OUTCOME BUDGET
(2009-2010)

Government of India
Ministry of Earth Sciences

June 2009

Chapter I: Introductory Note

Recognizing the importance of ocean and atmospheric services to the various sectors of this country, the Government of India created a new Ministry of Earth Sciences (MoES) in July 2006 with a view to reorganize the national effort in atmospheric and ocean sciences and related services by integrating related departments such as Department of Ocean Development, India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM) and National Centre for Medium Range Weather Forecasting (NCMRWF). The new Ministry of Earth Sciences has been formed for taking an integrated view of Earth System Science and to study the interdisciplinary links to understand phenomena like global climate changes, in addition to address all Science and Technology issues related to ocean and atmosphere. The Ministry of Earth Sciences aims to create a framework for understanding the complex interactions among key elements of the Earth System, namely ocean, atmosphere and solid earth, by encompassing national programmes in Ocean science, meteorology, climate, environment and seismology.

The MoES covers a wide range of activities contributing to various societal benefits in the areas of Weather (General), Weather advisories specific to agriculture, aviation, shipping, sports, etc, Monsoon, Disasters (cyclone, earthquake, tsunami, sea level rise), Living and non-living resources (fishery advisory, poly-metallic nodules, gas hydrates, etc), Coastal and Marine Ecosystems and Climate Change. The programmes of the ministry have been cast broadly into the following categories viz., (i) Atmospheric science, information & services, (ii) Ocean science information& services (iii) Geosphere & seismological hazards (iv) Polar science & cryosphere (v) Ocean technology(vi) Coastal and marine ecosystems(vii) Climate science (viii) Non-living resources (ocean) (ix) Research vessels (x) R&D in Earth Sciences and (xi) Outreach. MoES aims to create a framework for understanding the complex interactions among key elements of the Earth System, namely ocean, atmosphere and solid earth, by encompassing national programmes in Ocean science, meteorology, climate, environment and seismology.

Organizational Setup

With the establishment of the MoES, the activities are broadly classified into three major activities (i) Ocean Science and Technology, (ii) atmospheric research and meteorological services (ii) seismic monitoring and earth quake research

For effective implementation of programmes in the forefront of Ocean Science, Technology and Services; two attached Offices were set up viz. the Centre for Marine Living resources and Ecology (CMLRE) at Kochi and the Project Directorate for Integrated Coastal and Marine Area Management (ICMAM) at Chennai; Three autonomous Institutions viz. the National Centre for Antarctic Research (NCAOR) at Goa, National Institute of Ocean Technology (NIOT) at Chennai and the Indian National Centre for Ocean Information Services (INCOIS) at Hyderabad, as well as nine Ocean Science and Technology Cells in universities/institutes and a chain of Marine Data Centres at National Institutions. The Department also maintained the permanent research station - Maitri in Antarctica apart from a fleet of oceanographic research vessels, which are well-equipped floating laboratories.

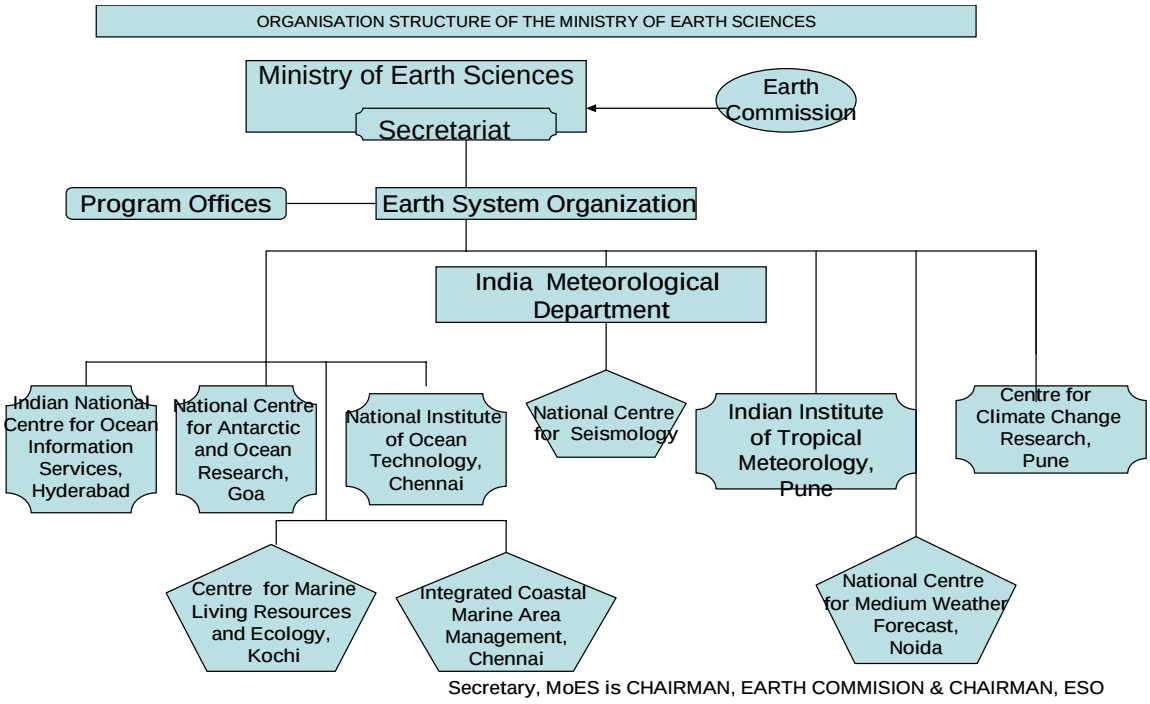
The atmospheric sciences and meteorological services are being rendered by dedicated three institutes viz., IMD, NCMRWF, IITM. The India Meteorological Department is one of the oldest of organized meteorological services of the world. In course of time it was evident that the nature of meteorological phenomena was distinctly different not only in the

tropics and mid-latitudes but also in different geographic regions characterized by large ocean basins like that of Pacific, Atlantic and the Indian Ocean. Thus topical research was the need of the day and the Indian Institute of Tropical Meteorology came up in 1962 and the National Centre for Medium Range Forecasting came up in 1989. Today they complement each others role and add to the overall scientific capability in the country.

Towards detection of earthquake and seismic monitoring system, an Earthquake Risk Evaluation Centre was established at Delhi for seismic microzonation. The Ministry has developed a close interaction at both research and operational level between the scientific community and ensuring that there is a seamless flow of data, information and knowledge that percolates down to the end users, thereby getting integrated with the development process in the country.

The MoES will have the following divisions at its Headquarters to look after the work of various Centres under it: Administration, Programme Offices (including a Disaster / Emergency Management Office), International Co-operation, Commercial Operations, HRD, Sponsored Research & Development and the Earth Science Organization proposed below.

The Organization structure including attached offices of the ministry is as follows:



MANDATE

The Ministry of Earth Sciences (MoES) is mandated to provide services in forecasting the monsoons and other weather/climate parameters, ocean state, earthquakes, tsunamis and other phenomena related to earth systems through well integrated programmes. The Ministry also deals with science and technology for exploration and exploitation of ocean resources (living and non-living), and playa a nodal role in Antarctic/Arctic and Southern Ocean research. The Ministry's mandate covers Atmospheric Sciences, Ocean Science & Technology and Seismology in an integrated manner.

The other major mandate of the ministry includes formulation and implementation of programmes in ocean science and technology for long term scientific, technical, economic and geopolitical benefits. With the adoption of ocean policy statement and U.N conference on Environment Development in 1992 and with UN Convention on Law of the Sea coming into force in 1995 for India, the activities were expanded and oriented towards exploration and exploitation of living and non-living resources within our EEZ and beyond for the socio-economic benefit and sustainable development of marine sector, including protection and preservation of its environment. Currently the activities of the Ministry, upgraded into Ministry in February 2006, are directed towards the development of Technology with the active participation and support of national R&D laboratories, educational institutions and industries to harness the ocean resources. A wide range of schemes, which are highly multi-disciplinary in nature that required a multi-institutional approach are being implemented. The activities under these schemes would range from development of several cutting edge technologies, including deep sea mining technology, to providing ocean information services; and conducting marine geophysical surveys, development of potential drugs, setting up of metallurgical plant for extraction of metals from polymetallic nodules, conducting front-rank research in polar and southern ocean studies. Recognizing importance of translating scientific knowledge to the societal benefits, the Ministry had strengthened infrastructure facilities in its three autonomous bodies National Institute of Ocean Technology(NIOT), Chennai, Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, National Centre for Antarctic and Ocean Research (NCAOR), Goa, and 2 attached offices (Centre for Marine Living Resources and Ecology (CMLRE), Kochi, Integrated Coastal Marine Area Management (ICMAM), Chennai primarily to carry out most of its activities during the X Plan

a). India Metrological Department (IMD), New Delhi (Sub-ordinate office): IMD is the Principal Government agency in all matters relating to Meteorology, Seismology and allied subjects. The primary objectives are to undertake meteorological observations and to provide current and forecast meteorological information for optimum operation of weather-sensitive activities like agriculture, irrigation, shipping, aviation, off-shore oil exploration etc. and warn against severe weather phenomena like tropical cyclones, dust storms, heavy rains and snow, cold & heat waves etc. which cause destruction of life and property, and identify the potential consequences of an earthquake, both in relation to existing structures as well as in the planning new facilities “in terms of cost effectiveness”, and maintain liaison with other scientific organizations in the country in the fields of agriculture, hydrology, oceanography, air pollution, Seismological and Earthquake hazard evaluation etc and to provide customized meteorological services for specific purposes such as Commonwealth Games 2010.

b). Indian Institute of Tropical Meteorology(IITM), Pune(Autonomous body): IITM is a premiere research Institute and functions as a national centre for basic and applied research in Ocean-Atmosphere Climate System required for improvement of Weather and Climate Forecasts of the tropics in general with special reference to monsoon meteorology over India and neighbourhood. The objectives of IITM are to generate, promote, and guide scientific knowledge and to conduct research in the field of meteorology and atmospheric sciences that has potential application in various fields such as agriculture, economics, health, water resources, transportation, communications, etc.

c). National Institute of Ocean Technology (NIOT), Chennai, (Autonomous body) an autonomous institute under the Ministry, started in 1993 as the technical arm with a view to develop reliable indigenous technology to solve the various engineering problems associated with harnessing of non-living and living resources in the Indian Exclusive Economic Zone (EEZ), which are about two-thirds of the land area of India. The major functions are Development of technology related to the country’s needs in the field of deep sea mining,

ocean energy, marine instrumentation, materials development, oceanic data collecting devices and observation systems etc. in consonance with ocean policy and national priorities, Research and development of ocean related technology projects sponsored by the industry and Development of required technologies for the management of coastal zone and islands of the country.

d) Indian National Centre for Ocean Information Services (INCOIS), Hyderabad. (Autonomous body) The mission of INCOIS is to provide ocean information and advisory services to the society, industry, government and scientific community through sustained ocean observations and constant improvements through systematic and focused research. The objective is to provide coastal and Ocean Advisory Services, Potential Fishing Zone advisory Service (PFZ), Ocean State Forecast, National Tsunami Early Warning Centre etc. The Tsunami and Storm Surge Early Warning System started in October, 2007 at INCOIS provides information on ocean waves swell etc which are quite valuable for Navy, Coast Guards, Merchant Ships and Coastal states. Similarly Fishing Zone Advisories are utilised by large number of fishermen on both cost.

e) National Centre for Antarctic and Ocean Research (NCAOR), Goa. (Autonomous body) The mission of NCAOR is to plan, promote, co-ordinate and execute the entire gamut of polar science and logistic activities of the country in order to ensure a perceptible presence of India in Antarctica and to uphold our strategic interests in the global framework of nations in the southern continent and the surrounding oceans. The Indian Antarctic and Arctic Scientific Expeditions are launched through and under the guidance of this organization.

f)National Centre for Medium Range Weather forecasting (NCMRWF) (Project Directorate), Noida, established in1989 works as an operational numerical modeling Centre for weather. An end-to-end global numerical weather prediction system is run to generate operational weather forecast products for short range (1-2 days), medium range (3-7 days), extended range (1 month during monsoon) and seasonal climate range (up to a season in advance during monsoon) and provided to various user agencies.

f). Integrated Coastal and Marine Area Management (ICMAM) (Project Directorate), Chennai. The ICMAM programme aims to develop appropriate tools and techniques to solve problems such as coastal erosion, ecosystem degradation and pollution. It is undertaking projects on shoreline management to control erosion, ecosystem modeling to address the problems reduction in productivity and Marine Ecotoxicology programme to prescribe safe water quality criteria useful in controlling pollution. The targets set for these programme include (i) collection of field data at Muthalapozhi / Vadnaplly (Kerala) and Uiiargrill Padukere (Karnatka) to study the erosion (ii) initiation of field data collection to study the hydrodynamics and biogeochemical characteristics of Chilka lake.

g) Centre for Marine Living Resources and Ecology (CMLRE): (Sub-ordinate office):The CMLRE, an attached office of MoES at Kochi is entrusted with the mandate of implementing the Marine Living Resources Programme of the Ministry and management of the Fishery Oceanographic Research Vessel, FORV Sagar Sampada. The major activities under this programme are charting of exploitable resources of the deep sea, promoting operational fishery oceanographic services, ecosystem monitoring & modelling, promoting, basic R&D on MLR and transfer of technology for societal development. The research vessel, FORV Sagar Sampada, forms the backbone of MLR research surveys.

Chapter II: Statement of Budget Estimate & Outcome Budget(Rs. In crores)

Sl. No.	SCHEME	Annual Plan 2008-09(BE)			Annual Plan 2008-09(R.E)			Annual Plan 2009-10 (BE)		
		B.E.			R.E.			B.E.		
		GBS	IEBR	TOTAL	GBS	IEBR	TOTAL	GBS	IEBR	TOTAL
1	Polar Science	35.50		35.50	57.50		57.50	94.00		94.00
2	Polymetallic Nodules Programme	15.00		15.00	15.00		15.00	13.00		13.00
3	Ocean Observations, and Information System (OOIS)	13.00		13.00	18.00		18.00	15.00		15.00
4	Marine Research and Technology Development(MRTD)	24.00		24.00	29.00		29.00	65.00		65.00
5	National Institute of Ocean Technology (NIOT)*	20.00		20.00	30.00		30.00	50.00		50.00
6	Coastal Research Vessels (CRV)	5.00		5.00	5.00		5.00	5.00		5.00
7	Delineation of Outer Limits of Continental Shelf	1.00		1.00	1.00		1.00	1.00		1.00
8	Comprehensive Topographic Surveys	5.00		5.00	5.00		5.00	6.00		6.00
9	Gas Hydrates Exp.& Tech. Dev.	12.00		12.00	6.00		6.00	35.00		35.00
10	O&M of Sagar Nidhi	12.00		12.00	20.00		20.00	22.00		22.00
11	Early Warning Sys. for Tsunami & Storm Surge	15.00		15.00	10.00		10.00	15.00		15.00
12	Data Buoy & O & M of Sagar Manjusha	10.00		10.00	15.00		15.00	18.00		18.00
13	Information Technology	1.00		1.00	2.00		2.00	10.00		10.00
14	National Center for Antarctic and Ocean Research (NCAOR)	15.00		15.00	15.00		15.00	15.00		15.00
15	Indian National Centre for Ocean Information Service(INCOIS)	30.00		30.00	22.84		22.84	20.00		20.00

16	Seafront facility	10.00		10.00	0.10		0.10	0.50		0.50
A-2	New Schemes:									
17	Development of manned submersible	5.00		5.00	0.01		0.01	5.00		5.00
18	Multichannel Seismic System- Sagar Kanya	5.00		5.00	0.01		0.01	0.01		0.01
19	Desalination technology(10 MLD)	10.00		10.00	0.01		0.01	5.00		5.00
20	Expedition to Arctic	2.00		2.00	2.00		2.00	2.60		2.60
21	National Oceanarium	0.50		0.50	0.01		0.01	2.00		2.00
22	Demonstration of Shore Protection measures - Pilot project	0.50		0.50	0.50		0.50	5.00		5.00
23	Int. Ocean Drilling Prog.(IODP)+Arabia sea	4.00		4.00	5.00		5.00	10.00		10.00
24	Ice class Research vessel	5.00		5.00	0.01		0.01	0.50		0.50
25	Headquarter Building	20.00		20.00	0.01		0.01	25.00		25.00
B-1	Ongoing Schemes:									
26	India Meteorology Department (IMD)	432.00		432.00	222.99		222.99	305.38		305.38
27	Nat. Centre for Med. Range Weather Forecast (NCMRWF)	11.00		11.00	13.00		13.00	20.00		20.00
28	Indian Institute of Tropical Meteorology	13.00		13.00	29.00		29.00	60.00		60.00
B-2	New Schemes:									
29	Multi-hazards Warning Support System	1.00		1.00	1.00		1.00	10.00		10.00
30	Centre for Climate	5.00		5.00	5.00		5.00	25.00		25.00
31	Dedicated Weather Channel & Commonwealth Games 2010	5.00		5.00	1.00		1.00	5.00		5.00
32	NIOT ext. centre West Bengal	0.50		0.50	0.01		0.01	0.01		0.01
33	Seismicity&Earth quake precursors	0.00		0.00	8.00		8.00	15.00		15.00
34	R&D in Earth & Atmospheric Sciences	7.00		7.00	11.00		11.00	20.00		20.00
	GRAND TOTAL (A+B)	750.00		750.00	550.00		550.00	900.00		900.00

Review of Annual Plan (2007-08): Statement of Outlays/Targets (2007-08) (As per the Outcome Budget 2007-08) and Actual Achievement Appendix-4, Annexure-I

No	Name of the Scheme/ Programme	Intended Objective/ Outcome	Annual Plan 2007-08 Outlay (Rs. In crores)	Quantifiable Deliverables	Processes/ Timeliness of the approvals	Achievements w.r.t. col.(5)	Remarks/ Risk factors
1	2	3	4	5	6	7	8
1	Polar Science and Antarctic Research	Launching of the XXVII Indian Scientific Expedition to Antarctica. Establishment of third permanent base in Antarctica: Collection of baseline scientific data and planning the design specifications of the station building; identification of the construction firm and working out the modalities. Planning and mounting of a combined expedition to the Southern Ocean and to the site of the Third Antarctic Base in the Larsemann Hills. Southern ocean Studies: Completion of analytical work of data collected during the last Expedition to the Southern Ocean Mounting a cruise in the tropical	.20.00	Initiation and completion of the targeted scientific projects mounted		All targeted objectives/tasks have been completed within the scheduled time frame. Analytical work of data collected during the earlier cruises is in progress as scheduled.	

		Indian Ocean as a linkage to the Southern Ocean studies Planning and mounting the Third Expedition to the Southern Ocean					
2	Polymet-allic Nodules Programme	• To identify most potential first generation mine site in retained area. • To study Environmental impact of mining. • To develop mining system in phases for exploitation of nodules. • To develop technologies for extracting metals from the nodules.	15.00	• Survey activities & Exploration at closer grid of 6.25k.m in proposed FGM site. • Monitoring and assessment of recolonisation of benthic environment • Development of collector and crusher system and testing with crawler. • Development of soil tester for in-situ measurement of soil properties at a water depth of 6000m. • Testing of primary process routes on the semi-continuous demonstration pilot plant set up at HZL with extraction of Copper, Nickel and Cobalt from PMN. • Testing of process route in Ferro-sillico-manganese plant at NML, Jamshedpur with 500 kg/day capacity. • Demonstration of		• Survey and exploration activities were carried out at a closer grid of 6.25 k.m. for selected blocks in the proposed FGM site. • Continuous monitoring of the environmental parameters by collection of samples at the test and reference areas for the benthic disturbance experiment periodically. • Crawler sea trials were successfully undertaken upon its successful development. • An in-situ soil sampler to measure soil bearing strength was successfully tested at a water depth of 5200 m.. • The primary process routes were tested on the semi-continuous demonstration pilot plant set up at HZL with successful extraction of Copper, Nickel and Cobalt from PMN. • A pilot plant for processing leached sea nodule residue on 350 Kg/ day has been set up and 6 nos. of campaigns have been carried out to produce standard grade Fe-Si-Mn. • ROV was developed and	

				remotely Operable Vehicle of 6000m depth • Development of Remotely operated Subsea Artificial Nodule Laying system		tested successfully for its functionality at a depth of 205 m off Mangalore. • A Remotely Operated Subsea Artificial Nodule Laying System has been developed for creating a small mine site similar to that of the one in CIOB. The system was tested off Chennai coast.	
	D. Research and Modelling (INDOMOD, SATCORE, R&D PROJECTS)	• Enhance basic understanding and knowledge base on oceanic and atmospheric processes for predictability of ocean climate and catastrophic weather events and improve operational prediction by the respective national agencies • Implementation of Global and Indian Ocean Regional Model and coastal wave forecast using SWAN nested with WAM • Generation of binned products of Chlorophyll-a, SST, and Kd-490 from satellite data and in-situ measurement of Chlorophyll and SST for the validation of satellite data.	15.00	• Experimentation with ROMS and MOM		• Various experiments based on Regional Ocean Modeling System (ROMS) to understand the sensitivity of the model to different parameterizations/options have been conducted and considerable progress in understanding the problems in simulating the sea surface temperature is obtained. • Fine tuning of Regional Ocean Model for realistic simulation is underway. Simulation for 1998 – 2006 was carried out and compared with available observational data sets. Model simulated the observed interannual and intraseasonal variations in the Indian Ocean realistically. • MOM for the Indian Ocean domain with high vertical (40 layers) and spatial resolutions (0.25 degree X 0.25 degree) was configured on SGI Machine with 6 processors. • The Regional Ocean Model	

						(ROMS) is being fine tuned for realistic simulations by introducing 32 vertical levels and MY2 mixing scheme in the model. The model simulations with realistic forcing are being carried out. The model is being fine tuned for realistic simulations. For the study area as 30 – 140 E and 30 S – 30 N with 1 degree resolution • Time-series stations have been planned along Goa, Mangalore, Kochi, Pondicherry, Parangipettai, Nagapattinam, Vishakapatnam and Machlipatnam coast, for the generation of optical data, for the validation of satellite derived ocean colour products • Daily processing of MODIS data for the generation of products like chlorophyll, TSM, k_d490 and SST. The processed data will be maintained on website in the form of daily, weekly and monthly composites. • The satellite data IRS LISS-III and LISS-IV (about 79 CDs) belongs to the three study areas has been imported, applied radiance conversion and unsupervised classified. • The Data has been clipped to the 25k SOI sheets and the classification has been started for the above data.	
3	E.	• Measuring oceanographic parameters over Indian Ocean using		• Deployment, acquisition, processing,		• Four Argo floats were deployed in the Indian Ocean	

	Observation Networks (Argo, XBT, Drifters, Gliders, Current Meter Arrays & Reference System)	different in-situ plat forms to understand the Indian Ocean dynamics and validation of ocean and atmospheric models. Measuring temperature and salinity profiles up to 2000 m.		quality control and dissemination of Argo Float data deployed by India • Generate and publish value added data products from Argo float data from the floats deployed in the Indian Ocean by different countries • Procurement of Argo floats, drifters, XBT, Current meters, etc.		86 floats are operational out of 136 floats deployed by India. All the active floats, data are received from INCOIS Satellite Data Acquisition and Processing System, processed and disseminated to user agencies after real time quality control. • Delayed mode quality control was applied for 34 floats and these data has been uploaded to GDAC • The trajectory data derived from 112 Argo floats were generated in netcdf format and uploaded to the DAC. • The value added products are updated regularly and published them on INCOIS web site. • Grided data sets of Argo T/S profiles using objective analysis is updated and made available on INCOIS live access server (LAS). • The value added products are updated regularly and published them on INCOIS web site. • Grided data sets of Argo T/S profiles using objective analysis is updated and made available on INCOIS live access server (LAS). • Several scientific studies	

						are being carried out using the Argo float data • Initiated action for procurement of Argo floats, drifters, XBT and current meter moorings • A Cruise is planned during November to deploy most of the above platforms along with time-series observations as a part of Bay of Bengal observatory pilot study.	
4.1	Marine Living resources programme	Assessment of deep-sea and distant water fisheries. Monitoring of the environment and productivity patterns in the Indian EEZ Monitoring and surveillance of HAB Studies on the benthos of the slope area (200 –1000m) Hatchery production of black pearl Preparation of antifouling compounds Assessment of myctophid resources in the Arabian sea. Southern ocean MLR FORV Data & Referral Centre Other R& D projects	4.00	Demersal fishery advisory for the area Atlas on seasonal climatology of Indian EEZ. Hand book on HAB species of Indian EEZ Bench mark data on marine benthos of shelf area. Techniques for growth and implantation of oysters in hatchery Techniques for fractionation and extraction of compounds with antifouling properties from Marine organisms. Being the first year of implementation, no outputs are expected. Survey and assessments of Krill/ fin fish resources in the Indian ocean sectors of the Southern ocean.	Being R&D programmes deliverables are not quantifiable at this stage.	Timely	Many of the outputs have commercial applications. Technologies need to be perfected and transferred to end users.

