My Dear Colleagues, friends, fellow employees, seniors, superannuated employees, well-wishers and admirers of Geological Survey of India,

1. While superannuate from service, most respectfully, I would like to bid farewell to all. I thank one and all who helped me to serve this great department for the last 37 years. At the outset, I profusely thank Shri Piyush Goyal ji, Hon’ble Minister of State (independent charge) for Power, Coal, New & Renewable Energy and Mines, Govt. of India; Shri Arun Kumar, Secretary, Ministry of Mines, Govt. of India; Dr. K. Rajeswara Rao, Addl. Secretary and Dr. N.K. Singh, Jt. Secretary, Ministry of Mines, Govt. of India for reposing confidence in me and offering me the responsibility to lead the organization for the last fifteen months. I am also grateful to them for their guidance and suggestions given from time to time while conducting my duties in the department. I thank all my colleagues, co-employees in the department who stood by me all these years and without their support, it would have not been possible for me to reach this stage. I take this opportunity to thank many other organizations who stood by me for smooth functioning of the department. In this regard, I am particularly grateful to the management of these organizations for their support while discharging my duties.

2. As you all know, Geological Survey of India, as a premier geoscientific organization, dedicates its service to the nation and always contributes to wealth of knowledge on baseline geosciences, adding to mineral wealth and fundamental geosciences of the country. On this occasion, I would like to list out a few services rendered by the great organization, especially outcome of recent activities which added to the pride of our country. Though, many of you do know about a few of things, but all do not know most of things happening in the department. I feel it is necessary that all should know all important and prime issues happening in the department, so that, unnecessary anxiety, misunderstanding and miscommunications can be minimized.

3. GSI Structure:
Geological Survey of India is dedicated to service of the nation for the last 166 years with colossal contribution in the development of India. The geoscientific work of GSI involves ground surveys, airborne and marine surveys, mineral exploration including coal, multi-disciplinary geo-technical, geo-environmental (including polar and glaciological studies) and natural hazards (including landslide and
earthquake) studies of societal significance, dissemination of data for public good and nurturing fundamental research. GSI has made its presence felt in national arena and is poised to build an economically and socially vibrant, creative and an enterprising India sharing its geoscientific data with entrepreneurs, administrators, policy makers and civil society. Following recommendations of the High Power Committee constituted by the Ministry of Mines and accepted by the Union Cabinet in October, 2011, GSI is an ‘Attached Office’ to the Ministry of Mines. The department, post reorganization, started functioning under Region-Mission matrix mode, having six Regions and five Missions along with three Support Systems commencing from its annual programme 2009-2010.

4. Programme formulation:
Geological Survey of India is an attached office to the Ministry of Mines. Main activities of the department are geological mapping of the country to offer guidance and suggestions to government on geoscientific activities of the country; to act as a repository of geo-science information required in various fields in the country; to create and update national geoscientific information and mineral resource assessment. These objectives are achieved through ground surveys, air-borne and marine surveys, mineral prospecting and investigations, multi-disciplinary geoscientific, geo-technical, geo-environmental and natural hazard studies, glaciology, seismotectonic study, and fundamental research. While formulation of any item of study in the Annual Programme of GSI, the following factors are normally considered: Outcome Budget document of GSI submitted to the Government; Government’s policies and directives, suggestions and guidelines; recommendations and requests made by stakeholders; follow up of recommendations of CGPB meeting and its 12 Committees; State Geological Programming Board recommendations etc. The programmes are initially formulated at Divisions / Projects taking cues and ideas from National Missions and Regional Missions who are think tanks. Region wise targets for different Missions were set by Policy Support System of Central Headquarters as policy requirements. Work targets in different components of activities for each geoscientist are set as per the Peer Review Collegium recommendations for target norms. The programmes are drafted and scrutinised at Regions and Heads of various Mission levels. Subsequently, Internal Peer Review of 100% programmes takes place at Central Headquarters with elaborate scrutiny and discussion between Regions, Missions and PSS and then GSI’s programme draft documents are improved along with details of nature, quantum and timeline of various components of study. Thereafter, External Peer Review of 20% of the proposals is done by external experts and eventually after incorporating all suggestions / modifications, the programmes are placed in the CGPB for discussion. After undergoing all these exercises and passing through the main CGPB meeting, the final outcome, items of study reach Regions where individual officers will be earmarked to execute items. Subsequently, if a Region wants to take up any other item, due to local need and urgency and could not be considered earlier and undergo the process as detailed above, they can propose the same and after having scrutiny at CHQ level, the item will be approved as an additional item. Normally, formulation of programmes are initiated in Regions with the commencement of CGPB Committee meetings which normally commence from August of every year and the entire process continue till the main CGPB meeting which is normally held at New Delhi in February or March of subsequent year. That means, the entire process of programme formulation takes a period of seven months. State Units are encouraged to propose suitable terrain specific items. Items may be initiated by individual officers, Project Directors, TC/PSS Directors, Regional Missions etc., but the items are properly treated and placed by PSS Divisions. Department takes sincere care while formulating programmes. So, I believe, there is little scope of error in project formulation. I do not think any other organization in the country or elsewhere takes this much elaborate care involving so many people at different levels while formulating any of their programmes.
5. Programme execution:
All items as detailed and assigned in Annual Programme of the Region / State Unit are executed by concerned geoscientists. Whether it is a standard field oriented item or laboratory item or service item, the concerned geoscientists take it up as per requirement of the assignment. As far as field items are concerned, normally two officers are assigned for each item and concerned field going officers take time for pre-field preparations, securing permissions from local authorities, survey and consultation of literature, making arrangements for field infrastructure, other field partners, surveyors, vehicles, drivers, contingent advances etc. Finally, the geoscientists proceed to field, establish camp in field (now-a-days in a rented accommodation at most places), initiate traverses and continue field studies as per requirement of the item. During the course of field study, they prepare various maps duly depicting ground conditions as per nature and scale of study. During the period, samples of rocks/soil are collected as per the requirement of study and as specified in NQT table of the assignment, make preparation of samples to the required specifications for their testing in chemical or other indicated laboratory and send the same to concerned laboratory. Maps are drawn duly incorporating field data, at times with the help of a Surveyor, if it is a Large Scale Map or Detailed Map. Drilling may be associated as per type of investigation and in such case, logging of cores obtained and preparation of core samples for their chemical or any other analyses as per the requirement is also part of the assignment. All these field jobs are attended normally within a period of 120 field days by each associated officer.

6. Programme monitoring:
While executing the assignment, the field party submits its monthly progress to its headquarters which will be transmitted to Regional headquarters and Central headquarters and then to Ministry. During the course of field study, the concerned Project Director, State Unit Dy. Director General, Regional Mission Head or sometimes even HoD of the Region may visit the field, monitor progress of work carried from time to time, and offer their expert guidance. Apart from that, the Regional HoD conducts Regional Advisory Council meeting quarterly where all field officers are invited and their work is reviewed in the meeting. Subsequently, PSS Division of Central Headquarters conducts one Term Review meeting for each Region, preferably in the month of December-January, when part of work is completed. Members of Term Review are normally concerned domain experts from PSS Divisions of Central Headquarters and external experts locally available in Regions, such as from other concerned Central organizations or Universities. The Term Review meetings are useful to review ongoing assignments and to suggest any mid-course correction, if required. After the suggestions emanating from the Term Review meeting, are addressed, field component of each item are usually completed by end of March every year. When there are checks and monitoring at so many points for each ongoing item during its progress, there is little scope for missing the target or objective of the assignment.

7. Quality Management Cell:
The QM Cell arranges external peer review of 20% of reports to be generated and circulated in a particular Field Season from various Regions/Divisions of GSI, randomly identified from the lot. Subsequently, a Collegium comprising Addl. Director General (PSS) as Chairman and National Mission Heads as Members functions for a proper determination of overall quality of externally peer reviewed reports.

8. Geological Mapping:
Out of the 3.146 million sq km mappable area of the country, 3.0996 million sq km has so far been covered by systematic geological mapping on 1:50,000 scale, bringing the total coverage to 98.53%. In the endeavour to bring entire mappable area under total coverage, the inaccessible areas have been
taken up for geological mapping with the aid of remote sensing and photogeology with limited field checks. None of the countries, even the advanced countries have the luxury of having geological map of their country on 1:50,000 scale, prepared based on actual field work on ground. All their maps were prepared based on aerial photographs and satellite image with limited field checks. India, in spite of having such vast area, has its baseline geological map on 1:50,000 scale, prepared based on field studies. During Systematic Geological Mapping a number of interesting problems may be identified where Specialized Thematic Mapping (STM) on 1:25,000 scale is being taken up to meet requirement of geological and mineral significance. It is reported that a total of 2,54,911 sq km area has been covered so far under STM.

