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BY

INDIA

THE 8TH SESSION OF COORDINATING COMMITTEE

ON

OZONE LAYER

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(INDIA)

February 1986.

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SUBMITTED BY INDIA AT THE 8TH SESSION OF COORDINATING COMMITTEE ON OZONE LAYER

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OZONE LAYER

K.CHATTERJEE
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INTRODUCTION :

The study of ozone in the atmosphere has assumed great importance in recent years because of the concern of the effect of the increased human activities on the stratospheric and tropospheric ozone. This concern arises from the fact that distortion of ozone layer may adversely effect the biosphere, earths' climate and weather.

1. OZONE MEASUREMENT IN INDIA

In India ozone observations were first made in 1928-29 at the Kodaikanal Observatory of the India Meteorological Department (IMD). Subsequently some more observations were made at Bombay & Pune with the introduction of Dobson Ozone Spectrophotometers. However, routine ozone observations of total ozone & umkehr started on a network basis from six stations in India during the IGY period (1957).

2. LISTING OF PRESENT FACILITIES IN INDIA

2.1 TOTAL OZONE NETWORK

The following six stations are operating Dobson Ozone photometer for total ozone and umkehr observations :

(i) Srinagar (34° 05'N)
(ii) New Delhi (28°34'N)
(iii) Varanasi (25°18'N)
(iv) Ahmedabad/Mt.Abu (23°04'N)

(v) Pune (18°32'N)

(vi) Kodaikanal (10°14'N)

2.2 BALLOON OZONE SONDE NETWORK

Vertical distribution of ozone in the atmosphere is being measured from the three stations in India - New Delhi, Pune & Trivandrum.

2.3 SURFACE OZONE NETWORK

Surface ozone measurement is taken from six stations in India - Srinagar, New Delhi, Pune, Nagpur, Kodaikanal & Trivandrum.

2.4 THE IMD BALLOON FACILITIES

The IMD operates 35 stations for measurement of upper air temperature and humidity upto 30 Km and taken twice a day from these station at 00 & 12 GMT hours. A map showing the ozone & Radiosonde facilities in India are given in Figs. 1 & 2.

2.5 OTHER MAJOR FACILITIES IN INDIA

Fig. 3 presents other major facilities & programmes that are already available or are being set up shortly in India.

3. SPECIAL PROJECTS

3.1 INDO-US WORKSHOP

A major Indo-US workshop on Global Ozone Problem was held at New Delhi, India during January 11-20, 1983 & organized as a part of the activities of the Indo-US Joint Commission.

.....3/-

The Workshop discussed the following auspects on global ozone problems:

(i) Measurements and study of ozone

(ii) Measurements and study of other minor species in lower and middle atmosphere.

(iii) Climate and chemical modelling

(iv) UV measurements & effects on Plants

(v) UV effects on human health

At the end of the workshop, a set of recommendations were made related to stratosphere and troposphere that have special relevant to India, particularly in the following fields.

(i) Trace species and Tropical Climate (Including Monsoon Dynamics)

(ii) Biomass burning & their consequences

(iii) Tropospheric chemistry and ozone

(iv) Satellite data on Ozone and Minor Species as obtained from Nimbus-7.

(v) Laboratory Kinetics

(vi) High elevation, Low latitude studies vis-a-vis UV-B dosage.

(vii) Skin damages from UV-B radiation.

3.2 INDO-USSR INTERCOMPARISON

An Indo-USSR ozone intercomparison campaign was held at THumba during March, 1983. The experiment involved measurements of atmospheric ozone profile, temperature profile and total ozone over the tropical station, THumba (8.5°N) using several types of Indian & Soviet rocket ozonemeters, IMD balloon ozonesonde,Radiosonde and Dobson ozone spectrophotometer for umkehr and total ozone. Surface ozone measurement using IMD surface ozone sensor was also made. The primary objective of the ozone campaign was to collect near simultaneous data-sets on the distribution of ozone concentration over Thumba using different techniques of ground based and balloon based and rocket borne instruments. The following are the experiments conducted during the campaign.

GROUND BASED : Dobson Spectrophotometer for total and vertical profiles of ozone concentrations and surface ozone measurement.

BALLOON BORNE: I.M.D. Radiosonde for meteorological parameters and IMD electrochemical ozone sonde for ozone profile upto 35 Km.

