

GEOINFORMATICS



10.0.0. Introduction

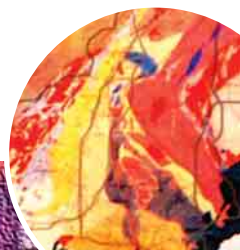
10.0.1. Rapid innovation in Information Technology has enabled spectacular breakthrough in every field of science. High processing speed, large storage capacity, easy network / wireless connectivity, mobile computing devices and ever growing Internet have ensured that it is possible to remain connected practically from anywhere, anytime, using anything. Any type of information i.e. voice, video, images, and text can be served over the common communication highway. The applications, which keep this highway alive and growing, are Enterprise Portals, unified messaging, Internet gateways and Groupware. In recent years, the Internet, which revolutionized the way we communicate and distribute information, is slowly evolving into a Cyber-Infrastructure or the GRID i.e. the technological solution to the problem of efficiently connecting data, computers and people with the goal of enabling derivation of novel scientific theories and knowledge. There is an exponential increase in capacity and power of computer networks and infrastructure services. Data and information are now being delivered through Web Services. Markup languages are being used to link text narrative at all levels of detail with spatial models, metadata, databases, images, material collections and human experts. All these advancements are waiting to be leveraged by Geological Surveys and similar organizations to provide services from which users can obtain appropriate products or create their own.

10.0.2. **Trends in Geological Surveys all over the world:** Geological Surveys while focusing more on applications with broader societal impact like health and human life, climate change, environmental modelling, disaster management and mitigation, are adopting Information Technology to manage the vast volume of geoinformation generated by them. There is a concerted effort to integrate information technology as an enabler in all aspects, such as integration of multidisciplinary data, interoperability, knowledge management, collaboration and dissemination. For instance, one of the key priorities of Geoscience Australia is to improve discoverability and access to Geoscience Australia's information assets via the Internet. Geoscience Australia has ensured integration of statutory digital exploration data filed by mineral tenement holders with its online data-bases to promote effective and efficient mineral exploration. The China Geological Survey is aiming to realize easy accessing and sharing of geological information in the distributed environment supported by Grid technology. USGS has joined GEON project (a collaborative research among different institutions to develop cyberinfrastructure) as a major partner and has made creation of key GEON-related databases a priority effort over the next several years.

10.0.3. There is also an international initiative of the geological surveys of the world through the One Geology movement, which is a flagship project of the International Year of Planet Earth (**IYPE**). The aim is to create dynamic geological map data of the world available via the web. A standard geological data format GeoSciML (Geoscience Markup Language) is also being developed under this umbrella.

10.1.0. Overview of current IT Management in GSI

10.1.1. In GSI, the overall responsibility for policy direction, management and oversight of activities of all Region/Operation level offices rests with the Deputy Director General of Operation Information Technology. His domain of activities currently includes IT infrastructure development, major



acquisitions, information security, e-governance initiatives and development of human resource through capacity building. The projects derived through such policy directives are implemented at the Region / Wing / Operation levels by the respective Directorates under the control of the respective Heads of Department (HOD).

10.1.2. The Committee recommends that in view of new hybrid matrix type of Organisational structure proposed for GSI, the IT development in GSI should reorient itself to the proposed organizational structure.

10.2.0. Background on GSIIT initiatives

10.2.1. Initial efforts of GSI in the field of management of spatial data came in mid-1980s with the formulation of 'Project Vasundhara' in collaboration with Indian Space Research Organization (ISRO). The achievement has been generation of a multi-layered thematic map of a part of the southern Peninsular India through collation of available geospatial data. Subsequently, GSI embarked on a project in collaboration with BRGM, France for prognostication of mineral occurrences in the greenstone belts of Dharwar Craton, where the geospatial data layers were integrated with the chemical assay values for identification of potential deposits.

10.2.2. The major initiative of GSI for management of its vast resource of geoscientific data was once again undertaken in collaboration with BRGM, France in the form of development of a 'Geoscientific database' during the IX Plan period. The work of building a comprehensive spatial and attribute database for map 1:50 K scale, drilling and exploration (Annexure-I) resulted in development of a core expert group, proficient in handling database technology and spatial data analysis. As a follow up activity, two successor projects, 'Project Geoinformatics' and 'Project Digital Archive' were initiated during the IX and X Plan period. The former led to collation of information extracted from the field season project reports into a structured format for the domains of geological mapping, drilling and exploration. The achievement includes completion of data input for 2000 toposheets (till September 2008) out of around 4900. Work is on for 608 more such sheets. In the beginning of the current decade, potentiality of the geospatial technology and emerging geospatial data market necessitated speedy completion of the conversion of analog data to digital format. Project Digital Archive was thus conceived to quickly implement digitisation of 1:50 K geological maps, conversion of analog field project reports to digital (raster) format, generation of metadata in respect of the reports, conversion of historical and archival maps as well as published maps of GSI to digital format. Project Digital Archive led to generation of around 4000 digital raster geological maps, its metadata, raster images of around 4500 historical and published maps, scanned images of around 30,000 field project reports along with their metadata.

10.2.3. Armed with the repertoire of data generated through Project Geoinformatics and Project Digital Archive, GSI visualized the need of implement a Net-Portal Project. A centralized deployment of Java based applications with RDBMS in the background was conceived. The Portal was designed, as a single gateway to GSI resources with an Internet interface for the public to access certain kinds of information and an Intranet application geared to serve organizational needs i.e. back-office transactions (Annexure-II) through a series of Management Information Systems (MIS). Also, GSI initiated development of networking infrastructure through creation of Local Area Networks (LAN) in its Regional and Operational units and connecting those through a Wide Area Network (WAN).

10.3.0. Current initiative – GSI Net & Portal Project

10.3.1. The advent of NSDI movement acted as a boost to the GSI Net and Portal Project. The vast volume of geo-scientific data gathered over last 155 years called for efficient management by way of a

centralized digital archive and it was imperative that GSI treat the data as a corporate resource and facilitate its exploitation through well-defined access protocols. The Portal was therefore conceived as a Project to enable knowledge creation, information management, dissemination of information relevant to societal needs, and to meet the need of scientific communities, potential investors, etc.

10.3.2. The outcome of the Portal Project is development of Management Information Systems covering the entire administrative processes, scientific data management systems and 1: 2 million and 1: 50 K geological map services, (see *Annexure-I & II*). As part of the GSI Enterprise Information Portal project, spatial data warehouse (SDW) has been implemented, through which Intranet/Internet users enjoying different access levels can quickly search for, locate and visualize geoscientific information generated by GSI. It consists of an application that enables Intranet users of GSI to load and maintain metadata about their data sets in a Data Catalog. A subsystem will query, search, locate and display geoinformation stored in the SDW in tabular and/or graphical formats. A third subsystem enables intranet viewers to load and update new and existing data sets in a secure environment. The GSI Portal also includes back office transactional applications, mail and collaboration services.

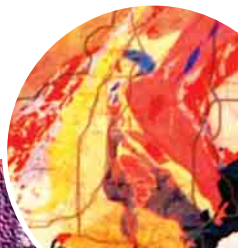
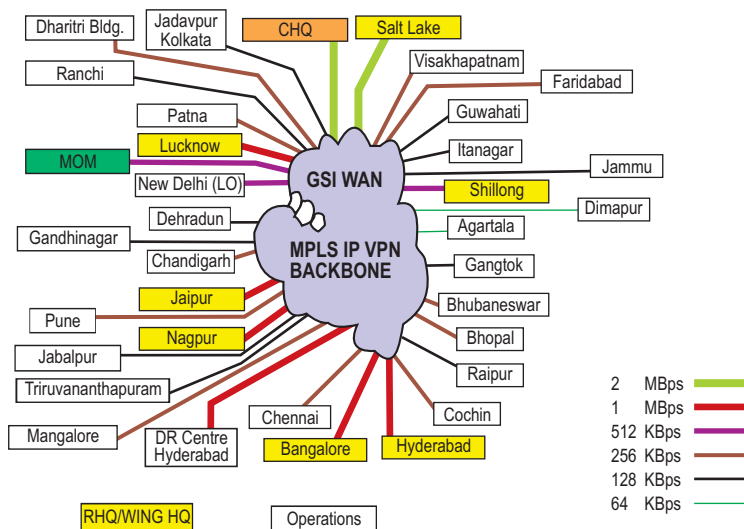
10.3.3. The project has been executed at an approximate cost of Rs. 20.5 crores. The Portal component alone accounted for Rs. 8.14 crores including hardware and software (The application development cost was to the tune of Rs. 2.71 crores). The network component (LAN and WAN) accounted for approximately Rs. 12.36 crores.

10.3.4. Local area networks (LAN) have now been implemented at all Regional Headquarters (RHQs) and independently located operational level offices of GSI for sharing of data between different nodes within the LAN and connecting to WAN for accessing intranet applications of GSI Portal. Wide area networking employing Multi-Protocol Label Switching – Virtual Private Network (MPLS-VPN) technology, connecting 36 GSI offices at different geographic locations and Disaster Recovery (DR) Site, is under implementation. Presently, commissioning of 32 links out of 37 has been completed; the other 5 links will be commissioned within a short time (see Fig.- X.1).

Connectivity:

Fig. – X.1

A. **Intranet (WAN) - MPLS IP VPN technology;** Bandwidth varies from 64 Kbps to 2 Mbps as per the diagram depicted in Fig-X.1 . Connection established for 30 locations



Intranet Bandwidth Distribution is given in Box-1 and details in Box-2

The Bandwidth Distribution

Box-1

Bandwidth	No. of Links	Locality
2 Mbps	2	CHQ (Kolkata), Bhubijnan Bhavan, Kolkata (HQ of ER, MW, CW)
1 Mbps	6	RHQs: NR (Lucknow), SR (Hyderabad), CR (Nagpur), WR (Jaipur), AMSE (Bangalore); Disaster Recovery Site (Hyderabad)
512 kbps	3	MoM (New Delhi), DDG's office, NER (Shillong), Liason Office (New Delhi)
256 Kbps	12	Dharitry Building (Kolkata), Shillong (Kumud Villa), Faridabad, Chandigarh, Bhubaneswar, Patna, Chennai, Bhopal, Pune, Vishakapatnam, Mangalore, Cochin
128 Kbps	12	Shillong (Motinagar), Gandhinagar, Dehradun, Jammu, Gangtok, Thiruvananthapuram, Jabalpur, Raipur, Itanagar, Gwahati, Kolkata, Ranchi
64 Kbps	2	Agartala, Dimapur

Box-2

At present connectivity has been established at 32 locations. Link of 5 locations viz. *Hyderabad, *DR Site, Pune, Itanagar, *Dimapur and *Ranchi is yet to be established.

* Link likely to be established by February 2009 end.

Services that will be provided through this links include:

1. Access to Portal by GSI employees from GSI offices without connecting to Internet.
2. Access to organizational e-mail system (gsi.gov.in domain) capable of exchanging e-mail with other domains.
3. Inter-office communication through IP Telephones.
4. Video-conferencing
5. Centralized Internet access
6. Organization-wide file sharing.

1 & 2 operational, 3 & 4 in the process of implementation, 5 & 6 in proposal preparation stage

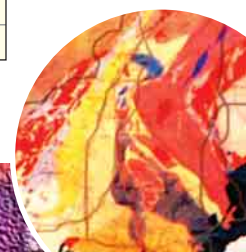
B. Internet - Internet link: 1 Mbps link (Internet Lease Line of VSNL) is presently operational. At present this link facilitates public access of GSI website (GSI Portal) that is hosted by GSI at Data Centre, Kolkata. One 4 Mbps Internet Lease Line link will be established soon which will be utilized for organization-wide Internet access. Internet traffic from all GSI offices will reach through GSI intranet (MPLS VPN) to CHQ Internet Gateway. This 4 Mbps link will take the traffic to internet. This implementation will separate incoming traffic from Internet i.e. public access of GSI Portal from outgoing traffic i.e. GSI users accessing Internet.