A national project of three years duration on Geomorphological and Lineament Mapping was launched earlier that involved mapping of landforms of entire country on 1:50,000 scale and identification of various types of lineaments of tectonic and structural significance. Geomorphological guides play an important role in oil / mineral exploration programmes. They also provide important inputs for geo-engineering, geotechnical and geohazard mitigation projects. The project involved GSI and NRSC as the nodal agency for quality and execution and 23 partner institutes as working centers. The project has been successfully completed and maps derived from the project are in public domain.

10. Hyperspectral / Multispectral Mapping:
Hyperspectral survey is the emerging technology, which deals with spectral signatures of the Earth’s crust, mainly in the Very Near Infra Red and Short Wave Infra Red spectral ranges with very narrow bands. It helps in identifying rocks and minerals indicative of mineralization. In the absence of relevant satellite data and airborne data, GSI has confined its hyperspectral study mainly in the form of building up of spectral library. It will help for a detailed study of mineralized zone / alteration zone on 1:50,000 scale using downloaded Hyperion-Hyperspectral data and Landsat ETM+ multispectral data for building up spectral library for minerals which may be applied in extension / virgin areas.

A project on “Application of hyperspectral / multispectral remote sensing techniques for mapping of alteration / mineralized zone and building up of spectral library in Chitradurga schist belt including G.R. Halli and Ajjanahalli gold prospects has been executed. It helped mapping of alteration / mineralized zones using ASTER / Landsat multispectral data, using various image processing techniques. Different sets of multispectral satellite data namely ETM+ (Landsat 7), OLI (Operational Land Imager-Landsat 8) and ASTER were used. The ETM+ and OLI data were downloaded from USGS website. The ASTER L1B data (purchased from Japanese Space Agency through NRSC) was used for image analysis. Image processing was done in ENVI 4.8 software. The mineral abundance maps showing alteration minerals like clay, iron oxides and silica apart from carbonates were identified. The study helped to establish Chitradurga Central Shear Zone and its extension further south. The spectra of rocks were collected in the field by using ASD spectro-radiometer.

Application of microwave remote sensing data in delineation and characterization of faults in the eastern Himalayan foreland fans in Darjeeling and Jalpaiguri districts of West Bengal was also taken up. The objective was to delineate lineaments and specific geomorphic features along major lineaments through interpretation of RADAR microwave data for their characterization and study temporal changes. The approach is new with constraints of availability of microwave data. Spaceborne SAR data of different satellites viz., ENVISAT, ALOS PALSAR and SENTINEL-1 for the period of more than a decade were processed under SAR Interferometry module of ERDAS software.
NGCM has been taken up since 2001-2002 to generate baseline geochemical data base on 1:50,000 scale to identify prospective areas for probable mineral occurrences as well as for soil fertility assessment, human / animal health, and in establishing environmental baseline of geochemical parameters. The main objective of the NGCM is to create a seamless geochemical base map on 1:50,000 scale of different elements for the entire country where the main medium of sampling is fluvial/stream sediment or slope wash material in 1km x 1km or 2km x 2km cells depending on various terrain conditions of the country. Composite samples from these cells are subjected to analyses for 64 elements to derive anomalous zone/s of elemental concentration after interpretation.

Plan to cover OGP areas: The country’s total landmass of 32.8 lakh sq km spreading over 5112 Toposheets (1:50,000 scale) is depicted by hard rock, soft rock and alluvial sediments. The mappable area of the country is 31.4 lakh sq km and out of this an area of 5.71 lakh sq km occurring as discontinuous patches across peninsular India has been designated as Obvious Geological Potential (OGP) area based on the geological milieu and known mineral occurrences. Geological Survey of India has been carrying out National Geochemical Mapping (NGCM) since the Field Season 2001-02 and till March 2017, an area of 7.75 lakh sq km i.e. 24.6 % of the mappable area has been covered by this mapping. Out of 7.75 lakh sq km, an area of 4.11 lakh sq km was covered in OGP terrain. Moreover, out of 7.75 lakh sq km area so far covered under NGCM, 0.44 lakh sq km area fall in the Himalayan terrain, whereas, the remaining part i.e., 7.31 lakh sq km is in the peninsular India. Sampling in all these areas has been carried out by following 1 km x 1 km grid. To complete the entire OGP area of 5.71 lakh sq km, an area of 8.13 lakh sq km spread over 1151 Toposheets has to be covered. Till date 5.91 lakh sq km area out of 8.13 lakh sq km has been covered. The plan to cover the accessible part of the entire OGP area by March 2019 is as follows:

(i) Total OGP area: 5.71 lakh sq km.
(ii) To cover 5.71 lakh sq km OGP area, 8.13 lakh sq km to be completed by March, 2019
(iii) OGP area covered till March 2017: 4.11 lakh sq km.
(iv) Remaining OGP area: 5.71 - 4.11 = 1.60 lakh sq km.
(v) Therefore, to cover remaining OGP, an area of 2.22 (i.e., 8.13-5.91) lakh sq km has to be covered.
(vi) Area under inaccessible terrain (disturbed area, wildlife sanctuary, large reservoir etc.): 0.37 lakh sq km.
(vii) Therefore, to complete OGP, an area of 1.85 (i.e., 2.22-0.37) lakh sq km is to be covered.
(viii) Area proposed to be covered during FS 2017-18 is 1.50 lakh sq km.
(ix) Remaining area to complete OGP is 0.35 (i.e., 1.85-1.50) lakh sq km which is to be completed in FS 2018-19.

Plan to cover non-OGP areas: Patches of OGP area adding up to 5.71 lakh sq km are spread over an area 8.13 lakh sq km in the peninsular India. The total area of the hard rock terrain of peninsular India, barring Deccan trap lava terrain, is about 13.2 lakh sq km. Till March 2017 an area of 7.31 lakh sq km has been covered and by March 2019 the coverage will increase to about 10.30 lakh sq km area considering coverage of 1.50 lakh sq km during FS 2018-19. The remaining part of the hard rock terrain i.e. 2.90 lakh sq km is proposed to be covered. It may be noted that this is a non-OGP area and existing parameters like grid spacing, number of samples, type of samples need to be considered afresh. This has to be decided after thorough discussion. In addition to the above, sampling pattern for the following areas are also yet to be decided.
• Deccan Trap area: It covers about 5 lakh sq km with monotonous lithology of basaltic origin. These areas are traditionally treated as least important for mineralisation.
• Gangetic Alluvium: Area is about 7.0 lakh sq km and it is a least priority area from viewpoint of mineral occurrences.
• Himalayan terrain: About 5.0 lakh sq km area and this is a least priority area excepting a few localities of mineral showings.
• Thar Desert: About 2.0 lakh sq km area is also of least priority.

12. National Geophysical Mapping (NGPM):
NGPM programme was initiated during FS 2002-2003 with an objective to generate basic and derived maps of Bouguer Anomaly and IGRF-corrected magnetic total field maps of the country by conducting ground gravity and magnetic surveys on 1:50,000 scale with an approximate observation density of one station in 2.5 sq km. The maps thus produced may be used for creating conceptual models of subsurface geology and structure. The gravity-magnetic anomaly maps will be helpful in identification of potential areas of interest from mineral exploration point of view in both shallow and deeper levels. A total of 3.54 lakh sq km area is completed by Geophysical Mapping Programme till March, 2016 of which 1.69 lakh sq km falls within core OGP and a total area of 1.96 lakh sq km of the overall OGP area. A total of about 4,11,910 sq km area has been covered till December, 2016 since initiation of the project. GSI is geared up to complete NGPM in the remaining core OGP area, i.e., about 1.85 lakh sq km, by March, 2018.

13. Remote Sensing and Airborne Survey (RSAS):
RSAS of GSI had taken up airborne surveys through GSI owned Twin Otter Airborne Survey System (TOASS), acquired in 1986. Till January, 2017 the total achievement of the TOASS in Multi-sensor Geophysical Survey is 6.98 lakh line km. During FS 2015-16, the TOASS was given for outsourcing for its comprehensive operation and maintenance with an agreement to carry out 60,000 line km per year. The aircraft started flying during F.S. 2015-16 and 2016-17 and covered the target of 60,000 line km. GSI is also acquired Heliborne Geophysical Survey System (HGSS) ‘Garuda Vasudha’ on board Dhruv Helicopter (VT-HAU) which will be flown for probing inaccessible areas.