ROCKET BORNE : India & USSR optical ozonemeters and chemiluminescent payload for vertical profiles of ozone upto 80 Km. Meteorological

payloads for the measurements of temperature and winds upto about 80 Km. A total of 11 stratospheric balloons and 16, M-100 B Rockets were launched during the campaign. The programme has yielded for the first time, a large number of vertical distribution profiles of ozone over Thumba from the ground upto mesospheric level, all collected within a span of eight days. The data has been jointly utilized by India, and USSR scientist for study of ozone over the tropical areas and the priliminary result were presented at COSPAR meeting 1984. A reprint of the paper presented is given in the enclosure (**Appendix I**). All the profiles collected during the inter-comparison have been plotted and given in Fig. 3. This may be taken as model ozone profile over Thumba, India.

3.3 TOTAL SOLAR ECLIPSEEXPERIMENT FEBRUARY 1980.

During the total solar eclipse of 16 February 1980, the IMD had established two facilities one at Gadag (15°25'N) other at Raichur (16°12'N) in the path of totality & organised meteorological observations from soil surface to 30 km in the upper atmosphere. In addition, the IMD network of Radiosonde & Ozone network made a concerted effort for an uninterrupted observations. Rocket borne ozone sensors & met. sensors were also used during the solar eclipse period for collection of data of vertical profile of ozone and temperature from Thumba & Balasore. These experiments during total solar eclipse had yielded valuable sets of upper air data & the results were presented in the form of scientific papers in the International Solar Eclipse Symposium held at New Delhi during January 1981. Some of the interesting results are given at **Appendix II.**

3.4 INDIAN MIDDLE ATMOSPHERE CONTRIBUTION PROGRAMME

Indian Middle Atmosphere Programme (IMAP) had constituted a Working Group on Minor Constituents & Atmospheric Chemistry and another Working Group was constituted on Atmospheric Ozone Campaigning which have direct bearing on the ozone depletion problem. In India, both these Working Groups are very active & have made very useful contribution . In addition to the two IMAP

Working Groups, other IMAP Working Groups of interests in relation to ozone are :

(i) Stratospheric warming campaign

(ii) Measurement of minor constituents

(iii) Grab sampling facilities at the Balloon Facility at Hyderabad & Gas Chromatograph Facilities at the National Physical Laboratory, New Delhi and the Physical Research Laboratory, Ahmedabad.

(iv) Development of water vapour sensor.

(v) Rocket measurement of NO & O_2

3.5 UN-PHOTOMETER MEASUREMENT OVER INDIA

A UV photometer has been developed for direct measurement of UV radiation at the ground surface by measuring radiation at wavelengths 280 nm, 298 nm & 310 nm. To provide a continuous information of UV-B doses received in India, seven such UV-B photometers are being installed at New Delhi, Trivandrum, Pune University, Andhra University, Mysore University, Shillong, Jodhpur during IMAP-C period.

3.6 SLASH & BURN EXPERIMENT IN INDIA

To find out the effect of slash & burn agriculture of rice paddy fields, action is in progress to have simultaneous measurements of methane & ozone at the surface at few stations in India. To begin with such a facility is being established at Shillong (NE India), for the study of CH_4, NO_2 & Ozone relationship in the troposphere.

4. LISTING OF DOCUMENTS IN RELATION TO OZONE MEASUREMENTS IN INDIA :

4.1 Proceedings of Indo-US Workshop on Global Ozone Problem

4.2 Preliminary results of Indo-USSR ozone intercomparison.

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4.3 A full scientific report on the ground based & balloon based ozone measuring during the Indo-USSR ozone intercomparison, Thumba in March 1983.

4.4 Ozone measurements over India during the Total Solar Eclipse of 16 February 1980.

4.5 Minor constituents in the Middle Atmosphere

4.6 Solar UV-B data during IMAP campaign.

5. INDIA'S CONTRIBUTION IN THE VARIOUS INTERNATIONAL BODIES IN THE FIELD OF OZONE

Indian Expert(s)* in the field of Atmospheric Ozone are working as Atmospheric Ozone Rapporteur for the Region II (Asia) of the WMO since 1977 till date and also serving as one of the Rapporteurs on Ozone as it relates to Climate in the Commission of Atmospheric Sciences(CAS) of the WMO.