				Data Products on benthos, fishery, HAB etc. Scientific information, data and samples			
4.2	Development of potential drugs from the ocean	To harness potential bioactive substances from marine organisms for human therapeutic purposes.	5.50	Under R&D mode, exploration of potential drugs from marine organisms. Outcome /deliverables are not quantifiable. However, human resources and infrastructure would be developed in our country. A considerable number of Patents and research publications are expected subject to hits encountered.	First instalment to the new centres would be issued immediately after the issuance of Administrative Order. Subsequent releases to the grantees are processed subject to receipt of requisite financial documents, etc.	So far two molecules are in the advance stages of drug development for (i)anti-diabetic and (ii) anti-hyperlipidaemic activities. Nine more hits are in pipeline for confirmation of its activities.	Though the marine organisms are thousand times potential sources for bioactive compounds than the terrestrial plants and animals, the achievements made world-wide so far is very little as this field with uncertainty. However, India needs its capability and infrastructure to explore bioactive substances from marine

							organisms for therapeutic principles.
4.3	Coastal Ocean Monitoring and Prediction Systems	To assess the health of the seas	2.00	Updation of status of marine pollution at 76 locations Initiation of GIS based information system for 5 locations and completion of database for 10 locations Development of an oil spill trajectory model for Indian Ocean region	Project Document	In progress	
4.4	Integrated Coastal and Marine Area Mngt	Application of scientific tools and techniques like mathematical modeling for Integrated Coastal Zone Management	5.00	Investigation of vulnerability of Indian coastline for coastal erosion Ecosystem Modelling for Kochi and Chilka Marine Ecotoxicology experiments for Cadmium completed and Arsenic initiated Storm Surge model development		Initiated Water quality modeling in progress Initiated	Manpower inadequate to conduct field activities. Mostly depend on project fellows of other institutions. Project manpower often leave the project due to lack of employment guarantee.
4.5	Marine Research and	Providing assistance for undertaking research projects, manpower		Providing assistance to 9 OASTCs and supporting	Regular scheme	- Formulation of a New Policy on Ocean and Atmospheric Science &	-

	Development	development and capacity building in Ocean and Atmospheric science and technology subject specialties.	4.5	research projects outside OASTCs		Technology Cells (OASTCs) - 9 OASTCs and the CoE received financial assistance - The ongoing projects under Manpower programme received financial assistance - Establishment of a Fish Breeding and Rearing Facility at the CoE in Marine Biology - Creation of a Centre of Excellence in Marine Microbiology at Goa University.	
4.6	1. Assistance to seminar 2. Foundation Day Celebration 3. Science Parks establishment 4. Workshops on marine Technologies etc 5. Outreach programmes 6. OAST subject in schools 7. National Awards, Prizes etc	1.To support Seminar, Symposia 2.Celebration on 27th July 2002 3.OSTCs subjects in school 4.National Awards	2.00	70 Seminars etc Earth Day Celebrated 22nd April Foundation Day Celebrations 27th July 6 Science Parks establishments Outreach programme 2 National Awardees Money incurred from Rs.1.00 lakhs to Rs.10.00 lakhs for each Nation Award	• Already 50 Seminars/ Symposia supported Celebrated Two parks are expected 2 Awards were distributed To be processed	Subject to concern from various agencies Timely approvals from Ministry of Finance	1.

4.7	Ocean and Atmospheric Science & Technology Cells (OASTCs)	Providing assistance for undertaking research projects, manpower development and capacity building in Ocean and Atmospheric science and technology subject specialties.				All the ongoing projects under OSTC and outside OSTC will continue to receive financial assistance. About 10-15 fellowships to be granted under Marine Manpower Development programme. 5 new projects under Manpower programme are expected to be approved during this year. A new M.Tech programme in Ocean Technology at IIT, Madras, Chennai with on-job training at NIOT to start.	
5.0	National Institute of Ocean Technology - NIOT Assessment of worst case operation conditions for design reference manual	Reference for seasonal and extreme values of coastal hydrodynamic parameters like waves, currents and water levels	20.00	Procurement of equipment and software			
5.1	Underwater components	To develop specialized non-off-the-shelf components (in Indian markets) for underwater applications in association with industry.		Development of Fibre Optic Connectors for 6000 m. Design of underwater motor with 250 kW rating. Development of Sub-sea power converter.	To be completed by Mar 08. Project will continue in 2008-09. completed by June 2008.	Prototype connector tested for pressure sets of connectors have been delivered Design review carried out, Vendors being identified for the procurement of sub components	
5.2	Electronic	To establish a facility of excellence to		Installation of test facilities	Establishm	Installed Helium leak detector,	

	support facility	provide electronics support to various activities and projects of NIOT .		for Helium leak detector, Impedance analyzer, battery condition monitor, shock &vibration	ent of these facilities are expected to be completed by Mar 08. Project will continue in 2008-09.	Battery condition monitor& Impedance analyser	
5.3	Echo sounder	To develop a portable 200 kHz echo sounder with an integrated GPS and a RF telemetry to use in shallow waters		Echo-sounder with integrated GPS.	To be completed by Mar 2008.	Integrated Echo-sounder developed & tested till 75m depth.	
6	Operation and maintenance of Sagar Paschimi, sagar Purvi and Sagar Manjusha sagar sakthiand	Continuous operation of the vessels for the COMAPS and other Ministry's programmes	5.00	Availability of vessel without interruption to the programmes of theMinistry	Continuing scheme	Vessels were made available for collection of samples	Nil

7	Delineation of Outer Limits of Continental Shelf (CLCS)	To establish outer limits of Indian continental shelf and to submit the Indian claim to the Commission on the Limits of Continental Shelf (CLCS), along with the supporting scientific and technical data under UN Convention on Law of the Sea.	0.01 1.00	• Updating the data inventory and work pertaining to submission on delineation of continental shelf • To develop state-of-the-art national marine geophysical data archival, processing and interpretation facilities.		A comprehensive study of the various scientific and technical issues was carried out for defining and substantiating India's potential continental shelf claims. • Establishment of a Data Centre to archive the marine geophysical data acquired and geophysical data processing and interpretation facilities at NCAOR. • Conducted survey and organized a workshop for carrying the CLCS work for Myanmar	
8	Comprehensive Bathy metric studies	• To prepare a comprehensive seabed topographic map for the entire EEZ of the country using the state-of-the art technologies of multibeam swath bathymetric systems. These data collected in Arbian Sea, Bay of Bengal and Indian Ocean would be useful to identify the major topographic features in the EEZ. • To carryout systematic sediment sampling, and analyze to assess potential of seabed resources in the EEZ • To improve our understanding of the seabed morphology and enhance our knowledge of the existing scientific issues such as paleoclimatic regime of Indian Peninsula	5.00	AS indicated in column no. 3.		• Continuation of Bathymetric survey beyond 500 m. water depth off Andaman & Nicobar Islands and Lakshadweep islands using the chartered vessel. • Continuation of shallow water surveys off Marmugao and South Chennai. • Processing and interpretation of the collected data	

9	Gas hydrates Development of Support Submersible SS2500	1. Shallow water trials of SS 2500 2. Testing & integration of LARS 3. Deep water trials of ROV	10.00	1. Shallow water trials of SS 2500 2. Testing & integration of LARS 3. Deep water trials of ROV		Shallow water trials of SS 2500 have been completed	
9.1	Development of Autonomous Coring System	1. Review of preliminary design of ACS 2. Completion of final design of ACS 3.Infrastructure development		1. Review of preliminary design of ACS 2. Completion of final design of ACS 3.Infrastructure development		Preliminary design is in progress upon identification of Foreign partner and signing of agreement.	
9.2	Studies on Gas Hydrates Exploration	1. Collection of long core samples in KG and Mahanadi basin 2. Geophysical survey		1. Collection of long core samples in KG and Mahanadi basin 2. Geophysical survey		Collection of long core samples in KG and Mahanadi basin has been completed. Samples are being analysed.	
10	Acquisition of new Research Vessels by NIOT	To build a new multipurpose vessel for technology services and demonstration to cater to the ongoing and the new mission mode programs of MoEs during XI Plan and beyond	100.00	The project will be completed by the end of 2007.		The vessel was successfully acquired, in December 2007 in Chennai upon its delivery.	
11	Maintenance of buoy network	Production, integration, testing and calibration of additional buoys to establish 40 buoy network.	15.00	Production, integration, testing and calibration of additional buoys to establish 40 buoy network.		Production, integration, testing and calibration of additional buoys to establish 40 buoy network.	

		Dissemination of data from minimum 40 buoy network. Deployment and maintenance of buoys in specific weather window with maximum 2 long periods (3 weeks) and short periods (1 week) each in Arabian sea and Bay of Bengal. Data will be quality controlled and disseminated to end users. Data will be quality controlled and disseminated to end users		Dissemination of data from minimum 40 buoy network. Deployment and maintenance of buoys in specific weather window with maximum 2 long periods (3 weeks) and short periods (1 week) each in Arabian sea and Bay of Bengal.. Data will be quality controlled and disseminated to end users.		Dissemination of data from minimum 40 buoy network. Deployment and maintenance of buoys in specific weather window with maximum 2 long periods (3 weeks) and short periods (1 week) each in Arabian sea and Bay of Bengal. Data will be quality controlled and disseminated to end users. Data will be quality controlled and disseminated to end users	
12	B. Early Warning Center for Tsunami & Storm Surges	• Setting up a dedicated Early Warning Centre for Tsunami and Storm Surges on 24 operational basis • Collection, monitoring & archival of real-time data from Seismic, tide gauge, BPR and other sub-systems for use in operational early warning • Developing Decision Support System (DSS) • Set up and maintain communication facilities for data reception as well as dissemination	35.00	• Operate Interim Tsunami Warning Centre on a 24x7 basis. • Procurement of Systems and Software required for upgradations at the ITWC. • Setting up a dedicated Early Warning Centre for Tsunami and Storm Surges at INCOIS • Manpower induction		• Interim Tsunami Early Warning Centre is operational on 24 X 7 basis and receiving Tsunami warnings from the Pacific Tsunami Warning Centre, Japan Meteorological Agency and Indian Meteorological Department. • The information of the 12 major earth quakes occurred during February were monitored, advisories were generated and provided to Director, INCOIS, Control Room of MHA and Secretary, MoES. • Work has been initiated by M/s.	

		• Tsunami and Storm surge Modelling • Creation of High Resolution Bathymetry dataset by conducting surveys. • R & D in Seismology and Ocean sciences • Capacity building, Training and Education • Up gradation and maintenance of the equipments • Periodic Rehearsals				Tata Consultancy Services for establishment of Data Centre and Other technical support facilities at INCOIS • Establishment of VSAT facility for receiving Tide Gauge Data from Survey of India (SOI), Dehradun. is under progress. • Equipment for establishing the INSAT MSS and DRT Hub Stations has been received from M/s. BEL, Bangalore. Two Antennas have already been erected • First Meeting of High-level committee on Decision Support System (DSS) and Standard Operating Procedure (SOP) has been organized • Tunami N2 model was optimized for Indian Ocean to generate scenarios for Scenario Data Base with reduced computational time. • A one day workshop on Paleo-Tsunami was organized at INCOIS • Seven Scientists were inducted at Scientist 'B' level. • Interim Tsunami Early Warning Centre is operational on 24 X 7 basis and receiving Tsunami warnings from the	

						Pacific Tsunami Warning Centre, Japan Meteorological Agency and Indian Meteorological Department. • The information of the 15 major earth quakes occurred during July-Aug were monitored, advisories were generated and provided to Director, INCOIS, Control Room of MHA and Secretary, MoES. • A full-fledged Tsunami Warming Centre set up at INCOIS was dedicated to the Nation in October 2007.. • Communication system was setup for receiving Tide Gauge Data from Survey of India (SOI), through VSAT Communication and the Tide gauge data is being received in real time.	
13	Information technology	Automation of Office work of the Ministry Video conference facility by connecting all the centre of the ministry	1.00	Operation of FTS Intra MOES Video conference facility		Made fully Operational Developed and Commissioned Installed Video conference facilities.	
14	NCAOR	• The smooth functioning of the day-to-day activities of the Centre • Augmenting the existing facilities	15.00	• Initiation and completion of the targeted scientific projects mounted		All targeted objectives/tasks are being completed within the scheduled time frame.	The combined expedition proposed is

		• Implementation of ISO • Identification of firm to provide the requisite consultancy services Phase-III civil works. • Refurbishing the Phase I block of NCAOR. • Acquiring of additional land for residential accommodation, Guest House and project offices. Continuation of In-House research programmmes at NCAOR in the realms of Ice core studies, Paleoclimatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography					subject to the availability of a suitable ice-class vessel.
15	INCOIS-Infrastructure development Operations and Maintenance	• INCOIS infrastructure development • Operations and maintenance of INCOIS infrastructure facilities • Residential, Guest House and Hostel Accommodation • Acquisition of Adjacent Land • Administration, Finance & Accounts, Stores and Purchase	35.00	• INCOIS infrastructure development • Operations and Maintenance of infrastructure facilities • Initiate action for construction of Residential Quarters, Guest house and Hostel • Acquisition of Adjacent Land • Administration, Finance & Accounts, Stores and Purchase		• Carried out routine operations and maintenance of infracture facilities • Administration, Finance & Accounts, Stores and Purchase • Acquisition of adjacent land is underway • Carried out routine operations and maintenance of infracture facilities • Initiated action for construction of Residential Quarters, Guest house and Hostel	

						• Administration, Finance & Accounts, Stores and Purchase • Acquisition of adjacent land is underway	
15.1	C. Computational Facility (High Performance Computing System, Ocean Portal)	• Computational Facility • Technical support for various programmes / projects of INCOIS, Systems Administration, IT planning and implementation • Development and Maintenance of INCOIS Website & Ocean Portal • Maintenance of various communication facilities, networking • Ocean Information Bank • In-situ and satellite observation systems and reception • Ocean Data Management • Generation and Validation of Satellite Products • NODC, Indian Ocean (Argo & IO-GOOS) Data Centre		• Operations and Maintenance of Computational Infrastructure and Web based Services • Update the Ocean Information Bank • Database generation • Generation of Metadata base • Data Services to users • Development of web-interface for realtime display of in-situ and remote sensing data		• Carried out the routine operations and maintenance of the existing computational infrastructure • Ocean Information bank is being updated with the data from Moored Buoys in real time and tidal data received from Survey of India • Development of COMAPS web-based data query and display system is underway. • Metadata base was generated for Moored Buoys, Drifting Buoys and XBT data sets • Provided data to the users as per their requests • Carried out the routine operations and maintenance of the existing computational infrastructure • Finalized the network architecture for Tsunami Warning Centre. • IBM p590, p570 and Storage systems received as part of Tsunami project were placed at	

						Information Block and powered on. • Ocean Information bank is being updated with the data from Moored Buoys, Tide Gauges in real time. • Remote Sensing data from AVHRR (NOAA-17, 18) and MODIS (Aqua and Terra) are being received in real time. Data products viz. SST, Chlorophyll, Aerosol Optical Depth, Clouds etc are being generated in real time. • Real time data display system was developed for the moored buoy data and remote sensing data • Provided data to the users as per their requests	
15.2	A. Coastal and Ocean Advisory Services (PFZ, OSF, VAS)	• Generation and dissemination of PFZ Advisories weekly thrice on Mission Mode. • Establish an Ocean State Forecast and Information system to provide forecast and real-time information on ocean parameters • Providing value added services		• Generation and dissemination of the PFZ Advisories • Use of MODIS Aqua Data operationally for generation of PFZ Advisories • Procurement and installation of new Electronic Display Boards (EDB's) • Conducting User Awareness Programmes and User Interaction		• 25 PFZ advisories were generated and disseminated through 1557 faxes/phones to all the coastal states and islands • Tendering process was initiated for procurement of Electronic Display Boards • A new PFZ Validation project has been sanctioned to the School of Oceanographic Studies, Jadhavpur University, West Bengal. • Ocean State Forecast was generated and disseminated to	

				workshops • Extend the PFZ validation Projects to other Coastal States • Generation and dissemination of OSF • Validation with satellite data and in-situ observations • User Interaction • Initiate Coastal Forecast		the users. • Coastal Wave Forecast disseminated to through Digital Display Board, Village Information centres for selected locations • A wave rider buoy and a current meter were deployed off Pondicherry as part of the second phase of pilot project on coastal sea state forecast in collaboration with NIO • PFZ advisories were generated and disseminated through 231 faxes/phones to all the coastal states and islands. • A new PFZ Validation project has been sanctioned to Central Institute of Fishery Technology, Kochi for carrying out the validation experiments off Gujarat Coast. CIFT, Veraval Regional Centre will carry out this work. • Nine Electronic Display Boards were installed at Paradeep, Penthakotha, Astaranga, Arjipalli, Bahabalpur, Chudamani, Talachuan, and Kharanasi of Orissa State, Harne Paj, Ratnagiri District, Maharashtra • Two field awareness campaigns on PFZ Advisories were	

						organised at Ennore Kuppam Fish Landing Center and Kovalam Fish Landing Center, Tamilnadu • Ocean State Forecast was generated and disseminated to the users. • Coastal Wave Forecast disseminated to through Digital Display Board, Village Information centres for selected locations Coastal Ocean Forecast data generated and disseminated to the users. • Validation with ECMWF winds is underway	
16	Sea Front Facility	To develop and establish an integrated sea front facilities like R&D Centers, and Laboratories, Integration Bay for R&D works, Coastal Jetty and Test Ponds	10.25	identifying the land having sea front area, procurement of Land, establishing sea front facility initially with external services for the sea front facility		Identification of land in consultation with State Govt. is in progress.	
17	Development of Manned Submersible	Finalising the specification of Manned Submersible 2. To identify the joint partner through global tender 3. Pre-bid meeting with potential partner, if required 4. Technical Evaluation of proposals from the potential partners 5. Preparation of agreement for the joint development	5.00	1. Finalising the specification of Manned Submersible 2. To identify the joint partner through global tender 3. Pre-bid meeting with potential partner, if required 4. Technical Evaluation of proposals from the potential partners 5. Preparation of agreement for the joint development		1. Finalisation the specification of Manned Submersible completed 2. Global tender was floated 3. Pre-bid meeting with potential partner was conducted. 4. Technical evaluation of bids received is under progress.	

18	Multichannel Seismic System	to assess the vessel and design a suitable 2D multi-channel seismics system through a reputed designer/offshore service contractor, who shall integrate, supervise and install the equipment •To procure all the equipments/ components as per design for their installation for sea-trials and operation	5.00	Tendering for procurement of various equipment			
19	Demonstration of shore protection scheme Water quality monitoring at select tidal creeks /estuaries	Field data collection and model setting, calibration Installation of artificial reef at test site (Uppada, Andhrapradesh) Water quality management schemes and inlet stabilization recommendations for tidal creeks and estuaries	1.00	Field data report, modelling report Identification of potential sites and prioritization One season survey shall be completed		Preparatory works in progress Preparatory works in progress Desk study in progress	
20	Desalination	Design of all major components and initiation of procurement process for 10 MLD floating desalination plant Installation of LTTD plant for waste heat from thermal power plants. Floating of tenders to establish LTTD plant at six more islands with higher capacity	10.00	• Design of all major components for 10 MLD floating desalination plant. • Installation of LTTD plant at NCTPS, Ennore • Finalization of tenders to establish LTTD plant at six more islands with higher capacity • Realisation of suitable alternator and design of suitable power module for Wave Powered Data buoy	New	• Design is under progress. • A Steering Committee was constituted to review the design and progress of 10 MLD Plant. • Installation of LTTD plant at NCTPS, Ennore and performance monitoring of the plant • Realisation of suitable alternator and turbine for Backward Bent Ducted Buoy • Design of suitable power module and its performance study for Wave Powered Data buoy	Nil

20 (a)	Energy					Theoretical studies on new wave energy turbine.	
21	Expedition to Arctic	• Initiation of exploratory scientific programmes in collaboration with other Arctic nations • Launch pilot expedition to the Arctic in a phased manner during the summer of 2007 and the late winter/early Spring of 2008. • The Summer projects which have already been initiated during August – September comprise: . Initiation of action for the establishment of a permanent Indian research base at Ny-Alesund.	1.00	Field data collection pertaining to atmospheric sciences, geology, microbiology and glaciology		The first phase of the expedition and summer-time data collection already completed. Laboratory analyses in progress. Action is also being initiated to have a permanent station building at Ny-Alesund on lease from Kings Bay.	
22	MLR Berthing Facilities (included in item No. 16)	Initiation for acquisition of land and appoint consultant for preparation of a document		Negotiation with State Government are underway			
23	National Oceanarium	Identification of suitable partner to execute the work. Initiation for acquisition of land and appoint consultant for preparation of a document	0.95	Negotiation with State Government are underway			
.24	IODP Development of an Initial Science Plan is in progress	Initiation of action for Associate membership in IODP. Finalization of a science plan prioritizing the deep-sea drilling in the Bay of Bengal/Arabian Sea/western Andamans. Participation by Indian scientists in various programmes of the IODP.	4.00		• Six months to an year.	• Development of an Initial Science Plan is in progress..	
25	Headquarter Building	to construct a new modern building having required amenities to house	10.00	Completion of construction of the building in 2 years		Estimates have been prepared by DRDO based on DSR 2002	

		the headquarters				adopted by CPWD and prevalent market variation/rates	
26	Construction and commissioning of a Polar Research Vessel	Appointment of a consultant for finalization of the design specifications Finalisation of the details of the onboard laboratories and sampling equipment	1.00			Detailed F.R preparation is under progress.	
27	India Meteorological Department Training	Imparting of training in Meteorology,Telecommunication,Instrumentation and Seismology to IMD personnel and persons from developing countries under WMO Programme.		Continuation of imparting of training under WMO Programme.	To enhance trained manpower in Meteorological work.	2007-08	
	Satellite Services.	40 Nos Digital Met. Data Dissemination (DMDD) equipment and associated uplink equipment has been procured and is being installed. 5 Nos GPS receivers for monitoring of total precipitable water received and installed. Transcription of 30,000 magnetic tapes containing INSAT data will be completed.	10.00	40 Nos DMDD equipment will be installed. Commissioning of GPS receivers and transcription of magnetic tapes.	Quality of dissemination of satellite imagery to forecasting offices and monitoring of Total precipitable water will improve. Transcribed INSAT data will be used for research activities.	Installed 37 Digital Meteorological Data Dissemination using INSAT reception System.	
	Observatories	Interactive Voice Response system	28.00	IVRS system will be		Installed 125 AWS and made them	

	and Weather stations	will be established. High speed data terminals, VSAT systems and Data Terminals will be installation at field stations. Action for placement of order for RTH computer system and 2 Nos. AMSS in progress. Old DCPs will be replaced and Earth Station will be established at Pune. AMI's at Mumbai airport and at 7 other airports will be installed. Radiation equipment will be installed. Two indigenous DWRs will be commissioned at Bhuj and Kochi. Digitization of 1 Lakhs analysed weather charts will be completed.		installed. High Speed Data Terminals, VSAT systems and data terminals will be installed. Order for RTH computer system and 2Nos. AMSS will be placed. AWS will be commissioned. AMI's will be procured. Radiation equipments will be commissioned. Two Nos fabricated indigenous DWRs will be installed. Digitization of weather charts will be completed.	Installation of AWS will improve acquisition of surface weather data. IVRS, and High Speed data terminals will enhance speedy transmission of weather data and information. Order to be placed for RTH and AMSS. Installation of AMIs at airports will improve aviations services. Study of radiations will improve.	operational.	