14. Multi-sensor aerogeophysical surveys in OGP area:
As the progress in this line is not meeting the timeline to cover the entire country with GSI owned Aircraft TOASS, GSI launched National Aerogeophysical Mapping Program (NAGMP) through outsourcing, initially in the identified Obvious Geological Potential (OGP) and adjoining areas on express mode with the focus on Mineral Exploration through part utilization of NMET fund. NAGMP is planned to acquire uniform aerogeophysical data initially over the identified Obvious Geological Potential (OGP) and its adjoining areas followed by covering rest of the country in a fixed time frame and to prognosticate suitable areas for mineral targeting. This will ultimately enhance mineral exploration activities in the country and attract foreign investments in the mineral sector.

In the first phase, OGP and adjoining areas of around 0.81 million sq km area has been divided into 12 blocks and the blocks are planned to be covered by aerogeophysical studies in a period of three years with line spacing of 300 m and flight height of 80 m above ground level (AGL). Magnetic-Gradiometry and Radiometric surveys will be taken up by engaging Project Implementing Agencies (PIA’s) for data acquisition, processing, integration and interpretation. The promising areas of mineral potential identified by this project will be detailed by heliborne surveys through high resolution Electromagnetic, Gravity, Gravity-Gradiometry and Magnetic surveys.
In order to achieve this objective, a consultant (Paterson, Grant and Watson, Canada along with International Geoscience Services, UK and Elmekci Consultants, India) was engaged to prepare the Detailed Project Report (DPR), floating of EOI, manage the tendering process and identify the suitable PIA’s to execute the project. Initially, a pilot project has been taken up in the first year to cover four identified blocks (Block 1 to 4) covering an area of 0.20 million square km with 0.75 million line km coverage. Accordingly, global tender process completed and PIAs identified. The survey was formally inaugurated by Shri Piyush Goyal, Hon’ble Minister of State (i/c), Power, Coal, New and Renewable Energy and Mines, Govt. of India, through video conferencing from the Constitution Club, New Delhi on 7th April, 2017. Two aircrafts equipped with geophysical sensors belonging to a consortium of service providers led by M/s McPhar International (India) with other partners formally commenced aero-geophysical data acquisition from Dr. Babasaheb Ambedkar International Airport, Nagpur.

The production surveys commenced in Block-4 of four blocks identified as a pilot project, keeping a base station at Chandraapur Air strip in Maharashtra. Block-4 falls in Bastar cratonic areas in Chhattisgarh containing Sausar, Sakoli and Dongargarh Group of rocks. Sausar Group is famous for its manganese mineralisation, whereas Sakoli Group for substantial base metal and iron mineralization. The Block falls in adjacent parts of Maharashtra (Bhandara district) & Chhattisgarh (Baloghat, Rajnandgaon, Durg & Raipur districts) covering an area of 48, 052 sq km, (0.18 million lkm).

For successful completion of this challenging and prestigious project, a highly experienced and internationally recognised external Technical Supervision cum Quality Control (TS-QC) consultant, M/s IDP Geosciences Services Pvt. Ltd. UK, a consortium of M/s Paterson, Grant & Watson Ltd. (Canada), International Geoscience Services Ltd (UK) and Datacode (India) has been identified through global tendering process to monitor overall activities and ensure quality data acquisition, processing, analysis, compilation / integration and interpretation leading to identify potential blocks. These blocks can be taken up for follow-up detailed surveys involving mineral commodity/area specific sensors (EM, gravity, gravity-gradiometry, magnetic gradiometry, radiometric etc.) to assess mineral potentiality. Both PIA and TS-QC consultant will impart hands on training to geo-scientists of GSI associated with the project in every stage of the project implementation.

As launching of the project itself took almost two decades and ultimately it is being fructified, and flights are now flying for data acquisition, many more flights are to join the stream, and many more foreign Project Implementing Agencies are expected to join in taking up other blocks identified. Once data acquisition is completed in all identified blocks, GSI will be geared up to place the data in public domain, which is expected to attract many domestic and global entrepreneurs to explore green fields. The project unleashes great opportunities for development of mineral sector in the country in near future.

15. Under the project NGPM, ground geophysical surveys (Gravity-Magnetic) of the core Obvious Geological Potential (OGP) area i.e., 3.44 lakh sq km out of the total area (32.87 lakh sq km) will be covered by the end of FS 2017-18, which is nearly 10% of the country. These areas cannot be excluded from the proposed aero geophysical survey due to the following reasons. (i) Under NGPM project magnetic and gravity data are collected at fixed station interval, whereas, in aero geophysical surveys continuous data recording is done with magnetic and spectrometric sensors. (ii) Magnetic data collected through ground geophysical survey under NGPM is with one station per every 2.5 sq km area. Whereas, the magnetic data acquired through airborne surveys is at a much higher resolution i.e., data sampled at every 5 m along the flight path. Hence Aeromagnetic data contains much more details when compared to the data acquired through ground surveys. (iii) In the proposed project, while aero magnetic map of the entire country has to be prepared, initially areas within OGP have been prioritised for Phase-I. These
aeromagnetic and radiometric data will be available to all stakeholders for further detailed exploration in order to discover concealed deep-seated mineral deposits. (iv) Best practice adopted globally for mineral exploration is to cover with aero magnetic & radiometric surveys at uniform flight height as well as flight interval, followed by high resolution surveys in the zones of interest identified by these surveys. GSI is also proposing to follow similar approach.

16. GSI also planned to take up Heliborne Survey System (HGSS, Garuda Vasudha) on board the GSI owned Dhruv (VT-HAU) helicopter. Heliborne surveys were planned in F.S. 2016-17 but, as the achievement was not satisfactory due to various setbacks in this domain, it is being contemplated to take up heliborne surveys also through outsourcing process at selected and identified zones.

17. Marine and Coastal Surveys:
GSI commenced its activities in offshore since 1965. GSI has a fleet of three ocean going vessels. RV Samudra Ratnakar carries out survey in Exclusive Economic Zone (EEZ) and beyond while RV Samudra Kaustubh and RV Samudra Shaudhikama carry out survey within Territorial Waters (TW). On addition of the state-of-the-art research vessel R.V. Samudra Ratnakar, the activities are increased manifold, especially to identify offshore mineral potential within the EEZ of India. The total EEZ coverage including TW is 19,88,199 sq km out of a total EEZ area of 20,14,900 sq km. Regular scientific cruises are being undertaken onboard Ocean Going Research Vessel ‘Samudra Ratnakar’ with state-of-the-art equipment. A national level programme titled “High Resolution Sea-bed Mapping and Natural Resource Evaluation in EEZ of India and beyond” has been launched during FS 2014-15. The marine maps produced during sea bed mapping shall be used for identifying offshore mineral deposits, placer deposits as well as for development of ports and harbours etc.

GSI also covered about 4.7 lakh sq km by swath bathymetry so far out of 5.38 lakh sq km committed by GSI to be done through multibeam echo-sounder in deep water as per MoU with MoES. During FS 2016-17 (up to January, 2017) parametric studies have been carried out within EEZ and 12,156 l km of bathymetry, 5281 l km of magnetic survey and 11,377 l km of gravity survey, 10,906 l km of sub-bottom profiling and 2,449 l km of seismic survey was covered by the cruises of RV Samudra Ratnakar, Samudra Kaustubh and Samudra Shaudhikama.

GSI is in the process of acquiring yet another vessel, a Geotechnical Vessel. M/s Alion Science Technologies (AST) is identified as the foreign consultant for procurement and SCI shall be the Indian consultant. The agreement for construction of the vessel has been signed between GSI and M/s Triyards Marine Services Pvt. Ltd, Singapore and the shipyard for the construction of the vessel has also been fixed. The construction of the vessel is expected to be completed within 24 months, i.e., by 2019-20.

In the Exclusive Economic Zone, GSI has identified lime mud off Okha, Gujarat and off Pudimadaka, Andhra Pradesh, Fe-Mn encrustations in the Andaman Sea, micro manganese nodules off Lakshadweep and sporadic occurrences of phosphorous concretions in the marine sediments off Tamil Nadu, Karnataka, Maharashtra, and Gujarat coast. In the coastal areas, heavy minerals viz. ilmenite, sillimanite, rutile, zircon, monazite, garnet have been identified off Ratnagiri (Maharashtra), Chavarra & Thiruvananthapuram (Kerala), Kanyakumari (Tamil Nadu), Andhra Pradesh and Odisha; construction grade sand off Ponnani and Kollam (Kerala) as well as Mangalore (Karnataka) and carbonate sands off Kanyakumari have been identified.