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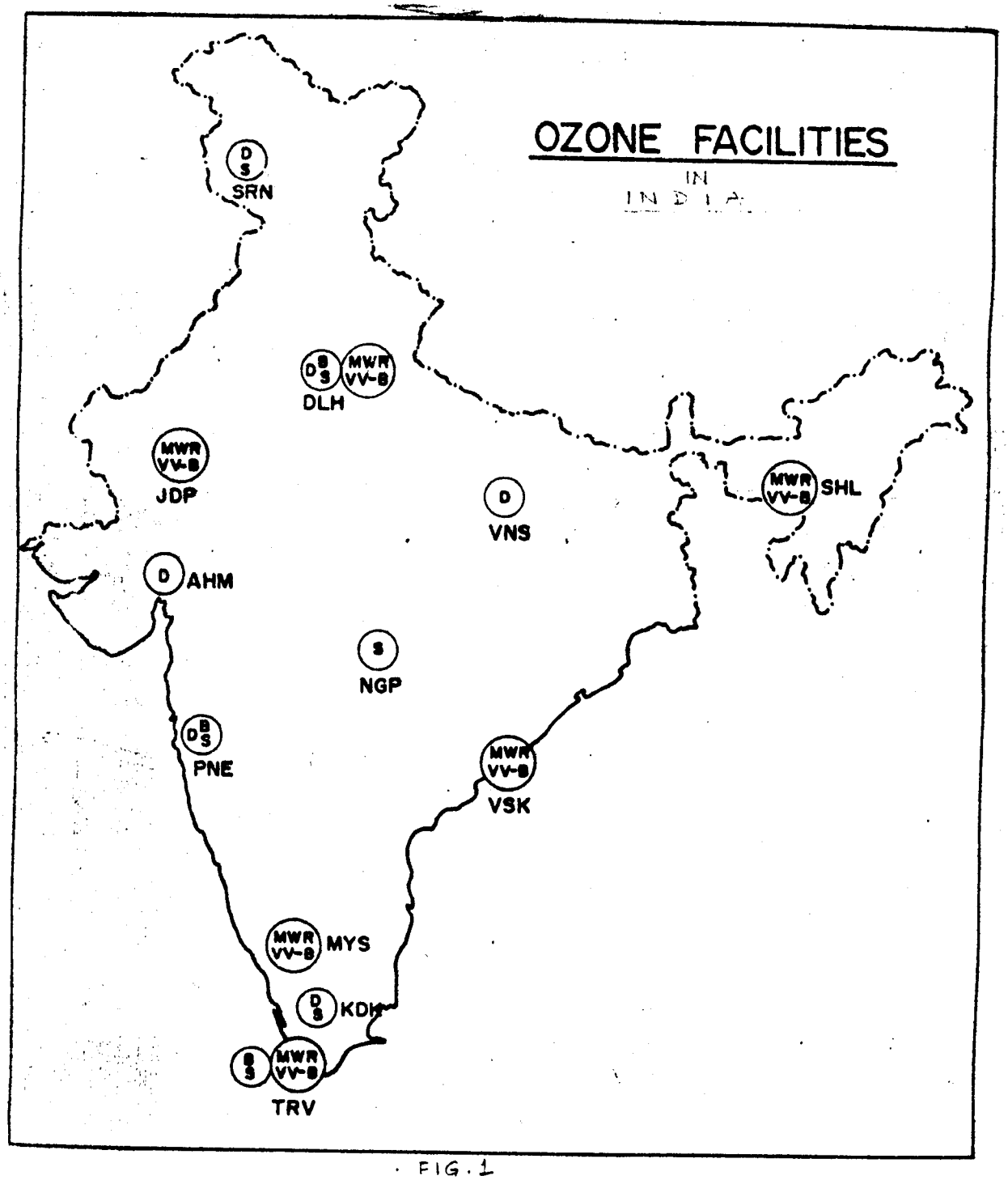
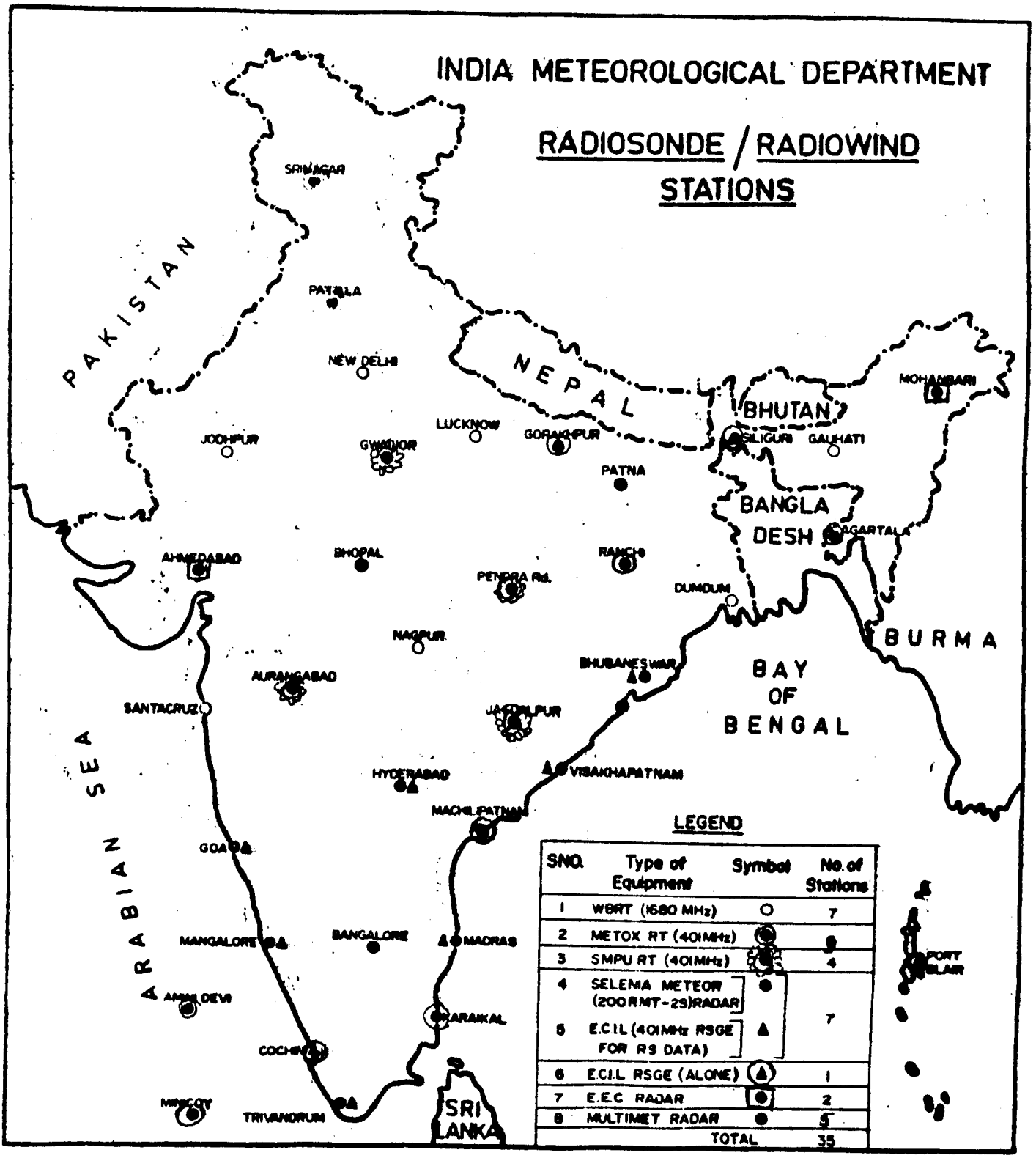