					Commissioning of DWRs will help in detection of cyclones. Digitized charts will be useful for research work.		
	Other Meteorological Services	National Agromet Centre at Pune will be modernized along with three Agromet Research Units at Anand, Rahuri and Banglore. Hydrometeological Division at Delhi will be upgraded. Archival and digitization of seismic analogue charts will be initiated. Spare parts for IMS Ground Systems will be procured. Commissioning of 10 Nos IMS-1500. Expenditure on ongoing schemes to sustain the Plan growth in the field of Meteorology.	10.00	National Agromet Centre at Pune and research units at three stations will be modernized. Hydromet. Division at HQ will be upgraded. Archival and digitization of seismic charts will be initiated. IMS-1500 will be installed and commissioned in upper air network and spares will be procured.	Agromet Services will improve. Hydrometeorological services will be enhanced. Archival and digitized seismic charts will be useful for future research work. Upper Air Data quality will improve.	24 Agromet Centres have been set up by increasing the total AAS to 127.	
	Other Programmes	VSAT based Delhi Telemetry Network will be augmented. VSAT	10.00	Equipment for VSAT based Delhi Telemetry Network	Understan	Set up 2 Seismic Stations for online data reception with broad band	

	(W B project on Hydrology and EREC)	based seismic telemetry network in NE India will be established. Seismic Hazard and Risk microzonation of 5 cities including Delhi on 1:10000 scale will be initiated. Implementation of W B Project on Hydrology Phase-II will also be taken up.		will be procured along with equipment for NE India. Microzonation on 1:10000 scale for Delhi and other cities will be taken up. Action will be initiated for W B Bank Project on Hydrology Phase-II.	ding of Seismic hazard and Risk Evaluation for NCT Delhi will improve. Hydrometeorological study will generate quality data base which will be an asset to water resources development.	connectivity. Microzonation of Delhi, Ahmedabad and Guwahati have been carried out.	
	Mod of IMD Weather Services	Order for High Performance Computing System (HPCS) for global data process and numerical weather prediction (NWP) for weather forecast will be placed. Order for new integrated and automated systems for 20 airports, 550 AWS and 1350 ARGs to be placed. Order is also to be placed for 12 DWRs. Optical theodolites will be procured for installation at 62 stations. 5 GPS Radiosonde systems will be commissioned and new generation radiosondes and AWS will be developed.	239.62	Order will be placed for HPCS, integrated and automated systems for airports, AWS and ARGs. Order will also be placed for DWRs. Optical theodolites will be procured along with 5 GPS Radiosonde systems. New generation Radiosonde and AWS will be developed.	Weather forecasting will improve significantly. Acquisition of surface data and rainfall will improve. Cyclone detection network will be strengthen	Meso-scale models such as WRF were made operational.	

					ed. Upper air data quality will improve.		
28	Indian Institute of Tropical Meteorology (IITM) Climate Variability and Dynamics	• To conduct basic research in all the aspects of atmosphere-ocean-land system with special reference to the tropics. • To organize interdisciplinary research aimed at understanding the fundamental atmospheric and oceanic processes controlling weather and climate in tropics and its practical application to the society (e.g. prediction & predictability). .	11.00	• Increased number of Research papers to be published in peer reviewed journals, proceedings and scientific/ technical reports, also to be presented in the national/ international seminars/ symposia/ conferences • More specialized lectures will be delivered outside by the IITM Scientists .	Immediate	• Development of a system for long-range prediction of seasonal monsoon and extended range prediction of active/break spells. • Estimation of monsoon climate under different climate change scenarios, quantification of uncertainty in estimation of monsoon climate under climate change scenarios and study of sensitivity of the estimate of monsoon climate under climate change and understanding of roles of internal variability and external forcing in predicting the future monsoon climate.	Nil
2.	Short Term Climate Prediction	• Background preparation for acquiring a Ka-band Doppler Precipitation Radar and a X -band weather radar on a mobile platform to study interaction between cloud and environment. • To build a prediction system of	11.00	• More number of scientists will be involved in academic activities such as providing expertise, examinership, teaching and research guidance to the post-graduate and Ph.D. students of	Immediate	• Observational and modeling efforts to improve understanding of clouds and its interaction with environment leading to precipitation. • Training to the Institute's scientists within the Institute	Nil

		active and break spells of the monsoon. • To build trained human resources in the field required by the country		various Universities		and at the selected international centres of excellence in other countries, as well as inviting a few internationally reputed scientists to impart training in specialized are proposed.	
3.	Cloud Aerosol Interaction and Precipitation Enhancement Experiment	• To understand cloud-aerosol interactions and the potential of rain enhancement by seeding the clouds.		• In collaboration with NCAR instrumented air craft and cloud seeding air craft will be hired from NCAR, USA,	Immediate	• Ground preparation and instrumented aircraft booking	Nil
4.	High Performance Computing and Infrastructure Development	• To establish and maintain a major supercomputing facility at the Institute, as a central facility to cater to the HPC needs of all the modeling groups within the Institute, and also to share the facility with other groups in the country • Establishment of Information System in Meteorology and Atmospheric System including infrastructure augmentation • Construction work of the buildings for the followings will be undertaken: Centre for Climate Change Research		• Site preparation for the High Performance Computer is proposed. • Subscribe to most of the journals in the field of meteorology and atmospheric sciences in print and on-line version	Immediate	• Acquisition of a High Performance computing system with 5 teraflop capability upgradable to 10 teraflop for the climate modelling and extended range prediction, upgradation and modernization of the existing, library, information, publication activities and construction of residential quarters of higher types and a students hostel are proposed.	Nil

		High Performing Computer for the Institute with a Modernized Training Hall and a Laboratory for Lidar and Additional housing facility for newly recruited scientists at Centre for Climate Change Research					
29	NCMRWF	Parallel experimental runs with the new high resolution T254/L64 analaysis-forecast system. Inclusion of more satellite data High resolution mesoscale model and data assimilation Extended range and Seasonal Forecasts of Monsoon 2007	13.00	Verification of the new high resolution T254/L64 forecast system Assimilation of NOAA and METOP satellite radiances; QuikScat winds. Forecasts were provided to MoES/IMD		Numerical weather prediction model implemented resulting an improvement in the forecast on a special reservation of 150 to 50 km. Extreme events such as heavy rainfall in March, 2008 have been forecast and track prediction of SIDR Cyclone.	The deliverables are very much dependent on the augmentati on of man power
30	Multi-Hazards Early Earning Support System	Development of a multi hazard support system					
31	Centre for Climate Change Research	Understanding and detection of climate change with particular reference over the tropics and the Indian monsoon region.	04.00	Manpower generation will be taken up	Immediate	• Groundwork for acquiring the equipment and the construction of the office space is proposed	Nil

32	Dedicated Weather Channel	• Phase-I may focus on the currently available observations, forecast products, advisories/ warnings and also those additional inputs which might be available by next year as part of IMD's modernization plan. It is proposed that the live up-time for the channel could be kept about 3 hours in this phase and total up-time of channel to about 6 hours.		As mentioned in column 3.			
33	NIOT Extension Centre	Identification of land for setting up of the centre.		Initiated negotiation with the State Government.			
34	Research and Development Programmes	Monitoring of micro Met. Parameters and grant of financial aid to research institutes and universities working on weather sciences. UV Radiation Network will be established.	3.28	Continuation of study of parameters and grant of aid to institutes. Radiation equipment will be procured.	Research activities in weather sciences will improve. Improvement in radiations study and research.	2007-08	
	TOTAL		690.00				

Review of Annual Plan (2008-09) : Statement of Outlays/Targets (2008-09) (As per the Outcome Budget 2008-09) and Up-to-date Actual Achievement Appendix-4, Annexure-II

No	Name of the Scheme/Programme	Intended Objective/ Outcome	Annual Plan 2008-09 Outlay (Rs. In crores)	Quantifiable Deliverables	Achievements as against column No. 5	Remarks/
1	2	3	4	5	6	7
1	Polar Science – Expedition to Antarctica	Planning, co-ordination and execution of the XXVIII Indian Scientific Expedition to Antarctica. Initiation of the work of structural strengthening of Maitri	BE 34.50 RE 44.67	As proposed in column no (3)	The Expedition Group comprising members utilizing the DROMLAN airservice facilities have already left India en route to Antarctica in two groups, while the third group is scheduled to set sail from Goa on the 2nd December 2008	
1.2	Establishment of New Station in Antarctica	Establishment of India's New Permanent Research Base in the Larsemann Hills of East Antarctica. The scheme comprises- Construction of living accommodation, recreational and dining facilities, MI Room, scientific laboratories, water supply facilities, storage and container yards, waste handling modules etc. Construction of approach ways, helipads, and berthing facilities for the vessel Establishment of power generation units Establishment of communication facilities Establishment of labs in different disciplines with basic instrumentation and sample handling, computation and processing facilities	BE 4.00 RE 4.00	As proposed in column (3)	NCAOR has already short-listed M/s IMS Ingenieurgesellschhaft mbH, Germany as the consultant-architect for the design of the research base. The firm was identified by a duly-constituted Technical Committee on the basis of a global Expression of Interest. The consultant firm is being retained to develop a final design for the station, to draw up a tender document for undertaking the	

					construction work, and to assist NCAOR in identifying the agency that would undertake the task of prefabricating the modules and erect them at the site. A tentative time schedule has also been drawn up for the various tasks, as per which the fabrication of modules would commence by Oct-Nov 2009 and the construction at site would start in the Polar season 2010-11 and would be completed by 2012. A DPR has been submitted to the Ministry as a prelude to the finalization of the EFC Memorandum for the scheme "Establishment of the Third Indian Antarctic station" during the XI Plan period. .	
1.3	Southern oceanographic studies	Mounting of a major multi-institutional and multi-disciplinary expedition to the Indian Ocean sector of the Southern Ocean Analytical work of the samples and data collected during the last expedition to the Southern Ocean	BE 1.00 RE 12.60	As proposed in column no. (3)	Analytical work of samples and data collected during the last expedition has already been completed and the results have been /are being published in many peer-reviewed journals. Action initiated for mounting the next expedition during January 2009.	

2	Polymet-allic Nodules Programme	To identify most potential first generation mine site in retained area. To study Environmental impact of mining. To develop mining system in phases for exploitation of nodules. To develop technologies for extracting metals from the nodules.	15.00	• Survey & Exploration at closer grid of 6.25k.m in selected blocks in proposed FGM site. Bathymetry slow scans & backscatter studies in FGM site. • Monitoring and assessment of recolonisation of benthic environment • Testing of three primary process routes on the semi-continuous demonstration pilot plant set up at HZL with extraction of Copper, Nickel and Cobalt from PMN. • Testing of process route in Ferro-sillico-manganese plant at NML, Jamshedpur with 500 kg/day capacity.	Survey work carried out at CIOB site and data being analysed. About 23 tonnes of nodules collected for metallurgical studies. Laboratory studies on samples collected in a cruise conducted under EIA are in progress Activies at NML & IMMT for improving certain section of process packaged are under progress Demonstration of Fe-Silico-Mn Plant from the residue of IRRL(N) process are giving encouraging results Leaching demonstration of NML(J) process using alternative reductant is under progress	
2.1	Development of Collector and Crusher systems for Manganese Nodule mining	•To mine manganese nodules from the central Indian Ocean basin.	9.00	• Integrated Mining Machine with Collector and Crusher System • Testing the system at 500 m depth	• Detail Design has been completed order for various sub-systems are being given. Major Components like drum, cleated belt have already arrived. Strengthening of ship deck design is completed & IRS vetting is finalized.	
2.3	Development of upgraded version of Soil Tester	•Development of upgraded version of soil tester •Testing for qualification of system at	6.00	• Design and realization of light and compact soil tester • Modification and procurement of sub systems	Analytical nodule laying system demonstrated at 518 m depth off Chennai. 'Detailed design completed	

		Central Indian Ocean Basin		• New mechanical and electrical termination	& tender documents being prepared	
3	Ocean Observation and Information Services - Observation Networks (Argo, XBT, Drifters, Gliders, Current Meter Arrays & Reference System)	Measuring oceanographic parameters over Indian Ocean using different in-situ plat forms to understand the Indian Ocean dynamics and validation of ocean and atmospheric models. Measuring temperature and salinity profiles up to 2000 m.	16.02	Deployment of 40 Argo Floats 30 Drifting Buoys XBT Observations along 4 shipping lanes Retrieval and Redeployment of Current Meter Mooring Arrays Deployment of new Current Meter Mooring array.	Deployed 8 Argo Floats XBT Observations were carried out along the major shipping lines Bay of Bengal Cruise were organized	
	D. Research and Modelling (INDOMOD, SATCORE, R&D PROJECTS)	Enhance basic understanding and knowledge base on oceanic and atmospheric processes for predictability of ocean climate and catastrophic weather events and improve operational prediction by the respective national agencies Implementation of Global and Indian Ocean Regional Model and coastal wave forecast using SWAN nested with WAM Generation of binned products of Chlorophyll-a, SST, and Kd-490 from satellite data and in-situ measurement of Chlorophyll and SST for the validation of satellite data.	9.13	Regional Ocean Modelling System Retrospective forecast experiments with reanalyzed forcing Experimental forecast Modular Ocean Model Inter-annual run with best available forcing fields(i.e fresh water, air temperature, wind and humidity) Funding the Participating agencies to carry out the work Chlorophyll Generate Remote Sensing Products for the Project Areas Extend the Area to cover entire Indian Ocean Participation in cruises and collection of Bio-Optical Data Participate in CAL/VAL of	The Colorado University Princeton Ocean Model (CUPOM) was installed. The model was set up for the Indian Ocean region with 1/3 deg resolution, forced with atmospheric fluxes and nudged with observed SST and SSHA for forecast mode. The forecast of SST and surface currents are validated with observations. Sea level trend in Indian Ocean region has been computed from Argo, altimeter and model results to decompose the contribution of thermal expansion, thermo-haline effect and glaciers melting,	

				Remote Sensing Ocean Colour Sensors Develop Regional and Local Algorithms for better parameter retrieval Initiate CPR Surveys Contribute to ChloroGIN Project International Linkages Increasing domain of disseminated real time satellite data Linkage to other International programmes like ChloroGIN Indian Ocean, SE Asia and China, South America (ANTARES), N. Atlantic, Benguela Region.	etc. Ten year (1998-2007) simulations with interannually varying forcing fields were carried out using Regional Ocean Modeling System (ROMS). The model could simulate the major features such as Indian Ocean Dipole events in 2003 and 2006 INDOMOD Basin scale model has been set up for the region 30S-30N and 30-120E. Two fine resolution coastal models using POM are also set up for the east and west coast of India. A newly developed next generation mesoscale model (Weather Research and Forecasting) version 2.2 has been set up and a few numerical experiments were conducted. The results are compared with the existing MM5 model simulations. Upper ocean response of Nargis cyclone were analysed in conjunction with recently deployed flux mooring. The analysis indicated that the upper ocean heat content along the track of Nargis was high	

					as the cyclone moves towards Myanmar and hence the intensity of the cyclone increased. Deployed 3 ADCP moorings off Goa one on the shelf and the other two on the slop region. Analysis of current meter data off Goa during March-April 2003 suggest that the West India Coastal current has a remotely forced component even at periods as short as 10 days and water depth as shallow as 10-20m. A newly processed altimeter dataset released by CNES, France, has been analyzed to map the spatio-temporal variability of the East India coastal current Deployed 2 wave rider buoys off Dwarka (at 15m and 30m water depths) and 2 wave rider buoys off Ratnagiri (at 15m and 30m water depths). SATCORE MODIS – Aqua data products, chlorophyll_a, SST, K_490 and TSM, were generated for the period Apr-Sep, 2008 The implementation for	

					extending MODIS – Aqua processing domain to 40^0 S was initiated. The base map for disseminating MODIS – Aqua near real time (NRT) data to countries Sri Lanka, Maldives, Iran, Kenya, Oman, Tanzania and Thailand was prepared. The red tide index (RTI) algorithm was incorporated in SeaDAS and is currently being evaluated for live MODIS data sets and is undergoing further testing. The oil-spill detection exercise was continued using MODIS – Aqua high resolution data, in optical and IR bands. The goal of the exercise is to publish the results. Procurement of Hyper Spectral Radiometers is under progress Work done on "Evaluation of MODIS-Aqua high resolution data for oil-spill monitoring"	
4.1	Marine Living resources programme	Survey results of one cruise each in the Andaman sea, Bay of Bengal, Arabian sea and Central Indian ocean. Monitoring and Surveillance of Harmful Algal Blooms	4.00	Atlas on Marine Mammals in Indian EEZ. Atlas on Seasonal Climatology of Indian EEZ CD-ROM on Zooplankton of	Released in April 2008 Released in Sept 2008 Ready for release Under preparation	Being R&D programmes deliverables are not quantifiable at this stage.

		Bench mark data on the benthic fauna of the Indian C- shelf area 3rd workshop on the Scientific achievements of FORV Sagar Sampada Survey results of Southern ocean Krill / fishery resources expedition Construction of berthing facility and office complex to commence.		Indian EEZ GIS on marine benthos of shelf area Proceedings of 3rd Workshop	Workshop during Nov 2009 Southern Ocean Cruise Planned in during Jan-Feb 2009. Took procession of 10 acres of land on lease from Govt. of Kerala. . Site development is in progress.	
4.2	Drugs from the Sea	Discovery of potential drugs for: i) Antiviral; ii) Anti-fertility; iii) Anti-hyperglycemic; iv) Anti-hyperlipidimic; v) anti-malarial; vi) CNS; vii) Anti-leismanial; viii) anti-filarial; ix) Antibacterial; x) Antifungal; xi) Anti-osteoporosis; xii) Anti-trypanosomal; and xiii) Anti-cancer.	5.00	Under R&D mode, exploration of potential drugs from marine organisms. Outcome /deliverables are not quantifiable. However, human resources and infrastructure would be developed in our country. A considerable number of Patents and research publications are expected subject to hits encountered.	• Independent Review of the project has been completed • Six new centres have been inducted for strengthening the programme.	Considering the potential sources for bioactive compounds India needs its capability and infrastructure to explore bioactive substances from marine organisms for therapeutic principles.
4.3	Coastal Ocean Monitoring and Prediction Systems	To assess the health of the seas	2.5	Continuation of updation of status of marine pollution at 76 locations Continuation of GIS based information system for 5 locations and completion of database for 10 locations Collection of field data to initiate oil spill modeling at 5 selected sites initiated. Oil spill model for Indian Ocean region completed	Collection of data on pollutants initiated Collection of field initiated at Dhahanu	
4.4	Integrated Coastal and Marine Area	Application of scientific tools and techniques like mathematical modeling for Integrated Coastal Zone Management	5.00	Collection of data to initiate coastal processes modeling for Gopalpur, 3 locations in Kerala &	Data collection in progress in Kerala and Gopalpur. Karnataka not initiated due	

	Management			Karnataka - Initiated Ecotoxicological experiments for Chromium and Arsenic initiated Ecosystem Modelling in Chilka and Cochin – Water quality modeling completed. Collection of first season data for Sundarbans initiated Software development for storm surge model continued	to lack of funds Experiments in progress Planning work in progress for field collection in December 08 In progress	
4.5	Marine Research and Development	Providing assistance for undertaking research projects, manpower development and capacity building in Ocean and Atmospheric science and technology subject specialties.	5.00	Providing assistance to 9 OASTCs and supporting research projects outside OASTCs	16new projects have been sanctioned this year and around 10-13 projects are under process. Out of the total Outlay an amount of Rs 1.45 crores has been released including the old running projects for the period upto 30.09.08	
4.6	Ocean Science and Technology for Islands		11.73	•Open Sea Aquaculture	Mudcrab fattening will be demonstrated jointly with CMFRI in the backwaters of Cochin following the request from the coastal communities of Kerala. •Dept. of Fisheries, Govt. of Kerala, has requested NIOT to establish a seafront facility at Cochin / Trivandrum during the visit of the Hon'ble Minister of Fisheries, Govt. of Kerala.	•

					•In collaboration with RGCA under MPEDA, sea bass culture will be carried out in open sea cages. •Univ. of Madras has come forward to offer an acre of seafront land at Palavakkam, Chennai, for construction of hatchery facility to NIOT through M.o.U. •Cobia fish weighing 55 and 63 g were demonstrated to grow upto 510 and 650 g, respectively, within 110days.	
5.1	National Institute of Ocean Technology (NIOT) - Transducer development					
5.2	LTTD for waste heat from power plants	•To generate freshwater using the Low Temperature Thermal Desalination technology by utilizing the waste heat at Thermal Power Plants.		•Installation of LTTD plant at NCTPS, Ennore	Realization of the 10 m height steel structure for installation of plant components completed. •Main Components of the plant such as Flash Chamber, Condenser, vacuum system and deaerator were also erected.	•

5.3	Floating wave powered device	•To install a floating Wave powered device to power loads like a small rated Reverse Osmosis or to meet the lighting requirements of small islands		•Realisation of suitable alternator and design of power module for Wave Powered Data buoy	Fabrication of suitable alternator for Backward Bent Ducted Buoy under progress.	•
5.4	Studies on various types of Heat Exchangers	•Development of turbines towards OTEC / Wave energy to run LTTD plants or run small loads. To conduct studies on increasing the efficiency of wave energy plants.		•Fabrication / procurement and lab testing of various types of heat exchangers used for desalination system	A small plate type heat exchanger for vacuum applications was procured. •Further studies are under progress.	•
5.5	Wave energy devices	•To conduct studies on Renewable Energies like Solar Desalination.		•Studies on wave energy devices such as turbines	A small turbine is being fabricated	•.
5.6	Material studies for cold water pipes	•Material studies and testing for cold water pipes for desalination and renewable energy applications.	6.35	•Studies relating the cold water pipe configuration for higher capacity off shore desalination plant •Material qualification towards conducting experiments	Studies on FRP and Syntactic foam to verify its suitability for cold water pipe is under progress •Several Tests were carried out on Syntactic foam in various forms like 100% parent material, a sandwich of Syntactic foam between GRP sheets, etc.	•
5.7	Interface connection concepts, design and testing	•Interface design and testing for riser connections to floating bodies.		•Design, Modeling, fabrication, testing and Experimentation of interface components for pipe and floating bodies.	Under progress	•
5.8	Design of Suction pile anchor	•Modelling and testing of fixed and floating offshore platforms, moorings, risers, anchors, buoy design, model studies and field testing		•Suction pile anchor development	•The procurement of the suction pump and the design of the suction pile are under progress	.

