ROYAL REDDY**

Ciw. Meg & Centre SPL Coy Bangalore — 42

**NK. ROBERT FRANCIS**

303 Fd Pk Coy, 2 Engr Regt.
c/o 56 APO

**HAV. JIT RAM**

67 Engr Regt. Bridging 4 Coy.
BbG & Centre Roorkee

**L/NK BALDEV**

67 Engr Regt Bridging 4 Coy.
Beg & Centre Roorkee

**NK.DAYAL SINGH (DARDI)**

Chanan Singh (Fauzi),
Village Mundian Kalan,
Samrala Road Dist. Ludhiana
(Punjab)

**NKJAGTAR SINGH (GILL)**

To. Sajjan Singh (Gill)
V.P.O. Kot Khaira
Vya Tarsi kka
Dist Amritsar
Pin code 143116 (Punjab)

**L/NK B. P. THIMMAIAH**

409 Field Company,
11 Engr Regt, c/o 99 Apo

**L/HAV S SHEKAR**

Ciw. Meg & Centre SPL Coy
Bangalore-42

**L/NK ASHOK SUREGAVOKAR**

36 Field Company,
5 Engr regt c/o 56 Apo

**L/NKGOPALREDDY**

433 Field Company,
201 Engr Regt, c/o 56 Apo

**HAV. B.V. SUBARAYAN**

Ciw. Meg & Centre SPL Coy
Bangalore — 42

**L/NKGOVINDARAJ**

162 Br. Coy, 16 Engr Regt
Bangalore - 42

**SPR. DEVASAGAYAM**

Ciw. Meg & Centre SPL
Coy Bangalore — 42

**NK GAJANAN JADAV**

107 Engr Regt. Rhq
c/o 56 Apo

**HAVBALWANT SINGH**

Vill Mansoor Pur Po
Khamaano Kalan
Dist Ludhiana (PUD)

**CDR. V.P. SATHIAMOORTHY**

Recidence: 90 - Katari Bagh, Willington Island, Cochin - 682 004 Kerala
Office: Officer — in — charge, naval Analysis Unit, Head Quarters Southern Naval Command, Cochin Kerala — 682 004
Tel: 6851 exn. 652

**HAVSHAMSHER SINGH (TANUJA)**

To. Shamsher Singh (Tanuja7
VPO Khari Sarf Ali,
Teh Assandh
Dist. Karnal (Hariana)

**CAPTG.P. KRISHNAMURTHY**

106 Engr. Regt c/o 56 Apo

**LTCDR. R.S.GILL**

Recidence: 23/597 S.P. Marg Service, Officer's Enclave, New Delhi — 110021

Office: Directorate of Naval Air Staff, Naval Headquarters
New Delhi — 110 011
Tel: 373398

**L/HAV MOHAN KUMAR**

664 Engr Plant Coy c/o 56 Apo

**SPR K.G. PILLAI**

Ciw Meg & Centre SPL
Coy Bangalore — 42

**CDR(P)S.K. CHANDNA**

Recidence: 160-A, Naval Officer's Flats, Airport Road, Dabolim, Goa — 403 801
Office: Aircats, Naval Air Station, Ins Hansa,
Dabolim, Goa — 403 801

**HAV K.G. SUBRAMANI**

Ciw. Meg & Centre SPL Coy
Bangalore — 42

**NB/SUBJ.S. KALIRAMAN**

4 corps Air SP Sig unit
c/o 99 A.P.O.

**LTCDRA.S. CHOUHAN**

Flight Commander, 321,
Garuda Flight INS
Garuda Cochin

**LT(P)M.S. KHELA**

Recidence: L-10/5, Jal Ratan deep,
Bangur Nagar Goregaon
West, Bombay — 400 062
Office: 321 Flight. Butchirajupalam,
Visakhapatnam — 530,006
Tel: 8322

**MECH (AL) 3 HOSHIAR SINGH**

Recidence: 258 Bishnoi Colony,
Rajgarh Road, Hissar
(Haryana) 125 001
Office: Air Electrical Department
Ins Vikrant c/o FMO
Bombay 400 001

**WGCDRB.D. AADHOK**

Recidence: No 1 Marlow,
35 Sir Pochkhanwala Road,
Worli Sea Face
Bombay — 400 025
Office: Chief Operation Officer Air
Force Station,
Bombay — 400 033

**LTA.A. KHAN**

Recidence: c/o Lt Col A H Khan,
56, Amauiqunj, Amurabad
Lucknow — 226 004
Office: Naval Air Technical Achool,
Naval Base Cochin —
682 001

**CK (O) I D. SEBASTINE**

Recidence: Polliyal House,
No XI/1231 west Odatha,
Veli, fort Cochin Pin 682 001
Office: I.N.S. Tunir, S & S Mess
c/o F.M.O. Bombay 400 001

**WG CDR V NATARAJAN V.M.**

Recidence: c/o V.V. Ramanan, 21
Tirumalai Nagar, Perungudi
Madras — 96 600 096
Office: D.D. (A.I) Air Hq (V.B.)
New Delhi — 110 001

**AA3P.K. BALAKRISHNAN**

Recidence: c/o Shri K.C.K. Nambiar,
Madathil House, P.O. Koodali
Cannanore (Dist) Kerala
Office: Air Engineering department,
ins. Vikrant c/o FMO,
Bombay — 400 001

**CK (O) I C. VENUGOPALAN**

Recidence: Chembakasseri House,
Near Palat U-P- School,
P O Tiruvannoor Nada DT
Calicut Pin 673 029 Kerala
Office: I.N.S. Alleppey c/o FMO
Bombay — 1 400 001

**FLT LT AJIT KUMAR**

Recidence: Vazhappallil, Madamon PO.
Vadasserikkara,
Pathanamthitta 689 665
Kerala State

Office: 122 HFc/o 5 Wing AF
c/o 99 Apo

**POELARR.K. KAPOOR**

Recidence: Vill & P.O. Sullah,
Teh Palampur, Distt Kangra
(H.P.) 176 085
Office: 321 Vizag Flight.
Butchirajupalem
Vishakhapatnam — 530 006
Tel: 8322

**WGCDRR.S. TANDON**

No 2 MP (Air) NCC T.T.
Nagar Bhopal

**FLT LT V.M. KHANNA**

Recidence: 794/15, Guru Ram Das
Nagar, Putlighar,
Amritsar (Punjab)
Office: Aircrew Examining Board,
Airforce Station, Hindan
Distt. Ghaziabad (UP)
Tel: 867652 Ext 360

**FLT LT N.M. RAI**

Recidence: Olemando House,
P.O. Madvo, Puttur TLQ,
South Kanara Karnataka
State
Tel: Thingalady 55
Office: Air HQRS Communication
Sqdn, Air Force Station,
Palam New Delhi 10

**SGT R.N. VISHWAKARMA R.N.**

Recidence: Village — Tarkulahi
P.O. — Matiary Via Bhore
Dist — Gopalgani (Bihar)
Pin — 841 426
Office: Air HQ Comn Sgdn,
Air Force Station Polam
New Delhi — 10

**MAJ B.K.SINGH**

Recidence: —29 B Saroini Nagar,
Lucknow 226 008
—26 Universal Apts,
East Street Poona
Tel:
Tel: 23806
Office: 92 Base Hospital, c/o 56A.o

**SQDNLDRK.I.TRIVEDI**

Recidence: 46, Adarsh Colony,
Udhampur (Jand K)
Office: Sr Met O. NACC c/o 56 Apo

**SGT S.B.GUPTA**

Recidence: Sador Bazar, P.O. Dagshai,
Distt Solan. Himachal
Pradesh
Office: No 122 H.F. Air Force,
No 5 Wing A.F. c/o 99 Apo

**LTCDR N.P.SINGH**

Recidence: 6 Fernson Apartment
(First Floor),
Choolakkaparamvil Road,
Cohm - 681 018
Office: Chief Inspector Met. Trg
School, Ins Garuda Cohin -
682 004
Tel: 6851/541 or 294

**SGTK.N. MANDAL**

Recidence: Kashinath Mandal, Kharpara;
Kahtala Lane P.O. Baidyabati
Dist. Hooghly (W.B)
Pin 712 222
Office: No. 121 Helicopter Flight
c/o 56 Apo

**SGTA.B. JADHAV**

Recidence: Ashok Jadhav, Kothi,
Station Road, Ahmednagar
Oty — 414 001 Maharashtra
Office: No. 121 Helicopter Flight,
c/o 56 Apo

**KARL KESSLER**

Blumenweg 3
7901 Illerkirchberg,
W-Germany
Tel: 07346-5250

**SGT JOSEPH MATHEWT.**

Recidence: Thomoroyiel House,
Vilakkudy P.O. Kunnicode.
Kerala 691 508
Office: No 121 HF AF (c/o AF stn
Bombayl c/o 56 Apo

**SQN.LDRS.K.S. PURI**

Recidence: E/476 Greater Koilash
(Part two),
New Delhi — 48 110 048
Office: Command Hospitol
(Air Force), Agram,
Bangalme — 7 560 007

**DAVID WILLIAMS**

39 Bowness Avenue,
Didcot Oxon,
OX U8NF,
United Kingdom

WINTERING PARTY MEMBERS ON THE DECK OF FINNPOLARIS JUST BEFORE THE DEPARATURE 1ST MARCH 1984

LT COL SS SHARMA
108 RDE Colony, Dighi Poona-411015
Tel 27222

DR SRH RIZVI
c/o DR Saz RIZVI, Rahat Clinic Durgah Huzrat Abbas RD Rustam Nagar,
Lucknow 226003, U P

MR SHIVAPRASAD GANESH PRABNU MATONDKAR
At P O Matond Tal Vengurla Dust Sindudurga Maharastra
Tel 4612 Nio Goa

CAPT PARAMJIT SINGH
39, Defence Enclave, Vikas Marg Delhi 110092
Tel 563001/5712780

CAPT RR SINHA
62 Munirka Enclave New Delhi
Tel 665599

CAPT RAM KUMAR
Vill P O Thaska, Distt Hissar Haryana

SURGEAN LCDR A BANERJEE
2/3 Muilinagar Lucknow
Tel 49769

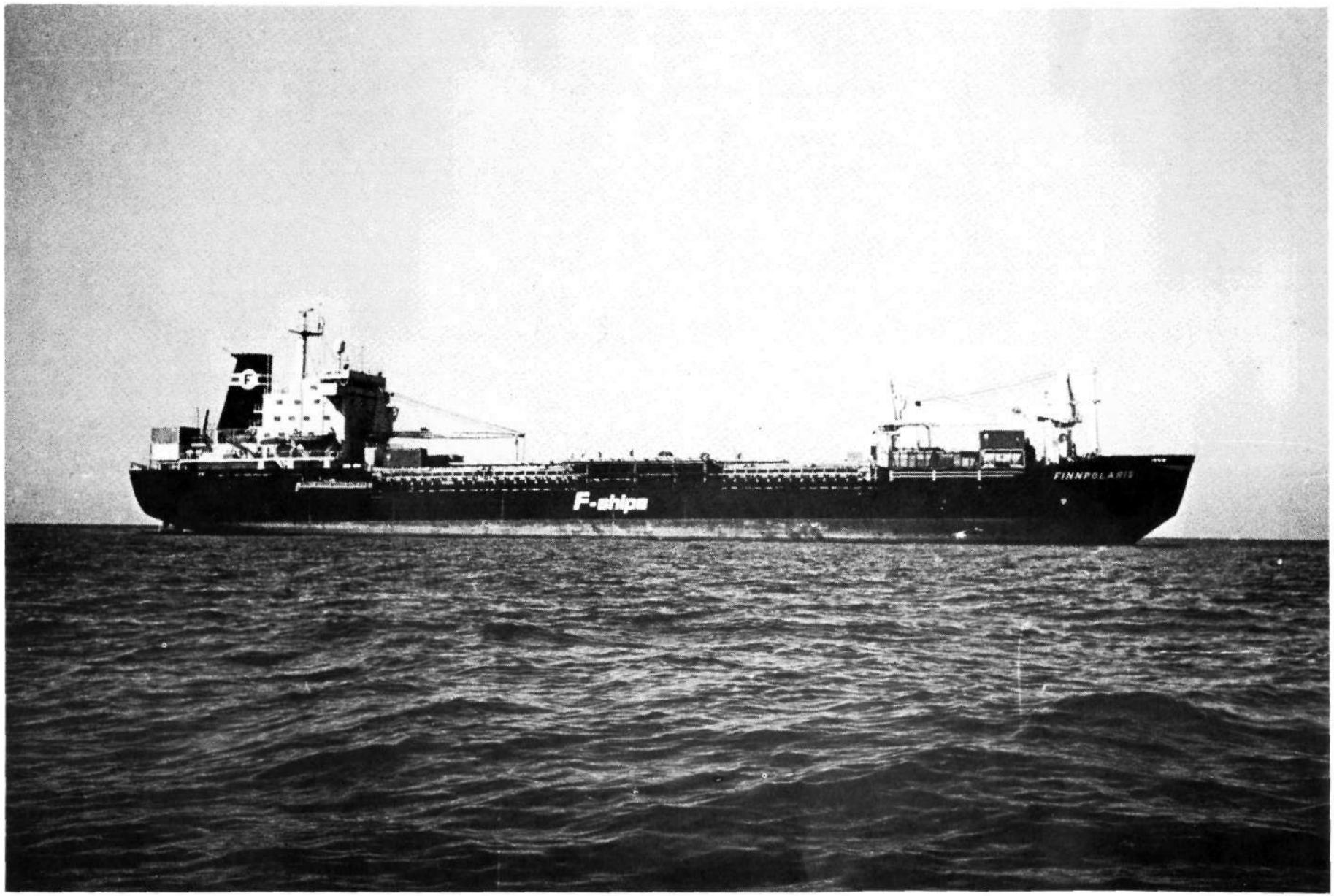
N SUB S JOSEPH
H No 5 Kottabomman Street Chrome Pet Madras 44
Tel 564471