Seabed mapping carried out so far led to explore heavy minerals (HM) and construction grade sand resources (off Kerala coast) in the Territorial Waters (TW) of India which has resulted in delineation of
economically viable deposits. Further, large resources of high grade calcium carbonate clay (lime mud) located along the outer continental shelf and continental slope off Gujarat and Maharashtra are being estimated. The second phase of detailed marine geological exploration program ‘National High Resolution Seabed Mapping and Resource Evaluation within EEZ of India and beyond’ has been launched. Operational strategies such as marine surveys through progressively closer intervals, systematic ocean bottom probing and sampling, prognostication of natural resources based on conventional methods, conceptual modelling etc., have been finalized for a focused approach for targeting and prioritizing search for offshore mineral resources within EEZ of India. R.V. Samudra Ratnakar with enhanced exploration capabilities led to plan for long-term project proposals for deep-sea exploration of lime mud, REY, SMS, and phosphorite within the Indian EEZ.

18. Geoscientific data integration:
The main objective of the project is integration of multi-thematic data involving geological, ground geophysical, aerogeophysical, remote sensing and geochemical survey on 1:50,000 scale to prognosticate new mineral deposit. After integration of several data sets target blocks in terms of mineralization were identified for ground check near J.C. Pura, Karnataka. As per petrographic and EPMA studies of selected magnetite bearing ultramafics, few magnetite grains are found to contain gold, silver, monazite, xenotime and zircon. The findings warranted a further detailed evaluation of mineral potential of J.C. Pura Schist Belt with respect to gold and silver.

19. Data dissemination Policy & MoD clearances:
Consequent upon NMEG-2016, there has been need to attract foreign collaborations and investments, and the government is mandated to place precompetitive data in public domain. But till that time, most of the data was not considered suitable to be placed in public domain due to limitations and restrictions by the Ministry of Defence. In order to overcome the difficulty, Ministry of Mines and Niti Aayog pursued with the Defence Ministry and subsequently Defence Ministry relaxed many limitations and listed and issued an Office Memorandum dated on 20th May, 2016 to that extent. The novel approach helped to bring change in our dissemination policy. As per the relaxations permitted, baseline geosciences data can be shared in public domain as listed below.

(i) Geological map on 1:50k scale in shape file format containing a maximum of 31 layers as per the 1:50k geodatabase. These maps will be overlaid on corresponding image of OSM.
(ii) Geochemical maps prepared on 1:50k scale in shape file format duly marked with sample locations with sample density of one per sq km. These maps will also be overlaid on corresponding scanned image of OSM.
(iii) Airborne spectrometric maps on 1:50k scale with digital data of total count only.
(iv) Gravity data with values up to 1 mgal for non-restricted zone and values upto 20 mgal for restricted zones can be shared.
(v) Magnetic data with values up to 5 nT for non-restricted zone and values upto 100 nT for restricted zones can be shared.
(vi) The restricted zones as per MoDs Map Restriction Policy will remain in vogue.
(vii) Latitude/Longitude/altitude values will be in concurrence with those shown on Survey of India’s Open Series Maps. Open Source elevation data shall be used for sharing of data for restricted zone.
(viii) For offshore region, gravity data with values up to 1 mgal and magnetic data values up to 10 nT can be shared.
(ix) The bathymetric contours could be depicted with 10 m contour interval (ci) between 0-100 m depth; 100 m ci between 100-500 m depth; and 500 m ci for depths beyond 500 m.
Data on surface sediment distribution can be shared for areas beyond 200 m from coastline and up to 200 m from coastline data as available in the navigational charts will be shared.

For sub-bottom profiles, depth of sea bed should not be depicted; only sub-surface bottom reflection may be shared.

As regards sharing of data in digital format, it was agreed that maps with resolution of 1:50k scale can be allowed for sharing.

Access to the data should be given only to the registered users having a non-disclosure agreement. The agreement should also clearly define minimal financial liabilities that are enforceable to act as deterrent for data misuse.

20. Baseline geosciences data generation:
Baseline geosciences data is used for understanding geology, stratigraphy, metallogeny etc. GSI shares its baseline data as per its data sharing and accessibility policy and MoD clearances. The geoscience data and its dissemination by exploration agencies increase mineral targeting efficiency. It also encourages Earth science professionals to conduct research in mineral exploration in order to reduce geological uncertainty and enhance the opportunities for discovery. There is evidence from mineral rich countries like Australia and Canada that increased exploration activity and discovery of economic resources, can be directly attributed to the release of pre-competitive baseline, geosciences data. A study commissioned for the Prospectors and Developers Association of Canada (PDAC) has found that one dollar spent on baseline geosciences data generation pulls in five dollars of private exploration expenditure. The high quality interpretations that can lead to the discovery of a deposit depend upon the nature of data and its resolution. The compatibility of baseline geosciences data with the end user software for spatial and statistical analysis for prospectivity is also important.

Australia is uniformly held out as an example of a country with high quality baseline data availability. A comparison between the baseline data availability with GSI and Australia is attempted to indicate India’s position. (i) In Australia, a download facility for all Australia’s geological map images at 1:250K scale is available. Digital map of the continent is available at 1:100K and 1:250K scales and for some areas at 1:5M or 1:500K or 1:1000K scales. Whereas in India, hard copies on 1:50K scale are available for more than 98% of entire country for purchase. Soft copies of 1:50K geological maps are available for registered users. Digital Map of more than 98% area of the country is available on 1:50K scale. The digital shape files need to be put in public domain for free download along Open Series Map (OSM) layers; (ii) In Australia, Gravity Map of entire country is covered. Raw digital and processed data is freely downloadable in various formats. Whereas in India, hard copy of compiled Bouguer gravity contour map on 1:5M/2M scale with 5mGal contour interval, carried out by GSI, NGRI, Sol, OIL and ONGC for the entire country is available for sale. Restricted for purchase by registered and authorised users only. Gravity data on 1:50k scale need to be placed in public domain. Further, in India, National Geophysical Mapping (NGPM) for ground magnetic and gravity data is being collected at one data per 2.5 sq km interval and has covered an area of 2.8 lakh sq km. The data is in the form of reports. (iii) Aeromagnetic mapping of entire country is completed. In Australia, raw digital and processed data is freely downloadable in various formats. Whereas in India, (a) Aeromagnetic map (high altitude) of 13.69 lakh sq km is in analog form. It is available only for government agencies through MoUs and MoD clearance. For the rest, it is restricted. (b) aeromagnetic map (low altitude) of 8.4 lakh sq km over selected blocks is in analog form and part of it i.e., 5.04 lakh sq km is in digital form. It is available only for government agencies through MoUs and MoD clearance. For the rest, it is restricted. Digital data sharing permissions are required. 80 m flight height and 300 m line spacing data is being generated. Digital data (raw as well as processed data) needs to be put in public domain for free download facility; (iv) In Australia, radiometric mapping of entire country is completed. Raw digital and processed data is freely
downloadable in various formats. Whereas in India, radiometric survey (gamma ray) of 6.73 lakh sq km is completed. Out of this, the data of 5.04 lakh sq km area is in both analog and digital form. The remaining area has only analog data requires MoD clearance for dissemination. (v) In Australia, National Geochemical Survey project has covered entire country with sample density of one sample per 1000 sq km to 10,000 sq km. The data is available in the form of reports and GIS compatible digital form, freely downloadable. Whereas in India, National Geochemical Mapping (NGCM) has been carried out with sample density of one per one sq km over 5.4 lakh sq km. Hard copies and soft copies of toposheetwise reports are uploaded in the portal for public view. Digital NGCM maps are ready. The digital shape files need to be put in public domain for free download along with OSM layers. (vi) In Australia, onshore Deep Seismic Reflection Data (DSRD) is available for more than 15,000 km. DSRD for other areas is being acquired. The data is available to the public in GIS compatibility. Whereas in India, such type of DSRD project is yet to be taken up.

In a nutshell, keeping with the international best practices of providing pre-competitive baseline geoscience data to stakeholders, India needs to do the following to complete data generation to levels comparable to those of Australia. (i) Digital geological maps are to be made available in public domain. (ii) Already acquired analog / digital aeromagnetic data to be made available to exploration agencies; (iii) To complete NGCM and NGPM data acquisition for the entire OGP area on priority followed by integration of the entire data set and providing the same to the public in digital form as part of baseline geosciences data; (iv) Low-altitude, close-spaced aerogeophysical (magnetic, electro-magnetic (EM), radiometric, gravity data need to be disseminated in digital form to exploration agencies. (v) Repository of all GSI reports both baseline geosciences and mineral exploration category are to be made available in digital format in the public domain.

21. Natural Energy Resources:
Mineral exploration in India needs to be taken forward in a proactive and time-bound manner. Government of India has taken several decisions in this direction to enhance mineral exploration in the country. Government, in tune with the MMDR Act, 2015 and NMEP, 2016, has also formed a National Mineral Exploration Trust (NMET) with funds from auction of exploration / mining blocks. The NMET shall provide further boost to the mineral exploration initiatives in the country.