10.3.5. Along with link commissioning, provisioning of routing the private LAN IP has been done so that GSI Portal can be accessed through VPN without connecting to Internet. Integration of voice infrastructure i.e. Voice over Internet Protocol (VoIP) implementation is in progress. IP telephony servers (Cisco Call Manager) in failover cluster have been installed at Central Data Centre. Installation of Video-Conferencing infrastructure will commence soon. Implementation of WAN connectivity along with IP Telephony and videoconferencing infrastructure is likely to be in place by end of 2009.

10.3.6 The current endeavour is to maintain this 24X7 communication infrastructure and the Portal. With growing use of this infrastructure, increase in volume of data flow and consequent demands of increasing server performance, augmentation of various hardware/software resources will become a prime necessity. Normalization and population of all database and metadata-base structures through the Portal over the Intranet is a thrust area and the process is expected to be completed by XI plan period with annual milestones given in Table &–X. I:

Table – X. 1
Milestones: Database and Metabase, through portal over Intranet

Components	Status as January 09	Anticipated year of completion #				Action*
		2008-09	2009-10	2010-11	2011-12	
A. Published Paper Maps						
1. Geological quadrangle map (286)	Header metadata population complete for all maps, detail metadata population and uploading of images in progress					M&C Division, CHQ and Regions
2. District Resource map (338)						
3. Geology and Mineral map of states and regions (25)						
4. Entire India Maps (12)						
5. Coalfield maps (10)						
6. Marine maps (25)						
B. Archival Maps (~7000)	Metadata and images uploaded for 464 maps					M&C Division, CHQ
C. Aerogeophysical maps	Metadata for 122 blocks	Regular update necessary				AMSE Wing
D. Publications & Journals	Metadata population complete; uploading of actual documents in pdf format to be taken up based on policy decision and hardware / software infrastructure upgrade and softcopy conversion					P&I Division, CHQ and Regions
1. Memoir (139)						
2. Records /Ext Abstracts (237)						
3. Bulletin Series A, B, C (57, 47, 6 respectively)						
4. Palaeontologica Indica (12)						
5. Special Publications (73)						
6. Misc. Publications (82)						
7. Catalogues (6)						
8. Indian Minerals (85)						
E. Unpublished Reports (30000+)	Metadata population completed for 21390 general and 790 coal exploration reports; uploading of actual reports based on policy decision and hardware / software infrastructure upgrade					
F. GEOINFO						
1. Quiz, Photo gallery, Geotourism, Case studies	Regularly updated	Regular update necessary				All Divisions
2. Fossil repository	17755 records, uploading of images in progress					Curatorial Division, CHQ
3. Rock, meteorite repository	15 records					
G. People Search	Completed	Regular update through HRMS, Fine tuning of interface				HRD, Pers. & Adm. Divisions
H. Office Search	Completed	Yearly update necessary				All Divisions
I. GeoEvents (Itinerary and update of workshop, seminar, etc.)	Interface development completed linked – with HRMS	Regular update necessary				HRD
J. Activities & Capabilities of GSI	Completed (About Us & Services)	Regular update necessary				All Divisions
K. News/Findings Section	Completed	Regular addition necessary				All Divisions



Components	Status as January 09	Anticipated year of completion #			Action*
<i>L. Training</i>	Completed	Regular update necessary			TI
<i>M. Field season projects</i>	Application development Completed	Linked to FSPMIS – workflow controlled data entry to be continued every year			All regions Wings, PPM, CHQ/
<i>N. 1:2m Map Service</i>	Application development complete	Regular enhancement by adding new layers and tools			M&C, CHQ
<i>O. Download Zone</i>	Completed	Regular addition necessary			All Divisions
<i>P. Transactional back-office applications@</i>					
1. Payroll	Application being modified as per 6 CPC	User testing	Trial run	Daily usage necessary	Adm. section
2. HRMS	Application development complete	Trial run	Daily usage necessary		Adm., Pers., HRD
3. Claims	User testing in progress	User testing	Trial run	Daily usage necessary	Adm., Finance
4. Finance					
5. PQS	Application development complete	Daily usage necessary			Parliamentary affairs Divn.
6. VMS	Fine tuning in progress		Testing	Daily usage	E&T Divns
7. FSPMIS	Current Field season data entry in progress through back-end	User testing	Trial Run	Daily usage necessary	All regions / Wings, PPM, CHQ
8. LMS	Fine tuning in progress	User testing	Trial run	Daily usage necessary	All laboratories and projects

For Component 'A' to 'O' in Table above – GSI portal page is depicted in Fig – X. 2

* *All Geodata Divisions, specifically Geodata, CHQ will provide regular training, helpdesk support and monitor maintenance operations, coordinate further application development / modification.*

Uploading of actual unpublished reports and publications will continue in the XII plan Period.

@ *Once User testing is complete, trial run (simultaneous run of processes using application and conventional method) and regular usage to be done by respective Divisions.*

Fig – X.2

GSI Portal pages



10.3.7. The X plan project 'Digital Archive' resulted in generating toposheet-based digital files in various format for geological maps at 1:50000 scale. Migration / conversion of this varied digital data into Geoinformatics / SDW (Spatial Data Warehouse) format, with concurrent input of attribute data into the respective thematic domains (Geoscientific Database) through the standardized web-enabled forms is another thrust area and the process is expected to be completed as per the following schedule (Table: – X.2)



Milestones: Web enabled forms

Table – X. 2

Components	Status as on date	Anticipated year of completion				Action
		2008-09	2009-10	2010-11	2011-12	
Geoscientific Database*	Database normalized, data entry in progress, web-enabled forms ready for all domains					All Geodata, Geophysics Divisions,
Enterprise GIS*	Fine tuning of application in progress					Geodata, CHQ
	Edgematching of tiled layers in progress					All M&C Divisions
	Uploading of edgematched layers in SDW					All Geodata Divisions
	Reconciliation of features and further modification					All M&C and Geodata Divn

* During the XI plan period emphasis is on the Map50K domain. Similar work for other domains will continue in the next plan periods under activity 'National Geospatial Datasets'

10.3.8 With completion of Local Area networks in all offices of GSI, the stage is set for establishment of connectivity by commissioning of the Wide Area Network (WAN) or the GSI Intranet. With the WAN in place, widespread, spontaneous use of all portal and transactional applications has to be promoted vigorously.

10.3.9. Current applications available over portal

A. Internet

GSI home page, accessible through Internet, is segmented into different sections, each of which provides information of different type:

- a. Information of Field season programs of different regions and distribution of officers is available from an easy to use interface where query can be posted through a pair of combo boxes with the relevant output appearing in the form of portable document format
- b. 1:2 million map service of GSI portal is available over Internet. It facilitates a commodity based query on a 2 million scale map where output is displayed in the form of control points getting superimposed on the said map and further query on those points fetch detailed data from the ArcIMS (Arc Internet Map Server). It also offers a second option where query can be posted freely from a set of combo boxes with different themes as criterion. The output is displayed in the form of relevant reports which can be further pursued for report details
- c. A map interface helps fetch and display formatted data related to unpublished progress Reports, published paper maps, Historical maps, Aero-geophysical maps and GIS metadata based on NSDI (National Spatial Data Infrastructure) metadata standard.
- d. A complete news and findings section delivers important current news items and findings. News and findings of the past are being kept in an archive easily navigable from the home page.
- e. Static web pages provide information on organizational structure, gamut of activities, profile, products, services and training programs. Information on office locations, contact details of regional heads, information on employee details and answer to a host of frequently asked questions on geoscience are also available to the users accessing GSI portal through Internet.

- f. Home page for guest's hosts photo gallery drawn from various GSI resources and also dispenses information on geotourism that enriches the tourism map of India and is meant for different cross section of people.
- g. An exclusive download zone catering to assorted people for downloading of brochures, various documents and forms as per their requirement. A small section on tender related issue, vendor registration and information related to RTI is also accessible to the Internet users.

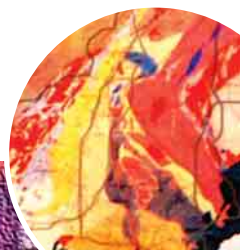
B. Intranet

❖ Administrative

- Payroll module for generation of pay bills
- Human Resource Management module – deals with inventory of employees, transfer and posting, deputation, promotion, performance appraisal, personal details.
- Claims – The transactional application module “CLAIMS” is meant for administrative processing of all financial claims pertaining to GSI employees, including the loans and advances
- Finance – The transactional application module “BUDGET” is meant for (head-wise) estimation of expenditure and subsequent allocation of the same to distributed Region/Wing offices for carrying out the projects/activities planned by the Department.
- Vehicle Management system
- Field Season Programme Management Information system – formulation and approval of Field Season Programme, achievement details, cost of projects, generation of reports for monitoring
- Parliamentary Question Information System – This system would handle all the questions raised in the Parliament pertinent to GSI and store the answers to those questions. It is intended that at any point of time the questions and answers can be accessed using a search criteria.

❖ Scientific

- Laboratory Management System – Functionality includes Receive and allocate Sample, Record Analytical Data, Generate Test Reports, Maintain Master Data (Instruments, Analysis method, Sample type etc)
- Geoscientific database - Map 1:50,000, Exploration, Geochemical Investigation, Drilling, Coal, Geophysical Investigation, Photogeology and Remote Sensing, environmental Geology, Natural Hazard (landslide, earthquake and flood), Rock Sample analysis (Petrology, Palaeontology and Geotechnical properties of rock)
- Enterprise GIS - The web GIS application can be accessed through portal, while data migration utility (Load and Update utility) and customized Metadata Editor can be accessed from ArcGIS ArcInfo clients. Web browser displays the map using ArcIMS and ArcSDE (Arc Spatial Data Engine) service and shows the corresponding attribute data from Geoscientific database



10.3.10. Difficulties:

10.3.10.1 Manpower: There is a serious shortage of trained and skilled manpower in the field of geoinformation management. In the changing scenario where GSI envisages integration of IT at all levels of its activity (scientific, technical and administrative) inadequacy of suitable human resource is proving to be a serious handicap.

10.3.10.2 Procedural delays and remedies: To maintain and run the GSI Enterprise Portal along with all transactional applications critical maintenance of the complete IT infrastructure is of utmost importance. However, procedural delays in getting administrative and financial sanctions in most of the cases proves to be a major hindrance. To run the existing IT operations, the following annual maintenance contracts have to be readily renewed every year. An indicative estimate of the cost involved is given in Table – X.3.

Table – X.3

Indicative Cost of Annual Maintenance Contract

Maintenance	Approximate cost per annum
GSI Portal	1 crore
WAN	1 crore
LAN at different offices	25 lakh
Software	1 crore
Physical infrastructure	15 lakh
Total	3.4 crores

10.3.11 During the discussions there were suggestions that to expedite the AMC renewal process etc., suitable administrative and financial sanctioning power may be delegated to Addl. DG (Geoinformatics). Moreover, to facilitate smooth day-to-day trouble-shooting (replacement of hardware components, minor upgradation of equipment, software, minor repair of infrastructure) requisite power may be accorded to the Directorates and the Dy DGs. The Committee has considered the suggestions carefully. The Committee is fully cognizant of the importance of the Portal Project to making GSI a world class geoscientific institution. Accordingly the Committee is of the view that the connectivity and hardware matters which are 'non-content', and which require engineering expertise, must be separated out for management, budgeting and monitoring. Accordingly the Committee recommends that the 'IT Infrastructure' should be a support system component, managed through outsourcing.