N SUB VS RANA
Vill Bibiwala Kapoor Faim PO Shatyanarayan Dist Dehradun UP

HAV PADMANABHAN
Karangoth House P O Inngal 673521 Kerala

L NK S SADEKAR
Vill Pal, Post Patve Taluka Sawantwadi Distt Sindudurga
Mahaiashtra

L NK CS THAMPI
Mathru Bhavan, Kudavoor-post Tnvandium Kerala 695313


F-ships
FINNPOLARIS

# Ms Finnpolaris
# Officers and Crew

**1st OFF. MARKKU ANTTILA**

Justeerinkatu 36
SF-48910 SUULISNIEMI
FINLAND
Tel: 952-67 305

**IsIENG. MIKKOMERILAINEN**

Tarkka-ampujankatu 20 D 39
SF-90120OULU 12
FINLAND

**2nd OFF. HEIKKI MARTOMAA**

SP-tolo as. 7
SF-31600 JOKIOINEN
FINLAND
Tel: 916-84 020

**2nd ENG. ANSSI VENTO**

Kuusiotie 1
SF-21200RAISIO
FINLAND
Tel: 921-785 363

**CAPTAIN LASSE KULJU**

Vuorentaantie 11
SF-20310 TURKU 31
FINLAND
Tel: 921-391 082

**RAD.OFF. PEKKAPERMITA**

Kirkkotie 10
SF-63700 AHTARI
FINLAND
Tel: 965-30 216 or
931-35 088

**3rd ENG. UNTO LAITINEN**

Riihisarkankatu 15 D 17
SF-80160 JOENSUU 16
FINLAND
Tel: 973-824 606

**CH. OFF. JARTTI MALMI**

Leiritie 38
SF-49510 HUSUPYOLI
FINLAND
Tel: 952-57 001

**CH.ENG. SIMOTOIVONEN**

Ylinenkatu 33
SF-26200 RAUMA 20
FINLAND
Tel: 938-210 464

**CH.STEWARD KAUKO KOMULAINEN**

Vuohenkellonkatu 5
SF-48800 KARHULA 7
Tel: 952-89 102
FINLAND

BOATSWAIN TAPANI BJORKBACKA

Valtakatu 20 A 10
SF-94100 KEMI 10
FINLAND

OS ULLA VIRTA

Roumo mlk
SF-26910 UNAJA
FINLAND
Tel: 938-30 307

ELECTRICIAN ANSSI LEHTOLA

SF-21610 KIRJALA
FINLAND
Tel: 921-748 953

CARPENTER HELGE LAUKKANEN

Kaitueentie 39 C 40
SF-50160MIKKELI 16
FINLAND
Tel: 955-336 147

OS SIMO PORKKA

Puuslellinnnne 3 G 55
SF-00410 HELSINKI 41
FINLAND
Tel: 90-5 634 213

MOTOR/WAN MARKKU TYNKKYNEN

Vddrdmaki
SF-58500 PUNKASALMI
FINLAND
Tel: 957-311 151

AB JUHA KORKKA

Marjorinne 9 B 15
SF-49410 POITSILA
FINLAND
Tel: 952-54 473

OS JYRKILAUSAMO

Aleksanlennkatu 21
SF-06100 PORVOO 10
FINLAND
Tel: 915-145 218

MOTORAPPR. JOUNI KUUSISTO

Pihlajotie 12
SF-21600 PARAINEN
FINLAND
Tel: 921-741 320

AB MARKKU HALINEN

Omakotitie 22
SF-52300 RISTIINA
FINLAND
Tel: 955-41 894

REPAIRMAN OLAVI ETELALEHTO

Yr|dnen 1
SF-49570 KANNUSJARVI
FINLAND
Tel: 952-52 289

COOK ERKKI LAAKKONEN

Juhanmkotu 12
SF-48710 KARHULA
FINLAND
Tel: 952-64 958

**COOKVILLESARAAAS**

Vuorelantie 6 D 72
SF-20720 TURKU 72
Tel: 921-367 472
FINLAND

**CATERING ASS. RIITTA RASINAHO**

Kaitueentie 39 C 40
SF-50160 MIKKELI 16
Tel: 955-336 147
FINLAND

**PILOT HEINRICH BRUNS**

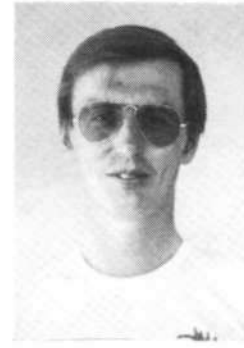
Koriwgstr. 2 A
D-2820 BREMEN 70
W-GERMANY
Tel: 0421-662 677

**CATERING ASS. SEIJA KOLVANKI**

Merikoskenkatu 2 A 2
SF- 90500 OULU 50
FINLAND
Tel: 981-346 095

**CATERING ASS. BIRGITTA PENTTINEN**

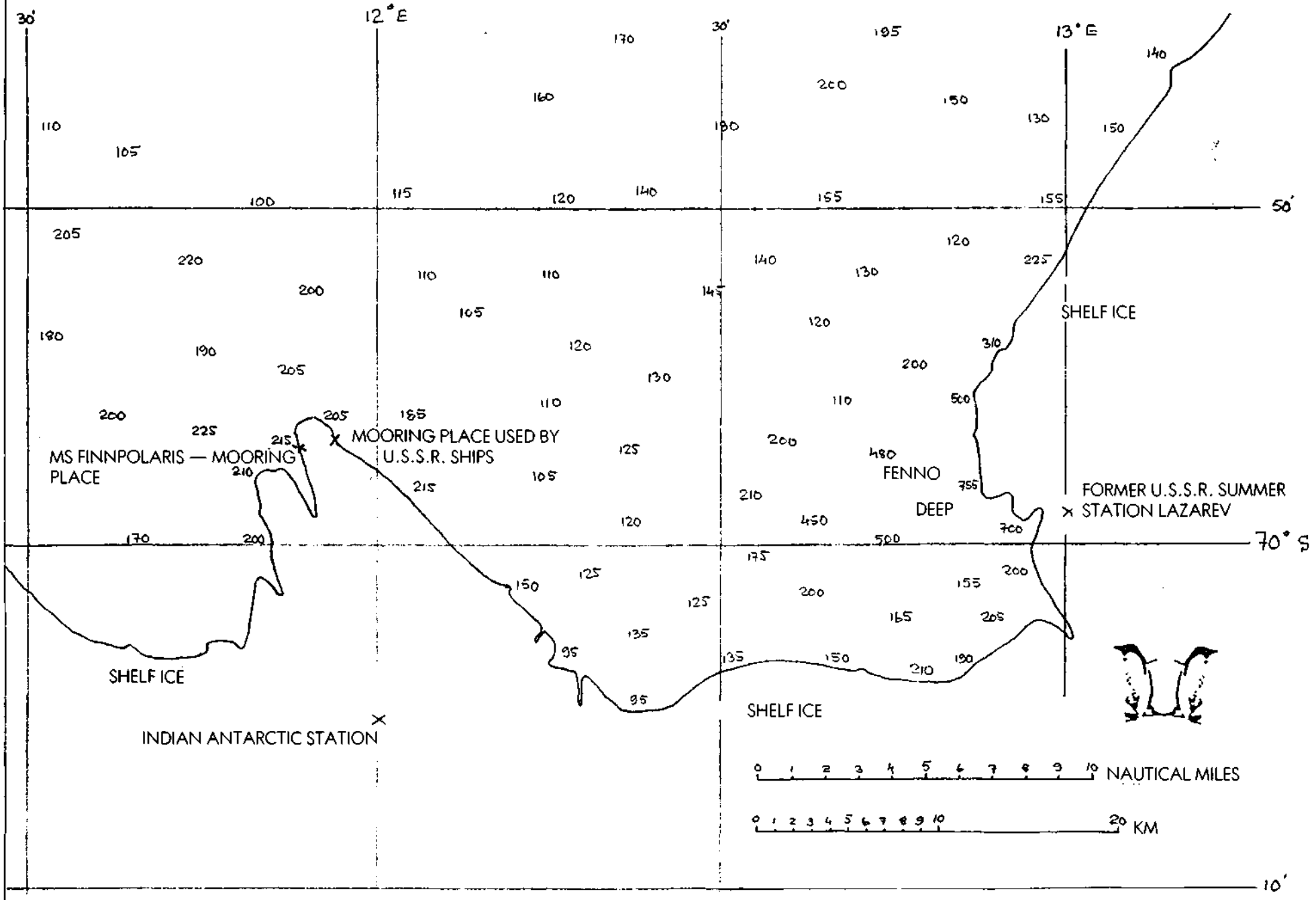
Puustellinrinne 3 G 55
SF-00410 HELSINKI 41
FINLAND
Tel: 90-5 **634** 213



**ENGINEER STIG MALMBERG**

Rönnvägen 38 log 34
SF-00270 HELSINKI 27
Tel: 90-481 283,
nffire 90-1941
FINLAND


**WINTER GAMES AT ANTARCTICA. ANSSI, JARTTI AND STIGU JUST AFTER START.**
**THE WINNER AND FINNISH CHAMPION**
**WAS AB JUSSI KORKKA (TIME 4:06)**




SEA CHART MADE BY CHIEF OFFICER JARTTI MALMI.

Dr. Harsh K. Gupta

# Major Events Of The Third Indian Scientific Expedition To Antarctica

DECEMBER 3, 1983 THROUGH MARCH 29, 1984

## DECEMBER 3, 1983

A week long hectic activity of loading/arranging cargo, fuel and food weighing some 900 tons, placing four helicopters in the holds of Finnpolaris, comes to an end. Relatives, friends and officials bid bon voyage to the 81 member team at 6 PM from Goa. Two military bands play send off music — the most touching being "Sare Jahan Se Achha Hindustan Hamara" (our country, India, is best in the world)————. Most of the members stayed on the deck till late hours, it is anyway too hot inside the cabins.

## DECEMBER 4, 1983

The scientific programme of the expedition begins with the first weather baloon released at 1130 hrs. The safety drill takes place at 1630 hrs. The refrigirated food container is not cooling adequately Engineers are trying to fix it. The stores are being secured. A contact has been established on Amature Radio with several Hams in India.

KING NEPTUNE WITH HIS COURT.

## DECEMBER 6, 1983

Finn Independence Day, Greetings are exchanged. The three doctor members of the expedition commission two hospital rooms. The ship crosses equator at 1602 hrs. There is a colourful ceremony on the deck. King Neptune permits the ones crossing equator for the first time after giving them a tough time.

CEREMONIES

CAN YOU SEE THE SOUTHERN CROSS?

# Crossing The Line Certificate

The translation of the Crossing the Line certificate.

WE NEPTUNE

THE LORD OF ALL SEAS AND WATERS, THE UNRESTRICTABLE RULER
OVER ALL THE DEEP SEA SAILORS. WE HEREBY MAKE KNOWN THAT GRACIOUSLY WE ADMIT

MISS/MRS/MR_____AS A MEMBER CITIZEN IN OUR GREAT
AND HUMID KINGDOM. SHE/HE HAS CROSSED THE EQUATOR LINE ON DECEMBER 6TH 1983 AND
THE EQUATOR SHOWER HAS BEEN GIVEN TO HER/HIM
ACCORDING TO THE TIME-HONOURED TRADITIONS.

THUS. SHE/HE HAS GOT A RIGHT TO SAIL IN ALL SALTY SEAS UNDER OUR GRATE PROTECTION.

FOR PROVE WE ISSUE THIS CERTIFICATE AFFIXED WITH OUR GREAT SEAL.