GSI, as one of the major stakeholders in the field of geosciences is prepared to take up the initiatives so that the nation can be one of the major players in the world not only with respect to mineral exploration but in the field of geosciences in total including societal and environmental issues. GSI has reoriented its priorities to meet the changes brought about in Government policies. From the FS 2015-16 GSI has been mandated to carry out G2-stage mineral exploration for identification of auctionable blocks. Emphasis was given by GSI for intensification of exploration for low-volume high-value minerals such as gold, diamond, base metals, PGE, REE, etc. During FS 2016-17, GSI has taken up about 81 items under G3 and G2 stage investigations and during FS 2017-18, about 85 items in G4, 60 items in G3 and 13 items under G2 stage, totaling 158 items in M-IIA investigations have been taken up under in different states. Similarly, 7 items in G4 stage, 3 items in G3 stage and 10 items in G2 stage and 4 items of Geothermal have been taken up in M-IIIB (Coal & Lignite) during FS 2017-18.

In tune with the thrust given in the XII Plan, emphasis was given by GSI for intensification of exploration for low-volume high-value minerals such as gold, diamond, base metals, PGE, REE, etc. Among the other cumulative resources estimated by GSI up to April 2015, copper ore stands at 712.35 million tonnes, gold ore at 178.39 million tonnes, lead zinc – 534.47 million tonnes, iron ore – 1414722 million tonnes,

Important prospects established during recent period area: Ajjanahalli gold prospect (Block-C, E and G), Bangaragatti gold prospect in Karnataka, Jagpura gold prospect of Rajasthan, copper and associated base metals prospects of Mundiwas-Khera block, Khera Main block, Nanagwas West Block of Rajasthan, Iron ore prospects of Yeraballi block, Telangana, Kalamang (West) and Gorumahisani block of Odisha, Limestone prospects of Larket block, Mawalong-Ishamati block, Jalaphet block Shyranj block and Um-Maju block of Meghalaya, Minyun-Ki Dhani block of Rajasthan and Khododa-Khabalia block of Gujarat. Besides, good resources was augmented for graphite from Tikari-Gauthana block of Madhya Pradesh and Bauxite resource from Bamantara block of Chhattisgarh, REE mineralization has been located from Mincheri block, Karnataka and Rajasthan, PGE from Tamil Nadu (Tasampalyam T2 and T3 sector), graphite from Arasanur, Karnataka and Betul in Madhya Pradesh, and copper and base metals from Uttar Pradesh & Rajasthan.

22. Project: UNCOVER India:
In view of the rapid depletion of surface/near-surface deposits, GSI has shifted its thrust to probe deep-seated deposits (up to a depth of 2 km). For this purpose, GSI has already launched a new initiative in association with Geoscience Australia in the form of Project: UNCOVER (India), whereby two transects - 550km long and 600km long respectively, will be studied by integrated approach in 3 years. One transect across the Aravallis has already been initiated in November, 2016. Three workshops have already been conducted on the theme in association with the Geoscience Australia.

23. NEnR (Coal and Lignite):
After HPC, 2009, Coal Wing of GSI was dismantled and Mission-IIB Natural Energy Resources (except oil & gas), with its headquarters at Eastern Region, Kolkata was formulated. The main activities of the Mission-IIB NEnR are: (i) Locating power grade coal at moderately shallow depth, (ii) Probing for superior quality non-coking and coking coal, (iii) Identifying additional resources in deeper part of basins as well as delineating concealed coal and lignite prospects through application of concept oriented search with multidisciplinary inputs, (iv) Establishing additional resources of lignite in southern and western states, (v) Assessment of CBM potentiality in selected coalfields, (vi) R & D programme on CBM studies, (vii) R & D programme on Shale gas studies, (viii) R & D programme on Resource Analysis, (ix) Upgradation of confidence level of coal resource, (x) Geophysical studies, (xi) Database development, (xii) Compilation of coalfield-wise data and upgradation of existing Memoir, (xiii) Development of laboratories for quick analysis of coal/lignite samples. All other activities of actual field execution of coal and lignite investigations in Regions are left to concerned Regions.

GSI has augmented coal resource in different States and the total resource of coal of the country stands at 308.802 billion tonnes and that of lignite stands at 44.60 billion tonnes as on 01.04.2016. Besides formulating detail exploration programmes, M-IIB NEnR has taken up three research items on following topics: (i) A petrographic approach on suitability of coal seams from Mahanadi Valley coalfields for coal liquefaction; (ii) Characterization of shale horizons with respect to shale gas potentiality and quantitative estimation of shale gas resources by direct method in Mohuda sub-basin of Jharia Coalfield; (iii) Stratigraphic correlation models between Gondwana sequence of Godavari and Satpura basins of India.

24. Coal Bed Methane:
Geological Survey of India was associated with CBM activity. At the instance of the Directorate General of Hydrocarbons, a nodal agency constituted by the Union Government for formulation of strategy for
CBM search and production, the first series of information dockets and data packages in respect of certain selected coalfields like Raniganj, Jharia, East Bokaro, West Bokaro, Sohagpur, Satpura, Birbhum and North Karanpura were prepared by GSI during 1997-98 on the basis of geological data accrued through geological investigations carried out by the department over the years. These documents lay foundation for leasing out blocks/sectors for CBM exploration by DGH to public/private bidders during 1st round of bidding in 2001.

GSI attached due importance to petrographic study of coal seams and generated significant data on maceral composition, vitrinite reflectance (indicating rank of coal) and micro-cleat pattern of the coal seams. These data were made available to DGH in subsequent years for refinement of data packages in respect of certain blocks of the aforesaid coalfields for awarding to public/private bidders during the 2nd round of bidding in 2003. Search and exploration for CBM was also included in the new charter of function of GSI during the X plan period. A programme for comprehensive study of CBM prospect in a number of non-cooking coalfields like Rajmahal-Birbhum, Talcher, Ib-River, Singrauli, Mand-Raigarh, Tatapani-Ramkola and lignite-fields of East Coast (Mannargudi and Ramnad) was formulated which include determination of in-situ gas content, study of adsorption isotherm, determination of chemical parameters, rock mechanical properties and permeability of coal seams, determination of maceral make-up, rank, micro-cleat network pattern and nature of in-filled mineralisation through detailed coal petrographic and SEM studies, determination of gas composition through gas chromatography. To gear up such studies following in-house infrastructural facilities were developed regarding (i) measurement of in-situ gas content by direct method through indigenously developed temperature canister and Rod-&-Mill apparatus, (ii) detailed cleat analyses and (iii) determination of vitrinite reflectance and thermal impact analyses.

Coal Bed Methane (CBM) prospect is being continued in different coal fields with an objective to generate base line data for CBM prospects in different coal fields. CBM related desorption studies have been taken up in boreholes drilled at Mand-Raigarh, Tatapani-Ramkola, Ib River, Rajmahal and Singrauli coal fields.

25. Shale Gas study:
GSI, as a pioneer study, drilled two deep drill holes to assess potentials of shale gas in Jharia coal field and found that in-situ gas content at depth is highly potential. Shale gas prospect in Mohuda sub-basin of Jharia coalfield was also taken up with drilling of two deep boreholes. In-situ gas content, vitrinite reflectance, rock eval pyrolysis reveal that carbonaceous shale horizons of Barren Measures of Barakar Formation of Jharia coalfield are akin to productive shale horizons all over the world and Mohuda sub-basin of the Jharia coalfield is potential site for shale gas prospect and carbonaceous shale horizons occurring beyond 800 m depth may act as excellent reservoir.

26. Underground Coal Gasification:
At the instance of Ministry of Coal, GSI actively participated in the meeting held for fixing criteria for selection of suitable coal reserves for application of UCG. GSI, considering the technical criteria and guidelines for prima-facie selection of UCG blocks identified six (6) blocks from Singrauli, Birbhum, Tatapani-Ramkola and Talcher coalfields.

27. Geothermal energy:
GSI was on look out for non-conventional energy resources almost since 1870s. GSI evaluated bout 340 hot springs in different parts of the country with an estimated geothermal resource potential of 10,600 MW, which ultimately lead GSI to publish Geothermal Atlas of India. Creation of Spatial Database on
Geothermal Springs of India, with an objective to establish spatial database with point geometry of Geothermal springs of India with all basic information of respective springs as attributes which will include Location, Geotectonic province, Geochemical characteristics, Mass flow parameters of thermal areas for future development of geothermal energy resources of our country. The compilation and transcription of reports pertaining to Northeast Himalayan Geothermal Sub-province has been completed. The compilation of Mud Volcano data of Andaman and Nicobar Island also completed with the help of Geothermal Division of Northern Region, Lucknow. With all its baseline data, GSI endeavour to offer its expertise in the field to any energy developing agency.