10.3.12 As regards the Portal, the Committee is of the view that it will be at the core of the Geoinformatics Mission. Fully appreciating the critical nature of this activity and the fact that it is essentially a unique combination of Geoscience and Informatics, the Committee is of the view that GSI must plan to create a special group of Geoinformatic personnel drawn from all the major streams i.e. Geology, Geophysics, and Chemistry.

10.3.13 The Geoinformation Mission will be headed by an Addl. DG and issues relating to administrative and financial powers will be resolved through his status as Head of Department. As in the case of other Missions, there would be a DDG (Geoinformation) in each Region overseeing the Mission work of the Region. His role will be critical because Regions are the authenticators and repositories of Geoscientific data. Directors (Geoinformatics) at State (Operational) level where data is generated will need to oversee the interfacing between Mission activities relating to baseline data, natural resource

assessment, fundamental and multidisciplinary geoscience as well as from the Support Systems (for Laboratory and back office applications etc. in particular) and the Geoinformatics Mission in order to be able to ensure continuous planned accretion of spatial and non-spatial data with the system.

10.3.14 Trouble shooting and maintenance matters will be handled through the Regional and State level IT infrastructure units of the Infrastructure Support System and the necessary coordination between the 'content' and the 'infrastructure' would be effected by the Addl. DG as HOD of the Region and DDG as Head of Office in the State Unit.

10.3.15. Data Centres:- At present the Central Data Centre which is the heart of all Enterprise-level activities pertaining to the GSI Portal, is situated in the 6th Floor, 15, AB Kyd Street, Kolkata over 300 sq feet area. There are already six server and networking racks in the server farm. Three more racks are being placed for installation of WAN and Portal Development environment. Any further, addition of new equipment more space will be needed within the current plan period. Planning for future expansion to include proposed new applications would certainly require much more space.

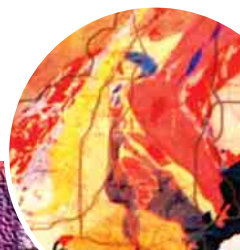
10.3.16. The Committee was informed that the present space is grossly inadequate and additional space is urgently required. The Committee considered the entire matter in detail and felt that for the long run, since the GSI Portal will be the bulwark and mainstay of GSI in the not too distant future, location of the Data Centre had to be properly planned, keeping in view the requirements in the larger perspective including:

- technical support
- connectivity
- ease of operation etc.

10.3.17. The Committee was of the view that expert opinion needed to be obtained relating to location of Data repository, networking components, Disaster Recovery etc. and recommended that an Expert Group be constituted including representatives of NIC, NSDI, GSI and Ministry of Mines to work out a long term plan.

10.4.0. Future Perspective:

10.4.1. The biggest and most important external global impact on the mapping agencies in the last one and half decade has been the development and widespread acceptance of Internet. Internet directly impacts traditional data collection, management and delivery activities. In Geoscience, for example, Field officers now routinely use GPS devices that can rapidly collect highly accurate location data and provide in - field validation. The manual map compilation process has been rendered obsolete by GIS based map production systems. The hard copy map has been replaced in majority cases by electronic delivery of digital data extracted from enterprise scale databases, and increasingly, this is giving way to online direct access to databases over the Internet. The demand for geoinformation is steadily increasing and GSI as a premier geoscientific agency has to adopt requisite strategic steps to leverage this opportunity. The GSI needs to adopt strategies that enable use of interoperable datasets across board by various national geoscience organizations, viz, Indian Bureau of Mines (IBM), National Natural Resource Management System (NNRMS), National Remote Sensing Agency (NRSA), National Resource Development Management System (NRDMS), Ministry of Earth Sciences, Ministry of Home Affairs and various state directorates, etc. The best way to achieve this objective is to utilize the currently available open standards developed by National Spatial Data Infrastructure (NSDI), Open Geospatial Consortium (OGC), International Standards Organization (ISO), the World Wide Web Consortium (W3C) and other organizations. Plan-wise future applications proposed by GSI is given in *Annexure - X*.



III. The following paragraphs depend substantially on GSI inputs developed after extensive interaction with GSI. The Committee would like to record that GSI's initial concepts of the Portal was based on the assumption that the Intranet would be extensively used by GSI units while the Internet would be for putting out general information, with a payment gateway in order to enable transaction relating to priced information. However, the Committee is of the very clear view that GSI's Portal must be developed to put out as much data as possible in the public domain (Para 12.7.1 to 12.7.8 may be seen), and expects that CGPB's Committee on Geoinformatics and data management will drive the process. Accordingly the following paragraphs are subject to changes made from time to time by the CGPB Committee with regard to orienting the Portal as a public information dissemination service.

10.5.1. Vision, Mission and Strategy for Geoinformation Management

10.5.2. **Vision:** To develop a geoscientific information delivery system that can access all kinds of data and can present to the user information in the context that he needs it.

10.5.3. **Mission:** To create a highly interconnected earth science 4D information system populated with high quality, easily available data, as well as a robust set of tools for analysis, visualization, and modelling to reveal new geoscientific relationships in space and time.

10.5.4. **Strategy:** Utilize information resources effectively by creating a comprehensive information environment that can enhance the discovery and extraction of geoinformation, ensure delivery of accurate, upto date and comprehensive products and services, and provide crucial support for the overall missions of the organization.

10.5.5. To fulfil this strategic plan GSI has to adopt a *comprehensive information environment* where Information Technology will be integrated in all stages of data and information handling, right from collection to the delivery stage. Comprehensive Information Environment will comprise of an infrastructure of hardware, software, standards, policies, applications & tools and services and will enable all GSI geoscientists to collect, process, analyse, store and disseminate GSI data and information in an efficient and organized manner. It will also ensure that the broader geoscientific community and other Stake holders can easily access, view and utilize GSI data & information. This holistic approach will support the overall mission of the organization as well as the national e-governance initiative. This environment can be realized through a Geoinformatic Mission, which will amalgamate all existing Geodata, Map & Cartography, Publication & Information activities into a single entity. The broad activity domains of Geoinformatics Mission will be as follows:

- **Information Infrastructure**
 - System development, integration and management
 - Nurturing of human capital for managing information resources
 - Repositories of information – existing legacy data and new information gathered through current projects and research
- **National Geospatial datasets**
 - Integration and analysis – Development of geospatial applications, spatial data decision support systems, development and adoption of standards, quality control
 - Strategic planning and overall information policy direction

- **Product Management**
 - Accessibility and dissemination – user management, publishing, interoperability, outreach strategies, mass communication, Intellectual Property Rights (IPR) related issues, security
 - Content creation and processing for web
- **3D/4D integrated applications**
 - Analysis and interpretation – multi-criteria analysis, interpretation based on multi-thematic and multi-dimensional modelling
- **Mobile Mapping**
- **e-governance, e-commerce & e-library**

Since the range and scope of the activity domain is clearly ambitious, the Committee would advice that the administrative Ministry set up a high level monitoring committee to facilitate execution of GSI's plans.

10.6.0. **Information Infrastructure:**

10.6.1. GSI has to adopt world-class enterprise solutions to improve the quality, accessibility, and sharing of information within the broad community. In the near future, GSI network (LANs & WAN) will transmit not only data but also voice and video. There will be also the need to integrate the technologies supporting data, voice, and video for improved quality of service. Much technological advancement will occur in networking, Internet architecture, wireless communication, and mobile applications. These and other emerging technologies like GRID and Web services will be critical in improving GSI enterprise architecture and it will be essential that the GSI information infrastructure keep pace and incorporate these technical changes to meet customer requirements.(see Table – X.4) In the following paragraphs the physical network and infrastructure are included for purposes of resource estimation though of course these resources would be controlled from the IT infrastructure unit.

10.6.2. In the long run GSI has to take leadership to develop a coordinated national geoscience information network to access and integrate state survey and GSI information resources (data bases, maps, publications, methods, applications, and data services).

10.6.3. In future GSI also has to deliver geospatial data using interoperable Web Map Services through its Portal. All web feature service schema must be compliant with OGC standards. Right now the map services in GSI Portal are delivered using Arc Extended Markup Language (ArcXML), an ESRI communication protocol. In future, Geoscience Markup Language (GeoSciML) will be the primary schema definition to be used by the web feature service once it reaches a suitable level of maturity.

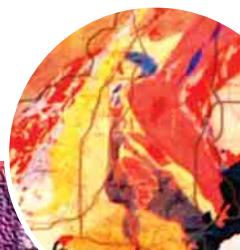


Table – X.4

Activity matrix – Information Infrastructure

Information Infrastructure - XI Plan Period
Activity :
<ul style="list-style-type: none"> ● GSI Intranet (WAN): Installation and commissioning of WAN and LAN at AMSE, Ranchi office (MPLS link commissioned in 32 out of 37 locations. Along with link commissioning, provisioning of routing the private LAN IP is being done so that GSI Portal can be accessed from any GSI office over the Intranet.) ● IP telephony: Integration of IP telephony (422 out of 721 IP telephones installed in 32 locations. Simultaneously population of Call Manager directory is being continued. IP telephony servers in failover clusters installed in Central Data centre, Kolkata). ● Video conferencing: Installation of video-conferencing systems at CHQ, RHQs and WHQs (Procurement of equipments and planning for installation in progress). ● System development and integration: Augmentation of existing Intranet and Internet applications and services. – Use of all back office transactional applications in day-to-day office work – simultaneous data entry; Consolidation of 1:50K map service. Data entry in Geoscientific database; Addition of new layers like Coal & lignite basins, Meteorite, Geochronology as part of 1:2m Map service. Introduction of new map services based on current FS projects; Legacy data entry in Field Season Project Management Information System (FSPMIS) and application development for query through Portal – seamless integration between FSPMIS, spatial data services and Report metadatabase. ● Capacity building for development of trained human resources ● Implementation of e-security
Human Resource:
<ul style="list-style-type: none"> ● 50 Geoscientists (for management of data repository at CHQ, RHQ/Wing and Operation offices), 16 Computer engineers, 50 Data entry operators (for input of legacy and current data) ● Third party system Integrator for development and integration of new services and application modules for Portal and for installation of WAN, IP telephony and Video Conferencing
Technology:
<ul style="list-style-type: none"> ● Service-Oriented Architecture, GIS, RS, RDBMS, WebGIS, XML, GeoSciML; ● Technology for augmentation of physical facilities (IP telephony, Video conferencing, e-security etc)
Outcome:
<ul style="list-style-type: none"> ● NSDI node ● Electronic access control in Data Centre and Disaster Recovery Site ● Improved spatial data and metadata services ● Robust transactional applications, e-payment, e-procurement, etc
Information Infrastructure – XII Plan Period
Activity :
<ul style="list-style-type: none"> ● Geoscience Network – GSI Intranet extended to an infrastructure for sharing resources and expertise between GSI and other geoscientific agencies (IBM, MECL, State agencies, etc) and public pilot projects with 2-3 agencies ● IP telephony and video conferencing: extensive use over all offices of GSI to communicate and collaborate ; virtual meeting; web seminar ● GSI Enterprise PORTAL – Gateway to integrated applications providing multi-thematic, multi-agency (IBM, MECL, NNRMS, etc) spatial data services (e.g. tenement registry service, spatial decision support systems); spatial data extraction and delivery through Web services; Discussion forum, public response regarding natural hazards using web services based on real-time GIS

Human Resource:

- 125 Geoscientists, 21 Computer engineers, 75 Data entry operators
- Third party system Integrator for development and integration of new services and application modules for Portal and extending the network infrastructure.