GIVEN AT EQUATOR 67° 32.58 EAST.

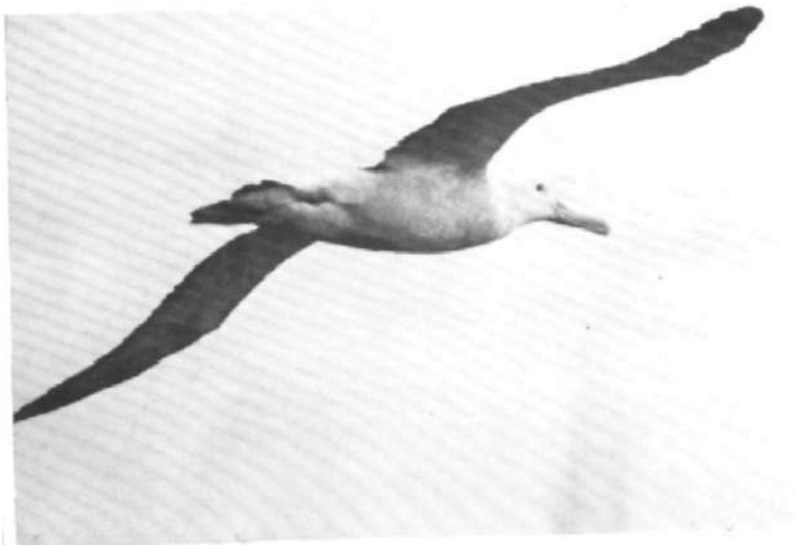
EX OFFICIO

LASSE KULJU
MASTER
MS FINNPOLARIS

EQUATOR SHOWER GIVEN FOR THE ONES CROSSING THE LINE FOR THE FIRST TIME.

GOODBYE MAURITIUS — BOUND FOR ANTARCTICA,

ALBATROSS



DECEMBER 7JHROUGH 9, 1983

Various gears and equipments are checked. Orders are placed to receive missing items From Mauritius. The container hold is nick-named "Bombay Street" and stinks like one. A film is screened there every night after supper.

DECEMBER 10, 1983

The hydrographic winch is not functional: The oceanographers have tears. The ship arrives at Port Louis at 1400 hrs. Hectic activity starts to fix the refrigirated food container, the hydrographic winch and to receive various stores orde-ed.

DECEMBER 14, 1983

The ship sails from Mauritius towards Antarctica at 1215 hrs.

DECEMBER 18, 1983

The ship crossed 40 S latitude at 0600 hrs. There is quite a bit of rolling and pitching. The ship's speed is reduced to 5 knots or less. Checks are conducted to ensure that cargo and helicopters are well secured. The Finn officers are treated to a cocktail by the expedition members.

DECEMBER 19, 1983

Warm clothing appears on the expedition members as the temperatures have dropped to 5°C or less.

DECEMBER 20, 1983

Very bad weather. Sea state 5-6. Lot of rolling and pitching. Ten cases of sea sickness.

DECEMBER 21 TROUGH 23, 1983

Scientific and Logistic committees, formed earlier, continue to meet off and on. The site of permanent station is being discussed for the last several days. Keeping various parameters in consideration, the choice is narrowed down to three possible general area at the shelf.

DECEMBER 23, 1983

Excitement over the ship as the first iceberg was cited at 0400 hrs at 55°33'S, 32°03'E.

CHRISTMAS EVE

**DECEMBER 24, 1983**

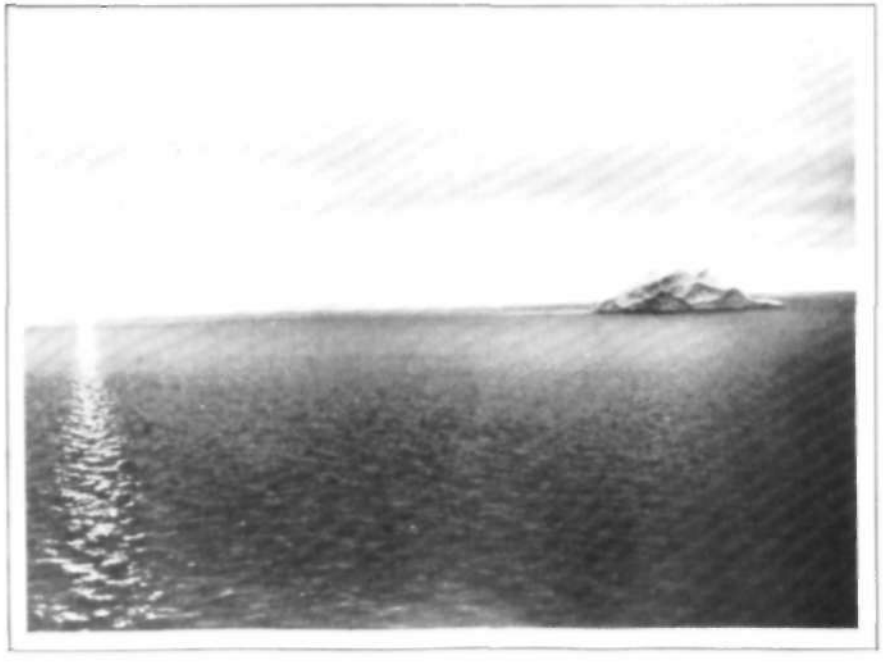
After a week long spell of bad weather, it finally improves. A beautiful Christmas party. Everyone is relaxed and happy.

**DECEMBER 25, 1983**

Plans for discharging cargo from the ship are finalized. The week long table tennis tournament is concluded with Mr. Nayak as winner and Dr. Baner|ee as runner.

SANTA CLAUS ARRIVED

MERRY CHRISTMAS



RECONNAISSANCE SORTIE BY THE CHETAC HELICOPTER.

## DECEMBER 26, 1983

Fast ice is all around the ship. At 1030 hrs prayers are held at the deck. At 1100 hrs the first reconnaissance sortie by the Chetak helicopter is conducted. There is broken sea ice all the way from our present position (69.2 S, 12 E) towards Antarctica. The ship continues to move breaking some 1 metre thick sea ice. At 2200 hrs another Chetak sortie is conducted and the base camp huts of the two previous Indian expeditions (1981-82 and 1982-83) as well as the Runway hut are located.

The sun hangs at the horizon at midnight: we are having 24 hrs day. People find it difficult to sleep.

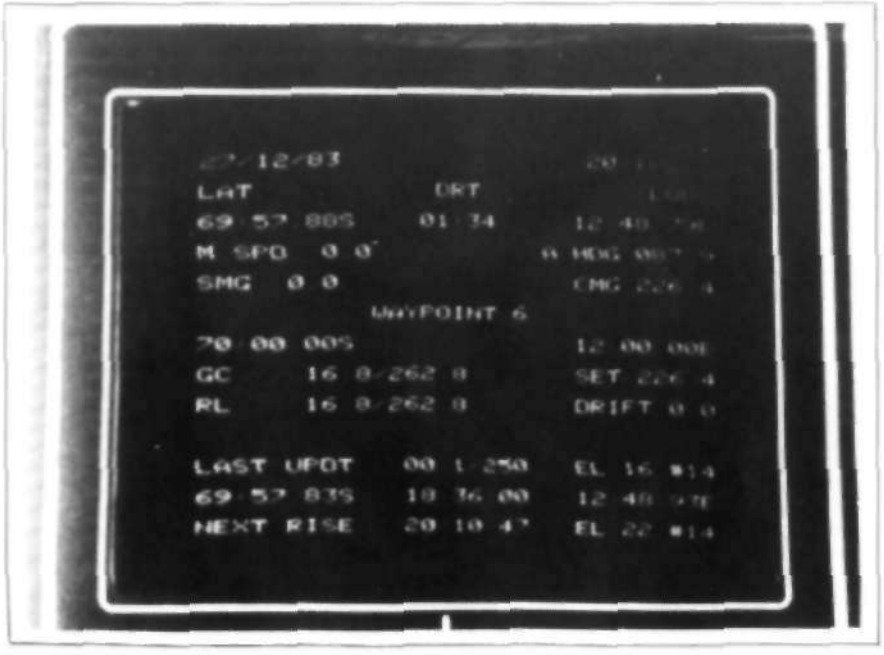
## DECEMBER 27, 1983

Finnpolaris is moored on to fast ice. Look — we have visitors! Curious penguins come flocking to the ship.

More detailed surveys are carried out to finalize the site of the permanent station.

The snow vehicles are started on the deck. They are lowered to the fast ice and quickly driven away along the land route marked to the base camp site.

SATELLITE NAVIGATOR SCREEN DEC 27TH.




PENGUINS


CURIOUS PENGUIN


UNLOADING BEGINS

HOW ABOUT ONE PHOTOGRAPH?

## DECEMBER 28, 1983

Construction party moves to the site of the base station and establishes a camp using BAS and medium Arctic tents

## DECEMBER 29, 1983

Digging of foundation begins at the base camp site While carrying an under-slung load MI-8 helicopter crashes into icy waters at 1430 hrs With God's grace all on board the ill fated helicopter are rescued

## DECEMBER 31, 1983

Bad weather and snow drift covers the dug out trenches for foundation and other stores transported to the base camp

A welcome news from New Delhi Ma|or Pavan Nam is blessed with a daughter

A simple New Year eve get-to-gether to ring in the new year

## JANUARY 1 THROUGH 10, 1984

Unloading of the ship is in full swing A helipad has been set-up *at* the base Due to some logistic problems, most of the cargo which was to be transported underslung on MI-8 helicopter has now to be transported in the fuselage This involves opening up the already pre-slung stores and placing them piecewise Operation "WHISK" commences Two loading teams are organized Efforts to bring the ship to shelf are fruitless Intermittent bad weather slows the progress of work

## JANUARY 12, 1984

As a part of the scientific program, a scientist camp is to be established at Shirmacher Hills a small range some 60 kms away from the shelf In the morning a reconnaissance sortie is flown to the Sarmacher hills and a camp site near a fresh water lake is selected At 1600 hrs a party of 9 starts from the base camp in a Piston Bully with all the scientific equipment, ruel, food and tents loaded on the sledge Following the Russian track, marked every kilometer with a pole with a gum boot hat, the party reaches the Lake Point at 2000 hrs From here the lakes start and the helicopter is to transport men and material to the Shirmacher hill camp site, some 20 kms away The helicopter could not come due to technical problem and the scientist party pitches two tents and sleeps there Wasn't that a pretty site

BASE CAMP

MI-8 CRASHED INTO ICY WATERS

INDIAN-FINNISH GALLEY TEAM.

THERE WAS ABOUT 700 TONS CARGO TO BE DISCHARGED.

CARGO STOWING INTO MI-8 FUSELAGE.

AIR CONTROL ON THE BRIDGE.

MI-8 WITH UNDERSLUNG CARGO.

RUSSIAN STATION NOVOLAZEREVSKAYA AND THE STATION DOG "PRIMA".

CAPTAIN ANIL HARNAL. CIGAR IN HONOUR OF NEWBORN BABY.



JANUARY 13, 1984

Today is Friday and the thirteenth of the month.However, without any mishap the camp is established by 1900 hrs at Shirmacher hill.

JANUARY 15, 1984

The satellite communication terminal has been commissioned at the base camp. The construction party is very happy as they can call their families from the base itself.

JANUARY 16, 1984

Our scientists visit the Russian Station Novolazerevskaya.

JANUARY 17, 1984

Blocks A & B of the permanent Indian Station have been completed to the roof level. The ship has still not succeeded in reaching the ice shelf. Most of the structure material has been transported through the helicopters. Still quite a bit of structure material is left. And there are 1000 barrels of fuel, food etc to be transported. In case Finnpolaris does not succeed in reaching the shelf over the next week or so, it would become necessary to transport material over the fast sea ice using the snow vehicles.

JANUARY 21, 1984

Finnpolaris finally reached the ice shelf. Pisten Bullys with sledges are brought alongside, and the unloading activity is in full swing. The last vehicle left the ship at 4 in the morningl

JANUARY 25, 1984

Captain Anil Harnal is blessed with a daughter.

## JANUARY 26, 1984

Today is our Republic Day. The sun has shown after a long time. The structure of the base station has been completed. The roof has been cladded and the color design is arranged to depict the TRICOLOR, our national flag. We cannot afford to take a day off and hence a simple function of flag hoisting and National Anthem is arranged. Our friends from the Soviet and East German stations as well as the Finn crew participate.

FLAG HOISTING.

CELEBRATIONS ON BOARD MS FINNPOLARIS.

FRIENDS FROM THE SOVIET AND EAST GERMAN STATIONS.

SHIRMACHER Hill RANGE.

DRMADANIAI.

JANUARY 29, 1984

A batch of our scientists visits Novolazerevskaya station. Fresh water lake sampling is done collectively by the East German and Indian Scientists.