28. OCBIS:
Online Core Business Integrated System Project is the official portal of the Geological Survey of India, designed, developed and hosted by the GSI. The objective is to provide a single window access to information and services being provided by the GSI for the broad geoscientific community, citizens and other stakeholders. To provide comprehensive, accurate, reliable and single point source of information about GSI, its activities, achievements, geoscientific information and its various facets. The Project will ensure holistic integration of infrastructure, standards, policies, applications & tools and services and enable all GSI geoscientists and administrators to collect, process, analyze, store and disseminate GSI data and information in an efficient and organized manner. It will also enable the broader geoscientific community and other stakeholders to easily access, view and utilize GSI data & information. This holistic approach will also support the overall mission of the organization as well as the national e-governance initiative. The project has already gone Beta live in September, 2016 and became operational from April, 2017. Presently, the focus of the project is on stabilizing OCBIS infrastructure and applications and to promote widespread usage through training and handholding. GSI’s Information Technology vision achieved a milestone with OCBIS Enterprise new portal www.gsi.gov.in

(i) Completion of New Data Centre at Dharitri Building, Salt Lake, GSI, Kolkata with commissioning of infrastructure component. The state-of-art Data Centre is housing: Cisco Nexus Data Center Products for Network; Architecture HP Blade Server and HP Superdome-2 for Server; Architecture HP 3-Par 10400 Storage - capacity is 200 TB; HP Data Protector for Back Up; Sanovi Disaster Recovery Management for replication between DC and DR Best of breed Non-IT devices with control-monitors for mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. The Data Centre is capable of catering to all users independent of any browser/devices. The Data Centre (DC) hosts all scientific and administrative applications and robust email solution with MS Exchange Suite and Skype for Business for Mail Messaging and IM.

(ii) Bhukosh, the integrated spatial data management portal service facilitates authorised users to visualise, query data, create maps and download. One can access a host of geoscientific data pertaining to Geological mapping, Geochemical mapping, Geophysical Mapping, Aerogeophysics, seismotectonics, Landslide, Geochronology and meteorites in the form of map services.

(iii) FSPMIS together with Laboratory management System (LMS), Drilling Management Information System (DMIS), Vehicle management Information System (VMIS) and Smart Application are amongst the core applications open for usage. One can directly formulate a programme in FSPMIS, propose analysis of samples in specific laboratories, assign drilling units and vehicles as per requirement from GSI’s resource and monitor activities over a period of time. The Smart application hosted in a GPS aided mobile field device ‘touchpad’ has been configured to collect sample/observation data from the field in both online and offline mode. The field records can directly be uploaded to the Central repository for ready
consultation by the Project team. The device is a very rugged one and can withstand dropping impact up to 5 feet, water and dust. It has long-life, user-replaceable battery and sunlight-readable, high sensitivity 7-inch multi-touch screen. Device is loaded with Windows 8.1 professional operating system.

(iv) Support services like, CGPBIS, Grievance, RTI, Legal, Rajbhasha, Parliamentary questionnaire, are open for familiarization and usage. Elaborate training and hands-on sessions are continuing in batches for each module for a smooth migration experience to the New OCBIS Portal. User can directly contact Helpdesk over IP phone 10013/14 or email – ocbis.helpdesk@gsi.gov.in to get support round the clock.

GSI focus now to convert the vast volume of geospatial data into GIS format. Compilation of different categories of maps has been made available in GSI portal. Digitization of 6,090 mineral exploration reports has been completed and all reports have already been uploaded in the portal. Process of digitization of the Mission–I and Mission-IV reports is on.

29. Synthesis and updation of all India Unified Legend for 1:50K GMS:
Standardisation and final rank categorisation of all lithological units used in 1:50k GMS sheets with formulation of compatible geometric_id and Alpha-numeric; and implementation of geometric_id in lithology layer of 50K geodatabase has been prepared for the first time for Indian Stratigraphy. Unified Legend of all Regions along 16 digits geometric_id (taking into consideration age, Super Group, Group, Sub-Group, Formation, Member, litho-unit) have been inserted in personal Geo-data base of Geology 1:50K after topology correction and removing spatial/attribute mismatches. The first comprehensive stratigraphic database of India upto litho-unit level has been prepared. A write-up on stratigraphy of India in 1:50K scale in tabular format in terms of age upto litho-unit level named as “All India Unified Legend for 1:50K database upto litho-unit level” has been prepared for the first time for Indian Stratigraphy. The users of the database can erect the stratigraphy on their own upto litho-unit level of any part of the country by arranging the geometric-id in descending patter, the oldest unit in the base following by younger units sequentially on top. The dataset is now available through GSI portal.

30. Quaternary Geological Atlas:
The Quaternary period consisting of the Pleistocene and the Holocene epochs, includes the last 2.6 Ma of earth’s history. The Quaternary Period is characterised by frequent and rapid environmental changes. The many cycles of climatic transformations during the Quaternary Period has exerted a strong impact on the activities and distributions of the early human race. Quaternary Geology is an inter-disciplinary science and has tremendous implications for the well-being of mankind. Quaternary Geological Atlas shall be the representative of dominant domains of Form-Process-Material ensemble in India. The Atlas will enlighten and serve the purpose of igniting interest in the geological phenomena that are being optimally utilised by human society. The Geoscientists of GSI have been carrying out geological investigations of various natures. The compilation of the vast data generated on Quaternary Geology of the country will serve as a model that attempts to graphically display the order in nature and to depict the historical and causal connection and continuity. The legend, colour connotations and alpha-numeric notations are maintained as per the ‘Unified Legend’. Keeping in the aforesaid view, Quaternary Geology Atlas of is compiled and brought out by the GSI for the first time in FS 2017-18.

31. Library:
The Central Library of GSI was established in 1856 and it houses the richest collection of geoscientific literature in India. Currently it holds in its archive more than 7,00,000 publications including 600
geological and related journal titles. The archival collection of books in English and other languages dating back to as early as 16th Century makes it a rare repository of geoscientific literature.

32. Online Journals:
GSI has subscribed to 14 titles of Geoscience Journals bought out by ‘Elsevier’ during 2017 for online access to its 31 office locations all over India. The office locations include Central Headquarters, all Regional Headquarters, outlying State Units and M&CSD offices. The ‘Elsevier’ is a reputed publishing house of scientific journals and books based in the Netherlands and the subscribed titles include ‘Precambrian Research’, Tectonophysics’, ‘Talanta’, ‘Journal of Applied Geophysics’, ‘Earth and Planetary Sciences’, ‘Journal of Structural Geology’, ‘Journal of Geochemical Exploration’, ‘Engineering Geology’, ‘Geochemica et Cosmochimica Acta’, ‘Geomorphology’, ‘Computers and Geosciences’, ‘Spectrochimica Acta B’, ‘Palaeogeography Palaeoclimatology Palaeoecology and Quaternary Research’. The publisher has also activated a few journals of Geoscience World on complementary basis for feedback. The journals and research papers therein can be accessed from GSI premises on any desktop system connected to LAN. The publisher is providing access on designated static IP address at 31 locations, however journals can be accessed at any desktop system connected to LAN in the office premises through Google search, provided net connectivity is available.

33. GeoParks and Museums
Since inception, the Geological Survey of India started curatorial functions as a support facility to preserve the rocks, minerals, fossils and meteorites collected during field surveys, through exchange and as gift. Curatorial Division, Central Headquarters centrally co-ordinates the country-wide GSI activities on Museum, Geopark & Geological Monuments. It currently maintains three running geology galleries namely Siwalik Fossil Gallery, Invertebrate Fossil Gallery, Rock & Mineral Gallery displaying exhibits like rock, mineral and fossil specimens; models, maps with illustrations in the Indian Museum, Kolkata. Curatorial Division, CHQ also maintains Rock, Mineral, Fossil and Meteorite Repositories. GSI has also identified and declared 26 sites throughout the country as National Geological Monuments to focus attention on such marvels of nature and to protect and preserve these for posterity. Beside CHQ, all Region & State Units maintain geological museums display rock, mineral and fossil specimens; maps, diagrams, photographs etc.

34. National Centers of Excellence for Geoscience Research (NCEGR):
Geological Survey of India established three National Centers of Excellences at Kolkata, Faridabad and Bangalore to augment its Research & Development capability. Besides, GSI also has six Regional Laboratories. All these laboratories carry out meaningful researches in three principal branches of geosciences, viz., Petrology, Palaeontology and Geochronology & Isotope Geology as well as catering to upgradation of quality of Mission-I and Mission-II Projects. The NCEGR would spearhead high quality research in diverse fields of geology utilizing state-of-the-art instrumentation and through formation of several experts’ research groups. GSI carry out several research projects with an idea to augment mineral resources of the country.