Technology:

- Grid computing, Wireless network, High speed Internet, (Open Geospatial Consortium) OGC compatible Web services integrated with Digital data delivery, real-time GIS
- Integrating e-commerce with spatial technology
- Audio & Video streaming; multimedia technologies

Outcome

- Increased collaboration within the broader geoscientific community
- Greater information dissemination to the common public
- Digital data delivery
- Cost effectiveness

Information Infrastructure – XIII Plan Period**Activity :**

- **Geoscience Network** – Establishment of country-wide network encompassing all geoscientific agencies, academic institutions and user agencies; exploring avenues for global networking
- **GSI Enterprise PORTAL** – Gateway to integrated applications providing multi-thematic, multi-agency 3D/ 4D spatial data; spatial data extraction and delivery through Web services; Discussion forum, public response regarding natural hazards using web services based on real-time GIS

Human Resource:

- 125 Geoscientists, 21 Computer engineers, 75 Data entry operators
- Third party system Integrator for development and integration of new services and application modules for Portal and extending the network infrastructure.

Technology:

- Same as XII plan

Outcome

- Same as XII plan

Information Infrastructure – XIV Plan Period**Activity :**

- Augmentation of infrastructure for global scientific collaboration, real time data input, storage, processing, analysis and delivery

Human Resource:

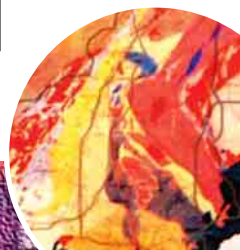
- 125 Geoscientists, 10 Computer engineers, 75 Data entry operators
- Third party system Integrator for augmentation of infrastructure.

Technology:

- As available and relevant

Outcome

- Same as XII plan



10.7.0. National Geospatial Datasets:

Consolidating Geoscience Knowledge is a priority area. In coordination with Regional and Wing offices a comprehensive effort is on to build national geospatial datasets to address current and future national issues. The project Geoinformatics is the primary vehicle to arrive at this destination. Under the aegis of this project, outputs and products of all current GSI programmes and the legacy data holdings have to be digitised, and standardized as necessary to ensure interoperability. Spatial and attribute data entry in all Geoinformatics domains will continue through Portal. The initial goal will be to build a centralized repository of all GSI information holdings. Simultaneously effort should be given to deliver the data compatible to Open Geospatial Consortium (OGC) web map services standards. This implies long-term management of standardized datasets in a secure environment, and with efficient systems to locate and retrieve the data using indexes and metadata.

GSI is well positioned to provide the architecture for a geospatial information repository through the Spatial Data Warehouse (SDW) of the Enterprise GIS (EGIS) module of the Portal, the efficient inquiry system of EGIS and the EIP. GSI will be responsible for integrating and making interoperable the heterogeneous geoscientific databases, for supporting the continued development of the National Spatial Data Infrastructure (NSDI), and for innovation in the field of geoscience mapping and product generation. (Table-X.5)

Table – X.5

Activity matrix – National Geospatial Datasets

National Geospatial Datasets – XI Plan Period	
Activity :	<ul style="list-style-type: none"> ● Enterprise GIS, Geoinformatics (Map 50K and other domains such as drilling, geochemical exploration, natural hazards, quaternary geology, geophysics, glaciology etc), ● Conversion of all 1:50K geological maps to standardized GIS format; attribute data entry in geoscientific database and validated spatial file upload in spatial data warehouse. ● Collation and compilation of data generated through NGCM and GPM projects in a RDBMS environment ● Standardization of stratigraphic legend ● Development and adoption of standards
Human Resource:	<ul style="list-style-type: none"> ● 160 Geoscientists (analysis of geospatial data generated through NGCM and GPM along with conversion of legacy geological map data distributed over CHQ, RHQ, Wing, Operation offices, 60 Data entry operators (for digitisation job in different offices of GSI)
Technology:	<ul style="list-style-type: none"> ● GIS, RDBMS, CAD, visualization techniques, service oriented architecture (SOA); OGC standards, GML, GeoSciML, Digital Cartography (Map composition- legend generation)
Outcome	<ul style="list-style-type: none"> ● Digital Geological map of entire country at 1:50K (~4900 toposheets) following the standardized legend ● 1:50k digital data access through portal
National Geospatial Datasets – XII Plan Period	
Activity :	<ul style="list-style-type: none"> ● Enterprise GIS, Geoinformatics (All domains, especially environmental and natural hazards), ● Conversion of all large scale geological maps (pertaining to investigation projects) to standardized GIS format; attribute data entry in geoscientific database and validated spatial file upload in spatial data warehouse.

- Edgematching for all tile-based spatial layers
- Collation and compilation of data generated through NGCM and GPM projects in a RDBMS environment integration with GSI Portal through FSPMIS and Laboratory Management System (LMS)
- Standardization of symbology, nomenclature, attribute values, semantics for other domains
- Seamless scale-independent database creation – pilot project
- Graphic and attribute data entry for current field season projects through Portal,

Human Resource:

- 200 Geoscientists (enhanced manpower required for edgematching, conversion of large scale maps and pilot project), 3 Computer engineers, 100 Data entry operators

Technology:

- GIS, RDBMS, CAD, visualization techniques, service oriented architecture (SOA); OGC standards, GML, GeoSciML,
- Digital Cartography (automatic generalization and classification algorithms)

Outcome

- Seamless Geological map of entire country at 1:50K available through Portal with drilldown and data extraction facilities;
- Graphic and attribute data population of all other domains through Portal,
- Standardization of Map symbology, nomenclature etc.

National Geospatial Datasets – XIII Plan Period**Activity :**

- Completion of legacy data entry for all domains in to the geoscientific database and spatial data warehouse
- Delivery of multi-thematic data and 3D data through OGC compatible web services
- Graphic and attribute data entry for current field season projects through Portal
- National and international correlation of standards (collaboration with NNRMS, NRDMS, SOI, foreign geological surveys etc)

Human Resource:

- As in XII plan

Technology:

- 3D GIS, 3D spatial database, 3D visualization techniques, service oriented architecture (SOA); OGC standards, GML, GeoSciML,
- WebCartography (user-controlled map display, query and visualization)

Outcome

- Seamless multi-thematic spatial data layers for the entire country at 1:50K available through Portal with drilldown and data extraction facilities;
- Semantic homogeneity and interoperability within spatial data of different agencies

National Geospatial Datasets – XIV Plan Period**Activity :**

- Continuous update of geospatial databases, augmentation of data warehouse – integration of all field data collection processes with scientific and back office applications

Human Resource:

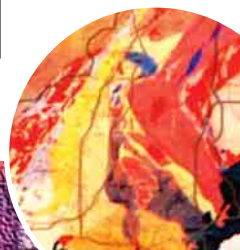
- As in XII plan

Technology:

- As available and relevant

Outcome

- Globally standardized, interoperable, semantically homogenous multi-thematic and multi-dimensional geoscientific datasets available to the community for viewing, exploration, visualization and extraction.



10.8.0. Product Management:

GSI's product basket consists of conventional hard copy maps, reports and publications – all in analogue form. The stage is now set for GSI to respond to customer request through electronic means, portal, web feature services, customized print-on demand, online systems to simplify and speed up delivery. GSI has to produce datasets in specialized forms to support geoscientific research, such as raw data as well as in a form, which is understandable by non-geoscientists. Coupled with digital data access and delivery comes the issue of licensing of digital data and copyright issues which has to be resolved. GSI has already converted most of its unpublished reports in digital form and currently is engaged in various efforts to digitalize other legacy data holdings. (Table – X. 6)

Activity matrix – Product Management

Table – X.6

Product Management – XI Plan Period
Activity :
<ul style="list-style-type: none"> ● Generation of new product series from national spatial datasets (e.g. geological maps at scale 1 :50000) – digital format (raster) ● Revision of old product series such as geological quadrangle maps, district resource maps etc ● Archival of historical maps and publications ● Conversion of old paper map series to digital (high-resolution raster) format ● Metadata generation for all product series ● Content creation and processing for web ● Dissemination, publishing, mass communication, IPR related issues and security
Human Resource:
<ul style="list-style-type: none"> ● 100 Geoscientists (for content management in different offices of GSI), 4 Computer engineers, 40 Data entry operators
Technology:
<ul style="list-style-type: none"> ● Spatial database, Digital cartography, GIS based map compilation and composition ● Desktop publishing ● Analogue to digital conversion best practice.
Outcome
<ul style="list-style-type: none"> ● Digital data products and dissemination ● Archival and metadata for all products, ● New raster / pdf products, ● GIS database for selected compilations (geomorphology, geochronology, tectonics etc)
Product Management – XII Plan Period
Activity :
<ul style="list-style-type: none"> ● Generation of new products (extracted from national geospatial datasets) – regional geology guides, multimedia products ● Widespread dissemination using electronic media ● Leisure products (e. g. GeoTour Maps / educational guides) ● Metadata generation for all product series ● Content creation and processing for web

- Dissemination, publishing, mass communication, IPR related issues and security
- Conversion from analog publishing format to digital library (Publications, maps, journals)

Human Resource:

- 125 Geoscientists (for content management in different offices of GSI), 4 Computer Scientists, 50 Data entry operators

Technology:

- Web GIS, Web Cartography, RDBMS
- Portable Electronic publishing
- Multimedia technology

Outcome

- Standardized product development
- Updated Seismotectonic Atlas, Earthquake Compilation, etc
- Regional geology guides, multimedia products in DVD / Blue-ray Disk (BRD)

Product Management - XIII Plan Period**Activity :**

- Introduction of newer product series from scale independent seamless datasets as per customer demand
- Dissemination using user controlled map service
- Collaboration with other geoscientific agencies (NNRMS, NRDMS, SOI, etc) to develop and utilise new markets and opportunities – pilot project

Human Resource:

- As in XII plan

Technology:

- Web GIS, Web Cartography, RDBMS, collaboration tools and services
- Portable Electronic publishing
- Multimedia technology

Outcome

- Standardized product development
- Development of new markets

Product Management - XIV Plan Period**Activity :**

- Provision of series of customizable / flexible products and services as per user requirement available through GSI Enterprise Portal
- Collaboration with other geoscientific agencies to develop and utilise new markets and opportunities

Human Resource:

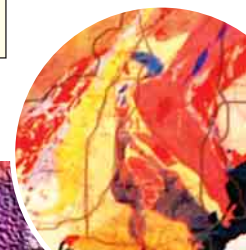
- As in XII plan

Technology:

- As available and relevant

Outcome

- Whole gamut of authentic geoscientific products and services easily available to the user community through a secured gateway



10.9.0. 3D/4D Integrated Applications:

10.9.1. Earth functions as a very complex system and to address the many complicated problems posed by this system, integrative and innovative approaches are required. These problems are inherently 4-D in nature involving the subsurface and variation with time. Thus, their solution requires data analysis that is far more complex than provided by traditional 2D GIS. Advances in computer hardware and geologic modelling and visualization software now provide us the opportunity to construct 3-D databases and geologic maps that retain all the information in a 2D traditional geologic map while explicitly and quantitatively extending this information throughout the subsurface. As the premier geoscientific agency of India, GSI also deals with large volumes of multidisciplinary data sets. Barring few project-level efforts so far GSI has been storing, analysing data in a predominantly 2D system. It has now become necessary to extend this into an integrated organization-wide effort to adopt a 3D geologic data model, a 3D digital database based on that model and a philosophy, framework, and set of new tools with which to construct, portray, and distribute 3-D geologic map information. (Table-X.7)