JANUARY 30, 1984

Earth scientists visit Wohlthot Mountains, a range some 40 kms south of Shirmacher range. It is a great day: the ships unloading is over with the remaining barrels being sent to the Base camp.

FEBRUARY 5, 1984

The camp at Shirmacher hill is closed, after 24 days of very productive geological, geophysical, biological and meteorological experiments and observations.

FEBRUARY 6 THROUGH 13, 1984

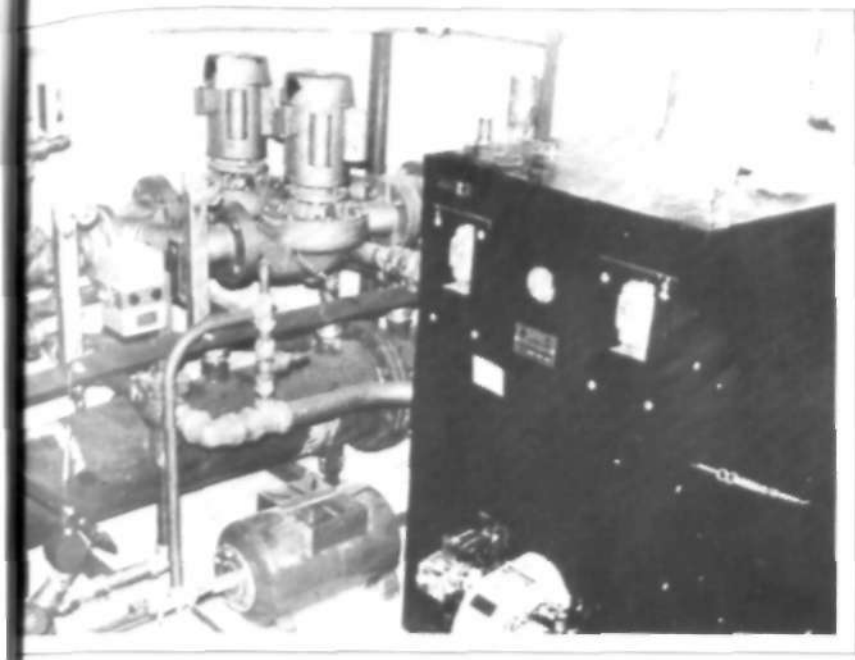
Extremely bad weather. However, internal work on generators, electrification, snow melt plant, boilers, heating and furnishing continues at the base station.

FEBRUARY 14, 1984

The generators are test run and found OK. The clading of the building is taken up on war footing.

FEBRUARY 15 THROUGH 23, 1984

Extremely bad weather continues. Winds gusting to 70 knots prevail. Finnpolaris moves over to high seas. However, work has to be continued at the base station as we are running out of time. Gradually various services are commissioned.



WORK HAS TO BE CONTINUED

**FEBRUARY 24, 1984**

The base station is functional. The labs have been set-up and wintering team of 12 moves in at 1700 hrs.

**FEBRUARY 25 THROUGH 28, 1984**

Another blizzard hits the shelf. Forty of us are at the base station. During nights the base station looks like a big dormitory. The post office work of placing expedition catchets on some 1500 philately envelopes is carried out. The blizzard was a God gift — as it gave an opportunity to test the base station under winds gusting to 80 kts.


EXPEDITION CATCHETS.

BASE CAMP WITH ARCTIC TENTS.


STATION COMMANDER LT COL S S SHARMA.

SUNNY DAY AT THE BASE.

RADIO ROOM IS FUNCTIONAL AND SATELLITE COMMUNICATIONAL TERMINAL INSTALLED. CAPT PARAMJIT SINGH AND M.R. NAYAK (MR "TELEX")

FINNISH GIFTTO THE DAKSHING GANGOTRI STATION:
SAUNA BATHHOUSE STOVE. MADE IN ANTARCTICA BY STIGU AND KESSU. HAVE A GOOD SAUNA BATH!

## MARCH 1, 1984

The wintering team visits ship for the last time. The sun is shining gloriously. We all have beer on the ship's deck. At 1530 hrs ship sails off leaving 12 members of the wintering team waving. God bless them — they are going to spend 10 lonely months before the next expedition arrives in December 1984.

We are all proud of having accomplished the task of setting up a permanent Base Station in Antarctica in just one Antarctic summer. This is a world record.

## MARCH 2 THROUGH 17, 1984

The sailing is slow as the weather is bad, often passing through sea state 6, more over we are stopping twice a day for oceanographic sampling. The maximum recorded roll is 28°. Finnpolaris crosses 40°S latitude at 21.50 hrs on March 13.

## MARCH 18, 1984

Finnpolaris arrives at Mauritius at 1400 hrs. Finnpolaris passangers spill all over the pretty island.

## MARCH 19 THROUGH 21, 1984

Expedition news is all over Mauritius and there is wide media coverage and publicity. Several reception/dinners are arranged. Prime Minister of Mauritius, Hon ' ble Mr.Jugnauth, accompanied by the Hon ' able Minister for Energy and Indian High Commissioner visits the Finnpolaris on March 21 at 1200 hrs.

## MARCH 22, 1984

Finnpolaris sails for Goa, India at 1430 hrs.

## MARCH 29, 1984

Finnpolaris approaches Goa. The country is reeling under port workers strike. Dr. Qasim flies over to the ship to congratulate and welcome the team. We finally arrive Goa at 12 Noon. The team is overwhelmed when the striking port workers give a hearty welcome.

Thus, with God's grace and hard work of team members, the Third Antarctic Expedition comes to a successful end.

GOODBYE BY IT COL S S SHARMA.

WINTERING PARTY ON THE ICE SHELF.

FROM THE LEFT: MINISTER FOR ENERGY HON. M. UTCHANAH, PRIME MINISTER OF MAURITIUS HON. A. JUGNAUTH, HIGH COMMISSIONER FOR INDIA HE. PREY SINGH, EXPEDITION LEADER DR HARSH GUPTA AND THE CAPTAIN OF MS FINNPOLARIS LASSE KULJU.

OCEANOGRAPHIC SAMPLING.

Dr. A.K. Bakhshi

# Scientific Work During The Expedition

Several scientific programmes of contemporary interest that may have far-reaching significance were undertaken during the Third Indian Scientific Expedition to Antarctica by a team of 16 scientists belonging to various disciplines of science. Most of these scientific programmes were in continuation of the scientific studies carried out during the first two expeditions, though some new programmes have also been initiated this time. The various scientific programmes include studies on meteorology, radio-ware propagation, geology, geophysics, chemistry, glaciology, microbiology, marine biology and oceanography.

In the field of meteorology, as in the previous two expeditions, the primary objective this time too was the collection of as much scientific data as possible concerning meteorological parameters over the seas between India and Antarctica and over Antarctica itself. It is believed that the weather of Antarctica influences to a great extent the weather over Indian sub-continent and that a detailed study of these meteorological parameters over the Antarctica may help in understanding the vagaries of weather over India — particularly the monsoons over which India is critically dependent. A laboratory fitted with the various instruments to measure these parameters was set up on board the ship. Many radio-sondes and omega-sondes were launched during the expedition. In addition to it a permanent meteorological station was established to record the surface and upper air atmospheire parameters such as temperature, pressure, wind radiation, ozone, cloud cover and weather phenomenon. This laboratory is capable of recording these parameters during the Antarctic winter. During the entire stay in Antarctica, weather charts were received regularly from Molo and Pretoria and on the basis of these charts, the air-crew was briefed about the weather forecasts.

During the first two expeditions (1981-82 and 1982-83), the study of the ionised atmosphere (Ionosphere) and the unionised atmosphere was undertaken. This study was continued this time too because for a proper understanding of the radio-ware propagation, the data over a considerable beriod of time is reguired. Ionosphere is that lauger of the atmosphere which consists of electrically charged particles called ions. These ions are produced by knocking out electrons from the atoms by means of ultraviolet radiation coming from sun. This ionospheric layer is very important for radio-communication. The state of this ionosphere keeps on changing with time. A detailed study of the state of ionosphere shall therefore be of immense use in radio-communication, particularly for India which is trying HF communication between India and Antarctica. A Riometer tuned at 20 MHz was used for this study. In addition to these ionosphere studies, an experiment to study surface-wind pressure fluctuations using microbarograph was conducted at the permanent station site and at Dakshin Gangotri.

Although most of the Antarctica is snow covered, nearly 2 procent is free from a permanent cover of snow and ice. One such area is the Schirmacher range (70° 22' 40' 'S, 11° 54' E — 70° 44' 35' 'S, 11° 46' 30' ' E) of the Queen Maud Land of East Antarctica, where a station was set up from 12th January to 5th February. All the scientists visited this area and carried out various studies and collected necessary samples. During this period, the geological and structural mapping of this range was completed on the scale of 1:25 000. The total area mapped this time was 35 sq. kms. whereas during the second expedition a reconnoitry mapping of on area of 45 sq. kms. in the central part of this range was carried out. Systematic sampling for petrological, mineralogical, structural and radiometric age dating was also done.

In this hilly Schirmacher range, of bare ground, soils have also begun to form. Since the Antarctic climate is characterised by extreme cold and extreme aridity, these soils are therefore formed under the conditions of low precipitation and almost complete absence of higher plant life. Many soil samples from the various sites in this area were collected for detailed chemical analysis with special emphasis on cation exchange capacity, estimation of various cations and nutrient content etc. Many samples of the flora of this area which is mainly consisting of lichens and mosses were also collected for detailed investigations. It is believed that eventually the plants, particularly the lichens may give scientists an additional support to the hypothesis of the existence of Gondwanal and in the geological past.

Magnetic surveys involving the total intensity measurement of the earth's magnetic field were also conducted during the expedition. These surveys were done using a couple ot robust Geometrics Model Gr — 816/826. Proton

WEATHER BALLOON RELEASED.

Precession Magnetometers having a sensitivity of 1 gamma. These studies were basically of the three types. Firstly, the earth's magnetic field was monitored for six full days at Schirmacher Hills (70°45'S, 11°37'E), and for one full day at the base station on the ice-shelf (70°06'S, 12°00'E). One magnetometer was continuously used to keep track of diurnal magnetic variations to correct the magnetic field observations during these surveys. It was observed that magnetic storm like conditions prevailed during a couple of nights when the earth 's total intensity varied by several hundred gammas over a short duration of a few minutes. Secondly magnetic measurements were done over a number of geological contacts — surface manifestation of possible mineralization, identified by the geologists during the geological mapping of the Schirmacher Hill range. A number of magnetic profiles totalling 5 line kms at an average spacing of 6 meters were conducted. The data obtained was reduced for diurnal variations. On the basis of the data, quite a few interesting magnetic anomaties have been discovered. Their association with other geological inferences has been useful in indicating areas with metal/mineral potential. Finally, four magnetic profiles were taken between the Runway Hut (70°02'S, 12°00'E) and the Base Station (70°06'S, 12°00'E) on the ice shelf. These profiles indicated similar magnetic field pattern. Two of these profiles were extended further south of the Base Station to a distance of 5 kms and were found to show similar magnetic field pattern. Encouraged by these results, one profile was extended furthur south by 20 km — thereby making the total magnetic profeling on the shelf 60 line km. The data obtained here are also reduced for diurnal variations and are being interpretend in terms of flexuse of the ice-shelf and/or upwasping/inodulation of the sea floor.

There are about 12 glacial lakes in the Scirmacher range, the largest being ] km long and 0,75 kms wide. A fresh water lake near the landing site of the first expedition was studied for biological productivity and bacterial population. Such studies on this lake were carried out in the earlier expeditions too. A large annual variations in chlorophyll, total suspended matter, bacterial counts and pH have been observed from year to year. In addition to it, some fresh water lakes were studied for microbiology and productivity and the vegion around these lakes is being studied for soil microbial counts (bacteria and fungi) in relation to soil charactenstics like moisture, content pH, P, N, C, temp, and grain size. A few lakes were also studied for diurnal changes in microbiology and productivity. It can be concluded *on* the basis of these studies that the freshwater systems in this range are highly productive. "The continent of the Antarctica is surrounded by the Southern Ocean which is about 36 million sg. kms or about 20 percent of the world's oceans. The Antarctic seas are very rich in zooplanktons particularly krill ( Enphausia Superba). Krill is a very rich source of protein and is the first Antarctic resousce, which India can think of exploiting in the near future. During this expedition zooplankton samples for the study of distribution, abundance and biology of krill and other zooplanktons, in general, were collected from polynya, from several localities distributed over a geographical area within the Antarctic circle and from many latitudinal stations enroute. In addition to it many stations were set up on the north-bound transect from the Antarctic to Mauritius between 69°S to 33°S inclusive and the water samples taken at 3 depths within the enphotic zone, were analysed for standard parameters like glorophyll and the primary productivity etc. The data collected between the 69°S latitude and the Antarctic convergence will be closely related to krill bio-man values obtained from this expedition. Similar studies were also carried out in the region of the surrounding sea, when the ship was along side the shelf.