35. Laboratory facilities:
GSI has good Laboratory facilities at Central Headquarters, all Regional Headquarters and at a few important State Units and other places. These labs have state of the art equipment, a few of them are listed below: Raman Spectroscope (for a rapid, non destructive and reliable way to confirm / identify the mineral species semi-quantitatively); equipment for Fluid Inclusion Studies (Leica DMPL) Research Microscope and Linkam Heating-Freezing Stage (for mainly fluid inclusion study, non destructive, for fairly accurate determination of chemical properties of trapped phases within a mineral and pressure-
temperature conditions of entrapment); (a) Hydrothermal Apparatus System, (b) Super Kanthal Extra Heating furnace / Silicon Carbide Furnace, (c) Graphite Furnace for 1 atm experiments (for experimental petrology research at high temperature and pressure); LA-MC-ICPMS (for determination of isotope ratio of radioactive elements (U-Pb, Hf, Pb) for in situ dating of zircons and determination of Sr and Pb isotopic ratio of whole rocks); Ultra Low Level Packard Liquid Scintillation Counter (3170TR/SL) (for determination of \(^{14}\)C age of organic matters from Quaternary sediments); Isotope Ratio Mass Spectrometer (GEO 20-20, SerCon, UK) (for stable isotopic ratio determinations (S in sulphides, C and O in carbonates and D/H in water samples); Electron Probe Micro-Analyzer (SX-100, CAMECA, France) with Carbon Coater (for determination of mineral chemistry, X-ray imaging and CHEMIN dating to aid in variety of petrological studies); Laser Ablation Inductively Coupled Plasma Mass Spectrometer (LAICPMS) (for REE and Trace element mineral chemistry up to ppt level, bulk chemistry of rocks).

The types of high-end laboratory facilities that abound in different laboratories of the department at different places of the country surpass any standard world class Research Organization. Research items taken up by these laboratories encompass a wide spectrum of topics ranging from experimental petrology to terrain evaluation and ore genesis. All the projects have been highly appreciated by different review committees and the outcome is seen in the form of quality publications. The Meteorite & Planetary Science Division (MPSD) has initiated projects involving different aspects of meteorite research, which is aimed to bolster the meteorites and planetary science research in India.

36. Geochronology & Isotope Geology Division of NCEGR, Kolkata is one of the first laboratories in the country to introduce systematic radiometric dating facility. The laboratory has been generating extensive Rb-Sr and K-Ar age data on Indian rocks. The laboratory took up projects covering a wide gamut of geosciences research from geochronological study of Archaean and Proterozoic cratonic blocks to provenance study in Himalayas to Mesozoic granitic intrusion related to Himalayan collision to Quaternary evolution of Bengal Basin. TL/OSL laboratory of NCEGR, Faridabad determine ages of samples which will help building chronostratigraphy of Late Quaternary deposits.

37. Further, GSI endeavours to procure High-Resolution Secondary Ion Mass Spectrometer (HR-SIMS) for further precise analysis of samples. HR-SIMS is an internationally recognized technology. Its main use has been for high precision and high-resolution U-Pb geochronology of zircon and other U-bearing minerals, such as perovskite, monazite, uraninite, baddeleyite, rutile, apatite, xenotime, cassiterite, tantalite and sphene. It can reveal timing of magmatism, metamorphism, mineralization and sedimentation and thus help develop an understanding of how the timing of geological events millions or even billions of years ago have produced the mineral and energy resources we depend on today.

38. Gem Testing Lab.
Gemmology Laboratories of GSI, especially the lab situated at CHQ, Kolkata receive from general public, jewelers, and traders etc., quite a large number of commercial gemstones regularly for their testing. Normally, treatments are done in gemstones in order to enhance their beauty. Of this huge number of gemstones, many come out as natural but treated ones. The various methods of treatment of gemstones include dyeing, fracture or cavity filling, heat treatment, lattice diffusion, formation of doublets and triplets etc. The main challenge of the Gemmology Laboratory is to differentiate the pristine natural gemstones from artificially treated / developed ones. The Gemmology Laboratory aims to study these treatments in contrast to the natural pristine ones, using conventional gem testing instruments as well as Raman spectroscopy.

39. Chemical Laboratories:
GSI has state of the art Chemical laboratory facilities at all Regional Headquarters and many State Unit offices. Chemical analysis is an inextricable part of the curriculum of geological science. Providing precise and accurate data of chemical analysis is the main function of the chemical laboratories. The Central Chemical Laboratory, GSI, Kolkata plays the pivotal role of setting ultimate synchronization amongst various Regional and State Laboratories for providing precise and accurate analytical data as demanded by geologists for fulfillment of flagship programmes like, NGCM, Mineral Investigation projects, Fundamental and Multidisciplinary Geo-Science Research projects etc. The analysis of major minor and trace elements from ppm/ppb to percentage level are being carried out by sophisticated state of-art instruments like ICP-MS, XRF, AAS (Flame/ GTA/ VGA), DMA-80, Fire-assay cum, ISE, etc. These labs have analytical capabilities to analyse and identify at elements at ppb level. The facilities available in different stations are in large number, such as, 30 Nos of Atomic Absorption Spectrophotometer (AAS); 8 Nos of Inductively Coupled Plasma Mass Spectrometer (ICPMS); 7 Nos of X-Ray Fluorescence Spectrometer (XRF); 12 Nos of Ion Selective Electrode (ISE); 7 Nos of Direct Mercury Analyzer (DMA). In order to take maximum advantage of all these laboratories, Chemical laboratory networking has been formulated with the Central Chemical Laboratory at a nodal position for better and integrated management of all laboratories within GSI in day to day operation related to planning, programming, procuring of high-end equipment, budgeting, analytical output, manpower usages etc. Further, it is pertinent to mention here that the Central Chemical Laboratory, GSI, CHQ, 15 A&B Kyd Street, Kolkata and Chemical Laboratory, GSI, Southern Region, Hyderabad have been assessed and accredited by NABL in accordance with the Standard ISO/IEC 17025:2005 General Requirements for complete testing and calibration laboratories in various methods of Chemical Testing and their ranges of testing and limits of detections are specified.

40. Meteorite studies:
Meteorites are extra-terrestrial remnants of asteroids and other celestial bodies that fall on the earth from space. The main source of meteorites is the asteroid belt (Ceres, 4 Vesta, 2 Pallas and 10 Hydiea) lying between the orbits of Mars and Jupiter. GSI, being custodian of all meteorites, landed or found, within Indian Territory, possesses a rich collection of over 600 meteorites. Diverse types of chondrites, achondrites and iron meteorites enrich GSI’s collection. Study of these meteorites has been an important research theme of GSI for the last two decades. Being custodian, GSI established a meteorite gallery, housed in CHQ, Kolkata.

41. Engineering Geology:
Geological Survey of India has made commendable contribution in Engineering Geology at a large number of Water Resource Development Projects like hydroelectric, irrigation and river linking projects, within and outside the country for their successful completion. GSI has been rendering geotechnical consultancy services to WAPCOS for the upcoming hydroelectric projects in Punatsangchhu and Kuri Gongri, Bhutan.

42. Geohazards Research & Management (GHRM) Cell:
GHRM Cell under National Mission-IV has been re-constituted in 2016 as GHRM Centre with two constituent Divisions, namely, (1) Landslide Studies Division and (2) Geodynamic Studies Division. Landslide Studies Division will continue spearheading National Landslide Susceptibility Mapping (NLSM) programmes of GSI. Geodynamic Studies Division shall be the nodal point for GPS studies in GSI including setting up of proposed permanent GPS stations, monitoring, acquiring and scientific post-processing of data.

43. National Landslide Susceptibility Mapping (NLSM):
Govt. of India declared GSI as the ‘Nodal Agency’ for landslide data repository and landslide studies. GSI has undertaken a national programme – National Landslide Susceptibility Mapping (NLSM) since 2014-15 to prepare seamless landslide susceptibility map on 1:50,000 scale for 0.42 million km² hill area of the country which is spread over parts of 19 States. Under this project, the Priority 1 target area (0.28 million sq km) is accessible and populated areas where NLSM work is currently in progress by using both remote sensing source data and extensive fieldwork with a perspective plan to complete the Priority 1 target by FS 2019-20. Till now, NLSM maps are prepared and placed in GSI portal for public viewing. Landslide inventory containing 8,667 landslide incidences has been finalized for uploading in Bhukosh portal under NLSM and the same has been handed over to Mission-III for uploading.