5.9	Offshore platforms for wind turbines	•Offshore platforms for supporting wind turbines.		•Design of structure for supporting wind turbines.	Under progress	•
5.10	Inter-Institutional R & D towards developing technologies for mining polymetallic nodules	It is proposed to carry out research studies and developmental activities in various areas where underwater pressure, corrosion and fatigue come into play viz. Micro structural examination of fatifued thick-plate welded joints, metallurgy of weld joints for Aluminium alloys for sea water, Environment Assisted cracking of High Strength Steels in Seawater, use of high strength(700MPa) steel weld metals for offshore application, effect of microstructure on fatigue crack propagation, Development of Sub-sea control systems, and Acoustic Positioning and imaging systems, study of corrosion, fatigue, Wear, Corrosion, Seals performance(rotary and reciprocating), New materials, Hydraulic fluids, Underwater flow and density meters for large solid media, Sub-sea health monitoring systems, Underwater electrical and electronic systems – indigenization etc.	13.10	•Identifying key areas of research, interaction with institutions, technical surveys •Design and reviews for development of sub sea drives •Fatigue, wear and corrosion testing	The development works on sub sea drives is under progress •Study on materials is initiated •Manpower is awaited	
5.11	Underwater Electronic Support facility	•To establish a facility of excellence to provide electronics support to various activities and project of NIOT •To create infrastructure for reducing the development time and facilitate rapid prototyping •To develop expertise in Marine electronics	10.00	•Initiation of establishing shock and vibration test facility •Initiation of Environmental testing facility •Establishment of shock and vibration test facility •Establishment of facilities for environmental conditions	Establishing shock and vibration and Environmental testing facility has been initiated •Review of similar facilities in other Institutes & laboratories is in progress as suggested by the INRC of NIOT	

		related issues				
5.12	Development of Underwater Components	•To develop specialized non-off-the-shelf components(in Indian markets) for underwater application in association with industry		•Fabrication of the mechanical and electrical components of Underwater motor •Testing of Underwater motor •Testing of Tsunameter in deep water •Analysis of Tsunameter data and validation •Integration and testing of sub sea power converter •Development of fibre optic connector	Fabrication of the mechanical and electrical components of Underwater motor is in progress •Scheduled in Mar 09 •Testing of Tsunameter in NIOT Tank is icompleted Deepwater trials are •Dry test has been completed. Fabrication of pressure compensated casing is in progress. Field testing is scheduled in Nov 2008. •Four sets of connectors have been developed. Testing is in progress	•
5.13	Marine Sensor & Technology Development	•To develop new shallow water sub bottom profiler transducers and hardware using the transducer technology developed by NIOT •To develop acoustic sensors in collaboration with Bharath Electronic Ltd, Bangalore for projects of mutual interest after signing an MoU. •To develop sensor technologies to detect, classify and identify (localize) buried objects under seabed using Acoustic and Magnetic Detection of Objects(AMDO) for shallow and		•Initiation of establishing new laboratory facilities for proposed activities •Review of literature for Buried Object Scanning Sonar (BOSS) •Identification of off the shelf components for BOSS •Preparation of Project Definition Document for BOSS system •Literature study for Synthetic Aperture Sonar (SAS) •Documentation of BEL Projects •Preliminary design studies of	Action has been initiated for establishing new laboratory facilities •Review of literature for Buried Object Scanning Sonar (BOSS) has been completed •Identification of off the shelf components for BOSS is in progress	•

		deep-water applications •To develop user based biosensors for oceanographic applications		BOSS transducers •Procurement of off the shelf components for BOSS system •Preparation of Project Definition Document for SAS system •Optimization of transducer design for BOSS Procurement of active materials for BOSS transducers	•Preparation of Project Definition Document for BOSS system is in progress •Literature study for SAS is scheduled for Jan - Mar 09 •In progress •Preliminary design studies of BOSS transducers is in progress •Study of the existing Sub-bottom profiler has been undertaken as precursor to BOSS as per the suggestion of INRC, NIOT •Scheduled during Jan - Mar 09 •Scheduled during Jan - Mar 09	
5.14	Development of support submersible ss2500 (10th Plan Continuing)	•Gas Hydrates Exploration	-	•Land based integrated testing of launching and recovery system •Commissioning of lars on sagar nidhi •Deployment of the submersible with gas sensors at gas hydrate site •High resolution survey of selected area of pmn site at central indian ocean basin using rosub 6000	Land based trials have been completed •Lars commissioned onboard sagar nidhi •Deployment of at gh site scheduled for mar 09 •Survey at pmn site is proposed in Dec 08	• Awaiting for fund release
5.15	Technical	•To develop a reference manual for	10.70	•Field data collection at three	Bathymetry has been	

	Criteria Atlas	engineering design of coastal infrastructure and coastal protection along the coast of India, providing seasonal extreme value estimates of hydrodynamic loads in the form of waves, currents and water levels at 40 locations, for different return periods such as 5, 10,25,50 and 100 years.		sites. •Infrastructure development and equipment procurement. •Creation of database to assimilate NDBP data and secondary data from INCOIS for oceanographic parameters- wave, tide, current and littoral transport of sediment. •Atlas for spatial and temporal variation of oceanographic parameters for Indian coast leading to design criteria definition for select sites.	prepared from secondary data like ETOPO2, CMap, and Coastal Extractor etc. •Secondary data like 6 hourly global winds, sea level pressures, water surface elevations etc are being collected, reformatted to be used in the models and are being analyzed. •Wave model calibration is under progress. Different domains (Bay of Bengal, Arabian sea, North Indian Ocean, Indian ocean etc) are being tested for the sensitivity of boundary and mesh resolution. Results are being compared with NDBP data. •Hydrodynamic model setup for tide and storm surge is under progress. Domain size, mesh resolution, boundary locations, etc are being finalized	
5.16	Development of Autonomous Coring System	Sampling & Ground truth validation	-	•Design review of autonomous coring system •fabrication of acs with participation of niot personnel •assembly, integrating and testing of acs at joint partner's site •qualification trials of acs & deployment at gas hydrate site	- design review of acs completed •fabrication of acs has started and niot personnel have been deputed in batches •assembly, integration &	•

					testing at joint partner's site will be completed by dec 08 •qualification trials at gh site by dec 09	
5.17	Ocean Acoustics	•To undertake a wide spectrum of research activities that will lead to a better understanding of underwater acoustic signatures of various nature, the mechanism of sound propagation in the oceans, how acoustic transmissions can be employed to measure the physical properties of the ocean and its boundaries, acoustic scattering and bioacoustics. •To design and develop marine systems, which include underwater acoustic systems/devices, Oceanographic systems and implementation of advanced methods of data acquisition for carrying out the above emphasized research. •To perform data processing and analysis, and interpretation using approaches drawn from theory, numerical modeling, and observations, for precise judgment. Understanding the theory, the measurement tools, and the numerical tools within the same context will be required. •To establish two fully instrumented pontoons, followed by assembly, integration and deployment, which can serve as platforms to conduct open sea experiments like acoustic scattering studies, calibration of low frequency acoustic devices / instruments, etc. The Acoustic Test Facility will continue to be maintained and used for	10.59	•Measurement and characterization of ocean ambient noise in shallow waters	The automated noise measurement system has been developed successfully deployed and retrieved. Time series ambient noise measurements have been obtained for 2 weeks in the pilot phase.	

		calibration and other work. •To create a unified platform to work under the broad area of "Ocean Acoustics & Marine Systems", giving emphasis to scientific research and technology development.				
6.0	Operation and maintenance of Sagar Paschimi, sagar Purvi, Sagar Manjusha & Sagar Nidhi	•Providing ships for scientific community for various research activities	5.0(Sagar Purvi & Sagar Paschimi)	•Providing ships for scientific community for various research activities	Utilization of ships appx. 320 days in a year	
7.0	Delineation of Outer Limits of Continental Shelf (CLCS)	Initiation, continuation and completion of the task of development of a Marine Geodatabase at NCAOR. Formal lodging of India's submission for an extended continental shelf Defense of India's submission	BE 1.00 RE 1.31	*Updating the data inventory and work pertaining to submission on delineation of continental shelf To develop state-of-the-art national marine geophysical data archival, processing and interpretation facilities.	The work of data migration as the first step in database development has already commenced The Homepage for the database has been created and the Metadata format development is in progress Action has been initiated to procure the requisite hardware and software.	India's submission before the CLCS dependent on the clearances and directives from the Government.
8.0	Comprehensive Swath Bathymetric Survey of Indian EEZ (NIOT, NIO & NCAOR)	To carry out the swath bathymetric survey of entire EEZ and preparation of detailed report	BE 5.00	• Continuation of Bathymetric survey beyond 500 m. water depth using the chartered vessel. • Continuation of surveys in shallow water using the coastal vessels at NIOT, NIO • Processing and interpretation of the collected data, data archival and map		

				generation. • Sediment core archival, infrastructure development..		
9.0	Development Of Support Submersible Ss2500 (10th Plan Continuing)	•Gas Hydrates Exploration	-	•Land based integrated testing of launching and recovery system •commissioning of lars on sagar nidhi •deployment of the submersible with gas sensors at gas hydrate site •high resolution survey of selected area of pmn site at central indian ocean basin using rosub 6000	Land based trials have been completed •lars commissioned onboard sagar nidhi Fished at 1000 m depth successfully •survey at pmn site is proposed in dec 08release	
10.0	Acquisition of new Research Vessels by NIOT	To build a new multipurpose vessel for technology services and demonstration to cater to the ongoing and the new mission mode programs of MoEs during XI Plan and beyond	12.00	iii. Operation and Maintenance		
11	Early Warning Center for Tsunami & Storm Surges	Setting up a dedicated Early Warning Centre for Tsunami and Storm Surges on 24 operational basis Collection, monitoring & archival of real-time data from Seismic, tide gauge, BPR and other sub-systems for use in operational early warning Developing Decision Support System (DSS) Set up and maintain communication facilities for data reception as well as dissemination Tsunami and Storm surge Modelling Creation of High Resolution Bathymetry dataset by conducting surveys. R & D in Seismology and Ocean sciences Capacity building, Training and Education	15.00	Improve Redundancy for Observing Systems (Seismic, BPR, Tide Gauges, etc) Capacity Building, Education and Training for Public, Authorities, Media, etc. Generation of High-resolution bathymetric and topographic data Refinement and implementation of Coastal Inundation Models Generation of High-resolution Coastal Vulnerability Maps for entire coastline R & D Aspects Tectonic Modelling of Andaman	Tsunami Warning Centre operated on 24x7 basis and the information of the 84 major earth quakes (during Apr 01, 2008 to Sep 30, 2008), monitored the event, generated advisories and provided to Director, INCOIS, Control Room of MHA and Secretary, MoES. Tsunami Warning Centre is receiving continuous data through VSAT communication from 17 seismic stations installed	

		Up gradation and maintenance of the equipments Periodic Rehearsals		Trench Use BPR Seismic Trigger Data for computing the Source Parameters Efforts to become Indian Ocean Tsunami Warning System Initiate Efforts to handle Multi-Hazards (Storm Surges, etc.)	and maintained by IMD for tsunami warning purpose. Also data from 10 stations operated by Wadia Institute of Himalayan Geology & above 300 international stations is being received. The present version of 'Early Bird'' software was replaced with 'Hydra Software' developed by USGS for Real Time Processing and Analysis of seismic data being collected from 17 stations of RTSMN. Real time data from two tsunami buoys is being received continuously through satellite communication at intervals of one hour. Data from 16 (15from SOI & 1from NIOT) Indian tide gauges & nearly 50 international tide gauges situated in the Indian Ocean is being received continuously through satellite communication at intervals of 5 minutes. About 200 school children visited the Tsunami Early Warning Centre on 27th August, 2008.	
12	Maintenance of Forty Buoy	Establishment of 40 buoy network More buoy network to make 40 buoy alive	8.73	•Establishment of 40 buoy network	•Achieved	

	Network	always Data reception at INCOIS Data analysis and applications		•More buoy network to make 40 buoys alive •Assembly and integration of data buoys - Wave / Met / Environmental type – 60 Nos.	•Assembly and integration of 35 nos. of data buoys of Wave/Met/Environmental type buoys have been completed till October 2008.	
13.	Information Technology	Development of Content Managed Website for MoES/IMD	1.00	Development of Content Managed Website for MoES/IMD	Developed interface for the MoES website and development of IMD website (Phase I) is under progress	
14.	National Centre for Antarctic and Ocean Research (NCAOR)	Infrastructure development, operations and maintenance In-house R&D activities Phase III Civil works and augmentation of facilities at the Adm. Complex	BE 15.00 RE 15.00	The smooth functioning of the day-to-day activities of the Centre Creating ISO-level standards. Implementation of Phase-III civil works. Initiation of refur-bishing the Phase I administrative block rooms in an open-frame modular pattern Continuation of In-House research programmmes in the realms of Ice core studies, Paleo-climatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography.	An SFC Memorandum for Phase III Civil works and augmentation of facilities at the Adm. Complex has already been submitted The following new R&D activities are being initiated during the year: Glaciological and Ice Core Studies in the East Antarctica (GICSEA): An integrated scientific program for understanding the climatic and environmental changes in East Antarctica during the late Holocene Trends in Antarctic Sea-Ice Diatoms for Deciphering Polar Environmental Changes [DDPEnC Gulf of Mannar – Its Nature and Evolution Geological and structural	

					character-ization of the Anadaman-Nicobar subduction zone Assessing the functional diversity of psychrotrophic/psychrophilic bacteria along redox gradients in lake water, snow and ice from Antarctica	
15	INCOIS-Infrastructure development; Operations and Maintenance	INCOIS infrastructure development Operations and maintenance of INCOIS infrastructure facilities Residential, Guest House and Hostel Accommodation Acquisition of Adjacent Land Administration, Finance & Accounts, Stores and Purchase	5.35	Execution of Construction works Extension of INCOIS Building Residential Quarters Guest House Hostel Accommodation	Planning for execution of Construction works of extension of INCOIS Building, Residential Quarters, Guest House, Hostel Accommodation is under progress	
	A. Coastal and Ocean Advisory Services (PFZ, OSF, VAS)	Generation and dissemination of PFZ Advisories weekly thrice on Mission Mode. Establish an Ocean State Forecast and Information system to provide forecast and real-time information on ocean parameters Providing value added services	11.50	Improvements in Generation Operational PFZ Forecast with Wind Parameter Operational Forecast for Tuna Fishery using SST, Chl, Kd-490, MLD, etc. Improvements in Dissemination 2nd Phase Procurement and Installation of new Electronic Display Boards (EDB's) – 40 No.s Operationalise Location –based Services Validation, Awareness & Training Conducting User Awareness Programmes/User Interaction workshops Market Research Survey	Forty Seven integrated PFZ advisories were generated and disseminated to the fishery community of the PFZ sectors of all coastal states of India including islands during Apr 01, 2008 to Sep 30, 2008 Procurement of New Generation Electronic Display boards is under way. A Prototype board along with the web-based software for automatic updating of the boards has been developed and demonstrated successfully at INCOIS	

				R & D Initiate Fish Tagging Experiments to understand the behavioural aspects of Target Fish Species Pursue R&D and modeling to improve the forecast Improve the spatial resolution and accuracy of the wave, swell Forecast Extent the forecast for 10 days and at 3 hourly interval for Arabian Sea and Bay of Bengal Validation of the forecast (spatially and temporally) Initiation for global ocean forecast Enhancement of delivery chain of OSF (DDB, TV, radio, VIC, direct to Sea) Extension of coastal sea state forecast to Tamil Nadu coast Validation of high resolution wind products for coastal sea state Forecast Sensitivity studies and validation experiments for oil spill models Value added services	Provided the Satellite and in-situ based information to the users for Tuna fisheries. Analysed the Tuna fish catch data provided by the fishermen associations with the corresponding satellite images of SST, Chlorophyll, Kd_490, etc. A methodology for the Tuna forecast is being prepared. An abstract entitled "Benefits derived from the Fishing Operations done using Potential Fishing Zone (PFZ) Advisories" has been submitted to SPIE Asia-pacific Remote Sensing Conference scheduled to be held at Noumea, New Caledonia during November 17 -21, 2008. A Peer Review Meeting of all the Validation Projects was organized at INCOIS on April 15, 2008 for reviewing the progress of the existing projects and recommendation of new projects. Validation studies were carried out off Gujarat, Goa and Northern Kerala and southern Kerala and the results revealed higher catch per unit effort (CPUE)	

					in the notified area compared to operations conducted outside notified area with a low CPUE for the same species An user interaction workshop and awareness campaigns were organized at Ratnagiri on May 29, 2008 Neelangarai Kuppam, Chennai on July 05, 2008 and September 27, 2008 and at Neendakara, S. Kerala on July 15, 2008. Ocean State Forecast Coastal ocean forecast was generated and disseminated to the coastal population of Pondicherry through Television, All India Radio, Village Information Centres and digital display board. Wave forecast for Tirunelveli and Tuticorin region was generated and broadcast to the population of these areas trough FM radio. Spectral Wave Model was setup hindcast (three days) and forecast (seven days) mode for betterment of coastal wave forecast. and various experiments were carried out for fine tuning the model. The model was	

					then setup for the Gujarat Maritime Board and Maharashtra Martime board consultancy projects. Wave data for Gujarat Maritime Board and Maharashtra Maritime Board are being disseminated regularly. As part of developing the Ocean forecast and nowcast system for Karwar, a wave rider buoy was deployed at Karwar and the data is available to the user community in real time. Wave and wind conditions were generated and disseminated to ORV Sagar Kanya and ICGS Priyadarshini, Vizag. Validation of wave data for the recent cyclone Nargis was carried out. Prepared time series of ECMWF first day forecast wind data for Cyclone Sidr for the period from October 20th to Nov 30th, 2007 Wind validation was conducted for a four month period (Feb-Mar 2008 and June-July 2008). Wave data is validated using buoy data for the location off Maharashtra coast. Validation of swell waves during extreme conditions	

					are underway. Implementation Tidal Current Model is underway Ocean State Forecast user interaction workshop was organised for the fishermen and state officials at Karwar during 11-12 July 2008 and for Indian Navy officers at INCOIS on July 11, 2008.	
	C. Computational Facility (High Performance Computing System, Ocean Portal)	Computational Facility Technical support for various programmes / projects of INCOIS, Systems Administration, IT planning and implementation Development and Maintenance of INCOIS Website & Ocean Portal Maintenance of various communication facilities, networking Ocean Information Bank In-situ and satellite observation systems and reception Ocean Data Management Generation and Validation of Satellite Products NODC, Indian Ocean (Argo & IO-GOOS) Data Centre	6.39	Computational Facility Enhance the internet bandwidth from 2 Mbps to 4x2 Mbps (BSNL & VSNL) and configure to meet the operational requirements of Tsunami Warning Centre. Implementation of High Performance Computing Facility at INCOIS. Enhancement, Upgradation and Maintenance of INCOIS Website & Ocean Portal including Locations Based Services Engage professionals for Facility Managements Services (FMS) in the areas of computer hardware, software, networking, communication including maintenance of electrical and AC units. Ocean Information Bank Data Assembly Meta data base generation and web-publishing Quality Control of in-situ data Generation and validation of remote sensing data products.	Computational Facilities Facility Management and Comprehensive Annual Maintenance contract signed with M/s IBM for three years for INCOIS IT infrastructure Enhanced the internet bandwidth from 2 Mbps to 4x2 Mbps (BSNL & VSNL) and configure to meet the operational requirements of Tsunami Warning Centre Enhancement, Upgradation and Maintenance of INCOIS Website & Ocean Portal including Locations Based Services is under progress Ocean Information Bank Automated the entire process of acquisition, processing, quality control, database generation and dissemination of moored buoy data to the user	

				Networking of Marine Data Centres Initiate Data Warehouse and Data Mining Concepts Software development for Data Delivery, Visualization and Transfer Generation of data products and dissemination as per the user requirements Establish data reception system for Oceansat-2 Participation in IODE, ODINCINDIO, OGC	agencies for their operational activities. INCOIS took over the operational dissemination of moored buoy data to the users from NIOT from May 01, 2008. The entire process of moored buoy data reception, processing, real-time quality control and dissemination to the users [Indian Meteorological Department (Delhi and Chennai), Directorate of Naval Oceanology and Meteorology (Mumbai, Port Blair, Vizag, Goa, Kochi), and Coast Guard (Chennai)] by email has been automated. Remote Sensing data from AVHRR (NOAA-17,18) and MODIS (Aqua and Terra) are being received in real time. Data products viz. SST, Chlorophyll, Aerosol Optical Depth, Clouds etc. are being generated in real time and published in INCOIS website INCOIS started providing Atmospheric Profiles retrieved from MODIS onboard Aqua and Terra Satellites to IMD in near-real time for their operational use.	