A lot of hydrochemical work has also been done during the expedition. Eleven stations were set up during the voyage from the Antarctica to Mauritius. Water samples from standard depths down to 2000 m were collected using Niskin Samplers filled with reversing thermometers and were analysed on board the ship for dissolned oxygen, pH, alkalinity, salinity, nitrite-nitrogen, phosphate-phosphorous, and silicate- silicon. Similar analysis was also carried out on water samples taken from different depins of two fresh water lakes of the Schirmacher range. Many sea water samples were also taken from various stations set up south of 40° latitude for the trace elements like copper, cadmium, iron nickel etc.

Scientific achienements of this expedition are, no doubt substantial but these is still a lot to be done. These achienements *are* in fact a prelude to the research in depth which will be carried by the Indian Scientists at Antarctica in years to come.

# Telex from Antarctica:

Lt Col SS Sharma, Leader of 3rd Indian Antarctic Expedition

and commander of Dakshin Gangotri station

# Wintering in Antarctica:

## INTRODUCTION

With the setting sun in horizon and the hoots of MV Finnpolaris slowly casting off the shelf on the eve of the 1st of March 84, a new era started in Indian scientific venture at Antarctica. The first wintering party of 12 fearless determined countrymen were left in the white wilderness, to share the pleasure and miseries together for the scientific progress, in the hostile environment of Antarctica in Dakshin Gangotri station.

A mixed feeling of sorrow and joy prevailed in minds of the members; sorrow for departing hard working colleagues, whose 60 days of hard labour in impossible conditions enabled the erection of present station, and joy for the excitement in anticipation of the great challenge and adventure expected in days to come.

## PLANNING AND PREPARATION

At first opportune moment, the stock of situation was taken and plans drawn to tackle immediate problems before the next blizzard starts or severe antarctic winter sets in. Separate working groups for different problems were formed and tasks assigned. Surg. L Cdr Aloke Banerjee, the specialist physician from Indian Navy, was assigned tasks pertaining to immediate survival like shifting of food stuff inside the station, making the hospital functional and working out an effective plan for shifting to alternate location in case of a blow-out in present station.

Capt Ram Kumar and Capt Rajiv Sinha, the two engineers from Indian Army, were made responsible for vehicle maintenance and looking after the engineering aspects of the station. Communication responsibilities were given to Capt Paramjit Singh, the telecom engineer from the army, while the author with the assistance of Dr SRH Rizvi and Mr Prabhu Matondakar took responsibility of organizing scientific activities.

By the time the members had only warmed up themselves and sharpened their tools, a severe blizzard threatened the station on March 6, which shook everyone. The blizzard, which lasted for six days, had a wind speed of over 80 knots. During gusts, it created abnormal vibrations in the structure which gave a feeling of crossing the rolling fourties in MV Finnpolaris. On March 8, the inlet structure for three 50 kW generators in block A collapsed due to the cover of same by drifting blizzard snow, which damaged fuel lines and accumulated a huge quantity of snow in the generator room.

The gusting winds created a panic amongst the members as the opening so created was causing a threat to the structural stability of A block. Due to this blizzard all construction stores, food items and scientific instruments lying outside the station got buried in 1.5-meter-deep snow, which took considerable time in retreival. The communication aerials broke down. Out of 1300 fuel barrels lying in the fuel dump at half a kilometre from the station, only 500 were visible.

Though this blizzard did cast a shadow of the events to come, it however was a blessing in disguise. A crash program for recovering the essential items for survival as well as for stocking the fuel barrels in close vicinity of the station and strengthening the structure was taken up. Soon Aloke, with the help of Prabhu, Paramjit, Thambi and Rizvi oranized recovering essential food items for immediate day-to-day consumption in limited clear spell after this blizzard.

Col Sharma, Ram, Rana and Joseph organized the recovery of fuel barrels from the fuel dumps by means of a crane. After recovering the first 20 barrels on the first day, Ram thought the task appeared to be comparatively simple. However, his hopes were shattered when he saw Rana struggling with the vehicle engine in — 20°C and later reporting about the remote possibility of the crane vehicle being available for the rest of the winter due to serious engine defects. Nevertheless, a new technique of pulling thee buried barrels with the help of the other Pisten Bully, using ropes and hooks provided by MV Finnpolaris, was evolved and the group started working with a lot of dash and drive.

Though Ram, Rana and Joseph were apparently cheerful, they were having sleepless nights due to the power position in the station as the only serviceable of the three generators of capacity 50 kW was due for maintenance. To cater for this, they positioned two 12.5 kW and one 5.5 kW generators supplied by DRDO and commissioned the auxiliary system in A block in few days.

Rajiv with the help of Padmanabhan and Thambi got down to a stupendous task of ensuring the safety of the structure and efficient functioning of water supply and exhaust systems during bad weather periods and snow clearance

from doors and windows during clear periods. They recovered a lot of the building stores from the area around the building, which they utilized for strengthening some critical areas of the structure. They removed many tonnes of snow from alternate locations immediately after various blizzards. This group was seen struggling aroud the station day and night with smiling faces.

Paramjit set up the antenna of his radio sets and tried establishing a contact with India on his medium power 400 W set but without any success. His satcom terminal, the only means of communcation, also started showing continuous errors due to internal defects, which he detected and rectified by struggling for two nights without any rest.

Rizvi and Prabhu were busy helping Aloke and Rajiv as well as in their own scientific investigatios. Strength profiling of snow on the ice shelf by Col Sharma, releasing of balloons for upper air data by Rizvi and microbiological studies in the station laboratory by Prabhu were started with determination and the scientific activities picked up their rhythm by mid March.

## WEATHER

The weather played a significant role in disrupting the efforts put in by the members in worsening the working conditions. The month of March witnessed 19 blizzard days. In March the temperatures were moderate, but wind speeds and snow accumulation around the station were very high. By the end of March, all windows on the ground floor in the living block were fully covered. The month of April experienced moderate wind speeds but a steep fall in temperatures with mercury doing down to — 32.5°C on April 29 and the average temperature remaining below — 25°C on most of the days. Starting trouble in Pisten Bully vehicles and freezing of water in the inlet pipe of overhead tank became a regular feature of every morning. The antenna control motor inside the satellite terminal dome started behaving erratically which created an alarming situation.

Despite all the hardships, the members maintained their peace of mind and continued their battle for survival against all odds. By the end of April Aloke and the party had recovered one-year food requirement and stacked it nicely in a block. Ram had recovered 500 barrels from the fuel dump and positioned them very close to the station. Ram, Rana and Joseph worked untiringly on the two unserviceable generators and put them in order by replaicing the worn-out couplings. Padmanabhan and Thambi had removed the anchor straps from the building in order to reduce the vibration level during blizzards, and sufficiently strengthened the building structure by putting additional structural members at critical places. They recovered some of the base tents from the old base camp area and some more useful stores from the area around the station.

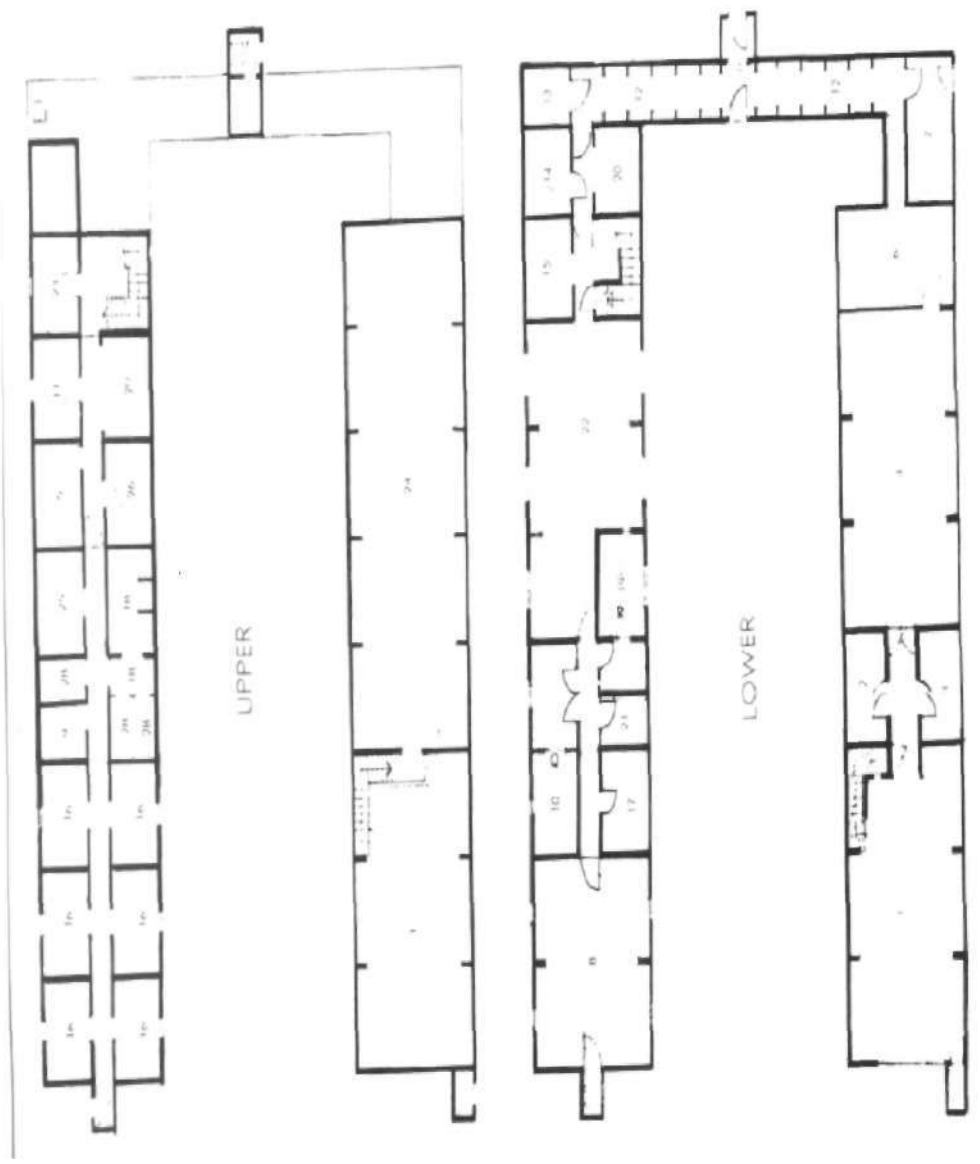
Search for three buried skidoos is still on, even during the polar night. Paramjit installed an air heater below his satcom dome to overcome extreme cold defects in the satcom antenna and the equipment is functioning well. He is also working on repairing a 1.5 kW transmitter, which became defective

SNOWCATS

during transportation, to establish a high-frequency contact with India. Cutting of snow and filling in the snow melt plaint is being shared by all members in rotation. Strict control on the use of water has become necessary. Bathing and washing is allowed once a week. Smoking is restricted to the dining hall as a safety measure against fire in the station, which has fuel tanks and barrels around.

At the time of filling this report in later part of May, the station is undergoing its polar night. The blizzards are observed on most of the days and the visibility during blizzards is practically nil. The members have put the station in good shape by working round the clock. Sadekar is using his skill and imagination in preparing different dishes out of the limited frozen food available. Aloke has treated the author, Col Sharma, Joseph, and Sadekar from severe back ache they developed due to the extreme cold.

Tambi got a major eye injury while working in the workshop, which has been well looked after by Aloke by surgery. Snow profiling on the ice shelf by the author, releasing of meteorological balloons for upper air study and recording other meteorological data by Rizvi and study of bacteria of Dakshin Gangotri bases by Prabhu have become regular features of day-to-day activities. Auroras are often observed on clear nights. Despite of all uncertainties in stock the first wintering party is ready and fully confident to face the challenging task lying ahead.