Table – X.7

Activity matrix – 3D/4D integrated app

3D/4D integrated applications – XI Plan Period
<p>Activity :</p> <ul style="list-style-type: none"> ● Compilation of all 3D/4D spatial data (e.g. borehole data, geophysical data etc) ● Collaborative project with Foreign Geological Surveys (BRGM, AGSO, BGS) towards effective management of 3D spatial data (transfer of technical know-how through pilot/ test-beds)
<p>Human Resource:</p> <ul style="list-style-type: none"> ● 40 Geoscientists, 10 Data entry operators
<p>Technology:</p> <ul style="list-style-type: none"> ● 3D GIS, RDBMS, 3D processing, modeling and visualization tools, ● customised 3D/4D geoscience analysis tools
<p>Outcome</p> <ul style="list-style-type: none"> ● Repository of 3D geospatial data ● Manpower trained in 3D/4D integration, visualization and analysis and techniques necessary to produce 3-D maps that retain all the detail in traditional maps while extending this information into the subsurface.
3D/4D integrated applications – XII Plan Period
<p>Activity :</p> <ul style="list-style-type: none"> ● 3D geospatial data entry in geoscientific database with special reference to Mineral life cycle and natural hazard management ● Collaborative project with Foreign Geological Surveys (BRGM, AGSO, BGS) and / or national / state agencies (SOI, IBM, MECL, NNRMS etc) to build 3D spatial databases and map services; ● Integration with baseline 2D digital databases
<p>Human Resource:</p> <ul style="list-style-type: none"> ● 90 Geoscientists, 10 Computer Scientists, 25 Data entry operators
<p>Technology:</p> <ul style="list-style-type: none"> ● 3D GIS, RDBMS, 3D processing, modeling and visualization tools, ● customised 3D/4D geoscience analysis tools

Outcome
<ul style="list-style-type: none"> ● Comprehensive 3D GIS archive for Mineral resource, natural hazards etc integrated with Portal, ● 3D simulation of Seismic hazards; ● 3D data model, maps and map services; shallow subsurface geology – basis for research in tectonics and sustainable utilization of mineral and energy resources
3D/4D integrated applications – XIII Plan Period
Activity :
<ul style="list-style-type: none"> ● 3D geospatial database with special reference to Mineral life cycle and natural hazard management ● Research on Spatial decision support system incorporating 3D/4D
Human Resource:
<ul style="list-style-type: none"> ● As in XII plan
Technology:
<ul style="list-style-type: none"> ● As available and relevant
Outcome
<ul style="list-style-type: none"> ● Spatial information management in a virtual 3D / 4D environment ● Sustainable natural resource development
3D/4D integrated applications – XIV Plan Period
Activity :
<ul style="list-style-type: none"> ● Extensive application of 3D/4D spatial technology in studies pertaining to sustainable natural resource development ● Spatial decision support system (SDSS) incorporating 3D/4D
Human Resource:
<ul style="list-style-type: none"> ● As in XII plan
Technology:
<ul style="list-style-type: none"> ● As available and relevant
Outcome
<ul style="list-style-type: none"> ● As in XIII plan ● SDSS available through GSI Portal

10.10.0. Mobile Mapping:

10.10.1. Mobile GIS for field mapping especially for Geo-chemical, Geological Mapping and Mineral exploration. Officers can enter the raw data collected at the field directly in to the 'Field Diary' module of FSPMIS available through GSI Portal over the Internet. The data / sample entered will be further processed/analysed offline at office/laboratory and the analysis results will be available to geoscientists through the LMS transactional application. Final results in the form of map and reports will be available to the public through GSI Portal in the form of map services and metadata and downloads. (Table-X. 8)



Table – X.8

Activity matrix – Mobile mapping

Mobile Mapping – XI Plan Period
Activity :
<ul style="list-style-type: none"> ● Widespread use of digital technology in field data collection especially in NGCM, GPM projects - synchronised with FSPMIS ● Deployment of best-practice digital workflow from field data collection to end product.
Human Resource:
<ul style="list-style-type: none"> ● All field going officers and staff and officers associated with National Geospatial datasets activity ● Officers posted at laboratories ● Officers in planning and monitoring divisions
Technology:
<ul style="list-style-type: none"> ● Handheld mapping tools (GPS, Mobile GIS, DataCard, etc) Internet, WAP, Digital camera
Outcome
<ul style="list-style-type: none"> ● Digital data collection – no more backlog of analogue data ● Workflow driven data collection, storage, analysis and distribution
Mobile Mapping – XII Plan Period
Activity :
<ul style="list-style-type: none"> ● Consultation of existing information available through GSI Portal from the field ● Direct field data entry – synchronised with FSPMIS and other transactional applications for all Field season Projects
Human Resource:
<ul style="list-style-type: none"> ● As in XI plan
Technology:
<ul style="list-style-type: none"> ● As in XI plan
Outcome
<ul style="list-style-type: none"> ● Digital workflow for all field season project – synchronised with FSPMIS – LMS – GSI Portal
Mobile Mapping – XIII XIV Plan Period
Activity :
<ul style="list-style-type: none"> ● Field officers consulting and updating the geospatial database online from field ● Upgradation of relevant transactional modules to incorporate new data models ● Upgradation of GSI Portal with new map and metadata services (for consultation from field) ● Digital library (for consultation from field)
Human Resource:
<ul style="list-style-type: none"> ● As in XI plan
Technology:
<ul style="list-style-type: none"> ● As available and relevant
Outcome
<ul style="list-style-type: none"> ● Complete integration of office and field processes using scientific and transactional applications available through GSI Enterprise Portal

10.11.0. e-GOVERNANCE, e-COMMERCE AND e-LIBRARY

10.11.1. In pursuance of the national e-governance plan GSI has to gradually adopt means to transact through electronic media. With the information infrastructure in place, new modules like vigilance administration, Right to Information Act, Grievance etc can be integrated with the portal through outsourcing. Priority will be given to e-commerce modules like e-payment and e-procurement in the

current plan period. To achieve this, GSI IT infrastructure has to be linked with the Pay and Accounts offices (PAO) of GSI which functions as the authority for any financial transaction of GSI. Similarly for e-payment, suitable payment gateway has to be created in collaboration with Banks. Modalities of these are to be decided through joint initiatives. Joining of Pay and Accounts offices can be done either by extending extranet facility with secured communication and authentication measures or extending the GSIMPLS VPN to those offices by establishing dedicated links. However, this can only be finalized after bilateral discussion and agreement. For e-payment gateway, GSI may use facilities of the existing providers of e-payment service.

10.11.2. Implementation of e-Library in GSI: Generally speaking e-Library replicates the resources of a physical library in an electronic format. Since it is electronic, it has better access and search capabilities than a conventional library. In Information Technology parlance, e-Library is a portal / intranet / extranet / Intranet site that keeps and disseminates library records / information to users through web based systems in a user-friendly manner. In short, it brings a library to the desktop of the user.

10.11.3. An e-library may contain the following:

1. electronically acquired documents e.g. journals, magazines and e-books
2. electronically published original documents / journals, etc.
3. digitised replica of materials that are originally in print format
4. links to free and open content that exists in web

10.11.4. thus, three broad categories of materials viz. original document, digitised contents and third party resources could be present in an e-library.

10.11.5. e-Library can add value to this IT infrastructure of GSI. Implementation of e-library in GSI is envisaged to extend the following services and needs development of a full-blown application covering the following arenas:

- Online access to Journals: GSI subscribes to different scientific journals which are also available online. By undertaking necessary formalities with the publishers, these journals can also be made accessible by any employee to GSI online on 24x7 basis. This will help GSI employees to access and download the latest issues of journals without any delay through his / her desktop without physically visiting the library.
- Offline access and archiving of Journals: Back issues of journals can be archived and kept ready for consultation by the employees. If archiving is done at GSI, employees can access the journals using its intranet without connecting to Internet. This will eventually reduce the cost and enhance the performance in terms of accessing library resources.

Activity matrix – E-governance and E-commerce

Table – X.9

E-governance, E-commerce and E-library – XI Plan Period
Activity :
<ul style="list-style-type: none"> ● Fine tuning of all back-office transactional applications (Annexure – X.II) ● New module - e-procurement, Vigilance administration, RTI, grievance, e-library ● Master and historical data entry ● Adoption of transactional applications for regular office use
Human Resource:
<ul style="list-style-type: none"> ● All employees of GSI ● Third party system integrators

Technology:
<ul style="list-style-type: none"> ● J2EE, RDBMS, JAVA, XML, etc ● Internet technologies
Outcome
<ul style="list-style-type: none"> ● Office automation ● Better administration and transparency ● Availability of earth science journals over WAN by scientific officers of GSI
E-governance, E-commerce and E-library – XII Plan Period
Activity :
<ul style="list-style-type: none"> ● Upgradation and critical maintenance of all back-office transactional applications, ● Addition of new modules as per requirement ● Adoption of GOI best practices through collaboration with other Government agencies, ● Bilingual information dissemination ● Interfacing with PAO offices
Human Resource:
<ul style="list-style-type: none"> ● As in XI plan
Technology:
<ul style="list-style-type: none"> ● As in XI plan ● Newer technologies as relevant
Outcome
<ul style="list-style-type: none"> ● Complete office automation
E-governance, E-commerce and E-library XIII & XIV Plan Period
Activity :
<ul style="list-style-type: none"> ● 24X7 maintenance of transactional applications ● Regular upgradation / addition as per policy / rule changes
Human Resource:
<ul style="list-style-type: none"> ● As in XI plan
Technology:
<ul style="list-style-type: none"> ● As available and relevant
Outcome
<ul style="list-style-type: none"> ● GSI Enterprise Portal – a complete means for e-governance and e-transactions

10.12.0. Human Resource:

10.12.1. Before embarking into the discussion for future requirement of manpower a quick glance at present scenario would be critical to understand the situation for future requirement of manpower.

10.12.2. Operations which are directly involved in processing of legacy data into structured format and digital conversion of maps and soft copy conversion of reports are Information Technology and Map & Publication (M & P) respectively. However, at Region/Wing or Operational unit level various

directorates are controlled by respective Dy. Director Generals. Besides, the data generated by current field projects are dealt by the concerned investigating officers under the jurisdiction of Regions, Wings and Operational Units. The current structural set up vis-à-vis deployment of geoscientists is detailed in Table – X.10

Human resource requirement

Table – X.10

REGION	Op: Information & Technology (JTS/STS + JAG)	Op: Map & Publication (JTS/STS + JAG)
Central Headquarters	8+2	14+5
Eastern Region Headquarters	4+1	10+3
Op: West Bengal-Sikkim-Andaman & Nicobar, Op: Orissa, Op: Bihar & Jharkhand	6+2	5+2
Southern Region Headquarters	5+1	8+2
Op: Andhra Pradesh, Op: Karnataka & Goa, Op: Tamil Nadu, Pondicherry & Kerala	12+4	13+5
Central Region Headquarters	4+1	5+2
Op: Maharashtra (East), Op: Maharashtra (West), Op: Madhya Pradesh & Chhattisgarh	5+3	4+2
Northern Region Headquarters	6+2	10+2
Op: Uttar Pradesh & Uttarakhand, Op: Punjab & Himachal Pradesh, Op: Jammu & Kashmir	7+4	4+4
Airborne Mineral Survey & Exploration	1+1	4+2
North Eastern Region Headquarters	1+1	5+2
Op: Assam Meghalaya Tripura Mizoram, Op: Arunachal, Op: Guwahati		0+2
Western Region Headquarters	3+1	7+2
Op: Rajasthan, Op: Gujarat	2+1	3+1
Coal Wing	3+1	6+2
Marine Wing	1+1	4+2
East Coast Op I, East Coast Op II, West Coast Op I, West Coast Op II		2+2
TOTAL	68+26	104+42

10.12.3. It becomes evident from the Table – X.10 that only 172+68 geoscientists are engaged in processing and formatting legacy as well as current data. The number is too meagre considering the scientists and technicians deployed in the Geological Surveys in the domain of data processing and dissemination. For instance the British Geological Survey deploys roughly 1/3rd of their strength in this domain.