OZONE FACILITIES
IN
INDIA
D S
SRN
D S
MWR VV-S
DLH
MWR VV-S
JDP
D
VNS
MWR VV-S
SHL
D
AHM
S
NGP
D S
PNE
MWR VV-S
VSK
MWR VV-S
MYS
D S
KDK
S S
MWR VV-S
TRV

FIG. 1


INDIA METEOROLOGICAL DEPARTMENT
RADIOSONDE / RADIOWIND
STATIONS
PAKISTAN
NEPAL
BHUTAN
BANGLA DESH
BURMA
BAY OF BENGAL
ARABIAN SEA
SRI LANKA
SRINAGAR
PATIALA
NEW DELHI
JODHPUR
GWALIOR
LUCKNOW
GORAKHPUR
SILIGURI
GAUHATI
MOHANBARI
PATNA
AGARTALA
AHMEDABAD
BHOPAL
RANCHI
PENDRA Rd.
DUMDUM
NAGPUR
BHUBANESWAR
AURANGABAD
SANTACRUZ
JAGDALPUR
HYDERABAD
VISAKHAPATNAM
MACHILIPATNAM
GOA
MANGALORE
BANGALORE
MADRAS
KARAIKAL
COCHIN
TRIVANDRUM
PORT BLAIR
LEGEND
SNO. Type of Equipment Symbol No. of Stations
1 WBRT (1680 MHz) 7
2 METOX RT (401MHz) 9
3 SMPU RT (401MHz) 4
4 SELENIA METEOR (200RMT-2S)RADAR
5 E.C.I.L (401MHz RSGE FOR RS DATA) 7
6 E.C.I.L RSGE (ALONE) 1
7 E.E.C RADAR 2
8 MULTIMET RADAR 5
TOTAL 35