					Ocean Information bank is updated with SeaWifs Chlorophyll data from 1999-2003 received from NIO. The Equatorial Current Meter Mooring Data is published on INCOIS web-site with visualisation and data delivery facilities. Provided in-situ and remote sensing data to the users on request.	
16.	Seafront facility	To develop and establish an integrated sea front facilities like R&D Centers, and Laboratories, Integration Bay for R&D works, Coastal Jetty and Test Ponds	10.00	Acquisition of land and development of land.	Pursing with state government.	
17	Development of Manned Submersible			•Evaluation of financial bids & identification of joint partner	Techinical evaluation has been completed	
18.	Multichannel Seismic System onboard ORV Sagar Kanya	To assess the vessel and design a suitable 2D multi-channel seismics system through a reputed designer/offshore service contractor, who shall integrate, supervise and install the equipment • To procure all the equipments/ components as per design for their installation for sea-trials and operation	5.00	Procurement and installation of equipment		
19.	Development and Commissioning of a Floating Platform Mounted Low Temperature Thermal Desalination (LTTD) Plant	•To identify and work with a private partner as a first step of commercialization of the technology. •Design, develop, demonstrate and commission 10 MLD floating vessel mounted Desalination Plant	-	•Identification of A Private Partner	*[EFC document for the project is yet to be approved]*	•Under Progress

	of 10 MLD					
20	Indian Scientific endeavors in the Arctic	Initiation of scientific programs at Ny-Alesund, Svalbard, Norway Establishment of an Indian Research Base at Ny-Alesund	BE 7.00 RE 2.45	As proposed in column no. (3)	The first phase of the studies and summer-time data collection have already been completed and laboratory analyses are in progress. A Permanent station building at Ny-Alesund (named "HIMADRI") has been taken on lease from Kings Bay to serve as the Indian Research Base. The station building was formally inaugurated on the 1st July 2008 by the Hon. Minister for Science & Technology and Earth Sciences. An MoU has been signed between NCAOR and NPI for collaborative scientific endeavors in the fields of glaciology, microbiology, geology and atmospheric sciences. India has been elected as a member of NySMAC.	
21	National Oceanarium	Design, development and commission of aquarium.	0.50		EFC proposal is being prepared.	
22	Demonstration of Shore Protection measures through pilot	•To characterize littoral transport phenomena along key sites of the Indian coast for sustainable coastal infrastructure planning and management. •To demonstrate the performance of	8.67	•Littoral transport characterization and assessment of erosion / accretion •Demonstration of environmentally friendly coastal	First site chosen at Ennore Port, north of the northern breakwater •Field data collection carried out for geophysical,	•

	projects	environmentally friendly shoreline stabilization measures at high priority sites. •Water quality monitoring and management studies (Waste Load Allocation) in tidal creeks and estuaries and inlet Stabilization measures.		protection measures at three sites •Pollution reduction strategies in tidal creeks and management of sand bar closures	geotechnical and oceanographic parameters completed •Data analysis and Mathematical modeling in progress •Desk study of secondary data for Ennore Creek completed	
23	Integrated Ocean Drilling Programme(IODP) *A study of the Geological and Tectonic Evolution of the Arabian Sea and Bay of Bengal sectors of the Northern Indian Ocean*	Finalization of National Science Plan for deep-sea drilling Participation by Indian scientists in various programmes of the IODP. Primary data acquisition in the Gulf of Mannar, western Andamans, south-west coast of India etc. Continuation of selective re-processing of seismic and gravity data collected as a part of the LCS Program Petrographic and geochemical studies of hard rock samples	BE 5.00 RE 5.00 BE 1.00 RE 1.00	As proposed in Column (3) Geophysical data acquisition: ~3000 lkm Gravity data modeling: ~ 3000 km	Approval has already been obtained for India to become an Associate Members in IODP Studies in the Gulf of Mannar are being initiated ass an in-house R&D activity of NCAOR during the current year A multi-institutional project (NCAOR, INCOIS, NGRI) to study the geological and structural characterization of the Andaman-Nicobar subduction zone has already been initiated and the first phase of land-based studies has been completed.	Dredging off the flanks of some of the seamounts in the Arabian Sea might not yield rock samples on account of the thin sediment cover.
24	Ice class Research vessel	•Finalisation of the design specifications •Finalisation of the details of on-board scientific laboratories and sampling equipment •Floating of a global tender and finalization of the construction firm	BE 5.00 RE 5.00	As proposed in column (3)	An EFC document for initiation of the scheme has already been submitted for consideration Action has been initiated to identify a consultant-	The initiation of construction activity is dependent on timely clearances and approvals

		•Identification of a Shipyard •Identification and appointment of a construction supervisor •Initiation of construction activities.			architect who can undertake the designing, prepare a global tender and assist NCAOR in follow-up action.	from the various Ministries, identification of the construction yard and the yard's schedule
25.	Headquarter Building	a new modern building having required amenities to house the headquarters	20.00	Complete 50% of construction of the building after obtaining the necessary clearances. .	Construction Work commenced.	
26	India Meteorological Department - Training	Imparting of training in Meteorology, Telecommunications, Instrumentation and Seismology to IMD personnel and persons from developing countries under WMO Programmes. Main outcome is development of Human Resources.	0.38	Continuation of imparting of training under WMO Programme.	Imparting of training is continued in all disciplines. Total 85 persons including 6 Foreign Trainees have been given training in the first half of the year.	
27.1	Satellite Services.	Ground Segment for reception and processing of Met. Data from INSAT-3D Satellite will be commissioned. Old CWDS receivers will be replaced by Digital CWDS. Action for establishment of Metop Satellite data receiving and processing system at New Delhi will be initiated. Main outcome will availability of facilities in IMD for processing of data from advances payload on INSAT-3D.	Rev: 5.53 C E: 4.47 Total 10.00	Reception and processing system and Earth station for INSAT-3D will be installed and commissioned. DCWDS (300 Nos.) receivers will be installed along coastal areas. Ground system for receiving and processing of Metop Satellite data will be procured and installed.	So far equipment installation only for Kalpana/INSAT-3A Met. Data processing system completed. It is now under testing. Installation will not be completed before March' 09. Meeting of expert group held on 15.10.08 to suggest the latest, robust & reliable technology available for procurement of DCWDS/CWDS. Final report/recommendations of expert group awaited Installation will not be completed before March' 09. RFP prepared for	

					Metop Satellite receiving and processing system and indent placed. At best, order will be placed before March' 2009.	
27.2	Operation Maintenance-- Observatories and Weather stations	Digital standard barometers (100 Nos) will be procured. 7 Nos Electrolysers will be established at RS/RW stations. Spares for IMS Ground System will be procured. Fabricated indigenous DWRs will be installed at Bhuj and Kochi and test equipment will be procured.	Rev: 16.36 CE: 6.26 MW 5.00 Total 27.62	Digital barometer will be procured. Electrolysers will be installed at RS/RW (20 Nos) stations. Spares part for IMS will also be procured. Fabricated indigenous DWRs will be installed and commissioned. Test equipment for DWRs at Chennai, Kolkata and Shar will be procured.	Revised delivery schedule starts Sept' 2008 for barometers. Installation will not be completed before March' 09. Case for obtaining in principle approval is under process. Spares will not be procured before March' 2009. Approval for procurement on PAC basis is yet to obtained. Indigenous development of DWRs is under process and first radar will be delivered in March' 09. VSAT established at 26 stations. High Speed Data Terminals (64 kbps) links established at 25 stations. Interactive Voice Response Systems (IVRS) at 26 stations commissioned.	
27.3	Aviation	Instruments (AMI's) for installation at	5.00	AMI's for installation at airports	Installation of integrated	--

	Meteorology	Airports will be procured		will be procured.	AMIs at Mumbai, Hyderabad, Bangore, Jaipur and Delhi (27/09) Airports Completed and at Amritsar, Guwahati and Chennai is under process for commissioning. Procurement of Transmissometers for six airports is under process.	
27.4	Argo Meteorological Services	Agromet Advisory Services will be modernized in India and Agromet unit at Pune will also be modernized.	10.00	Equipment for modernization of Agromet Advisory Services and Agromet research units will be procured and installed.	Equipment procurement delayed. Installation will not be done by March' 09. District Level Agromet Advisory Sservices based on District level forecast being issued from June 08. Grant-in-Aid to research institute / Universities working on Agromet Advisory Services to farmers continued.	
27.5	Seismic Hazard and Rsk Evaluation, Seismicity, Earth Quake	VSAT based Seismic equipment for Telemetry Network in NE India will be procured. Augmentation of Delhi VSAT based telemetry network will be completed. Microzonation of 5 cities will be continued.	15.00	Seismo Equipment for installation in NE India will be procured. Augmentation of Delhi telemetry will be completed. Microzonation of cities will be	Procurement of VSAT based Seismic Telemetry Network for NE-India is delayed. Earlier tender cancelled and retendering being done. Order for Ethernet LAN	

	precursor Studies	National Database for Seismic Hazard and regional Risk appraisal will be created. Geophysical/Geotechnical Laboratory and National Seismological and EREC data base will be established. Activities of ERE Centre will continue. Archival and digitization of seismic analogue charts will be continued.		done. Creation of National Data Base for seismic hazard and regional risk appraisal will be taken up. Geophysical/Geotechnical Laboratory and National Seismological and EREC data base will be established. Activities of ERE Centre will continue. Archival and digitization of seismic analogue charts will continue.	for EREC placed. Augmentation of NSN and NSDC facilities is continued. Case for placement of work order for digitization of seismic analogue charts under process.	
27.6	Mod. Of IMD Weather Services.	High Performance Computing System (HPCS) for global data processing and Numerical Weather Prediction (NWP) will be procured. Forecasting System will be partially commissioned through MFI. Action for procurement and installation of 550 AWS and 1350 ARG's will continue. 12 Nos imported DWRs will procured for installation. 5 GPS Radiosonde systems will be procured and deployed in upper air network.	364.00	HPCS system will procured and installed. Forecasting system through MFI will be commissioned. AWS and ARGs will be procured for installation. Imported DWRs will also be procured and installed. 5 GPS systems will procured for installation.	The price bids evaluation report of High Performance Computing system was accepted by M o E S. order for supply of STPCS issued.. Initial System Design Review and Site Survey Meetings for Upper Air, Climatology, Central information Processing, Public Weather Service and General Training for commissioning of Forecasting system held during 7-20 Sept' 2008. LC for ARGs opened and 300 ARGs are to be commissioned by March' 2009. Supply order placed for AWS & 200	

					AWS are to be commissioned by March' 2009. L/C for procurement of DWRs opened on 15.9.08. Design review meeting held with the firm on 29th & 30th Sept., 08. DWRs buildings at six airports-Delhi, Lucknow, Patna, Agartala, Mohanbari and Nagpur will be constructed through AAI. Case is under process for obtaining approval of competent authority for the construction through AAI. LC for GPS stations for Upper Air data opened on 24.07.2008. CDR meeting held on 25-26 Sept' 2008. Supply order for Optical Theodolites issued. 35 Nos of optical theodolites was to be delivered in October' 2008 but firm has requested for extension of delivery period.	

28	Indian Institute of Tropical Meteorology (IITM)					
28.1	Short Term Climate Prediction	To develop prediction techniques and improve the seasonal mean monsoon rainfall To develop methods for predicting active and break monsoon. To make preparation for acquisition of a K-band Doppler Precipitation Radar and a X -band weather radar for the study of interaction between cloud and environment, thunder-storm detection and urban air pollution studies. To acquire equipments for the urban air pollution studies To continue the In-house basic and advanced training program in meteorology and atmospheric sciences.	15.00 Approved by EFC	Development of a System for Seasonal Prediction of Monsoon Develop-ment of a System for Extended Range Prediction of Active/Break Spell Studies of Interaction between Clouds and Environment Thunder-storm dynamics and prediction including role of boundary layer fluxes, electrical forces etc. Urban Air Pollution, Chemical Transport Modeling and Middle Atmosphere Dynamics	Experimental forecast of All India Seasonal Monsoon Rainfall (AISMR) for the year 2008 by Dynamical and Statistical methods using various meteorological parameters and techniques. Surface electric field and Maxwell currents density measures under thunderstorms at Pune and Guwahati for study of their contribution *in* increasing the sub-cloud layer. Effect of electrical forces on distortion of polluted water drops was studied. Study of the scavenging of ions by aerosols was carried out Long-term trends in stratospheric tempera-ture, ozone and Nitric Oxide were studied by model simulations.	

					Seasonal distribution of ozone and its precursors over the tropical Indian region using regional chemistry-transport model was studied..	
28.2	Climate Variability and Dynamics	To strengthen the basic research required for improving the models for weather and climate forecast which includes programmes complimentary and supporting to the other new schemes of the 11th Five Year Plan. To upgrade the Existing Scientific Facilities such as establishment of Stable Isotope Ratio Mass Spectroscope Laboratory for Palaeoclimatic Investigation, instrumented tower for continuous Boundary Layer Measurements and restructuring of Existing Workshop	10.00 (proposed) EFC approved the project	Monsoon variability and Predictability Short Term Climate Diagnostics and Applications Rainfall Variability, Hydrological Modeling and Satellite Data Applications Aerosol and Climate Studies Infrastructure development viz, (a) establishment of a laboratory for Isotope Mass Spectrometer for enhancing the palaeoclimato-logical studies, (b) Instrumented tower for atmospheric boundary layer studies and , (c) Restructuring of the existing workshop	Role of the increased ocean heat content in the anomalously active tropical cyclone season over the South West Indian Ocean was investigated Long term trends of Indian summer monsoon rainfall and its relationship with synoptic systems over Bay of Bengal were studied. Spatio-temporal temperature trends over India during 1901-2007 showed that for North India, the winter and pre-monsoon maximum (minimum) temperature showed decreasing trend while monsoon and post monsoon maximum temperatures showed increasing trend for the period 1950-1990.	

					Characterization of aerosols over oceanic regions around India during pre-monsoon revealed significant day-to-day variability in aerosol optical depth (AOD). Aerosol loading was found to be relatively high over the Bay of Bengal (BoB) which is higher than those over Arabian Sea (AS) and North Indian Ocean (NIO). High fine-mode aerosol loading over BoB is found to be associated with air masses originating from northeastern Indo-Gangetic plains and southeastern Myanmar. (a) Mass Spectrometer has been acquired and development of the laboratory is under progress (b) Instruments for the tower have been acquired and put in use for the study (c) Workshop is being restructured to fabricate instruments required for the experiments.	
28.3	Cloud	To study the role of aerosols in rainfall	14.00	To understand cloud-aerosol	Ground work for hiring	

	Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX)	processes. To understand the microphysical changes in the cloud after seeding. To quantify the increase in rainfall after seeding. To develop optimum strategy for the cloud seeding as a guidance tool to operational programmes by the state governments		interactions and the potential of rain enhancement by seeding the clouds.	instrumented aircraft and background observations of aerosols and cloud microphysics has been under progress	
28.4	High Performance Computer and Infrastructure Development	To make ground preparation for housing the High Performance Computer. To strengthen the existing Information System in Meteorology and Atmospheric System.	28.33 (including 22.00 cr. for the HPC machine)	A HPC with adequate computing capability is crucial for (a) development of seasonal prediction system, b) development of extended range prediction of active/break cycles and c) basic research.	Currently no HPC is available at IITM. Being procured along with HPCs for four other Institutes of the MoES. Initiated work for construction of building and other infrastructure for the HPC.	
29	National Centre for Medium Range Weather Forecast NCMRWF	Global Modeling and Data Assimilation Assimilation of more data (conventional, satellite) Implementation of Grid-point Statistical Interpolation (GSI) assimilation scheme		Lufthansa AMDAR observations (obtained through special arrangement by IMD) Assimilation of SSM/I Precipitation rates Assimilation of GOES sounder (Radiance) Assimilation of METOP Microwave Humidity Sounder	Trial runs have been made, impact has been found to be positive Trial runs and their evaluation are underway Trial runs have been made and their evaluation are underway	

				(Radiance)		
29.2		Mesoscale Modeling and Data Assimilation		Implementation of the latest version of WRF	WRF 3.0 has been implemented Nested WRF3.0 model has been tested with 27 Km outer domain (RMC region) and 9Km inner nest (covering India) Nested WRF3.0 model for the Delhi-NCR region (9 Km outer domain for N. India and a 3 Km inner domain covering Delhi-NCR region) has been tested	
29.3		Forecast Demonstration Project (FDP) for Tropical cyclones		Appropriate changes in the operational schedule to meet the requirements of FDP Implementation of Tropical Cyclone Relocation procedure		Implemented & successfully tested for TC Nargis
29.4		Multi-Model Ensemble (MME) Project		MME forecast of daily rainfall forecast in medium range time scale using data from 4 global models, i.e. NCMRWF, NCEP, UKMO and JMA		Forecasts were generated on an experimental basis from June 01, 2008. Evaluation of the forecasts are underway
29.5		Infrastructure Development		Maintenance of Computing Infrastructure	AMC of Cray X1E was awarded	

				Procurement of HPC system Upgradation of support infrastructure Upgradation of Internet Leased Line .Upgradation of Storage of PARAM PADMA Establish web-based Data Service at	The L1 bidders has been shortlisted Proposal has been initiated and funds are being allocated The RFP has been floated Storage of PARAM PADMA has been augmented with a tired storage of 80 TB The RFP has been prepared and publication is awaited.	
30	Multi-Hazard Early Warning Support Interfaces (MHEWS)	• Develop disaster specific adaptable management frameworks [By integrating local scale lead-time impact assessment based on early warning, hazard mapping and risk management decision support systems (DSSs) with customized emergency preparedness mechanisms] • Develop critical and fail-safe communication and customized systems of protocols [by integrating technologies for evolving emergency response strategies linked to improved multi-hazard early warning] • Launch Projects for improved understanding of multi-hazard impacts • Adaptation of proven multi-hazard mitigation systems and technologies for planning emergency operations	1.00	• Interfacing Lead-Time Spatial Impact Assessment with Early Warning i) Demonstration Project for an Adaptable Cyclone Hazard Mitigation Framework ii) Content Enrichment on the Web GIS PORTAL (to be linked either to IMD/ INCOIS/MoES Web Servers after the application is developed) iii) Development of Local Scale Multi-Hazard Assessment Tools	Invitation of EOI was floated in Aug 2008. Response being evaluated for short listing of suitable firms	
31.	Centre for Climate Change	To make ground preparation for the Centre at IITM.	05.00	To develop national assessment and response capabilities with skills in different areas of climate	EFC is under final approval	

	Research			change, to build a strong science base and to synergize the research efforts on climate change by networking the national Institutions.		
32	Dedicated Weather Channel & Commonwealth Games 2010	• Phase-II may be implemented by early 2009 when more observations and improved weather forecast products become available through modernization process. The live up-time for channel can be increased to 6 hours and total up-time to about 12 hours during this phase.	5.00	As mentioned in column 3		
33	NIOT ext. centre West Bengal		0.50			
34	Research and Development Programmes	Study and Monitoring of micro Met. Parameters and grant of financial aid to research institutes and universities. Aerosol monitoring network will be established. Regional Grab Sampling for Green House Gases and Base line GHG's monitoring in India will be established. Measurement of Black Aerosol concentration at surface level will be initiated. GAW Network and Air Pollution Lab at Pune will be modernized.	7.00	Study of parameters and grant of aid to institutes/universities will be continued. Equipment for aerosol monitoring network, measurement of black aerosol concentration, GAW network and Air Pollution Lab will be procured. Establishment of regional Grab Sampling for greenhouse gases and base line monitoring of GHG's will be established.		

35	Seismicity Programme	Seismic Microzonation studies of Bangalore. Create facilities to monitor seismic activities in specific areas Crustal deformation studies V-SAT connectivity to Broadband stations in NE region. Setting-up of Multi-parametric geophysical observatories Support to ongoing projects	No specific allocation was made for seismicity programme. Supplementary grants have been requested 4.00 (Seismicity Programme) (*Grants are being utilised from Earth & Atmospheric science budget head)*	Preparation of Hazard maps Installation of broadband stations and strong motion stations in selected areas Setting-up of 7-8 GPS stations Estimation of earthquake parameters in real time.	Draft Report on Bangalore Microzonation is completed. Four broadband stations have been established around Siachen glacier to monitor micro-tremor activities in the region. A network of 18 strong motion stations has been established in NCR. Campaign mode GPS studies have been taken-up in Ladakh, Godavari region and A& N region. Seven GPS receivers are being established in Gujarat, Kashmir and Rajasthan. V-SAT connectivity is being provided to selected Broadband stations in NE India, Multi-parametric geophysical observatory is being established at Port Blair	
	TOTAL		750.00			

Statement of Outlays & Outcomes/Targets (2009-10) Appendix-5

S No.	Name of Scheme/ Programme	Intended objective/Outcome	Annual Plan 2009-10 Outlay (Rs. in Crores)	Quantifiable Deliverables	Processes/ Timelines of Approvals	Remarks/ Risk factors
1	2	3	4	5	7	8
1	*Expedition to Antarctica*	• Planning, co-ordination and execution Indian Scientific Expedition to Antarctica. • Establishment of third permanent base in Antarctica: initiation of construction work of new station. • Continuation of In-House research programmmes at NCAOR in the realms of Ice core studies, Paleoclimatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography. • Implementation of the Phase-III civil works.	51.35	• Planning, co-ordination and execution of the XXVIII Indian Scientific Expedition to Antarctica. • Initiation of the work of structural strengthening of Maitri • Establishment of third permanent base in Antarctica: initiation of construction work of new station. • Continuation of In-House research programmmes at NCAOR in the realms of Ice core studies, Paleoclimatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography Implementation of the Phase-III civil works. o Initiation of action for planning and design for residential accommodation, Guest House and project offices on the additional land being acquired from the Government of Goa		
	Scientific studies in the Indian Ocean sector of the	• Physical, biological and seabed sampling during the proposed expedition. Analysis of samples in the laboratory. Interpretation of results. o R & D output in the form of Scientific Publications.	Rs. 6.45	o Initiation and completion of the targeted scientific projects mounted		The mounting of the expedition

	Southern Ocean					dependent on the availability of a suitable ice-class research vessel.
	Establishment of the new research base in Antarctica	• *Establishment of the new research base in Antarctica* • *Operation and maintenance of new centre.*	81.25	• Identification of the consultant-architect • Finalization of the station design and the environs • Floating a Global Tender and identification of the construction agency • Fabrication of various living and lab. Modules in India and transshipping them to Larsemann Hills • Procurement of machinery and equipment		
2	Polymetallic Nodules Programme	• Conduct close grid surveys in the site allotted for India in the Indian Ocean and carry out EIA studies • Develop technology for mining nodules from the sea bed • Develop technology for extraction of metal from the nodules.	15.00	• Procurements of test coupons, test instruments, sub sea drives, imaging equipments, corrosion studies • Laboratory tests, calibration etc • Field trials, collection of data • Evaluation, modifications etc Development of Underwater Collection and Crushing Systems: Collector Crusher Development (10^{th} Plan Continuation) • Soil tester: modifications of the		

				existing soil tester- drives, structure, termination etc • Procurement of subcomponents electric motor, electronic components • Fabrication and integration frame, housing etc • Testing of the soil tester at lab		
3	Ocean Observation and Information Services	• Strengthening the in-situ observation network by deployment of a wide range of state-of-the art technology equipment in the coastal and open seas around India Generate, develop and validate a regional and global models for operational dissemination of data products and providing services.		Regional Ocean Modelling System o Retrospective forecast experiments with reanalyzed forcing o Experimental forecast • Modular Ocean Model • Inter-annual run with best available forcing fields(i.e. fresh water, air temperature, wind and humidity) • Deployment of o 50 Argo Floats o 30 Drifting Buoys o XBT Observations along 4 shipping lanes o Retrieval and Redeployment of Current Meter Mooring Arrays o Deployment of new Current Meter Mooring array. o Bay of Bengal Observations o Glider operations		
4.1	Marine Living resources programme	Assessment of deep-sea and distant water fishery Assessment of myctophid resources of the Arabian sea HAB monitoring and surveillance Benthic studies	10.0	Survey results of one cruise each in the Andaman sea, Bay of Bengal, Arabian sea and Central Indian ocean. Survey result of two cruises. Central/ Western Arabian sea Results of HAB field Expts.		

		FORV Data & Referral Centre Southern ocean living resources CMLRE infrastructure		Bench mark data on the benthic fauna of the Indian C- shelf. Proceedings of the 3rd workshop on the Scientific achievements of FORV Sagar Sampada Survey results of Southern ocean Krill / fishery resources expedition Construction of berthing facility and office complex to commence.	Being R&D programmes deliverables are not quantifiable at this stage.	NA
4.2	Coastal Ocean Monitoring and Prediction Systems	To assess the health of the seas	Rs.7.00	Continuation of updation of status of marine pollution at 76 locations Continuation of GIS based information system for 5 locations and completion of database for 10 locations Collection of field data to initiate oil spill modeling at 3selected sites initiated. Oil spill model for Indian Ocean region completed	Project Document	
4.3	Integrated Coastal and Marine Area Management	Application of scientific tools and techniques like mathematical modeling for Integrated Coastal Zone Management	12.75	Investigation of vulnerability of Indian coastline for coastal erosion at Gopalpur, Kerala Karnataka continued and initiated in Andhra Ecosystem Modelling for Kochi and Chilka. Field work for hydrodynamic modeling a Chilika Sundarbans continued and development of coefficient in Kochi backwaters completed Marine Ecotoxicology experiments for Cadmium completed and Arsenic initiated Storm Surge inundation model development. Development of software continued	Project Document	Manpower inadequate to conduct field activities. .