10.12.4. Keeping in view the enormous task of continuing with this mammoth infrastructure and to realize the future goal, adequate personnel equipped with the requisite skill-sets need to be inducted. Without a new generation of talented scientists to replace aging, departing staff, the ability of GSI to fulfil its missions will be severely compromised. GSI needs to devote substantial efforts to recruiting and retaining excellent staff and reemploy retired personnel of proven record till such time as the gap is filled through new recruitment. The induction and rejuvenation of the work force should take into account the new areas of expertise that will be needed in the future.

10.12.5. Even if the geoscientific staff of GSI was to increase substantially in the future, the increase alone would probably be insufficient for the agency to accomplish its goals solely through in-house activities. So far all information management activities in GSI have been performed by the geoscientists trained in techniques of geoinformation science. However, it is unlikely that the existing staff, even with major retraining, would be able to keep up with all of the new techniques and new knowledge required to carry out an ambitious program of integrative multidisciplinary geoscience.

10.12.6. During the IXth and Xth plan the thrust area in Geoinformation management in GSI was initially the **Geoinformatics Project** followed by the **Digital Archive Project**. While the former aimed at collating, digitalizing, storing, visualizing and analysing the vast volume of geoscientific information collected over the years, the latter served as a feeder project to convert the existing analog maps and reports to a digital form. Considering the immense volume of data – both projects were launched at distributed centres all over the country. Constraints were recognized in the form of lack of adequate trained personnel, lack of infrastructure for collaboration and data sharing and of course the sheer volume of data. Project Digital Archive has been completed (as far as legacy data is concerned) and the outputs are now available for use in the Geoinformatics project (which is still continuing). However, considering the complexity of Indian Geology and newer vistas of knowledge, lot of data standardization has to be done which would require Herculean efforts from the geoscientists. With the establishment of the Portal and GSINet the problem of infrastructure may have been solved (the hardware/software/network infrastructure needs to be upgraded periodically, as per requirement), but the manpower crunch still remains an unsolved issue. Induction of young, trained manpower is the need of the hour to carry the mantle ahead and to fulfil the future goals of the organization.

10.12.7. To achieve some of the goals mentioned above, GSI has to collaborate with foreign geological surveys and gain technical know-how, for some of the other goals it may have to resort to outsourcing. For example, the activity - 3D/4D integrated applications will necessarily require project-based collaboration with foreign geological surveys like BGS/GSC/BRGM (these survey organizations have developed considerable expertise in handling 3D/4D data and in multi-dimensional spatial database technology), whereas for maintaining and augmenting the information infrastructure and establishing the geoscience network GSI has to outsource the work to third party system integrators and OEMs. GSI will also need to induct computer/software/network Scientists for first-level maintenance, help desk service, research in Geomatics and monitoring of outsourcing activities. They will essentially act as the bridge between GSI geoscientists and system integrators.

10.12.8. The Committee has recommended that the high level Committee be constituted to work out detailed project frameworks, milestones and the manpower requirement for executing the activities pertaining to Mission-Geoinformatics. GSI may bring the plans worked out in consultation with this committee before the CGPB. However, in the Committee's view, the overall manpower requirements are likely to be of the following order and may be taken for purpose of overall organizational level manpower planning:



Table – X.11

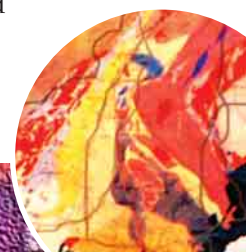
Consolidated manpower requirement*

Plan period	Activity domains	Manpower requirement			
		Geoscientists	Computer Scientists	Data entry operators	Others
XI	Information Infrastructure	50	16	50	Third party system integrators
	National Geospatial datasets	160	0	60	
	Product Management	100	4	40	
	3D/4D integrated applications	40	0	10	3D / 4D spatial database experts
	Mobile mapping	Officers associated with Project-National Geospatial Datasets			All field-going officers
	E-governance & E-Commerce	Officers associated with Project - Information Infrastructure			Hindi officers, Adm, MMD, etc. Third party system integrators
Total manpower - end of XI plan		350	20	160	
XII	Information Infrastructure	125	21	75	Third party system integrators
	National Geospatial datasets	200	3	100	
	Product Management	125	8	50	
	3D/4D integrated applications	90	2	25	3D/4D spatial database experts
	Mobile mapping	officers associated with Project - National Geospatial Datasets			All field-going officers
	E-governance & E-Commerce	officers associated with Project - Information Infrastructure			Hindi officers, Adm, MMD, etc. Third party system integrators
Total manpower - end of XII plan		540	34	250	

* Manpower requirement will remain the same for the next three plan periods i.e. XIII, XIV and XV plans.

10.12.9 Roles, composition, training of officers and staff associated with Geoinformation Management activity will be as follows:

- **Geoscientists (GS):** This will include Group A and B officers from Geology, Geophysics and Geochemistry and also personnel from other supporting streams. They will act as domain experts and project leaders based in Central Headquarters, Regional and operational offices all over India. They should have sound knowledge of application of Information Technology in geoinformation management. In house / outsourced / foreign training will be necessary to keep pace with the developments in the IT field, especially the geospatial domain.
- **Computer Scientists (CS):** At present no computer Scientists are posted in GSI. They have to be outsourced as per the demand of specific project. For example, for the Project - 3D/4D integrated applications, which is research based, long term association of Computer Scientists with geoscientists is necessary, as such long term arrangements will need to be entered into with a leading private software agency specializing in such applications. A professional consultant like NIC SI may be engaged to identify such agency. Recruited Computer Scientists will be placed mainly at CHQ.



- **Data entry Operators (DEO):** DEOs necessary for voluminous legacy data entry to various database and metadata-bases, which will include Master data entry in transactional applications, Attribute and graphic data (through digitisation) entry in geoscientific database and soft copy conversion of analogue information products. They will be working under the supervision of Geoscientists. At present no Data Entry Operator post exists in GSI.

10.12.9.1. The Committee recommend that requirement of DEO should be met through Agency level outsourcing separately at Headquarters and Regions.

- **Security personnel:** Especially needed in case of Central Data Centre and Disaster Recovery Centre at Kolkata and Hyderabad respectively. These centres house expensive servers and networking equipment, which need to perform smoothly in order to run the GSI information infrastructure 24x7. The Committee has already recommended outsourcing of these Support System services in Chapter IX.
- **Training:** Geoscientists working in Mission – Geoinformatics will require continuous skill upgradation. Training needs are projected in Table – X.12.

Training needs vis-à-vis mission

Table – X.12

Activity Domain	Role	Composition	Training needs	Venue of training
Information Infrastructure (Ref Page #)	System Administration	GS, CS#	System Adm	NIC, private (OEM)
	Network Administration	GS, CS	Networking	
	Data entry	DeO*	Computer awareness	GSITI
	Portal Administration	GS, CS	Database & Web technology	NIC, private (OEM)
	Content Management	GS		
	Application development	CS, GS	To be mostly outsourced – under supervision of geoscientists and computer Scientists	
National Geospatial Datasets – (Ref Page #)	Spatial database development	GS	GIS, RDBMS, RS	GSITI/private/ Foreign (ITC, Netherlands)
	Map compilation	GS	Digital map compilation	In house
	Text and graphic data entry	DeO	Digital data automation	GSITI
	Application development	CS, GS	To be mostly outsourced – under supervision of geoscientists and computer Scientists	
Product Management – (Ref Page #)	Digital products delivery	CS, GS	Database and Web technology, Cartography and visualization	Foreign (ITC, Netherlands) / Private
	New product development	GS		
	Dissemination	GS		
3D/4D integrated research – (Ref Page #)	3D GIS specialist	GS, CS	3D GIS, RDBMS PGRS,	Foreign geological surveys (BGS-UK, BRGM-France, USGS-USA, ITC - Netherlands)
	Image analyst	GS	Expert system	
	3D Application development	CS, GS	development, Multicriteria data analysis, VRML	

Activity Domain	Role	Composition	Training needs	Venue of training
Mobile mapping – (Ref Page #)	Field data collection	GS	GPS-GIS integration	GSITI, Private (OEM)
	Raw data compilation and integration	GS		
	Application Integration	CS, GS		
E-governance & E-commerce – (Ref Page #)	E-transaction	CS, GS	End user training	GSITI
	Application development	CS, GS	To be mostly outsourced under supervision of geoscientists and computer Scientists	
	Data entry	DeO	End-user training	GSITI

GS: Geoscientists, CS: Computer Scientists*DeO: Data entry Operator

10.12.10. **E-education:** A basic module of e-learning has been developed as part of GSI Portal project – it is still under rigorous testing and will be implemented gradually with the collaboration of GSITI. Through this module computer awareness can be provided to Group-C and other employees – basic familiarization regarding office software, operating system can be done through distance-education. This would be cost-effective both in terms of money and time.

10.12.11. **Software needed during Xlth plan:** Desktop GIS, Server GIS, Mobile GIS, Interoperability tools, Multimedia authoring software, Office software, Operating system, Digital security implementation tools, custom-built tools such as e-procurement module, e-payment module, etc

Cost – approximately Rs.7 crores including annual maintenance

10.13.0. **Partnership:**

10.13.1. The GSI Portal will need enormous resources to keep it functional at an optimally high level. Human resources within the organization are of course one aspect of it. However, GSI needs to ensure an institutionalised overarching mechanism, comprising the NSDI, NNRMS, NIC, NICS and NRDMS etc. in order to

- Develop and operationalise synergetic application
- Develop and use common standards and protocols
- Help create sectoral strength within the organization and in the private sector, and facilitate development of downstream applications
- Develop capacity in academic and R&D institutions so as to create long term geoinformatics strength
- Enter into joint collaborative projects with foreign geological surveys such as BGS, GSC, USGS, BRGM etc. for knowledge sharing etc.

10.13.2. The Geoinformatics Committee of CGPB is in the Committee's view the appropriate mechanism for this purpose.

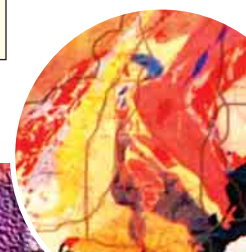
10.14.0. **Budget and Funding**

10.14.1. For operating Mission Geoinformatics in GSI the provision for funds under different plans are indicated in Table – X. 13.