1. GARAGE WORKSHOP
2. ELECTRICIANS WORKSHOP
3. DIESEL MECHANICS WORKSHOP
4. GENERATOR ROOM
5. BOILER ROOM/DAILY OIL STORE
6. CARPENTER'S WORKSHOP
7. WEEKLEY OIL STORE
8. LABORATORY
9. DARK ROOM
10. SURGERY
11. BASE COMMANDER'S OFFICE
12. ACCESS LINK
13. MELT TANK
14. SNOW MELT PLANT
15. OUTDOOR CLOTHING STORE
16. TWOMANBUNKROOM
17. LOUNDRY
18. WASHROOM AND TOILETS
19. KITCHEN
20. COLD ROOM
21. LARDER
22. DINING ROOM/LOUNGE
23. RADIO ROOM
24. MISC. STORAGE
25. SCIENTIFIC EQUIPMENT STORE
26. FOOD AND GENERAL STORE
27. ESCAPE SHAFT
28. TOILETS

Maj. P. K. NAIR

Capt. ANIL HARNAL

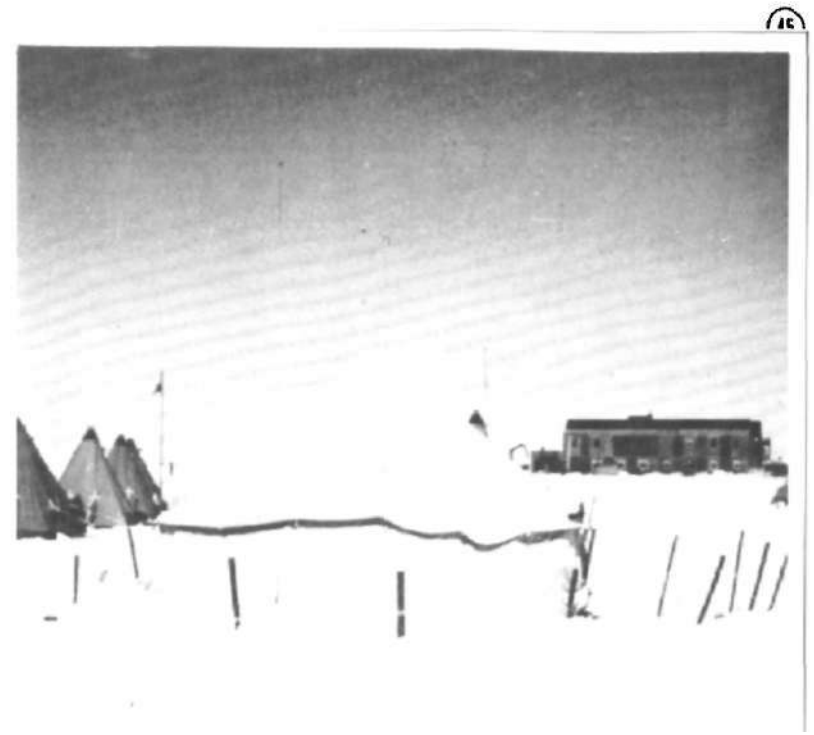
# Construction Of The Indian Antarctic Research Station "Dakshin Gangotri"

There is a flurry of activity inside the station. Finishing touches are being given before final departure. A blizzard rages outside with wind speeds gusting upto 150 kilometres per hour. The mercury has dropped to — 27°C and visibility is restricted to only a few metres. Conditions inside the base are very comfortable. The central heating system is on, and under test along with the other systems. The temperature inside is about + 12°C. The kitchen is fully functional and mugs of steaming coffee are passed around.

A communication from the ship on the satellite communication system brings the news that the weather is likely to dear for a few hours and all personel must move back to the ship. Twelve persons are being left behind to man the station during the long Antarctic winter. There is a sudden change of mood. The men being left behind pen their last letters to their lovedones. Somebody switches on a nostalgie marching tune.

This, then, is the culmination of two months of sustained effort. A permanent Antarctic station has been constructed and a wintering party is being left behind, an achievement made possible by the dedicated labour of a motivated group of people.

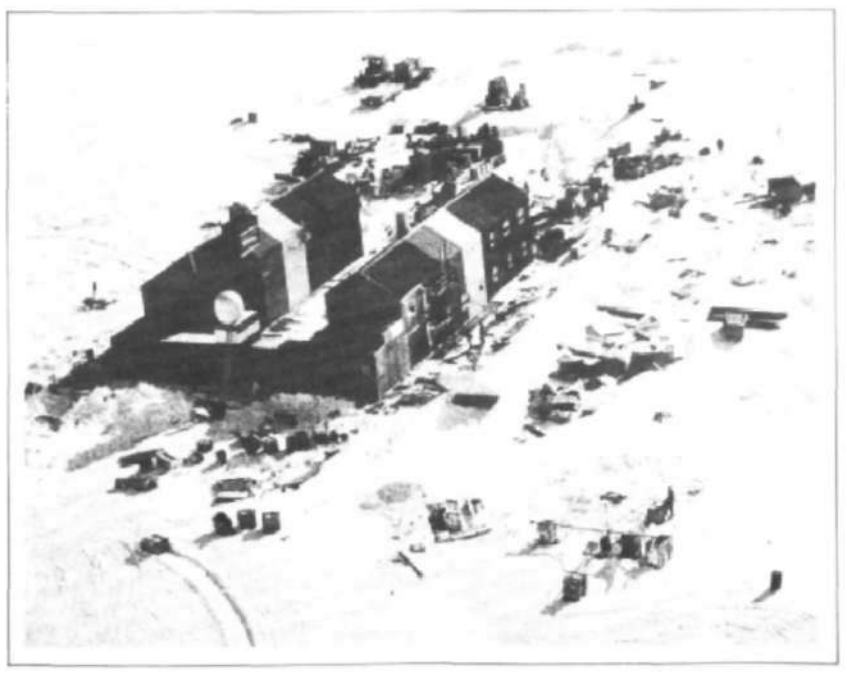
How did it all begin? The primary objective of the Third Indian Expedition to Antarctica was the construction of a permanent manned station, besides carrying out a number of scientific experiments and investigations. For this purpose a team of 81 members was selected from organisations all over the country. The logistic support was provided by the defence services, which is the usual practice with all countries. The Corps of Engineers of the Indian Army was given the actual responsibility of construction of the station. For this purpose, personnel was specially selected and trained. The operation, repair and maintainance of the snow vehicles was also undertaken by the army team.



THE PLAN OF THE DAKSHIN GANGOTRI STATION BUILDING.

MS FINNPOLARIS moored to the sea ice on 27 December 1983. Ma t.me was wasted and the vehicles were offloaded onto the sea ice, after locating a suitable ramp for negotiating onto the shelf from the sea ice. The recconoissance helicopters played a very useful role in locating the site of the station which had been selected provisionally from maps and air photos.

Operation "WHISK" was the name given to the task of offloading *the* stores from the ship and getting them to the base camp. So the MI-8 helicopter was operational from the 29th of December and worked unceasingly till all the stores had been offloaded. The total quantity of stores carried was about 500 tons, not including the fuel, which itself was about 400 tons. The foe! was shifted to the base camp by snow vehicles and sledges only after the ship came alongside the ice shelf.



At the base camp things were really humming. The camp itself was set up and consisted of 14 Antarctic Survival Tents and 6 Indian Medium Arctic Tents. Digging of the foundation for the station began and we started laying the foundation. A little time was lost, about 2 days, when the foundation got covered with 1-5 metres of snow because of a blizzard. It had to be cleared. The building now started to grow very fast, and by 22 January the structure of the building was complete.

Now started the difficult part of making the structure filt for living. The station consists of 2 double storeyed blocks connected by a link block. The task of providing power, water and heating started. The following systems were installed:

a) Electric supply, by three 62,5 KVA generator sets running on Jet Aviation fuel
b) Hot and cold water supply
c) Two boilers
d) Central heating by a low pressure hot water radiator system
e) A plant for melting snow for water
f) Waste disposal and sewage
g) Chemical toilets
h) Heated fresh air supply
j) Extract ventilation
k) A warm air unit for heating "A" block.

So much work in so less time was possible only by the tireless and dedicated working of the team, who worked from 8 AM to 11 PM with only one hour break for lunch.

In the meantime, a satellite communication terminal was set up in a servival tent and people could talk to their homes. Later, when the building was complete, another terminal was installed inside in the communications room.

Slowly, the scientists who were to stay for winter moved in and set up their laboratories, and before this team left Antarctica, they had already started their experiments.

We had many visitors to the base camp on our Republic Day ceremonies. They were Russians and East Germas from their Antarctic stations. But one visitor to the station who was photographed the most was a solitary penguin who decided to make his home in our base camp.

Soon the long days started growing darker and the moon began to shine in the nights. It started getting colder with temperatures touching about — 30°C with steady winds of about 80 to 100 kmph. The time for the first winter season in the new base "DAKSHIN GANGOTRI", had arrived. We said our goodbyes and left base camp, leaving behind many memories and an everlasting landmark to show the dedication and suicerity of all those who worked to make the station a reality.

In the end, it is worth mentioning that this is the first time that a station has been built in the Antarctica in only one summer, starting from scratch. And the Indian Army Engineers lived up to their motto of "SARVATRA", meaning "EVERYWHERE".

Stig Malm berg

# Notes
# From Antarctica
# By An Observer



SNOWCAT AND THE SLEDGE.

MI-8 ON THE HELIDECK.

## INTRODUCTION

After passing through the floe ice area between the latitudes of 65°S and 70°S MS Finnpolaris moored alongside the solid sea-ice on the 26th of December at midnight. The sun was about 15° above the horizon and there was no wind. The unloading of cargo started the next day. The heaviest loads, 4 snowcats, were unloaded directly onto the ice and then driven via a slope at the shelf ice edge found by helicopter reconnaissance to the place which had been chosen for the new station. The rest of the cargo including provisions, building material, generators, radio equipment with 2 satellite communication units, scientific equipment, etc. were taken to the station by helicopters and later — after getting moored alongside the shelf ice edge — by snowcats. The amount of cargo was about 700 tons and the unloading was finished at the end of January. The helicopter operations were sometimes hampered by snowdrifts, which took place during stronger winds (above 10 m/s). Visibility on the ground was then reduced and the pilot could not see the ground to put down the cargo safely.

The ship carried 4 helicopters: 2 Soviet-built Ml 8:s, the same type as used by the Finnish Air Force, and 2 Alouettes designed in France and built in India under licence. The payload of Ml 8 is about 2.5 tons and of Alouette about 0.9 tons, which means that several hundred flights would have been required if all the cargo had been unloaded by helicopters. Had we not been able to moor alongside the shelf ice it would not have been possible to unload directly to the sledges towed by the snowcats.

LIFTING CHETAK INTO THE HOLD.

ANTARCTIC FLOES.

## THE WEATHER AND THE SEA

During the antarctic summer the weather was good most of the time this year, which meant clear sky and weak winds. Air temperature was close to 0°C (during our stay the variation was — 10... +2°C in the daytime and a Few degrees colder at nights). Over the Antarctic there was an almost constant high pressure. The weak winds and brigt sunshine raised the surface water temperature resulting in stronger winds every now and then (a few day intervals) until the air mass was stabilized again. These stronger winds meant that we had to leave the ice edge and stay out at clear water. The stronger winds also resulted in a break in the unloading operations.

The low pressure route is between the latitudes of 50°S and 60°S. During our journey down there were temporary winds up to 30 rn/s in this part of the route. The sea state was such that the ship speed had to be reduced to decrease pitching and heaving when sailing against the wind, especially when the amount of cargo was small, about 3000 tons including bunker and water (the deadweight of the ship is 14.900 tons, deadweight = weight of cargo, fuel, water and provisions).

As mentioned earlier, we passed through the flow ice belt between the latitudes 65°S and 70°S. This floe ice consisted of 50...80 cm thick ice floes with a diameter of 5...50 m. Among the ice floes there were icebergs of different sizes and shapes floating. The biggest had a height above sea level of approx. 30 m, which means a draft of about 200...250 m, depending on the shape and density. North of lat. 65°S there is a westerly current and south of lat. 65°S an easterly current. Close to the shelf ice the easterly current clears the area from ice, which drifts to the Weddel Sea and is then carried further north by the westerly current, The landfast sea-ice by the continent has a thickness of about 2...4 m, depending on how many melting periods it has survived. When mooring alongside the sea-ice the task was to find a place which is kept clear of ice by the current so that the moving floes would not hit the ship. The ship was moored by means of wooden poles. The sea-ice is brittle (considerably more brittle than the brackish sea-water ice in the Baltic) so it cracks very easily when the swell starts and a new mooring site had to be looked for.

## THE SHIP

MS Finnpolaris (main particulars: length 160 m, breadth 21 m) is originally designed for export of Finnish pulp and paper products from Finland and import of bulk (coal, phosphate etc.) to Finland and is built to the Finnish ice class 1A Super. The ship has in principle a double hull amidships between the engine room bulkhead aft and the collision bulkhead in the fore. The holds have been given a parallelepipeds shape (box shape) for rational cargo handling where the cargo is moved vertically only, The tweendecks are equipped with retractable bulkheads in order to keep the box-like shape when the tweendeck hatch covers are closed.

Owing to the longitudinal side bulkhead, the ship has a good safety even if the outer shell would be punctured by a growler (ice formation with a height under approx 1 m above sea level). These growlers are difficult to see at reduced visibility and too small to be seen on the radar, whereas icebergs can be seen on the radar. All ship officers had experience in ship operations in icecovered waters and the ship was properly operated.