4.4	Ocean Science and Technology for Islands	• Demonstration of open sea cage culture of fin and shellfish • The introduction of coastal mariculture activity will help eradicating poverty among the coastal fishers and provide alternate employment.		• Laboratory studies on fattening of finfishes • Laboratory studies on breeding of finfishes • Survey for site selection for cage deployment • Procurement of sea cages and deployment • Optimization of finfish holding technology and cage maintenance • Feed selection / preparation / formulation • Feeding trials • Monitoring on growth parameters of finfish		
4.5	Assistance for Oceanographic Research	• Providing assistance to 9 OASTCs and supporting research projects outside OASTCs		- 9 OASTCs and the CoE received financial assistance		
4.6	Outreach (Exbition & Fairs Seminar)	To support Seminar, Symposia .National Awards		To support Seminar, Symposia including IITF, and other scientific conferences, and workshop organized by the Ministry and other academia in the field of ocean and atmospheric research.		
5	National Institute of Ocean Technology	★ Establishment of LTTD plant of suitable capacity at any of the Thermal Power Stations by utilizing the waste heat. ★ Installation of floating wave powered device to power a small rated R.O plant to generate the freshwater or lights for a small island. ★ Installation of a Solar Desalination system. • The estimated yield from the project is Technology development of important components for offshore projects		• Studies on various types of turbines, heat exchangers demisters and other major equipments • Design and field trials of floating wave powered device • Studies on solar desalination • Fabrication / procurement of equipments, sensors and other instruments • Material testing such as FRP for cold water pipe studies • Design, Fabrication, Testing and		

		including fixed and floating platforms, moorings, anchors, pipes, buoys, interfaces and cyclic load testing facility. • The technical criteria atlas shall provide data on environmental loading thereby enabling site selection and minimizing the effects of cost over runs from detailed investigations at a vulnerable site • Ambient Noise Characterization at specific locations. • Derivation of geo acoustic properties of sea bed. • Advanced acoustical method using high frequency system to study sea floor and related habitats. • Methods to reduce noise using active structural acoustic control. • Establishment of underwater electronic support facility to benefit the NIOT in-house projects and testing needs • Development of underwater electrical and electronic components in association with the Indian industry • Development of Autonomous Surface Vehicle for surveys in protected water bodies • Development of underwater acoustic, non-acoustic and biosensors as per the user requirements		Deployment of Suction Pile Anchor • Studies on interface components (Design and Experimentation) • Studies on offshore mounted wind turbine (Design and Model Studies) • Secondary Database Development • Field measurement • Infrastructure, Augmentation of laboratory facilities • Modelling • Data Analysis & Satellite Imagery interpretation • Low Frequency Acoustic Propagation in Shallow Water Ocean with Seabed Effects' • Vector Hydrophone array processing for underwater acoustic source localization and signal estimation • Automatic benthic ambient noise detector in strategically important places like Vizag, Kochi, Mangalore, Mumbai etc • Development of vector hydrophone array for application of port and underwater way security • Establishment of benthic vector service station at important ports Underwater Electronic Support Facility: • Mechanical & Environment facilities • Power & Communication (ii) Underwater Component development: • Development of Underwater Camera (iii) Marine Sensor & Technology Development: • Development of 180/20 kHz sensor • Development of bio-sensors		

6.	Coastal Research Vessels	Operation and maintenance Sagar Purvi and Sagar Paschmi		Operation & Maintenance of CRVs: To successfully implement COMAPS (ii) Operation & Maintenance of Sagar Manjusha: To successfully implement data buoy & Tsunami systems deployment. To cater for NIOT in-house projects (iii) Operation & Maintenance of Sagar Nidhi: ROV deployment & other programmes as recommended by JSTAC. Programmes as recommended by JSTAC (iv) Comprehensive Topography of EEZ of India: Procurement of software and hardware Data collection/outsourcing • Training / Office contingencies / salaries • Sample processing and other utilities		
6	Gas Hydrates	Development of Support Submersible SS2500: (ii) Development of Autonomous Coring System (iii) Studies on Gas Hydrates Exploration (iv) Benthic Station		Exploratory studies at gh site in KG Basin Exploratory studies at gh site in Mahanadi basin First shallow water sea trial Deep water sea trial at G.H Site Continuation of geophysical and geological studies Development & deployment of benthic station		
7	Delineation of the outer limits of the continental shelf (CLCS)	★ Defense of India's submission	1.18	Submission of the report to make claims Defense of India's submission before the CLCS dependent on the schedule worked out and adopted by the Commission.	-	

8	Comprehensive Bathy metric studies	• To prepare a comprehensive seabed topographic map for the entire EEZ of the country using the state-of-the art technologies of multibeam swath bathymetric systems. These data collected in Arbian Sea, Bay of Bengal and Indian Ocean would be useful to identify the major topographic features in the EEZ. To carryout systematic sediment sampling, and analyze to assess potential of seabed resources in the EEZ	5.00	AS indicated in column no. 3.		
9	Operation & Maintenance of Sagar Nidhi	To build a new multipurpose vessel for technology services and demonstration to cater to the ongoing and the new mission mode programs of MoEs during XI Plan and beyond				
10	Maintenance of Forty Buoy Network	★ Establishment of 40 buoy network ★ More buoy network to make 40 buoy alive always ★		• Assembly and integration of data buoys of met / environmental / wave type buoys (12 Nos.) • Deployment / retrieval / maintenance of network at Arabian Sea • Assembly and integration of data buoys of met / environmental / wave type buoys (12 Nos.) • Deployment / retrieval / maintenance of network at Bay of Bengal • Assembly and integration of data buoys of met / environmental / wave type buoys (13 Nos.)		
11.	Early Warning System for Storm Surge and Tsunami	Operation and maintenance of Tsunami Warning centre on 24X7 basis. Providing advisory services to the concerned authorities on the Tsunami advisory services.	20	• Improve Redundancy for Observing Systems (Seismic, BPR, Tide Gauges, etc) • Capacity Building, Education and Training for Public, Authorities, Media, etc.		

				• Generation of High-resolution bathymetric and topographic data • Refinement and implementation of Coastal Inundation Models • Generation of High-resolution Coastal Vulnerability Maps for entire coastline • R & D Aspects • Tectonic Modelling of Andaman Trench • Use BPR Seismic Trigger Data for computing the Source Parameters • Efforts to become Indian Ocean Tsunami Warning System • Initiate Efforts to handle Multi-Hazards (Storm Surges, etc.)		
12	National Centre for Antarctic and Ocean Research	Continuation of In-House research programmmes at NCAOR in the realms of Ice core studies, Paleoclimatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography. In addition, the following projects initiated during the previous year would be continued: 1. Glaciological and Ice Core Studies in the East Antarctica (GICSEA): An integrated scientific program for understanding the climatic and environmental changes in East Antarctica during the late Holocene 2. Trends in Antarctic Sea-Ice 3. Diatoms for Deciphering Polar Environmental Changes 4. Gulf of Mannar – Its Nature and Evolution				

13	Indian National Centre for Ocean Information SERvices.	To provide services coastal community on the PFZ and OSF		Potential Fishing Zone Mission • Improvements in Generation o Operational Forecast for Tuna Fishery using SST, Chl, Kd-490, MLD, etc. • Improvements in Dissemination o 2nd Phase Procurement and Installation of new Electronic Display Boards (EDB's) – 40 No.s o Operationalise Location –based Services • Validation, Awareness & Training o Conducting User Awareness Programmes/User Interaction workshops o Market Research Survey o Establishment of Information Kiosks with the coordination of local authorities, NGO's, etc. o Preparation of a consolidated report from all the PFZ Validation projects for the period 2007-08 o Publishing of a scientific paper from all the PFZ Validation Projects • R & D o Initiate Fish Tagging Experiments to understand the behavioral aspects of Target Fish Species • Pursue R&D and modeling to improve the forecast Ocean State Forecast		

				• Validation of the forecast (spatially and temporally) • Global ocean forecast on experimental basis • Extension of coastal sea state forecast to entire Indian coast • Efforts for inclusion of currents in open ocean forecast • Value added services • User interaction meetings with NGOs, and industries, other awareness programs, feedback collection • Enhancement of delivery chain of OSF (DDB, TV, radio, VIC, direct to Sea) Value - added Services and consultancy Services: INCOIS plans to take up value added services and consultancy services for the coastal and offshore applications. With the vast amount of in-situ and remote sensing data from available at INCOIS, Ocean models could be fruitfully utilized to undertake need based user projects for coastal and offshore applications.		
14	Demonstration of Shore Protection Measures through Pilot Projects	★ To characterize littoral transport phenomena along key sites of the Indian coast for sustainable coastal infrastructure planning and management. ★ To demonstrate the performance of environmentally friendly shoreline stabilization measures at high priority sites		• Procurement of Equipment • Field data collection Program • Laboratory infrastructure • Shore protection demonstration at Ennore • Procurement of workstation • Detailed field measurements &		

				experiments • Manpower recruitment for detailed study and design		
15	Sea Front Facility	To develop and establish an integrated sea front facilities like R&D Centers, and Laboratories, Integration Bay for R&D works, Coastal Jetty and Test Ponds	10.25	identifying the land having sea front area, procurement of Land, establishing sea front facility initially with external services for the sea front facility		
16	Development of Manned Submersible	Finalising the specification of Manned Submersible 2. To identify the joint partner through global tender 3. Pre-bid meeting with potential partner, if required 4. Technical Evaluation of proposals from the potential partners 5. Preparation of agreement for the joint development	5.00	1. Finalising the specification of Manned Submersible 2. To identify the joint partner through global tender 3. Pre-bid meeting with potential partner, if required 4. Technical Evaluation of proposals from the potential partners 5. Preparation of agreement for the joint development		
17	Multichannel Seismic System	to assess the vessel and design a suitable 2D multi-channel seismics system through a reputed designer/offshore service contractor, who shall integrate, supervise and install the equipment •To procure all the equipments/ components as per design for their installation for sea-trials and operation	5.00	Tendering for procurement of various equipment		
18	10 MLD Desalination Plant	To design, develop, install, commissio n, demonstrat e and operate a offshore Low Temperate Thermal Desalinatio n Plant of		Completion of design and analysis of plant Procureme nt major items and assembly of the equipment		

19	- Deep Ocean drilling in the Bay of Bengal and	- Finalization of National Science Plan for deep-sea drilling Participation by Indian scientists in various programmes of the IODP.	-4.57	Finalization of National Science Plan for deep-sea drilling Participation by Indian scientists in various programmes of the IODP.	-	-
20	Headquarter Building	to construct a new modern building having required amenities to house the headquarters	10.00	Completion of construction of the building in 2 years		
21	Construction and commissioning of a Polar Research Vessel	• Appointment of a consultant for finalization of the design specifications • Finalisation of the details of the onboard laboratories and sampling equipment	1.00			
22	*Scientific Expeditions to the Arctic*	➢ Initiation of full-fledged scientific programmes in different disciplines. In addition to initiating new projects, the following continuing projects are proposed to be resumed during the summer of 2009 and spring of 2010: ➢ Procurement and installation of basic instrumentation in atmospheric sciences, microscopes etc. at the Indian Research Station	2.60	• Initiation of exploratory scientific programmes in collaboration with other Arctic nations • Launch pilot expedition to the Arctic in a phased manner during the summer of 2007 and the late winter/early Spring of 2008. • The Summer projects which have already been initiated during August – September comprise: • Initiation of action for the establishment of a permanent Indian research base at Ny-Alesund • . Field data collection pertaining to atmospheric sciences, geology, microbiology and glaciology		
23	National Oceanarium	Identification of suitable partner to execute the work. Initiation for acquisition of land and appoint consultant for preparation of a document	0.95	Negotiation with State Government are underway		

24	India Meteorological Department					
25.1	Space Meteorology	Ground segment for INSAT-3D is to be commissioned and Cyclone Warning Dissemination Systems (CWDS) will be replaced by Digital CWDS in the coastal areas. Metop Satellite Data Receiving & Processing System to be established.	33.68	Ground receiver for INSAT-3D to be commissioned for receiving & processing of high resolution data Establishment of more 50 Nos. GPS and peripherals Establishment of ground receiving and processing system from NOAA/MODIS/Metop satellies. Installation and maintenance of DCWDS/CWDS.	2009-2010	--
2	Operation and Mainenance.	Maintenance a network of large number of observatories for acquisition of various types of weather data and keeping climatological statistics for operation and planning in various fields like Agriculture, water conservation, oceanography etc. Manufacturing of weather equipments and their test, calibration and standardization for use in basic observational network. Speedy exchange of weather data in the Northern Hemisphere through Telecommunication Hub.Augmentation and up gradation of varioud types of observational systems with state-of-art technology. Imparting of training in Meteorology, Telecommunication, Instrumentation and Seismology to IMD personnel and persons from developing countries under WMO Programme.	104.50	High Speed Data Terminals for 58 more Stations and SADIS 2G will be procured. Strengthening of internet band width and security Hydromet services of IMD. Division will be Up graded. Climatogical data rescue system will be established. Automated wet only precipitation chemistry samplers will be procured at 10 GAW stations. Printing Unit at Pune will be Augmented. Base line GHGs Monitoring and Regional Grab Sampling Monitoring of GHGs will be established. Establishment of Surface ozone network. Automatic wet only collectors, Chemistry Lab Equipments, UV-VIS spectrophotometer and High Volume Air Samplers (4) will be procured for air pollution study. UV radiation network and Aerosol Monitoring Network concentration at surface level. will be established. Manufacturing capabilities of Surface Met. Instruments in Workshop at	2009-2010	--

				Pune will be modernized. Up-gradation of test and calibration facility of airport met. Instruments. Digital Station Barometers for observatories will be procured. 50 ships recruited under "Voluntary Observing Fleet (VOF)" will be equipped with AWS. E-learning Scheme at Training Centres will be introduced. Two Nos. indigenous DWR's at Bhuj & Kochi will be installed and commissioned. 20 Nos. Electrolysers will be Procured and installed at RS/RW stations. Continuation of imparting of training under WMO Programme.		
3	Aviation Meteorology	To improve weather service for aviation by up-grading airport Met. Instruments with state-of-art technology to render aviation services at par with world standard aviation services.	27.00	Integrated Decision Support System (IDSS) will be set up. Aviation Meteorology Research Centre will be established.	2009-2010	--
4	Agromet Advisory Services	Agromet. Services in India are to be modernized. Agromet. Unit at Pune also to be modernized. Grant-in-Aid to Research institutes/universities working on Agromet Advisory Services to farmers will continue.	19.52	1st and 2nd floor of Agrimet Building will be renovated. Instruments will be procured for Agromet Advisory Services. CAgMO, Pune will be modernized. Grant-in-Aid to Research institutes/universities working on Agromet Advisory Services to farmers.	2009-2010	--
5	Seismic Hazard and Risk Evaluation	Improve seismic monitoring capabilities; Archival of old analog charts; Improve operational and training facilities in Seismology Division. Establishment of local earthquake Monitoring System, National Centre for Earthquake information and augmentation of existing local network & system for Micro Earthquake (MEQ) monitoring system. Continuation of routine activities of Earthquake Risk Evaluation Center such as Seismic Microzonation of NCT	82.57	Addition of 40 seismic monitoring stations; Raster scanning and vector digitization of seismic analog charts; Develop software for improving operations. Create infrastructure for setting up an operational centre and training centre at Ayanagar. Network and its augmentation by adding nine more field stations and replacement of Data Acquisition System (DAS) and communication equipment of existing 16 field stations. National Centre for Earthquake Information	2009-2010	--

		Delhi on 1:10000 scale and awareness programme		(NCEI) and Portable Micro Earthquake (MEQ) monitoring system will be established. VSAT based seismic equipment for telemetry network for NE India will be procured and installed. Seismic Microzonation of NCT Delhi on 1:10000 scale will be completed.		
6	W B Aided Project on Hydrology Phase-II	W.B. Aided Hydrology Project – Phase-II will be implemented in coordination with Center Water Commission, Ministry of Water Resources .	2.89	W.B. Aided Hydrology Project – Phase-II will be implemented in coordination with Center Water Commission, Ministry of Water Resources	2009-2010	--
7	Mod of IMD Weather Services	Weather services of India will be Modernized by inducting new advance technology equipments. In the process High Performance Computing System at IMD, Automatic Weather Stations (AWS), Automatic Raingauges (ARGs) and New Integrated and Automated Systems at Airports are to be procured and installed. 12 No. DWRs, 5 GPs radiosonde systems also to be installed. Lighening detection systems (10 Nos) are to be procured and installed. National Weather Radar Operation Centre (NWROC) at New Delhi to be established.	416.36	Approved for placing supply order has been issued. New Integrated and automated systems for 20 Airports to be procured. 550 Nos. Automated Weather Stations (AWS) and 1350 Nos. of Automatic Raingauges (ARG's) will be Procured for installtion. 12 Nos Doppler Weather Radars (DWRs) will be procured for installation. C-Band Polarized DWR will be procured at Delhi and at Jaipur for Common Wealth Games. National Weather Radar Operation Centre (NWROC) will be established at New Delhi. Forecasting System in IMD through MFI will be commissioned. Civil works in connection construction of office building will be done.	2009-2010	--
26	Common Wealth Games	To provide venue specific real time weather information and to provide venue/ event specific weather forecasts in medium, short and now cast range	40.70	C-band Radar, AWS and Wind profilers will be procured and installed. GSM and Satellite based Automatic Weather Stations for Commonwealth Games-2010 at New Delhi will be established.	2009-2010	--
27	Dedicated Weather Channel	To meet round the clock requirement of authentic weather & climate information to public. To provide detailed customized meteorological	20.32	Launch of Weather Channel in May 2009.	2009-2010	--

		products to various sectors. To promote research and applications in meteorology. To create public awareness about weather/ climate phenomenon and science of forecasting.				
28	Indian Institute of Tropical Meteorology (IITM).	•		•		
1.	Short Term Climate Prediction	• Dynamical Prediction System of Seasonal Mean Monsoon Rainfall • Extended Range Prediction of the Active and Break Spell of Monsoon • Studies of Interaction between Clouds and Environment, and Formation of Precipitation • Urban Air Pollution, Chemical Transport Modeling and Middle Atmosphere Dynamics • Manpower Development	21.40 Approved by EFC	• Development of a System for Seasonal Prediction of Monsoon • Development of a System for Extended Range Prediction of Active/Break Spell • Studies of Interaction between Clouds and Environment • Studies of Thunderstorm Dynamics and Prediction including Role of Boundary Layer Fluxes, Electrical Forces etc. • Urban Air Pollution, Chemical Transport Modeling and Middle Atmosphere Dynamics	-	-
2.	High Performance Computer and Infrastructure Development	• Completion of the site preparation such as specially constructed building with generator, UPS, Air Conditioning, etc., installation of the High Performance Computer and putting it in use and running the modelling applications on the system.	1.46 Approved by SFC	• Use for the modelling and observational studies in order to improve monsoon and climate prediction. • Data archival	-	-
3.	Cloud Aerosol Interaction and Precipitation	• Study the role of aerosols in rainfall processes. • Understand the microphysical changes in the cloud after seeding. • Quantify the increase in rainfall after	20.00 Approved by EFC	• Understand cloud-aerosol interactions and the potential of rain enhancement by seeding the clouds.	-	-

	Enhancement Experiment (CAIPEEX)	seeding. • Develop optimum strategy for the cloud seeding as a guidance tool to operational programmes by the state governments				
4.	Climate Variability and Dynamics	• Monsoon Variability and Predictability • Short-Term Climate Diagnostics and Applications • Rainfall Variability, Hydrological Modeling and Satellite Data Applications • Aerosol and Climate Studies	30.00	• Understand and predict the Indian monsoon rainfall (IMR) variability on different time scales and its connection with low-frequency phenomena. • Understand causes of the variability of monsoon rainfall over the Asian domain using coupled ocean-atmosphere modeling and other diagnostic tools. • Continue to develop climate forecast products tailored to suit the users' requirements and to demonstrate the utility of seasonal forecasts for the decision making in the areas of agriculture, water resources, etc. • Develop objective analysis schemes for mesoscale systems over oceanic area using satellite derived fields. • Develop infrastructure.	-	-
29	Numerical Modeling of Weather and Climate	Implementation of the UKMO end-to-end Global NWP system. T254/L64 based Global Forecasting System Development of Multi-Model Ensemble (MME) approach for forecasting rainfall in the medium range scale Development of NCMRWF-INM 4DVAR Ocean Data Assimilation System Fog forecasting system		Trial runs with the UKMO NWP system by the end of the year Optimum utilization of all satellite and other conventional data Assimilation of SSH and SST in the Global		

		Climate monitoring /modeling system uth Asian Regional Reanalysis project to understand the science climate variability and change over South Asia Setting up of Dynamical Dust Prediction system ing up of Trajectory models for emergency response		Ocean 4D Var Data Assimilation system and verification with independent data from buoys. Development of statistical-dynamical models for prediction of fog occurrence at various airports of India. Real-time monitoring of global SST, MJO etc. Implementation of dynamical downscaling system Studies on data availability for regional reanalysis		
30	Centre for Climate Change Research including Program on Global and regional Climate Change	To make ground preparation for the Centre at IITM. Develop national assessment and response capabilities with skills in different areas of climate change, to build a strong science base and to synergize the research efforts on climate change by networking the national Institutions. Launching of the Centre for Climate Change Research (CCCR).	60.00	• Develop a coupled modelling system for Climate Change Scenarios. • Incorporate extensive field campaign observations to improve model physics. • Generate an ensemble of high-resolution regional climate change scenarios using RCMs. • Assess the Climate Change Impacts on Indian Monsoon climate; India's water resources, agriculture etc and develop a Climate Change Data Archive and Retrieval system. •	-	-
31	R& D in Earth and Atmospheric Sciences	To carry out basic research activities in the field of ocean and atmospheric		• Apart from continuing the above activities, the major thrust will be on the extra mural funding support during the year 2009-10.		
32	Multi-hazards Early Warning Support			• Interfacing Lead-Time Spatial Impact Assessment with Early Warning • Demonstration Project for an Adaptable Cyclone Hazard Mitigation Framework • Content Enrichment on the Web GIS		

	System			PORTAL (to be linked either to IMD/ INCOIS/MoES Web Servers after the application is developed) • Development of Local Scale Multi-Hazard Assessment Tools		
33	NIOT extension Centre	To establish an ocean technology centre in the west Bengal				
34	Seismicity Programme , And National programme on Earthquake Precursors	Support to ongoing projects To study the continuation of structures beneath the ocean. Geotechnical studies in some selected cities namely Lucknow, Kolkata, Chennai etc. Geological and geophysical investigations in Kachch region Initiation of Systematic precursory studies in the country. V-SAT connectivity to selected permanent GPS stations and seismological observatories set up under the DST/ MoES projects.	11.00 (Seismicity Programme) + 58.60 (Earthquake Precursory Studies)	About 60 projects are to be supported. preparation of liquefaction map Depth and extent of active faults Setting-up of multi-parametric observatories will be initiated 4-5 GPS stations to be established.		