Note: Facilities marked with asterix are being planned others are already existing

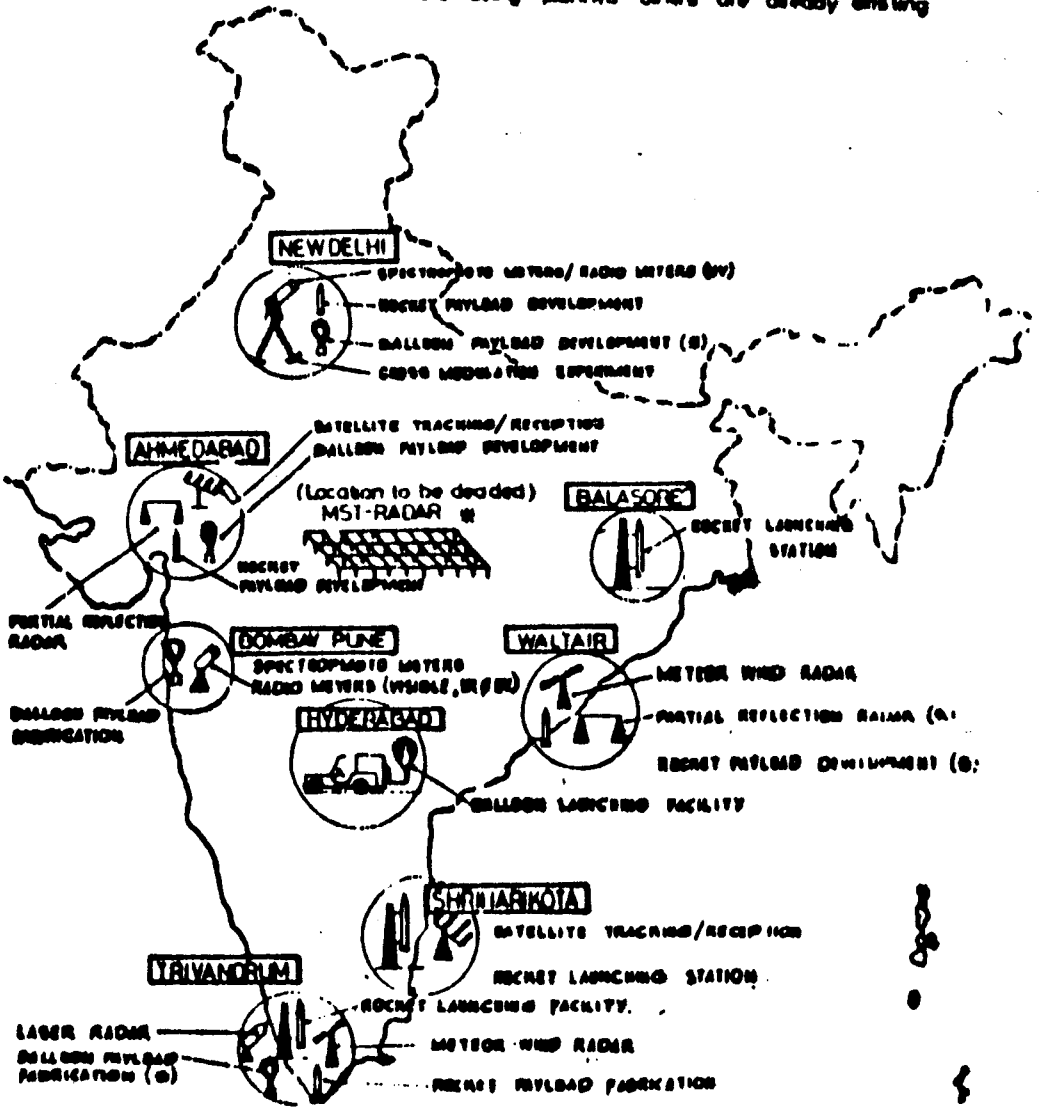


Fig. 3 Locations of Important Facilities for IMAP