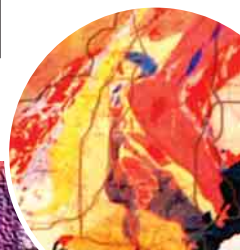
Present Applications: Intranet Scientific

Laboratory Management System	<p>The Laboratory Management System (LMS) has interfaces with three other system modules as follows: FSP Module; H R Management Module</p> <p>The following are the outputs that can be generated through the system:</p> <ul style="list-style-type: none"> ● Geo-Chemical Water Report ● Geo-Thermal Gas Analysis ● Monthly Report of Chemical Laboratory ● Report of Chemical Analysis by XRF-1; XRF-2; AAS/Fire Assay Technique; GF-AAS Technique; MS/NAA Method; HG-AAS; DC-ARC Spectrograph ● Report of Chemical Analysis by DC-ARC Spectrograph ● Quarterly Progress Review for Chemical Laboratory ● Monthly Statement of Sophisticated Instruments; Manpower; ● Report of X-Ray Analysis of Samples ● GIG Age Report- U-Pb Method ; Rb-Sr Method; Sm-Nd Method; Radio C Dating ● GEM Mineralogical Report; Monthly Report; Mineral Summary; Collection Detail; ● Report on Physical Properties of rocks ● Test Report of Soil Samples; Rock Samples ● Report of Chemical Analysis by HG-AAS; Mercury Analyzer; CHNS Analyzer ● Report of Petrology Grain Size Analysis; Fluid Inclusion; ● Report - Petrographic Study Mineral; Ore Mineral; Igneous Rock; Metamorphic Rock; Clastic Sedimentary Rock; Non-Clastic Sedimentary Rock ● Report Megascopic Petrological Study Mineral; Igneous Rock; Metamorphic Rock; Clastic Sedimentary Rock; Non-Clastic Sedimentary Rock; Loose Sediment 	Application is ready can be used for commercial samples immediately, indigeneous data can be processed after April,2009
Geoscientific database	<ul style="list-style-type: none"> ● Map 1:50,000 ● Exploration ● Geochemical Investigation ● Drilling ● Coal ● Geophysical Investigation, ● Photogeology and Remote Sensing ● Environmental Geology ● Natural Hazard (landslide, earthquake and flood) ● Rock Sample analysis (Petrology, Palaeontology and Geotechnical properties of rock) <p>Map 1:50,000</p> <p>The input from hard rock mapping and Quaternary geology mapping for individual topo-sheet is stored in a structured format. Such information are classified under the categories</p> <ol style="list-style-type: none"> 1. General information regarding the sheet and the investigator 2. Information on Lithology, mineralogy, litho-stratigraphic and geochronological age 	



<p>3. Information on nature of boundaries.</p> <p>4. Information on linear geological features, fossil occurrences, mineralisations, mines/quarries</p> <p>5. Geomorphic features, morphometry, morpho-stratigraphic unit,</p> <p>Exploration</p> <p>The Mining Exploration domain stores data generated through the mineral exploration programmes and stores attribute values from the following domains</p> <ol style="list-style-type: none"> 1. Location and RL, of the mineral occurrences, shape and dimension, host rock characteristics, structural setting, nature of alteration, nature of surface indications 2. Information on a Prospect, commodity, locality, RL, land use, brief regional geology and structure, genesis 3. Block details within a Prospect, type of deposit, surface indications, mineral paragenesis, 4. Information on Ore Body – length, width, thickness, orientation, grade, reserve 5. Information on different sample points in the prospect <p>Geochemical Investigation</p> <p>The Geochemical Investigation domain stores data generated through the Geochemical Exploration programmes which include</p> <ol style="list-style-type: none"> 1. Information on the area, purpose 2. Information on the survey description, sampling density, sampling type, sampling technique, grain size range, soil type, soil horizon, stream order, lithology 3. Description of Point, sample, Batch and analytical result. 4. Information on anomaly, the commodity, maximum and the threshold value <p>Drilling</p> <p>The Drilling domain stores data generated through the Drilling activities associated with different Exploration programmes. The data entry parameters are detailed below :</p> <ol style="list-style-type: none"> 1. Information on Borehole- inclination, bearing, length of borehole, RL of collar and bottom, commodity, supergroup 2. Borehole deviation details 3. Core recovery details 4. Geophysical logging details 5. Depth wise stratigraphic, lithological and structural details 6. Description of sample 7. Analytical results of the borehole samples 8. Description of the ore zone <p>Coal</p> <p>The Coal domain stores data generated through the Coal investigation programmes, inputs include:</p> <ol style="list-style-type: none"> 1. Information on Coal Basin; Stratigraphic description of the basin; results of the seismic study of the basin. 2. Information on Coal fields within a Basin 3. Information on Sector within a Coal Field 4. Information on Block within a Sector including information on drilling. 5. Information on Coal Seam, chemical analysis of the seam, reserve and grade of the seam. 	
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	<p>6. Information on Coal sample like chemical analysis, physical property, band analysis and petrography</p> <p>Geophysical Investigation,</p> <p>The Geophysical Investigation domain stores both metadata as well as actual data generated through the Geophysical investigation The broad data entry parameters are detailed below :</p> <ol style="list-style-type: none"> 1. Information on the Investigation area, purpose of investigation, 2. Definition of gravity base, local base and benchmark, 3. Information on the block of the Investigation area. 4. Description of the layouts for the Survey, grid and line 5. Methods employed 6. Data/Metadata collected from Gravity, magnetic, Self potential, IP Resistivity in time domain, IP Resistivity in frequency domain, Electromagnetic, resistivity sounding, transient EM and Spectral IP 7. Anomaly description <p>Photogeology and Remote Sensing</p> <p>The PGRS domain stores the inventory of the aerial photographs, satellite images and the data generated through the PGRS programmes. The broad data entry parameters are detailed below :</p> <ol style="list-style-type: none"> 1. Information on the storage of satellite images 2. Information on the storage of aerial photographs 3. Information on the properties to identify lithology, structure, geomorphology, landuse, structure, folds, lineaments and trend lines. <p>Environmental Geology</p> <p>The Environmental Geology domain stores the data generated through the Environmental Geology programmes. The inputs are detailed as follows :</p> <ol style="list-style-type: none"> 1. Description of the area of study, brief geology, geomorphology, biotic environment, meteorology, noise, air quality, aesthetics, slope, land use/ land cover, soil, water bodies, groundwater recharge area and socio-economy 2. Description of mine belt and potential mine belt 3. Environmental appraisal data of tourism site; data of urban areas; desert areas; coastal areas; river valley projects 4. Short description on hazards like earthquake, flood, landslide, waterlogging <p>Natural Hazard (landslide, earthquake and flood)</p> <p>The Natural Hazard domain stores the data generated through the programmes. They may be broadly subdivided into three subdomains, e.g. Flood, Seismic and landslide. The system is capable of storing parametric values as detailed below</p> <ol style="list-style-type: none"> a) Flood Hazard : <ol style="list-style-type: none"> 1. Floodplain description, along with morphostratigraphic units, available data from meteorological and hydrological stations 2. Flood description including flood parameters, flood effects and remedial measures b) Landslide Hazard : <ol style="list-style-type: none"> 1. Landslide description 2. Landslide zonation 3. Description of Geology 4. Description of Geomorphology 	
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	<ol style="list-style-type: none"> 5. Description of geotechnical properties 6. Origin of the slide <p>c) Seismic Hazard :</p> <ol style="list-style-type: none"> 1. Description of a seismic event 2. Earthquake data repository 3. Macroseismic data 4. Isoseismal curve description <p>Rock Sample analysis</p> <p>Results from various studies pertaining to rocks and fossils are structured in this system under the following heads</p> <ol style="list-style-type: none"> 1. Description of a sample 2. Thin section description 3. Polished section description 4. Geochronological age details 5. Mechanical property details 6. Palaeontological description 7. Whole rock analysis of samples <p>All these domains can be linked to the spatial datasets of Map 1:50,000 domain Enterprise GIS</p>	
Enterprise GIS	<p>Introduction:</p> <p>The web GIS application can be accessed through portal, while data migration utility (Load and Update utility) and customized Metadata Editor can be accessed from ArcGIS ArcInfo clients. Web browser displays the map using ArcIMS and ArcSDE service and shows the corresponding attribute data from Geoscientific database</p> <p>The application is capable of delivering functionalities:</p> <ul style="list-style-type: none"> ● Migration of legacy spatial data available in SHP / Coverage files to Multiuser Geodatabase ● Generation of Metadata (XML files) based on National Spatial Data Infrastructure (NSDI) format ● Web-enabled interface to show geological maps supporting major Internet browsers ● Separate Map interface for Coal, Marine and Geological Maps (1:50,000) ● Map service for dissemination of geological map in 1:2 Million with mineral information and search interface for metadata related to GSI reports ● Miniature Map service to search GSI products as maps and reports based on latitude and longitude values. <p>The GIS application can be broadly divided into the following subsystems:</p> <ul style="list-style-type: none"> ● The Spatial Data Ware House ● Load and Update Subsystem ● Metadata Editor ● The Inquiry Subsystem <p>The Spatial Data Ware House</p> <p>Work flow:</p> <p>The multi-user geodatabase acts as a centralized spatial data warehouse for all users across the organization, which include the following domains</p> <ul style="list-style-type: none"> ● Map50K ● Coal 	Application development complete and running

- Marine
- Photogeology & Remote Sensing
- Drilling
- Geochemical
- Geophysical
- Geothermal
- Glaciology
- Mining Exploration
- Natural Hazards
- Environmental
- Rock Sample

2.2. Load and Update utility

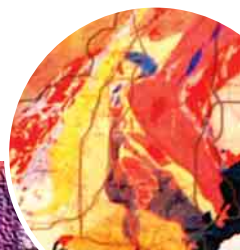
This system validates the geometry and the corresponding attribute information attached with them as per the specifications in geodatabase tables and uploads validated data.

2.3. Metadata Editor

A utility called GSI metadata editor incorporating the metadata specification of NSDI has been developed and integrated with the ArcGIS desktop. It generates metadata of individual layers and export the metadata into XML format for public viewing.

2.4. The Inquiry Sub System

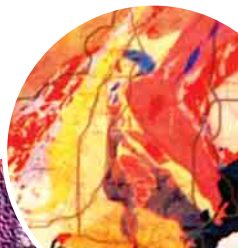
The Inquiry system has the facility of carrying out spatial analysis using Spatial Data warehouse as geodatabase source. Customized Map service is made available to the intranet user groups.



**Present Applications on Intranet
For Administrative work**

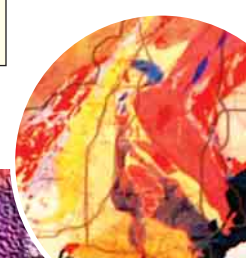
Module	Functionality	Status
Payroll	<p>The PAYROLL module is an integrated system that has interfaces with Human Resource Management System (HRMS) & CLAIMS. The intended users of the payroll module will be the users of Payroll department. In addition, the functionality will be available to the general employees with different screen access permissions For each employee Payroll computation will be achieved through this module.</p> <p>The Payroll system interacts extensively with the Claims and Personnel modules with respect to the following aspects:</p> <ul style="list-style-type: none"> ● Claims Module: Employee's advance (loan) amount from Claims module will be drawn to the payroll system at the time of monthly payroll transaction. ● Personnel Module: Employee pay fixation would be done through data received from the Personnel Module. Increment date, transfer date and deputation information are drawn to the Payroll system from the HRMS Module. <p>OUTPUT: <i>List of reports:</i></p> <p>Pay Bill, Pay slip, Monthly recovery schedule of Professional Tax, Monthly recovery schedule of CGHS, Monthly recovery schedule of HBA, Monthly recovery schedule of Motor Car Advance, Monthly recovery schedule of HBA Interest, Monthly recovery schedule of Interest of Scooter Advance, Monthly recovery schedule of Computer Advance, Monthly recovery schedule of GPF, Monthly recovery schedule of License Fee, Monthly recovery schedule of CGEGIS, HBA recovery Schedule for individual employee, CGHS recovery Schedule for individual employee, Motor Car Advance recovery Schedule for individual employee, HBA Interest recovery Schedule for individual employee, Interest of Scooter Advance recovery Schedule for individual employee, Computer Advance recovery Schedule for individual employee, GPF recovery Schedule for individual employee, Form 16, Form 13, Calculation Sheet For Family Pension And Death Gratuity In Respect Of Late Employee, Calculation Sheet For Pension, Gratuity & Family Pension for superannuation, Last Pay Certificate (LPC), No Demand Certificate (NDC)</p>	Modification as per 6 CPC completed, to be made functional from Feb,09
Human Resource Management System	<p>GSI Personnel Management System module deals with its employees' personal details and service history, with respect to the organizational set up and configuration.</p> <p>The Personnel Management System module has been built to cater to the following functions:</p> <p>Organization Set-Up and Configuration: Employee Personal Details and History Transfer and Deputation history Performance Appraisal Promotion Separation</p>	Application development complete awaiting utilization by Administrative