		Continuation of support to the projects related to site response studies, soil dynamics, active faults and crustal deformation studies in Himalayan region. Setting up of few permanent GPS stations along with Met packages at selected locations of the country. Continuation of support for earthquake awareness and education programme.				

Chapter III: Major Policy Initiatives

1. Operationalization of Earth Commission:

The Earth Commission was constituted by Hon'ble Prime Minister after the approval of Cabinet in the pattern of Space Commission and Atomic Energy Commission. Earth System Council [ESO] has also been constituted by Hon'ble Minister of Earth Sciences as per the decision of the Cabinet. The Earth Commission does not enjoy financial and administrative power since this specific point not included in advertently on the decision para while taking cabinet approval. However, the matter was adequately reflected in the Cabinet Note in text as per the decision of Committee of Secretaries meeting. Therefore, in order to make the Earth Commission effective in the implementation of various programmes, this matter needs to be approved immediately. The Cabinet Note in this regard has already been submitted to Cabinet Secretariat.

2. National Meteorological Policy:

There is a need to formulate National Meterorological Policy addressing atmospheric and ocean science which would be guiding principles for implementation of various research programmes in the area of atmospheric science, ocean science & related climate research. The output from these research programmes would be the input of weather advisory services, etc.

3. National Centre for Medium Range Weather Forecasting [NCMRWF]:

So far, some of the major programmes are continuing for a longer period of time, however, they are working like a institution. In order to provide permanent status to these programmes, there is need for institutionalization of these programmes and so this could perform in much focused and better way.

4. Career of higher level:

Urgent need to introduce various levels of scientific and technical manpower for strengthening existing skeleton structure of MoES specially by creating higher level of positions like Outstanding Scientist and Distinguished Scientist both at Ministry as well as the institutions under the Ministry for steering the research in the frontline areas and mentoring of younger scientists as a part of merit-based FCS, which is prevalent in Department of Space, Atomic Energy and CSIR.

Chapter IV: Review of the Past Performance

The progress achieved in respect of various projects undertaken by the Ministry of Earth Sciences during the financial year 2008-09 upto December 2008.

4.1 Polar Science :

- Launching of the XXVII Indian Scientific Expedition to Antarctica.
- The smooth functioning of the day-to-day activities of the Centre, including its various technical and non-technical sections/divisions, augmenting the existing facilities, both in terms of infrastructure and human resources, and introduction of ISO-quality management system.
- Action has been initiated towards refurbishing the Phase I administrative block rooms in an open-frame modular pattern so as to provide for sitting space for more number of persons with minimum wastage.
- The Government of Goa has already been approached for acquiring of additional land through them to provide for residential accommodation, Guest House and project offices.
- Continuation of In-House research programmmes at NCAOR in the realms of Ice core studies, Paleoclimatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography. A gist of the same is provided below:

★ Ice-Core Studies and Paleoclimatology: Ice core Drilling and Archival, Processing and analysis of the ice core samples collected

★ Polar Remote Sensing: Processing of data collected during the 26th Indian Scientific Expedition to Antarctica; Analysis of the results; Initiation of the research project under the IPY Project.

★ Polar Biology: Abundance, taxonomic and functional diversity of bacteria isolated from varied ecological niches in Antarctica (Schrimacher oasis and Larsemann hills)- Lake water, Sea water, Soil and Ice: (i) Estimation of retrievable bacteria as colony forming units, Isolation, Purification and preliminary identification from lake water samples from Larsemann hills and southern ocean sediment cores; (2) Standardization of DNA extraction procedures and 16SrRNA gene amplification from bacterial isolates from lake water samples; (3) Estimation of retrievable bacteria as colony forming units, Isolation, Purification and preliminary identification from sea water & soil samples from Schrimacher oasis and Larsemann hills; (4) Assessment of taxonomic diversity of bacteria retrieved from ice core and water samples through conventional and molecular methods; and (5) Molecular identification of bacteria isolated from ice core, water and sediment through molecular methods like 16SrRNA and Fluorescence *In situ* Hybridization.

★ Initiation of the IPY Project – Land Based Anthropogenic Impact on Antarctic Coast due to Coarse Particles, and Analysis of Antarctic Samples.

★ Bathymetric surveys and sub-bottom profiling of select deep lakes in the Schirmacher

★ Paleoclimatological studies on sediment cores to be retrieved from Antarctic lakes in the Schirmacher Oasis and the Larsemann Hills

Southern Ocean Studies

- Completion of analytical work of data collected during the last Expedition to the Southern Ocean
- Mounting a cruise in the tropical Indian Ocean as a linkage to the Southern Ocean studies
- Planning and mounting the Third Expedition to the Southern Ocean (January 2009).

Third Permanent Station:

- Finalisation of DPR as a prelude to the EFC
- Obtaining the mandatory approvals from the various Ministries

Continuation of baseline data collection

4.2 Polymetallic Nodule Programme

Survey & Exploration :

- Detailed chemical analysis, interpretation of the collected samples.
- Processing of the open reel tapes containing hydrosweep data for digitization and generation of maps at different scales.

Environmental Impact Assessment studies:

- Compilation of environmental database
- Continuation of monitoring of the environmental parameters
- Sediment plume dispersal – predictive model updating and related studies
- Evaluation of environmental variability in the nodule areas.
- Assessment of nodule associated fauna and other environmental parameters.

Technology Development(Mining):

* Collector and Crusher Development
* Artificial Nodule lying with Hopper
* Crawler subsystem development
* Testing and validation of collector crusher system

Technology Development (Extractive Metallurgy)

THE PROCUREMENT OF COMPONENTS AND FABRICATION IS IN PROGRESS. CRUSHER SYSTEM IS UNDER TESTING AND THE REALIZATION OF COLLECTOR IS UNDER PROGRESS

Development of upgraded version of soil tester

PRELIMINARY DESIGN AND DRAWING FOR THE NEW SOIL TESTER COMPLETED
MANPOWER IS AWAITED

Inter-institutional R & D for developing technologies for mining poly-metallic nodules.
Establishment of a corrosion and material test facility at niot campus
THE DEVELOPMENT WORKS ON SUB SEA DRIVES IS UNDER PROGRESS.
STUDY ON MATERIALS IS INITIATED

4.3 Ocean Observation and Information Services

D. Research and Modelling (INDOMOD, SATCORE, R&D PROJECTS)

Ocean Modelling and Data Assimilation

- Experimental generation of SST, Currents, MLD, Thermocline with models and observations (Quikscat, Altimeter and Argo) up to 2 days
- 10 days forecast ocean parameters viz. temperature, salinity, currents and sea surface height using the UK Met Office forecast products
- Seasonal forecast of SZST using MOM will be continued

INDOMOD

- Support the activities envisaged under various modules Viz. Ocean and climate, coastal ocean, hazard weather event and validation of ocean models by the participating agencies.

SATCORE

- Setting up of automatic processing chain for Generation of daily products of MODIS Chl-a, MODIS SST, Turbidity (Kd490), NOAA SST, IRS P4, OCM Chl-a.

- Conduct In-Situ measurement campaigns in collaboration with various academia and institutions
- Initiate Time Series measurements of in-situ parameters at least 4 coastal locations
- R&D for retrieval of geo-physical parameters from radiometers, scatterometers, altimeters & radar instruments and to develop regional algorithms for better retrieval accuracies in the Indian seas.
- Coral reef and health monitoring
- Red tide (algal bloom) detection and monitoring
- Chlorophyll mapping for the Indian Ocean under the CHLOROGIN initiative

R&D Projects

- Support the R & D projects

E. Observation Networks (Argo, XBT, Drifters, Gliders, Current Meter Arrays & Reference System)

- Deploy 50 Argo floats,
- Observation using glider in Bay of Bengal during cyclone
- Deployment of 30 drifting buoys,
- Carryout XBT Observations along the 4 shipping lines
- Mooring in Bay of Bengal
- AWS installation in 10 ships
- Bay of Bengal observatory, cruise

F. INCOIS-Infrastructure development; Operations and Maintenance

- Residential, Guest House and Hostel Accommodation
- Acquisition of Adjacent Land
- Administration, Finance & Accounts, Stores and Purchase

4.4 Marine Research & Technology Development

4.4.1 Assessment of Marine Living Resources and FORV

- Atlas on the distributional pattern of Marine Mammals on the Indian EEZ – Released in August 2007
- Atlas on Zooplankton distribution in Indian EEZ- by November 2007
- Atlas on Seasonal Climatology and Productive Patterns in the Indian EEZ – January 2008
- Southern Ocean MLR Survey (IPY 2008) - January- February 2008
- Database on Marine Benthos of Shelf Area - March 2008

(i) Release of CD-ROM on Marine Mammals in the Indian EEZ :- CD-ROM on the distribution, seasonal abundance and migratory routes of marine mammals was released to the Press by Hon'ble Minister for Science & Technology, Shri Kapil Sibal in April 2008. Along the Indian coast areas off Vizakhapatnam, off Trivandrum and the Kochi – Calicut sector have been identified for promotion of benign eco-tourism on marine mammal watching.

(ii) Monitoring and Surveillance of HAB : Harmful Algal blooms of Indian EEZ were monitored. Oceanic blooms was detected off Kochi in the 3rd week of August, 08 (Noccliluca sp.) off Goa in the first week of October, 08 (Nocliluca sp.), off Mangalore during the second week of October, 08 (Gonyaulax sp.) and in the Gulf of Mannar during the second week of October 08 (Green Nocliluca) . Major field experiment to understand the

bloom formation, spread and crash and its impacts on the biogeochemical cycling is planned to be carried out off Gujarat coast during February-March 2008.

(iii) Training on Acoustic techniques for fish and plankton biomass estimations: On week training was provided in September, 2008 to scientists from various National laboratories on the effective use of echosounders for biomass determination of fish planktons, by a team of foreign and Indian experts in the field.

(iv) Seasonal climatological atlas of Indian EEZ : Using the data collected through FORV Sagar Sampada for the past 10 years, an atlas was prepared which provides details on the seasonal attributes of the physical, chemical and biological parameters of Indian EEZ from surface to 1000 meter depths. The atlas was released in September, 2008 by Secretary, MoES.

(v) Southern Ocean MLR : Attended the Meeting of the Commission for Conservation of Antarctic Marine Living Resources (CCAMLR) at Hobart, Australia in the last week of October. The MLR team will be participating in the Southern Ocean cruise scheduled during January – February, 2009. Studies on benthic diversity, fish eggs and larval distribution and plankton diversity will be carried out.

4.4.2 Drugs from Sea

- Continued wide-spectrum bio-evaluation of marine samples.
- All the new Centres have commenced their project activities by recruiting the project staff.
- As per the guidelines of Ministry of Finance, the Ministry has constituted an Independent Expert Committee (IEC) under "Drug from the sea" programme under the Chairmanship of Prof. Samir Bhattacharya, Former Director, IICB, Kolkata. The IEC met six times at different participating Centres, discussed thoroughly with all the core project staff and made strong recommendation for continuous implementation of the programme.
- Commencement of In-House research activities at ICMAM-PD, Chennai for bio-evaluation of samples of marine microbes and at CMLRE, Kochi for macro organisms collected through the FORV-Sagar Sampada cruises.

Initiation of action for bar-coding of macro-organisms at CMLRE, Kochi and microbes at ICMAM-PD, Chennai

4.4.3 Marine Research and Capacity Building:

Creation of Centre of Excellence in key identified areas like atmospheric science, drugs from sea, etc
The ongoing projects under the 9 OASTCs and the CoE will continue to receive financial assistance
The ongoing projects under Manpower programme will also receive financial assistance
About 20 new projects under OASTCs and 6 new projects under Manpower programme are expected to be approved during this year
Academic assistance to be granted under Marine Manpower Development programme for students of a new M. Sc/M.Tech programmes

4.4.4 Coastal Ocean monitoring and Prediction System

Continuation of monitoring of marine pollution at 76 locations and consolidation of results to identify the trends of pollution

- Continuation of development of GIS based information system for 5 locations and database for 20 locations
- Initiation of field investigations at Chennai, Dahanu and Marmagao for development of site specific oil spill model

4.4.5 Awareness and Publicity (Exhibitions, Fairs, Seminars/Symposia)

- About 60 Seminars/Symposia etc have been supported.
- Earth Day on 22nd April 2008 and Foundation Day on 27th 2008 July were celebrated.
- Two National Awards for (i) Ocean Science and Technology and (ii) Atmospheric Science and Technology were awarded.
- About Scientist were Awarded for their scientific contribution.
- Contributed for Scientific magazines for increasing the students in OAST subject and quiz also organized.

- Rural exhibition and farmer awareness programme by M/s. Centre for Agriculture and Rural Development, New Delhi at Uttar Pradesh 72 district from, Agra, Jhansi, Kanpur, Allhabad, Varanasi, Faizabad, Meerut
- Earth Day, New Delhi on 22nd April.
- National Science Centre, New Delhi between the December 2007 and January 2008.
- National Science Museum, Kolkata

4.4.6 Integrated Coastal and Marine Area Management

- Collection of second set of field data required for development of models that predict the vulnerability of the coastline due to erosion, at Muthalapozhi / Vadanapally (Kerala) and Uliargrili Padukere (Karnataka)

- Initiation of collection of first set of field data required for development of models that predict the vulnerability of the coastline due to erosion at Gopalpur

- Initiation of experiments for determination of safe seawater quality criteria for Arsenic, chromium, Zinc and Lead in animals/plankton

- Continuation of field investigations required for development of ecosystem modeling for Chilka. Development of model co-efficients continued in Kochi backwaters. Initiation of preliminary investigation for site selection to conduct modeling activities in Sunderbans

- Initiation of development of finite element storm surge model.

4.4.7 Continuation of work on Cobalt Crust

1) Undertaking of three cruises
2) 75 dredging operations carried out for sampling
3) Initia sampling in Lakshadweep Sea and Laxmi Basin Seamounts
4) F-Mn crusts samples with variable oxide layer (from thin coating up to 7 CM) were recovered
5) Cobalt content ranges from 0.3% to 0.9% with an average of 0.6% and Platinum content from few ppb up to 1000 ppb considerable enrichment of Cerium (from 0.2% to 0.4%) is notable
6) First multibeam bathymetry map of the northern part of the Afanasiy-Nikitin Seamounts (10000 sq km)
i) Reconstruct Calcium Carbonate fluctuations during Quarternary
ii) Understand Paleaoceanographic charges during late quarternary period using benthic and plankonic foram techniques
iii) Understand link between climate change and weathering intensity in Himalayas and
iv) To generate high resolution climate change markers in the late quarternary

4.4.8 Ocean Science and Technology for Islands

Open Sea Aquaculture: Mudcrab fattening will be demonstrated jointly with CMFRI in the backwaters of Cochin following the request from the coastal communities of Kerala

- In collaboration with RGCA under MPEDA, sea bass culture will be carried out in open sea cages.
- Cobia fish weighing 55 and 63 g were demonstrated to grow upto 510 and 650 g, respectively, within 110days

b. Marine biotechnology and Deep Sea Biology: Coastal and offshore water samples were collected and screened for microalgae. Presently, 32 species are being explored for biolipid and biochemicals production.

C. ISLAND RESOURCE INFORMATION SYSTEM: A DIGITAL ELEVATION AND LAND USE / LAND COVER MODEL FOR NEIL ISLAND HAS BEEN PREPARED BY FOLLOWING STANDARD METHODOLOGIES USING ARC GIS DESKTOP SOFTWARE

- Digital Elevation Model (DEM) was also created for the Passage islands (Part of South Andaman islands) using toposheets (SOI) at 10 m contour interval.

d. Marine Bioinformatics: Primer database created for six marine microbes with a data of about 300 primers.

e. Materials for marine applications and antibiofouling measures: Biofouling studies on board CRV Sagar Purvi was conducted off chennai coast to study the biofilm formation on 15 different substrates including metals, synthetic polymers and wood.

4.5 National Institute of Ocean Technology

Energy and Fresh Water

- A waste heat recovery desalination plant is being set-up in North Chennai Thermal Power Station.
- The plant components and the structures have been erected. The commissioning of the plant would be in second quarter.

Development of Technologies for Offshore Structural Components

- Studies on FRP and Syntactic foam to verify its suitability for cold water pipe is under progress
- Several Tests were carried out on Syntactic foam in various forms like 100% parent material, a sandwich of Syntactic foam between GRP sheets, etc.
- The procurement of the suction pump and the design of the suction pile are under progress.

Technical Criteria Atlas

- Bathymetry has been prepared from secondary data like ETOPO2, CMap, and Coastal Extractor etc.
- Secondary data like 6 hourly global winds, sea level pressures, water surface elevations etc are being collected, reformatted to be used in the models and are being analyzed.
- Wave model calibration is under progress. Different domains (Bay of Bengal, Arabian Sea, North Indian Ocean, and Indian Ocean etc) are being tested for the sensitivity of boundary and mesh resolution. Results are being compared with NDBP data.
- Hydrodynamic model setup for tide and storm surge is under progress. Domain size, mesh resolution, boundary locations, etc are being finalized.

Development of Ocean Acoustics

- The automated noise measurement system has been developed successfully deployed and retrieved. Time series ambient noise measurements have been obtained for 2 weeks in the pilot phase.
- The NABL Re-accredited Acoustic Test Facility for Underwater Acoustics Test and Calibration as per ISO / IEC 17025: 2005 in the field of Electrical Testing. The certification is valid till August 2010.
- The projects have been approved by the Director, NIOT and the Chairman, Governing Council. The grants for the first year have been released in the month of June, 2008 by NIOT and the projects have commenced.
- Development of sub surface system has been carried out on trial basis. Improvement and development of more number of systems is being taken up.

Development of vector hydrophone in collaboration with M/s.Keltron has been taken up and interaction with M/s.Keltron has been initiated already.

Marine Sensors and Electronics

- Establishing shock and vibration and Environmental testing facility has been initiated
- Review of similar facilities in other Institutes & laboratories is in progress as suggested by the INRC of NIOT
- Dry test has been completed. Fabrication of pressure compensated casing is in progress. Field testing is scheduled in Nov 2008.
- Review of literature for Buried Object Scanning Sonar (BOSS) has been completed
- Preparation of Project Definition Document for BOSS system is in progress
- Study of the existing Sub-bottom profiler has been undertaken as precursor to BOSS as per the suggestion of INRC, NIOT

4.6 Coastal Research Vessels (CRV) & Other Research Vessel

- Providing ships for scientific community for various research activities: Utilization of ships appx. 320 days in a year

4.7 Delineation of Outer Limits of Continental Shelf

- Preparation and submission of the final document of India's extended shelf claims including:
  - Finalization of the raw, processed and interpreted database
  - Generation of all cartographic products In both analog and digital versions
  - Finalisation of the Executive Summary, Main Body and the Supporting Documents
  - Lodging of the country's formal submission

- Creation of a Marine Geo-database at NCAOR:
  - Finalised the tender and awarded the the task to M/s. Tata Consultancy Services for undertaking the development of Marine Geophysical Database at NCAOR.
  - Establishing the Marine Geophysical Database at NCAOR.

- Myanmar continental Shelf programme:
  - Completion of the data processing, interpretation and documentation at NCAOR, Goa and NGRI, Hyderabad simultaneously in concert with the scientists and technicians from Myanmar.
  - Handing over of the technical documents of the processing and interpretation work carried out to the Myanmar Government.

4.8 Comprehensive Systematic Bathy metric Survey of EEZ

- Continuation of Bathymetric survey beyond 500 m. water depth off Andaman & Nicobar Islands and Lakshadweep islands using the chartered vessel.
- Continuation of shallow water surveys off Marmugao and South Chennai.
- Processing and interpretation of the collected data

4.9 Gas Hydrates

DEVELOPMENT OF SUPPORT SUBMERSIBLE SS2500 (10TH PLAN CONTINUING): LAND BASED TRIALS HAVE BEEN COMPLETED. DEPLOYMENT OF AT GH SITE SCHEDULED FOR MAR 09. SURVEY AT PMN SITE IS PROPOSED IN DEC 08.
DEVELOPMENT OF AUTONOMOUS CORING SYSTEM: DESIGN REVIEW OF ACS COMPLETED. FABRICATION OF ACS HAS STARTED AND NIOT PERSONNEL HAVE BEEN DEPUTED IN BATCHES. ASSEMBLY, INTEGRATION & TESTING AT JOINT PARTNER'S SITE WILL BE COMPLETED BY DEC 08

4.10 Acquisition of New Research Vessel

- The ship was dedicated to the Nation on 3rd March '2008 and made operational for various cruises.

4.11 Early Warning System for Mitigation of Oceanogenic Disasters: Tsunami and Storm Surges in Indian Ocean

Deployment and Maintenance of Tsunami buoy network in Bay of Bengal - 2 Nos. (Till October 2008

- Sustain the tsunami Early Warning Centre activities
- Sustain Observational network
- Sustain Communication systems and switch over to INSAT Communication
- Modelling activities: Completion of other scenarios, coastal inundation and vulnerability maps
- Improve & Maintain Active Dissemination Chain
- Web application Operationalisation
- Serving as the Indain Ocean Regional Tsunami Warning Centre
- R&D in Tectonics, Paleo Tsunami Studies and Modelling
- Periodic Rehearsals

- Capacity Building & Awareness

4.12 Data Buoy Programme

- Assembly and integration of 35 nos. of data buoys of Wave/Met/Environmental type buoys have been completed till October 2008. 11 nos. of data buoys deployed in Arabian Sea in April-May 2008.
- 14 nos. of data buoys deployed in Bay of Bengal in July & October 2008.
- Real time data reception at INCOIS achieved through INSAT
- The wave forecasting model developed in collaboration with IIT Mumbai is being tested in real time at SW2 site and the results are good.

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4.13 Information Technology

Automation of the ministry's work.

4.14 Indian National Centre for Ocean Information Services

A. Coastal and Ocean Advisory Services (PFZ, OSF, VAS)

Potential Fishing Zone Mission

- Sustain the PFZ Advisory Service
- Sustain the Validation Projects
- Operationalisation of Integrated PFZ Forecast with Wind Parameter (After know-how knowledge from R&D of SAC)
- Survey/studies on sustainability of fisheries
- Procurement and Installation of 50 new Electronic Display Boards (EDB's) -2nd Phase
- Conducting User Awareness Programmes and User Interaction workshops in Kerala (April 2008), Maharashtra (June 2008), in Karnataka (October 2008), in Tamilnadu (November 2008), in Andhra Pradesh (December 2008), in Andaman Islands (January 2009), Orissa (February 2009)
- Establishment of Information Kiosks with the coordination of local authorities, NGO's, etc.
- Interactions with ISRO for establishing expert nodes for fisheries.

Ocean State Forecast

Open Ocean Forecast:

- Sustaining the generation and dissemination of general open ocean forecast (1.5°x1.5°) for Arabian Sea, Bay of Bengal and Indian Ocean.
- High resolution wave forecast (0.5°x0.5°) for the Bay of Bengal, Arabian Sea and the Indian Ocean.
- Extension of forecast up to 60 S.

Validation: Efforts for validation of satellite measured wave data using in-situ observations Spatial validation for site specific forecast Quality control procedures. Near real time validation.

User Interaction: Improve the collaboration with NGO's and other agencies for forecast utilization, Awareness campaign on Ocean State information system for port and harbors, shipping and oil industry.