The propulsion machinery consists of one directly connected 6-cylinder slow-running supercharged two-stroke crosshead diesel, which has an output of 7300 kW (9900 hp). This kind of a diesel engine should be run at a high continuous rating (approx. 50..80%) in order to avoid soot and slag formation in the exhaust piping and turbine. This is an obvious disadvantage, which can partly be overcome by using diesel oil instead of heavy fuel oil. While looking for a suitable mooring site, pulling out for unfavourable weather or ice conditions and taking samples for marine research, we sailed with a low engine rating. It was not possible to anchor due to great water depths.

Onboard the ship were ordinary crew and 81 Indians 15 of whom represented different research centres. The rest were from the Indian Army, Navy and Air Force.


FINNPOLARIS MOORED ON TO SHELF ICE.

## RESEARCH ACTIVITIES

The goal of the marine research during the voyage was to determine the productivity of the sea. Water samples taken from different water depths were primarily analyzed in the temporary laboratory container onboard. Further analyses were to be carried out in India. Different organisms (plankton, krill etc.) were also caught for further studies. It is common knowledge that the arctic and antarctic waters have the greatest productivity on earth. This is due to the vertical water streams, which bring a great amount of oxygen into the sea-water, and to the solar radiation in the summertime. Experience has shown that unrestricted exploration of a certain species (e.g. krill, whaile, seal, etc.) will result in an unpredictable disturbance in reproduction and in the relation between different species.

Beyond the conventional metheorological observations (balloon-carried radio sondes) research was conducted to find out the amount of ozone in the air. Yet a fully acceptable theory for the distribution variation of ozone over the globe has not been presented (the ozone concentration over oceans and industrialized land areas is high while it is low *over* unindustrialized land areas).

Among the scientists (of which 2 were women) there was also a group of geologists, who during our stay in Antarctica went for a few weeks trip to the mountain area further inland to take rock-samples and ice samples from the shelf ice.

## COMPLETING THE TASK

By the end of January the cargo had been unloaded and during February the construction teams could fully concentrate on the erection of the stamen and internal installations. The members of the construction teams belonged to the Indian Army. The Navy and the Air Force which had been responsible for the cargo handling operations could now assist in construction work and the station was ready for preliminary test runs of different installations at the end of February on schedule.

The wintering party moved into the building on the lost days of February. Soon the day came when it was time to say goodbye to the wintering party, i.e. the 1st of March. When the ship sailed the same day the weather was as beautiful as it was when we arrived at Antarctica on the 26th of December.

Our voyage back to Mauritius passed without any particular events worth mentioning. The scientists took water samples almost every day utAl we reached Mauritius.

# From The Notice Board:

SERVICES AVAILABLE

## EXPERTS

* IN CLADING WORK
* WORK CAN BE UNDERTAKEN
  IN ANY WEATHER CONDITION
  (Up to Max. Wind Sp. 35 Kts)
  (Up to Min. Temp —20° C)
•NOMINAL CHARGES

CONTACT:

GILL & CO

CHOU HOUSE
ANTARCTICA STREET
JULLUNDER
PUNJAB INDIA
TEL: 007

## EXPERTS IN

* RUNNING CANTEEN/CAFETERIA/RESTAURANT

* CAN PRODUCE ANYTHING OUT OF NOTHING

* CERTIFICATE (FROM KAUKO) HELD.

CONTACT:

NAT & CO

RASAM HOUSE

Sambar Street
Bangalore, Karnataka India
Tel 001

HOUSE FULL

## 12th week

**AT INDIAN HALL**


**EVERY NIGHT**

**AFTER 2200 HRS.**

HOUSE FULL HOUSE FULL
HOUSE FULL HOUSE FULL

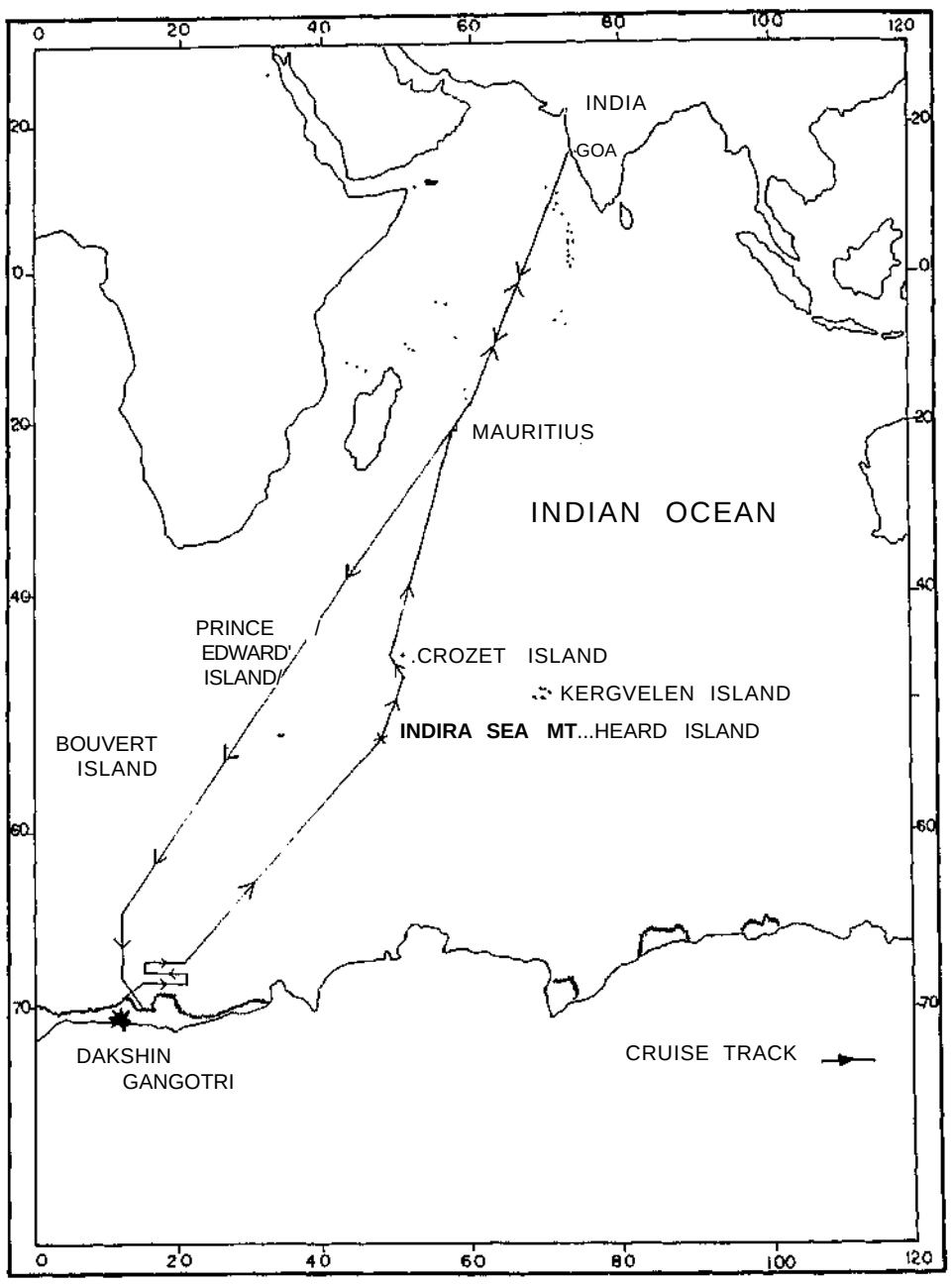
MI-8 PILOT.

DR ASHUTOSH SINGH AND AMATEUR STATION ONBOARD THE SHIP.

SMILE!

HELLO!


THIRD INDIAN ANTARCTIC EXPEDITION
(1983 - 84)
Name List of Members
Capt GP KRISHNAMURTHY
Spr KG PILLAI
Nb Sub JS KALLIRAMAS
Cdr VP SATHIAMOORTHY
Lt Cdr RS GILL
Cdr SR CHANDANA
Lt Cdr RS CHAUHAN
Lieut MS KHELA
Lieut AA KHAN
AAS PK BALAKRISHNAN
PO ELAR RK KAPOOR
ALISH SINGH Mach
CK "O" D SERASTINE
CK "O" V GOPAL
Wg Cdr BD MADHOK
Wg Cdr V SATRAJAN
FLT Lt AJIT KUMAR
Flt Lt VM KHANNA
Flt Lt NM RAI
Sq Ldr KI TRIVEDI
Cpl MANDAL KN
Sgt. JOSEPH MATHEW
Sgt. VISHWKARMA RN
Sgt. GUPTA SB
Sgt JADHAV AB
Sqn Ldr SKS PURI
Major BB SINGH
Lt Col SS SHARMA
Dr SRH RIZVI
Shri SGP MATONDKAR
Capt RR SINHA
Capt RAM KUMAR
Nb Sub S JOSEPH
Nb Sub VS RANA
Hav PADMANABHAN
L/NK S THAMBI
L/NK S SADEKAR
Capt PARAMJIT SINGH
Sqn Ldr ALOKE BANERJEE




THIRD INDIAN ANTARCTIC EXPEDITION

3rd DEC 1983 TO 29th MAR 1984

CRUISE TRACK FROM GOA
TO ANTARCTICA AND BACK

WÄRTSILÄ

# Shipbuilding In Wartsila

Wartsila is one of the largest industrial enterprises in Finland. The original company was founded in 1834 but Wartsila has grown to its present magnitude by mergers and acquisition of other companies as well. Yet our traditions os shipbuilders date back-to 1741 when the first shipyard was founded in Finland.

Today Wartsila comprises some 20 factories in Finland and has also production plants in Sweden, Norway, United States and Singapore.

The company which employs 17.500 people is engaged in shipbuilding, diesel engine manufacturing, heavy engineering and in the production of locks and sanitary porcelain. The company also produces consumer goods such as household porcelain, glass and enamel.

The major sector is shipbuilding, the sales of which amounted to USD 700 million in 1983. The Shipbuilding Division has specialized in the building of technically demanding tonnage, e.g. cruise ships, car/passenger ferries, icebreakers, gas tankers, chemical carriers and sophisticated dry cargo vessels.

The second biggest sector is diesel engine manufacturing with sales in excess of about USD 145 million. Wartsila, which is a public company, has 17.500 shareholders and is quoted on the Stock Exchange in Helsinki, Stockholm and London. In 1983 the total sales of the company amounted to about USD one billion.

WARTSILA HELSINKI SHIPYARD.

## HELSINKI SHIPYARD

The Helsinki Shipyard, founded 1865, is the most specialized shipyard within the Wartsila Shipbuilding Division. The yard is the leading builder of icebreakers and other special vessels for navigation in arctic conditions. The majority of the world's icebreakers since the Second World War have been commissioned from the yard.

Also in the building of luxury cruise liners and car passenger ferries is this yard famed for unique design, advanced technology and high quality. Full consideration of the customers' requirements and the know-how obtained from following up the ships' performance have contributed to make the yard the market leader.