	<p>REPORTS:</p> <p>On demand reports:</p> <p>This type of report will be generated on the basis of requirement. System would generate the report from a user interface based on the parameters stored in the system. Application development complete awaiting utilization by Administrative</p>	
<p>Claims</p>	<p>The transactional application module "CLAIMS" is meant for administrative processing of all financial claims pertaining to GSI employees, including the loans and advances, but excluding the monthly salary. This covers processing of diverse financial claims arising out of official and employee welfare activities eg. approved tours, grant of leave, medical expenses, contingent office expenses, maintenance of GPF account, registration of nominees for GPF and retirement related claims, retirement claims, loans and advances etc. The data generated through the processing under CLAIMS module (for various loans and advances) serve as inputs to the PAYROLL Module.</p> <p>The functionality cover processing of</p> <ul style="list-style-type: none"> ● Leave sanction and record as part of service book ● TA Advance and adjustment ● LTC Advance and adjustment ● Medical Advance and adjustment ● Contingent Advance and adjustment ● Overtime ● Honorarium ● Field establishment Allowance ● Reimbursement of Tuition Fees ● Newspaper Claim ● Grant in aid ● Permission for procurement of immovable property etc. ● Loans and advances <p>Workflow</p> <p>All claims related requests are routed by rule based workflow management system. On submission of a request, workflow engine forwards the same to the Rule Engine, which then executes the actual business rule defined in the metadata repository maintained in the database. This brings about an automated flow of the request to a desired result with tracking of the status at each step, thus saving time and imbining efficiency in the different business processes. All concerned person receives automated notification after completion of each significant business process.</p> <p>The leave records are updated in the database automatically after submission of the joining report and acceptance through a similar workflow process.</p> <p>Reports</p> <p>Reports have been designed for replication of the registers that are being maintained presently for each claims head. They include</p> <ul style="list-style-type: none"> ● Travelling Allowance History Sheet Register ● LTC Register ● Abstract Contingent Register ● Rolling Contingent Register ● Non-Rolling Contingent Register 	<p>Application development complete it is under testing stage</p>



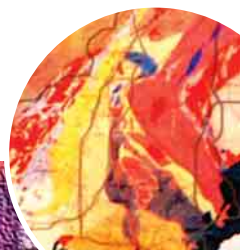
	<ul style="list-style-type: none"> ● Overtime Register ● GPF Advance Register ● Register for various categories registers ● Reimbursement of Tuition Fees ● Report showing the CGHS Register entries for employees ● Medical Register Report ● Grant in Aid Report . 	
Finance	<p>Scope</p> <p>The transactional application module “BUDGET” is meant for (head-wise) estimation of expenditure and subsequent allocation of the same to distributed Region/Wing offices for carrying out the projects/activities planned by the Department. The module also accommodates the estimation and allocation of loans and advances under separate expenditure head. Apart from these, the module takes care of the any funds allocated to GSI by any outside organization. The functionality cover</p> <ul style="list-style-type: none"> ● Initiation of the budget estimate from Central Headquarters percolating hierarchically to Divisions ● Consolidation of the budget estimate for placing demand to GOI ● Budget allocation ● Budget appropriation ● Demand for Fund ● Deposit Account maintenance <p>Workflow</p> <p>The budgetary estimation, consolidation, allocation, reappropriation processes all are routed by a rule based workflow following the GSI organogram. The following requests under the Budget module are processed through workflow management.</p> <ul style="list-style-type: none"> ● Master Maintenance ● Initiate Budget Estimate ● Provide Budget Estimate ● Provide Budget Estimate for Loan & Advance ● Allocate Budget ● Demand of Additional Fund ● Budget Appropriation <p>The production database tables are automatically updated with the balance amount under different head of accounts after completion of workflow processes wherever necessary.</p> <p>Reports</p> <p>Reports have been designed for replication of the statements that are being maintained and analysed presently for financial Management which include</p> <ul style="list-style-type: none"> ● Object Wise Fund Allotment for F.Y. ● History of Fund Allotment for F.Y. ● Object Wise Fund Expenditure for F.Y. ● Revise Budget Estimate for F.Y. ● Final Budget Estimate for F.Y. ● Statement showing monthly expenditure Report for F.Y. ● Budget Estimate Reports ● Budget Estimate Reports Scheme wise 	

<p>Vehicle Management System</p>	<p>GSI maintains a fleet of vehicles including Cars, Jeeps, Trucks and other heavy vehicles. Vehicles are primarily required for two reasons, one being for use in remote areas during the Field Season Program (FSP) and also for use as staff car at the major offices. The following broad functionality is identified for the proposed system</p> <ul style="list-style-type: none"> ● Vehicle Procurement ● Vehicle Ledger ● Vehicle Log Book ● Vehicle Allocation ● Vehicle Maintenance ● Vehicle Search ● Vehicle Reports 	
<p>Field Season Program Management Information system</p>	<p>Once a FSP Proposal is approved, it becomes a FSP Item. Usually its execution is initiated from 1st of October. During its execution, the Project director or the allocated Geologists against that item needs to perform a wide range of activities. This includes tracking of expenditure against each activity, entering monthly expenditure as well as achievement, forwarding sample to laboratory and so on.</p> <p>Initiate Item Execution</p> <p>The Project Director enters the actual execution date of an item. System changes the item status from <i>Approved</i> to <i>Under Execution</i>.</p> <ul style="list-style-type: none"> ● Monthly Expenditure <p>3 different heads of POL, Wages for local labourers, and others. The System displays expenditure details for the related FSP codes till date.</p> <p>Monthly Achievement Details</p> <p>The achievement details are noted as follows:</p> <ol style="list-style-type: none"> 1. Achievement Details Against Quantifiable Items 2. Achievement Details Against Non-Quantifiable Items <ul style="list-style-type: none"> ● Fortnightly Drilling Progress Report <p>It includes Bore Hole number, From Depth, To Depth (in meter), Total , Core Recovery, Cumulative Achievement for current FSY, No of days in reaming, Lowering of Casing, Shifting, No of unproductive days, Breakdown of Machineries, Non-availability of POL, Non-availability of fund etc.</p> ● Field Diary <p>The User can define a Grid with information such as FSP Code, (0,0) point lat, mesh size, no. of mesh, baseline azimuth- in the system.</p> <ul style="list-style-type: none"> ■ The User can define a Borehole and get the borehole id from Geo-scientific Database ■ The User can define a Pit/Trench Id with with information such as FSP Code, basin Id, Coalfield Id, Block Id, Prospect Id, Length, Breadth, commodity in the system. ■ Surface data can be entered for following parameters: <p>Status of Mine/Old Working, Name of Archaeological Object, Hotspring/Well, Description/ Name of Hotspring/Well, Altitude, Relationships between Rock Types, Additional Information</p> <p>User may upload upto 4 sketches/photographs and enter comments against them.</p> 	



	<ul style="list-style-type: none"> ■ Input for rock information with attributes such as Type, Field Sample No Rock name, Colour, Grain Size, Compactness, Specific Gravity, Category, Sample Purpose, Radioactivity, UV Effect can be made. User can fill in following sub sections against each of the Rock type: <ul style="list-style-type: none"> Mineral, Fossil name, Texture, Texture Description, Wall Rock Alteration (Name, Description), Structure, Mineralization, Regolith, Humus, Stream Sediment, Environmental Geology, Soil. ■ Sub-Surface data can be entered for the following: <ul style="list-style-type: none"> Run, Lithology, Deviation, Litho Section, Biostratigraphy, Fossil, Soil Section, Geophysical, Geophysical Log Data <p>Forward Samples to the Laboratory</p> <p>Create FSP notes</p> <ul style="list-style-type: none"> ● Create Monthly Diary ● Review like stage review, mid-term review (FSP review report) System displays all the review report uploaded so far against the previous FSP item (continued item). <p>FSP Technical Report</p> <p>When the PD (Project Director) submits the interim or final Technical Report of the FSP item. System displays all the Technical report uploaded so far against the previous FSP item (continued item).</p> <p>Circulate FSP Final Report</p> <p>After submission the System carries out following checks before sending the report for approval.</p> <ol style="list-style-type: none"> a. Testing of all samples pertaining to the FSP has been finished and their test report received. b. Achievement detail till the last month of the FSY has been entered. c. Drilling Progress report has been entered till the completion of work programme. d. Expenditure statements till the completion of work programme have been entered. e. All modifications of the FSP item are under approved status. <p>REPORT:</p> <ul style="list-style-type: none"> ● FSP Item Authorized users can generate FSP Item Details as per the FSP Code ● FSP Achievement Details ● FSP Estimated Cost Vs Expenditure ✓ In query mode, user can perform a search by providing FSP Code or the year or both (year being mandatory in both cases) for which the user wants to generate the Cost Estimation VS Expenditure Report ● FSP: Calculated Cost Vs Estimated Cost Authorized users can view calculated Cost VS estimated cost of a FSP by searching as per the (Region, Operation Unit Division/ Project) Site Code and FSP Code. ● Scheme wise Estimate Breakup <ul style="list-style-type: none"> ■ Drilling Unit Deployment ■ Monthly/Quarterly Performance Report by Region/ Wing-open issue 	
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	<ul style="list-style-type: none"> ■ Monthly Drilling Progress Report ■ Estimated Project Cost ■ Service Laboratory Information ■ Borehole Logging ■ Mapping Progress Report (monthly) ■ Consolidated monthly statement <p>Authorized users (PD- FSP, HOD- OU, HOD RHQ, HOD CHQ) will use this screen to <i>Driller Unit Association</i></p> <p>Authorized users can view Drill Unit Association Details by searching as per the Site Code and Driller Unit No.</p> <ul style="list-style-type: none"> ■ Physical Target for Operational Year (consolidated annual plan) ■ Scheme wise Expenditure Break up <ul style="list-style-type: none"> ● FSP Annual Plan consolidation <p>Authorized users (HOD Division) will use this screen to view a consolidation of the Annual Plans for a financial year and a chosen Site Code as per the activity. Site Code</p>	
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Proposed future applications – Plan wise

XI PLAN

Internet

- a. 1:50,000 map series depicting the **raster** layouts generated from 1:50,000 vector geological maps which constitute the 1:50,000 map service
- b. Development of an interface for common users for viewing and querying Field-season related details which will be drawn from the Intranet transactional application FSPMIS
- c. Creation of a section for detailing the geology of India, with maps and write-ups on various tectono-stratigraphic blocks of the subcontinent.
- d. Development of a e-procurement system to facilitate procurement process of the organization and integrate it with the already existing applications.
- e. Development of a Vigilance related activities like submission of online property returns, provisioning for lodging complaint through internet and tracking them by the complainant.
- f. Development of application for Metadatabase for **RTI** related material.

XII PLAN

Internet - Application development for sharing and interfacing of GSI data with other National Agencies dealing with geo-science information. This will involve pilot projects on interoperability related issues compliant to OGC standards, creation of Web Feature Service (WFS), Web Map Service (WMS), and Web Catalog Service (WCS) concurrent with standardization of map symbology and nomenclature.

Intranet

- a. Fine-tuning and synchronization for integration of data generated through Mobile Mapping into the existing Field-season programme Monitoring System and subsequently to LMS.
- b. Development of application for collation of huge volume of NGCM and GPM data and integrating them with the available 1:50,000 geological map service. Customized GIS tool for standard analysis of NGCM and GPM data served over GIS Portal.

XIII PLAN

Internet Building up of Application for delivering multi-thematic 3D/4D data through OGC compliant web service and execution of test bed projects

Intranet - Building up of application for extraction of metadata for the products generated through National Geospatial Dataset activity.

XIV PLAN

GSI Enterprise Portal serving as the integrated medium to collect, store, archive, explore, analyse, distribute geoinformation and a platform for fruitful collaboration, sharing and partnership between all concerned agencies and institutions.