Dissemination: Dissemination through Ocean Information system to local government and private industry through fax and email, delivery to offshore and through more village information centers.

Ocean Now-Cast: Dissemination of present sea state using data from satellite and in-situ platforms.

Value-added Products: Consultation job in providing data to ports, oil industry and power industry.

Coastal Forecast: Pilot experiments for coastal wave and wind forecast for Tamilnadu coast, Model setup for port and harbor areas, Oil spill trajectory and Information system, Feed back Collection, Initiation of R&D for other coastal parameters (sediment transport, Oil spills), Inter-comparison of forecasted wind product.

Extending the coastal forecast to Gujarat, Maharastra and Vishakapatnam coasts.

Global Wave Forecast: Experimentation with Wave Watch (WW III) for providing global wave forecast

Value - added Services and consultancy Services: INCOIS plans to take up value added services and consultancy services for the coastal and offshore applications. With the vast amount of in-situ and remote sensing data from available at INCOIS, Ocean models could be fruitfully utilized to undertake need based user projects for coastal and offshore applications

C. Computational Facility (High Performance Computing System, Ocean Portal)

Computational Facility

- Procurement and installation of HPC
- Integrated Office Automation Software
- Development and Maintenance of INCOIS Website & Ocean Portal (includes upgradation / procurement of web server s/w, web tools, mirror server, mirror site, etc)
- Maintenance of MS Exchange Server, Intranet (both hardware & software) and FTP Server
- Maintenance of computer hardware
- Maintenance of system software, commercial software packages, image processing software, GIS software, Tivoli software, etc.
- Maintenance of network components and peripherals
- Maintenance of Satellite Data Acquisition and Processing System
- (including hardware, software, storage server, etc)
- Operation and maintenance of Electrical, Civil, AC, DG, UPS, BMS, etc
- Electric Power, O&M, Consultancy, spares & consumables, diesel, water, etc

Ocean Information Bank

- Operations and maintenance of the data reception systems
- Establish real-time data reception system for Oceansat-2
- Data Assembly
- Meta data base generation and web-publishing
- Quality Control of in-situ data
- Generation of Centralized Database.
- Networking of Marine Data Centres
- Initiate Data Warehouse and Data Mining Concepts
- Software development for Data Delivery, Visualization and Transfer
- Data format conversions

Generation of data products and dissemination as per the user requirements

4.15National Centre for Antarctic and Ocean Research (NCAOR)

• Continuation of In-House research programmmes at NCAOR in the realms of Ice core studies, Paleoclimatology, Polar Environment & Ecology, Sea ice-atmosphere interaction and modeling, Polar Remote Sensing, Biological studies and Southern Ocean Oceanography. A gist of the same is provided below:

Ice-Core Studies and Paleoclimatology: Ice core Drilling and Archival, Processing and analysis of the ice core samples collected

Polar Remote Sensing: Processing of data collected during the 26th Indian Scientific Expedition to Antarctica; Analysis of the results

Polar Biology: Abundance, taxonomic and functional diversity of bacteria isolated from varied ecological niches in Antarctica (Schrimacher oasis and Larsemann hills)- Lake water, Sea water, Soil and Ice: (i) Estimation of retrievable bacteria as colony forming units, Isolation, Purification and preliminary identification from lake water samples from Larsemann hills and southern ocean sediment cores; (2) Standardization of DNA extraction procedures and 16SrRNA gene amplification from bacterial isolates from lake water samples; (3) Estimation of retrievable bacteria as colony forming units, Isolation, Purification and preliminary identification from sea water & soil samples from Schrimacher oasis and Larsemann hills; (4) Assessment of taxonomic diversity of bacteria retrieved from ice core and water samples through conventional and molecular methods; and (5) Molecular identification of bacteria isolated from ice core, water and sediment through molecular methods like 16SrRNA and Fluorescence In situ Hybridization.

4.16Sea Front Facilities:

Acquisition of Land is under progress

4.17Development of Manned Submersible

THE TECHNICAL EVALUATION COMMITTEE FINALLY SUBMITTED ITS REPORT TO NIOT, CHENNAI FINANCIAL BID OPENING & PRICE NEGOTIATION TO BE CARRIED OUT BY NIOT, CHENNAI FOR THE SUCCESSFUL BIDDER.

4.18Installation of MCS System

The specification have been finalised. The proposal would be submitted by NCAOR

4.1910 MLD Desalination Technology

Preliminary design has been carried out.
A steering committee has reviewed the preliminary designs

4.20Expedition to Arctic

- Initiation of exploratory scientific programmes in collaboration with other Arctic nations
- As a prelude to concretizing the scientific and logistics aspects of the Indian scientific endeavors in the Arctic during the year 2008-09, in March 2008, NCAOR sought scientific proposals at the national level for initiating scientific research at Ny-Alesund.
- The following projects have been identified for initiation at Ny-Alesund during 2008-09:
  Continuing programs
  - Study of Space weather effects on polar ionosphere
  - Measurements of atmospheric electrical parameters to understand global electric circuit
  - Snow-pack production of Carbon monoxide and its diurnal variability
  - Scientific investigations during the August 1, 2008 Total Solar Eclipse
  - Sedimentology and Geomorphology of the Ny-Alesund Region and its implication on Palaeoclimatic reconstruction.
  - Parameterisation of Glaciers in northern hemisphere to variations of climate – Inter annual and Intra annual

  New Programs
  - Changes in the quantity and quality of carbon pools in permafrost of Ny-Alesund
  - Multiproxy paleoclimatic studies on Quaternary deposits at Ny-Alesund
  - Carbon cycling in the nearshore environments of Kongsfjorden
  - Palaeoclimatic assessment of arctic Ocean using Diatom variability
  - Studies on hydrodynamics of the Kongsfjorden

- The summer studies of the above programs were carried out in a staggered manner during June –July and again during August-September 2008. The winter component of the studies is scheduled for initiation during March-April 2009.
- Data collection in respect of the above projects has been completed and completion of analytical work.

- A formal agreement was signed on the 27th June 2008 between the NCAOR and Kings Bay A.S., Norway, for taking on lease a station building at the International Arctic Research facilities at Ny-Alesund as the Indian Research Base in the Arctic. This station building with facilities for working and living space for a total of eight scientists has been christened "Himadri". The station building was inaugurated by H'ble Minister of Earth Sciences, Shri Kapil Sibal on the 1st July 2008.
- NCAOR signed an MoU with the Norwegian Polar Institute (NPI) for collaborative scientific endeavors in the fields of glaciology, microbiology, geology and atmospheric sciences. A Science Plan was drawn up and submitted to NySMAC for their endorsement.
- India was unanimously elected as a member of the Ny-Ålesund Science Managers Committee (NySMAC) at the 29th Meeting of NySMAC held at Brest, France on the 4th and 5th November 2008.

4.21 Vessel and other requirement for MLR

Preparation of project document for seeking approvals/clearance. Approach state government for acquisition of land.

4.22 National Oceanarium

Identification of location and preparation of project document for seeking approvals/clearance. Approach state government for acquisition of land.

4.23 Shore Protection measures through Pilot project

- First site chosen at Ennore Port, north of the northern breakwater
- Field data collection carried out for geophysical, geotechnical and oceanographic parameters completed
- Data analysis and Mathematical modeling in progress
- Desk study of secondary data for Ennore Creek completed

4.24 Integrated Ocean Drilling Programme

i. Initiation of action for Associate membership in IODP.

ii. Finalization of a science plan prioritizing the deep-sea drilling in the Bay of Bengal/Arabian Sea/western Andamans.

4.25 Ice Class Research Vessel

- Appointment of a consultant for finalization of the design specifications
- Planning the details of the onboard laboratories and sampling equipment

4.26 Infrastructure – Headquarter Building – Manpower Development

- Headquarter building construction is under construction.

4.27 India Meteorological Department

SPACE METEOROLOGY

- Installation/commissioning of ground segment for receiving and processing data from INSAT-3D commenced and will be completed during 2008-09.
- RFP for ground receiving and processing system from NOAA/MODIS/Metop satellies and 50 Nos GPS systems issued.
- 5 Nos. GPS based IPWV measure equipment installed at Delhi, Mumbai, Kolkata, Guwahati and Chennai.

AGROMET SERVICES

- District Level Forecast based on MME started from June 08.
- Grant-in-Aid to research institute / Universities working on Agromet Advisory Services to farmers will continue.
- .

SEISMOLOGY AND SEISMIC HAZARD &RISK EVALUATION.

- Spares for GSN equipments and Strong Motion Accelerographs shall be procured for smooth operation of the National network observatories.
- Five numbers of analog seismograph systems shall be procured from CSIO, Chandigarh for the maintenance of the national seismological network.
- As part of the project on "Archival and digitization of seismic analogue charts', supply order has been placed and work is likely to start soon. Renovation of Ridge observatory as part of this project has already been started.
- VSAT based Seismic Telemetry Network for NE-India is to be established.

- Ethernet LAN for EREC will be procured and installed.

OPERATION AND MAINTENANCE AND TRAINING.

- High Speed Data Terminals (64 kbps) links established at 25 stations 2 remaining.
- Interactive Voice Response Systems (IVRS) at 26 stations commissioned.
- VSAT established at 26 stations.
- Augmentation of Radiation Network of India to be completed.
- Digital standard barometers (100) and Dead weight tester (2 nos.) will be procured for use in observaories.
- Establishment of MPLs VPN Connectivity, Antivirus solution/LAN Security will be established.
- Procurement of unified threat management system (Network Security Solution for IMD) and Trend Micro neat suite premier antivirus solution is to be completed.
- High Speed Data Terminals (HSDT) 64 kbps at 6 IAF stations will be established.
- Archival of AWS data and On-line accessibility of analysed weather charts to be completed.
- Augmentation of printing unit at Pune to be completed.
- Replacement of old DCPs and establishment of earth station at Pune completed.

Radiation standard will be procured.

AVIATION MET.EOROLOGY

- Integrated AMIs at Mumbai and Delhi Airports installed and commissioned.
- Integration of IAAMS for new runway 29/11 at Delhi Airport.
- Aviation Met. Society formation is in process.
- Replenishment of sensors at Amritsar, Chennai and Guwahati Airports will be done.
- Transmissometers for six airports will be procured and installed, including Lucknow airport.

MODERNIZATION OF IMD

- Order for supply of HPC under modernization of IMD.
- Supply Order of 12 DWR placed. Design Review Completed. Construction of Buildings is under progress.
- Supply of 3 DWRs expected by Mar 09.
- RFP of C-Band Radar issued. Pre-bid meeting held.
- Design Review of AWS completed. Delivery to commence in Nov 08. Installation of 350 AWS by Mar 09.
- ARG's Design Review Completed. Delivery to commence in Nov 08. Installation of 900 AWS by Mar 09.
- Supply Order for procurement of 5 GPS Radiosonde placed. Design Review Completed. Training is in progress. Installation by Dec 08.
- Integrated Airport Met Instruments procured for 8 airports. Installation is in progress.
- RFP for 4 Nos Wind Profilers is under preparation and will be issued.

- Pre Bid Meeting for procurement of Lightening Detectors (10) held in Sep 08. Tender Opening on 21 Oct 08. Installation to be completed by Mar' 09.
- Transmissometers for Lucknow Airport will be procured and installed.
- Indigenous development of Radio Theodolite and GPS radiosonde along with ground system will be completed.

4.28 India Institute of Tropical Meteorology

Short Term Climate Prediction

Development of a System for Seasonal Prediction of Monsoon

- Forecast of All India Seasonal Monsoon Rainfall (AISMR) for the year 2008:

- The date of onset of Indian summer monsoon over Kerala for the year 2008 by using the information of the characteristic peak in weekly cumulative thunderstorm frequencies over selected stations of south peninsular India in the month of April was predicted as 26 May with model error ± 5 days. The onset actually occurred on 31 May (IMD).

Development of a System for Extended Range Prediction of Active/Break Spell

- Internal-feedbacks from monsoon-midlatitude interactions during droughts in the Indian summer monsoon..

- Eastward propagating MJO during Boreal Summer and Indian monsoon droughts: .

- Impact of the Indian Ocean Dipole on poleward propagation of Boreal Summer intraseasonal oscillation:

Studies of Interaction between Clouds and Environment

- Pre-monsoon to monsoon change in direction of vertical motions in the tropical lower troposphere from UHF radar observations:
-

Thunderstorm Dynamics and Prediction including Role of Boundary Layer Fluxes, Electrical Forces etc.

- Effect of electrical forces on distortion of polluted water drops:

- Boundary layer studies:
- Scavenging of ions and aerosols by snow at Antarctica:
-

Urban Air Pollution, Chemical Transport Modeling and Middle Atmosphere Dynamics

- Long-term trends in stratospheric temperature, ozone and Nitric Oxide: Model simulations:
- Seasonal distribution of ozone and its precursors over the tropical Indian region using regional chemistry-transport model:
-

Climate Variability and Dynamics

Monsoon variability and Predictability

- Asian monsoon variability and predictability:

- Long term trends of Indian summer monsoon rainfall and its relationship with synoptic systems over Bay of Bengal:
- Role of changes in local and remote SSTs in the formation and intensification of cyclonic disturbances over Bay of Bengal:
- Projected changes in South Asian summer monsoon by multi-model global warming experiments:
-

Short Term Climate Diagnostics and Applications

Spatio-temporal dissimilarities in temperature trends over India during 1901-2007

- Palaeoclimatological studies:
- .

Rainfall Variability, Hydrological Modeling and Satellite Data Applications

- Recent changes in monsoon rainfall over the country:
-
- Antarctic circumpolar wave variability and its implications on the extremes of Indian Summer Monsoon Rainfall:
- *Aerosol and Climate Studies*

- Aerosol radiative forcing during dust events over New Delhi:
-
- Characterization of aerosols over oceanic regions around India during pre-monsoon 2006:
- .

- Aerosol Study at Maitri, Antarctica.

- Development of Laboratory for Mass Spectrometer, improvement in information resources by adding a good number of journals and books, development of a Children's park, renovation of Guest House with modern amenities, renovation of Staff Quarters and Office building and ground work for construction of building for the High Performance Computer (HPC) are some of the activities carried out under infrastructure development programme.

- 60 papers have been published in national and international refereed journals during the year 2008-09 up to 30th October 2008. 4 Ph.D.s have been produced, 11 M.Tech. Students were provided research guidance and facilities at the IITM, 18 scientists guided the M.Sc., M.Tech. and Ph.D. students for their research projects during the year 2008-09 up to 30th October 2008.

4.29 National Centre for Medium Range Weather Forecast

- A version of Grid-point Statistical Interpolation (GSI) was successfully implemented on Cray X1E. Trial runs were made for Aug 2008. The evaluation of the trial runs are underway.
- Impact assessment runs with Lufthansa AMDAR observations (obtained through special arrangement by IMD) in BUFR code have been made.
- Trial runs with the following datasets
- • SSM/I Precipitation rates
- • GOES sounder (Radiance)
- • METOP Microwave Humidity Sounder (MHS) (Radiance)
-
- Implementation and testing of Tropical Cyclone Relocation procedure. Implementation of appropriate changes in the operational schedule to meet the requirements of FDP
- Testing of nested WRF3.0 model with 27 Km outer domain (RMC region) and 9Km inner nest (covering India) for tropical cyclones
- Testing of nested WRF3.0 model for Delhi-NCR region with 9Km outer domain (North India) and 3Km inner domain (covering Delhi-NCR) for fog forecasting and weather forecast during forthcoming Common Wealth Games 2010.
- Experimental Multi-Model Ensemble forecast of daily rainfall in medium range time scale
- Work to be initiated on the implementation of the UKMO Unified model (UM) based Global Forecast System
- The first experimental version of the 4D Variational Ocean Data Assimilation system with assimilation procedures for SST and Sea Surface Topography data was put into trials with real data
- Work to be initiated on South Asian Regional Reanalysis (SARR) project.

4.30 Multi-hazards Early Warning Support System

Establishment of a Program Office and initiation of broad-based consultation process with various institutions for finalising implementation strategies for the Programme Initiative

4.31Centre for Climate Change

Establishment of a Program Office and initiation of networked research activities capable of on science issues of climate change

Analysis of the IPCC 4th Assessment Report and the simulations of high resolution regional climate model (PRECIS) along with the observed data supports the view that seasonal Indian monsoon rains in the latter half of the 21st century may not be materially different in abundance to that experienced today although their intensity and duration of wet and dry spells may change appreciably. The Indian temperatures during the late 21st century will exceed the highest values experienced in the 130-year instrumental record of Indian data. The increasing trend in the minimum temperatures may reduce the rice yields in the Indo-Gangetic plains even with high rainfall

4.32Dedicated Weather Channel & Commonwealth Games 2010

India meteorological Department (IMD) be given the responsibility of taking up this task on priority and working towards speedy implementation of the same within a stipulated period of over 3 years from now

4.33NIOT ext. centre West Bengal

West Bengal Government offered two sites for inspection. The suitability of the site is being examined.

4.34R&D in Earth & Atmospheric Sciences

- The M.Tech Program on "Atmospheric-Oceanic Sciences and Technology" at IIT Delhi has been started from the current financial year along with one time funding for establishment of a M.Tech lab.

- MoU with NOAA has been signed on 16th April 2008 through Video conference mode on Earth Observations and Earth Sciences..

- The MoU with UKMO for exchange of technical knowledge, resources and obtaining software on "Unified Model" for weather and climate forecast was signed on 28th August..

- R &D through Extra Mural Funding : One of such projects is being funded for a five year period on RESPIM (Research for Seasonal Prediction of the Indian monsoon) at IISc. Bangalore.

- Building indigenous capability through Joint developmental work with CSIR with joint funding. A MoU was signed with CSIR on 19th March 2008 towards this end The whole system (hardware and software) will be available to MoES. The necessary training and related support for establishing the entire system at IMD, Pune is under process.

4.35Seismicity & Earth Quake Precursor

- Bangalore Microzonation has been completed on 1:20,000. Report is being published.
- Facility has been created to monitor earthquakes/ microtremor around Siachen Glacier.
- Campaign mode GPS studies taken-up in Uttaranchal, Ladakh, Godavari and A& N islands. 7 permanent GPS receivers being established at selected locations in Gujarat, Kashmir & Rajasthan.
- Liquefaction hazard potential assessment and mapping of Chandigarh region based on site characterization.
- GPR profiling of identified lineaments in NCR of Delhi.
- A multi-parametric Geophysical observatory is expected to be established at Portblair

- Strengthening of braodband and strong motion stations in Darjeeling –Sikkim Himalaya to study the seismic activity in that region.

- A network of 18 strong motion stations has also been established in NCR.

- V-SAT connectivity to selected broadband stations in NE region.

- Under National Strong Ground Motion Instrumentation Network, 204 accelerographs have been installed and out of this 146 are linked through NICNET at NIC hub in New Delhi.

- Under the Himalayan School Observation Programme in Earthquakes, 36 low-version seismographs have been installed in schools in NE region and 59 in NW region and in some selected schools of Delhi. An interactive website has also been launched (www.himselp.net.in) for earthquake awareness among school children.

- Support to ongoing projects sanctioned under seismicity and mission programme.

Chapter-V

Financial Review covering overall trend in expenditure vis-à-vis Budget Estimates / Revised Estimates.

A Statement showing Budget Estimates, Revised Estimates and Actuals for the past two years i.e. 2006-07 and 2007-08 and current year i.e. 2008-09 is on the basis of the position shown in the Statement following trends can be seen in Plan expenditure.

Major Head-wise trend of Expenditure in the recent years is as follows:

Name of the Scheme	Annual Plan (2006-07)		Annual Plan (2007-08)		Annual Plan (2008-09)	
	BE	Actual	BE	Actual	BE	Actual
1. Polar Science	41.00	41.00	20.00	28.48	35.50	57.38
2. Polymetallic Nodules Programme	19.00	14.85	15.00	8.10	15.00	14.59
3. Ocean Observations, and Information System (OOIS)	25.00	19.00	15.00	14.99	13.00	18.00
4. Marine Research and Technology Development(MRTD)	29.00	26.40	25.00	25.68	24.00	27.04
5. National Institute of Ocean Technology (NIOT)*	87.00	47.00	20.00	9.24	20.00	30.00
6. Coastal Research Vessels (CRV) & other research vessels	5.00	5.00	5.00	5.00	5.00	5.00
7. Delineation of Outer Limits of Continental Shelf	0.00	0.00	1.00	0.63	1.00	1.00
8. Comprehensive Topographic Surveys	9.00	4.00	5.00	4.82	5.00	5.00
9. Gas Hydrates Exploration & Technology Development for Exploitation	30.00	12.00	10.00	4.00	12.00	6.00
10. Acquisition and Operation of New Research Vessels	70.00	55.00	100.00	106.00	12.00	20.00
11. Early Warning Systems for Oceanogenic Disasters: Tsunami & Storm Surge	95.00	56.00	35.00	29.60	15.00	10.32
12. Information Technology	3.00	1.75	1.00	2.10	1.00	2.29
13 Data Buoy programme & Operation maintenance of Sagar Manjusha	25.00	18.00	15.00	6.00	10.00	14.80
15. National Centre for Antarctic and Ocean Research(NCAOR)			15.00	14.00	15.00	8.12
16. Indian National Centre for Ocean Information Service			35.00	24.00	30.00	21.20
17 Seafront facility			10.05	0.00	10.00	0.00
A-2. New Schemes:			5.00	0.00		

18 Development of manned submersible			5.00	0.00	5.00	0.00
19 Multichannel Seismic System onboard ORV Sagar Kanya			10.00	0.00	5.00	0.00
20 Desalination Project			1.00	1.00	10.00	
21. Expedition to Arctic			---	3.00	2.00	1.55
22 MLR Berthing Facilities (included in item No.16)			0.95	0.00		
23. National Oceanarium			1.00	1.00	0.50	
24. Demonstration of Shore Protection measures through Pilot project			4.00	0.00	0.50	0.50
25. Integrated Ocean Drilling Programme(IODP)+Arabian Sea basin studies			1.00	1.00	4.00	4.50
26 Ice class Research vessel			10.00	10.00	5.00	0.00
27. Headquarter Building					20.00	0.00
28 Meteorology Department	59.60	43.00	297.62	50.68	432.00	
29. National Centre for Medium Range Weather Forecast (NCMRWF)	25.25	22.39	11.00	5.83	11.00	7.68
30. Indian Institute of Tropical Meteorology (IITM)	11.20	7.91	13.00	13.83	13.00	29.00
31 Multi-hazards Early Warning Support System			0.00	0.00	1.00	1.00
32. Centre for Climate			0.00	0.00	5.00	5.00
33. Dedicated Weather Channel & Commonwealth Games 2010			0.00	0.00	5.00	0.00
34. NIOT ext. centre West Bengal			0.00	0.00	0.50	0.00
35. R&D in Earth & Atmospheric Sciences			3.38	0.00	7.00	8.73
Total	**534.05**	**373.30**	**690.00**	**368.98**	**750.00**	**469.56**

Chapter VI: Review of Autonomous Bodies

Under this Ministry, currently there are 4 autonomous bodies working in the specific areas of Ocean Atmospheric Science & Technology viz., INCOIS, Hyderabad; NIOT, Chennai; NCAOR, Goa and IITM, Pune. INCOIS and NCAOR are implemented under two schemes viz., OOIS and Polar Science respectively. The review of these autonomous bodies has accordingly been projected in the respective programmes of Chapter II.