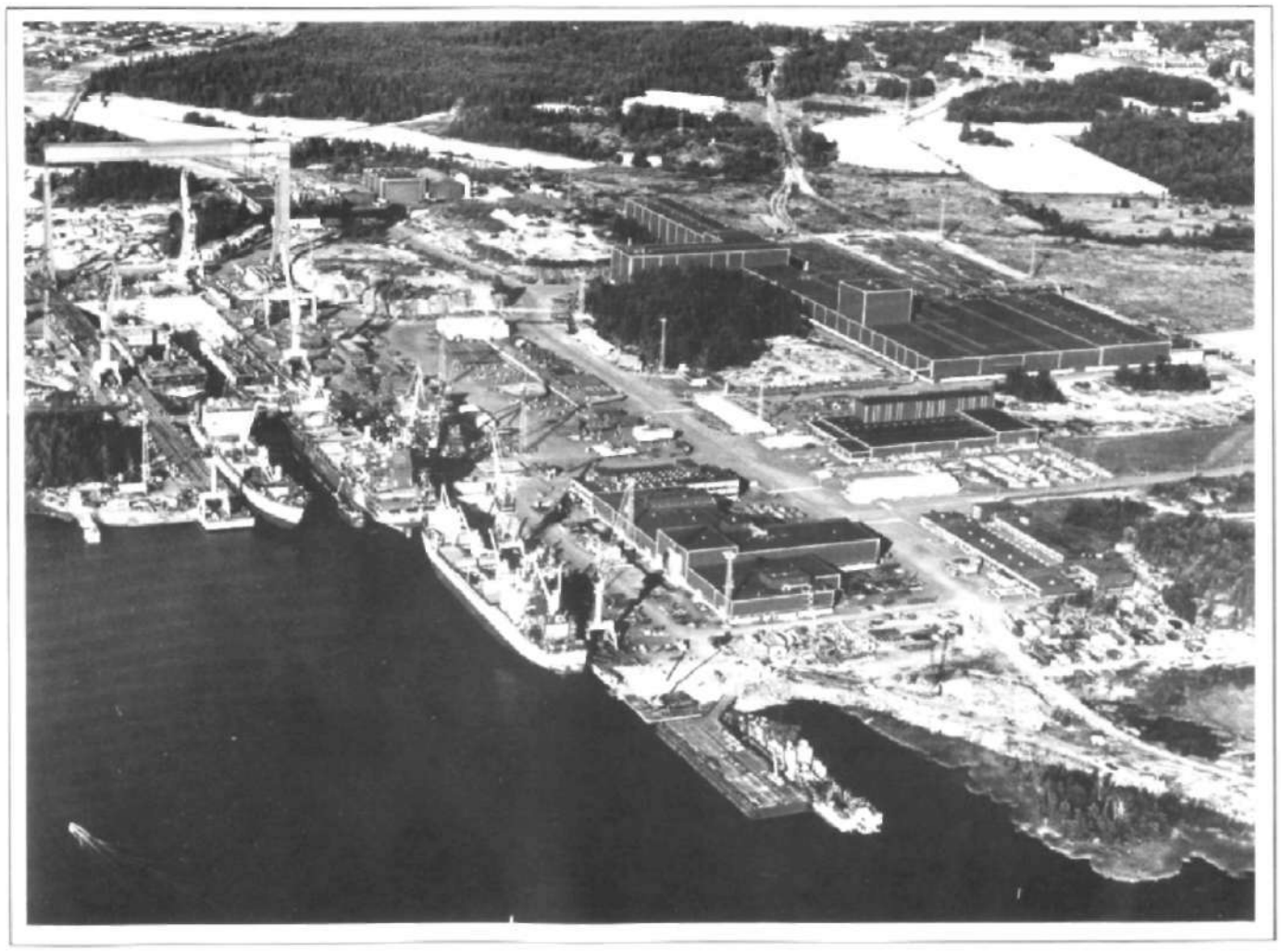
The production programme further includes such types of ships as cable-layers and advanced naval craft, which also demand a considerable research and design effort.

The yard has also been the first to lengthen modern cruise liners — no doubt a challenging task for which the yard is eminently equipped.

Shipbuilding takes place in a 400.000 $m^3$ enclosed building hall, one of the largest indoor shipbuilding facilities in the world, which can accommodate cruise liners up to 50.000 GRT and icebreakers up to 160.000 SHP. Necessary facilities for modern steel processing and rational ship outfitting are also of latest construction.

## PERNO SHIPYARD

The Perno Shipyard, which is the biggest facility within the Wdrtsild Shipbuilding Division, was built in 1976 as a hull construction facility. In 1982 all the shipbuilding facilities — outfitting included — were transferred from the older Turku yard to the Perno facility. This two-stage investment and the concentration of all newbuiiding activities in the Turku region to Perno resulted in one of the most comprehensively outfitted and efficient yards in Europe. The yard area of 1.440.000 square meters allows for future expansion and diversification — even beyond the scope of traditional shipbuilding. Ships are generally built up to a size of abt. 100.000 t.d.w. but the flexible dock arrangement enables the construction of vessels practically regardless of size. The lenght of the building dock is 250/365 m the width being 80 m while the depth is 12 m below sea level. The capacity of the gantry crane is 600 t the hoist height being 70 m. The dock and the outfitting quays in addition served by several 100-10 t jib cranes. The number of employees is about 3500.



PERNO SHIPYARD.

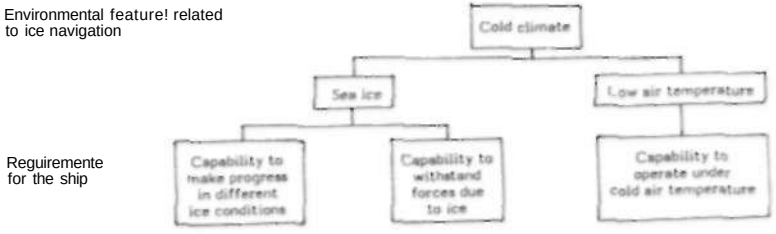
# Icebreaking Research At Wartsila

The growing interest in arctic and antarctic activities in particular, has considerably increased the need for icebreaking research. The basic technical problems are the same for ships and offshore structures. Fig 1 shows a systematic approach to analysing the problems related to icebreaking and to different areas of icebreaking research. The effect of sea ice or low air temperatures has to be considered in a great number of details of ships and offshore structures intended for service in ice. We can conclude that the special environment has to be considered in the desing and construction of almost every system or component of a ship or offshore structure. And to make this possible, information must be available on the behaviour of the components and systems in real ice and frost conditions.

In icebreaking research, the following three techniques are in use:

— full-scale testing
— model testing using simulated ice
— analytical investigation

All of these are important and in practice they are used to complement each other.



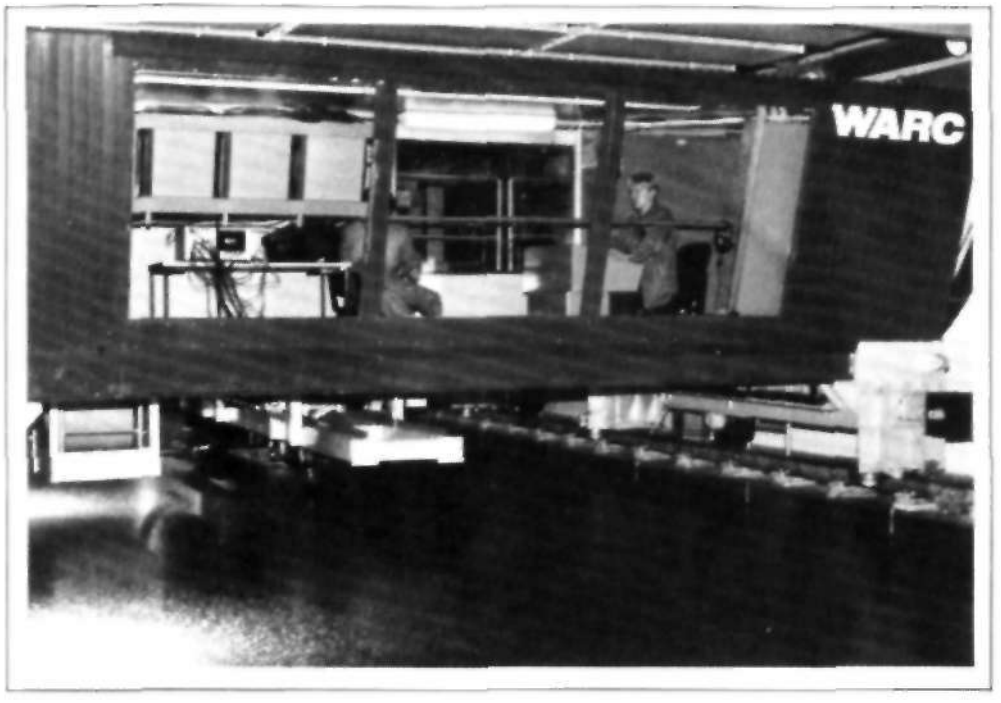

Hull main dimension!
Hull form
Hull appendage configuration
Hull aurtece
Propulaion machinery power
Type of machinery
Power, torque, rpm - characteristics
Dynamic characteristics of machinery
Manoeuvrability
Special devices for improving icebreaking capability
Hull structure
Hull appendage structure
Structure of propeller(s), shafting and propulsion machinery
Behaviour of propulsion machinery
Cooling water syatem

Materials in »B»nl
Equipment and machinery outside or in cold apacea
Ballaat water, hydraulic oil etc. fluid ayatema
Heating
Insulation
Accommodation
Structure on weather deck with regard to ice accumulation (icing)

FACTORS TO BE CONSIDERED WHEN DESIGNING ICE-GOING SHIP.

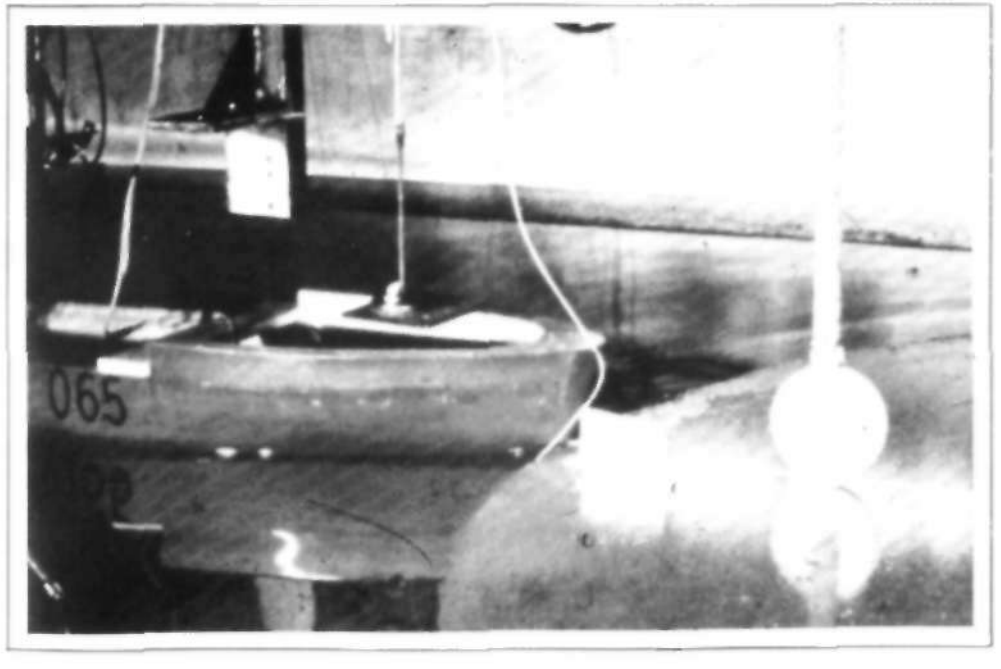
A FULL-SCALE TEST IN A PRE-SAWN ICE FIELD UNDERTAKEN TO STADY THE COMPONENTS OF ICE RECITANCE.

THE ANTARCTIC ICEBREAKER "ALMIRANTE IRIZAR" UNDERGOING ICE TRIALS IN THE WEDDEL SEA.




WARTSILA ARCTIC RESEARCH CENTRE IN HELSINKI, FINLAND.

A DRILLING VESSEL IN AN ICE IMPACT TEST FOR DIMENSIONING THE DYNAMIC POSITIONING SYSTEM.




Full-scale testing is, of course, the technique which gives the most reliable data. In this respect it is superior to the others and must form the basis of all icebreaking research. This technique itself can be used in icebreaking investigations, but it is chiefly needed for calibrating and developing the methods to be used in other modes of research.

At the Wartsila Helsinki Shipyard we have tested or been involved in the testing of ships of numerous different types, from small icebreaking tugs to a large icebreaking tanker (Fig. 2 and 3.)

Basically, all kinds of ice conditions in nature can be simulated in an ice laboratory, Fig. 4, and tests can be made with all kind of structures — ships, floating offshore platforms, jack-up structures, etc (Fig. 5).

All situations normally encountered by a ship in arctic or subarctic navigation can be simulated in the laboratory

— level ice
— channels (own and clogged channel)
— ridges (first-year and multi-year ridges; floating and grounded)
— ridge fields
— rubble fields
— ice under pressure
— small growler-type icebergs
— floes
— restricted water depth

Much remains to be done to furter raise the level of icebreaking model tests, and the present techniques are still far from the accuracy of the techniques used in ice-free testing. It should be noted that model testing in ice-free conditions has been routine for more than a hundred years, while icebreaking model tests have not been performed for more than 20 years. One obstacle to the utilization of ice model tests has been the characteristic of the model ice. Recent work done by Wartsila is expected to result in a new model ice material called MC Model Ice, which will have much better characteristics than the traditional high-salinity ice or carbamide ice, and some other advantages as well.

During the last 14 years of regular model testing, we have found that the best results are obtained when full-scale tests and model tests go hand in hand. We have also found that close contact between the ice laboratory and the shipyard building the icebreakers, though not absolutely necessary, is of the greatest benefit. The icebreaking model test basin at the Wartsila Arctic Research Centre (WARC) is so far the only icebreaking laboratory in the world that is owned by a shipbuilding division and that has close collaboration with a shipyard. The whole range of activities is thus linked together in a chain, which leads from basic ice research through applied research and model tests, product development and design to production and full-scale tests. All these phases may give, and actually do give, feed-back to each other, and we thus have real control over the whole field. This is why Wartsila, a privately owned company, has considered it well worthwhile to build its own ice laboratory.

# Index