44. Geodynamic Studies Division:
Geodynamic Studies Division shall be the nodal point for GPS studies in GSI including setting up of proposed permanent GPS stations, monitoring, acquiring and scientific post processing of data. The Division will take up comprehensive plan for setting up of permanent GPS stations and their analysis of data acquired; to oversee campaign mode GPS studies and inculcate capacity building among young geoscientists and to co-ordinate seismic micro zonation work being carried out by GSI. GSI does geodynamic studies in different parts of the country using differential GPS. Campaign mode and continuous GPS data from for period is used to examine evolving strain pattern in the Andaman Islands

45. GPS Permanent stations by GSI:
To monitor regularly strain variation within intra and inter-plate regions for earthquake monitoring, GSI has planned to establish 35 numbers of permanent GPS stations throughout India. During FS 2015-16, SG DRPC has established 5 stations at Agartala, Mangan (Sikkim), Itanagar (Arunachal Pradesh), Nagpur, Jammu and will establish another 2 stations at Little Andaman and Chennai during FS 2017-18.

Geodynamics Studies Division has established 5 nos. of permanent GPS stations at Pune, Kolkata, Thiruvananthapuram, Jaipur and Dehradun (under preparation) during FS 2016-17. During FS 2017-18, 10 nos. of stations will be established at Patna, Chandigarh, Aizwal, Gandhinagar, Bhopal, Raipur, Visakhapatnam, Jabalpur, Shillong and Lucknow for which instrument procurement process is initiated. Another 13 stations will be established in subsequent field seasons.

46. Seismo-Geodetic Data Receiving and Processing Centre (SG DRPC):
GSI is operating real-time SG DRPC with Central Receiving Station in Kolkata. Five multi-parametric observatories located at Mangan (Sikkim), Itanagar (Arunachal Pradesh), Agartala (Tripura), Nagpur (Maharashtra) and Jammu (Jammu & Kashmir) are installed with three-component digital broadband seismographs. These observatories transmit multi-parametric raw data in real time through Very Small Aperture Technique (VSAT) at Central Receiving Station (CRS), Kolkata which is equipped with modern facilities for processing, interpretation and archiving of multi-parametric seismo-geodetic data. Monitoring, maintenance and running of integrated real-time seismo-geodetic network is in place in the department and real time seismological data are being processed and analysed on day-to-day basis, monthly catalogue of earthquakes are being generated along with epicentral map and are uploaded in GSI portal. Further, micro seismic surveys (after shock studies) are also being carried out by deploying temporary digital seismographs for a specific period and reports are circulated through portal.

47. Environmental Geology & Medical Geology
GSI undertakes studies pertaining to geo-environmental assessment, especially, studies on fluoride and arsenic contaminations in ground water in various parts of the country.
48. Climate Change:
GSI is engaged in palaeo climatic studies through its various research programmes such as, studies of coastal regions, glaciology, desert geology and carbon sequestration. It is actively engaged in study of selected glaciers in the Himalayas. GSI is also planning to study extent of desertification, salinity changes etc. An integrated approach of study based on Quaternary geology including, chronostratigraphy and palaeontology in India as well as ice core studies in Antarctica is also in progress.

For more than a hundred years, GSI has been involved in the study of Himalayan cryosphere, the largest mass of snow and ice outside the Polar Regions. The different aspects of glaciological studies include study of glacier regime, mass balance, hydrometry, glacial and periglacial geomorphology, snow-cover studies and inventory of glaciers in the individual basins. As glaciers possess proxy records of climate changes in past, monitoring of glaciers is taken up by GSI and more than 40 glaciers have been monitored during last hundred years in the Himalayas.

49. Polar Studies Division:
Officers of PSD participate in Indian Scientific Expedition to Antarctica (ISEA) regularly under-take scientific programmes. Further, some officers of the PSD also participate in Arctic expeditions. GSI is actively engaged in research activities in Polar Regions through research projects undertaken by Polar Studies Division (PSD) located at Faridabad. PSD is involved in scientific activities at two places viz., in Antarctica and Arctic (Svalbard, Norway region). In Antarctica thematic research items are undertaken keeping in mind the broad objectives, accessibility and logistics availability. The research proposals of GSI in Antarctica can be conveniently categorized into three broad aspects/themes: (a) Ice Sheet dynamics of part of cDML area (from Maitri base). This area is a part of the large East Antarctica Ice Sheet (EAIS). Understanding its dynamics through continuous monitoring finally contributes to our understanding of the mass gain or loss of the EAIS. Similar project has been initiated in Larsemann Hills area (from Bharati base). (b) Understanding the Late Quaternary climate changes in Antarctica using sedimentological proxies and dating the events deploying TL/OSL techniques. Fluctuations in climatic conditions led to glacial maxima’s and deglaciations during the last 2Ka. Thematic research has led to the understanding of the fluctuations and its patterns from Schirmacher Oasis region. Similar studies are also being conducted in Larsemann Hills area. (c) Antarctica is an important component of Gondwana reconstruction model and, therefore, the thematic studies with objectives of understanding the passage of Rodinia and East African Antarctic Orogeny through space and time is a matter of intense research internationally. GSI is actively engaged in such studies and is constantly contributing in the geological understanding of East Antarctica; In the Svalbard regions of Arctic Norway, GSI is carrying out glaciological studies and monitoring of two glaciers. In addition, GSI is also working on the Late Quaternary deglaciation history of the NyAlesund, Svalbard area. PSD also maintains the only Polar museum and rock repository of its kind in the country.

The first Indian Antarctic Expedition was launched in December, 1981, wherein First Antarctic Research Station ‘Dakshin Gangotri’ was established in 1983. The second Indian Antarctic Station, ‘Maitri’ was built in 1988. GSI contributed since initiation and participated in all these expeditions, at times provided Voyage leadership too. Further, GSI’s contribution in initiation, overseeing the construction and commissioning of India’s prestigious third Antarctic Research Station ‘Bharati’ between 2009 and 2012 were remarkable.

50. Desert Geology:
Geo-scientific studies on desertification and its impact assessment in areas of Thar Desert, Rajasthan have been carried out to characterize and map different components of the Thar Desert in India.
Several palaeo climatic indicators have been identified and studied to infer various operative processes and geological evolution of the Thar Desert. Dating of sediments indicates different episodes of desertification and due formation in the Thar Desert.

51. Repository of Index Fossils:
GSI is the custodian of the fossil repository which also consists of rare index fossils. It has a unique collection of about 2,50,000 fossils representing the entire spectrum of geological time scale of the Indian sub-continent. The registered fossils of the Fossil Repository are open to geoscientists for further research.

52. GSI Training Institute:
Geological Survey of India Training Institute having its headquarters at Hyderabad has six Regional Training Institutes (RTI) operational at six Regional Headquarters and ten active Field Training Centers (FTC) catering to specialized terrain-specific geological training. GSITI initially imparted induction level training, i.e., Orientation Course for Geologists which was the main activity of the Institute. Slowly domain specific courses like specialized Basic, Refresher, Advance and Management courses became an integral part of the training activity for all scientific, technical and administrative streams of the department.

The training policy of GSI incorporates the basic tenets of the National Training Policy, 2012 (NTP-2012) formulated by the Department of Personnel and Training, Government of India. Training is defined as a proactive, systematic process through which an organization’s human resources gain knowledge, skills and behaviour by instruction and practical activities that result in improved performance. Training programmes of GSI Training Institute are centered on the thrust areas of GSI activities and also as per requirement of stake holders in geoscientific domain.

The policy in training and capacity building is intended to be specific to the activity domain of the GSI. It also takes cognizance of the training needs assessment (TNA) and priorities and thrust areas that are identified by the policy makers. The GSITI functions with a vision to be a well-regarded and highly respected geoscientific training institution providing unique multi-disciplinary knowledge in the national interest; to help develop world-class geoscientists in all leading geosciences disciplines. The training infrastructure will also facilitate high-end cutting-edge knowledge sharing and delivery mechanism within GSI and with other research institutions and also to strengthen and sensitize State DGMs in respective regional geological aspects to increase their role in mineral exploration and related fields.

GSITI is providing training in geosciences to various organizations, institutes and universities, such as, glaciological training for DST; Natural resources and disaster management for ISRO; Sedimentary geological mapping for ONGC; Chemical analysis for NMDC; Engineering Geology for Satluj Jal Vidyut Nigam Ltd.; GIS and geo referencing for IBM; Mineral Exploration for Coal India; Field training to students and teachers of various Universities and colleges. Some more important programmes to mention here are: MEA-sponsored international courses under ITEC / SCAAP programmes, such as, Remote Sensing and Digital Image Processing; Mineral Exploration and Mining; Geographic Information System (GIS); Geoscience Australia association in organizing Workshops on Project: UNCOVER India; Distinguished Instructor Short Course (DISC) by Prof. D. Oldenburg (SEG, USA) on Electromagnetics in Geophysical exploration being organized jointly with NGRI and IIG. As the programmes are increasing, participants are also increasing in number year after year, about 3090 in the year 2016-17.

53. National Geoscience Data Repository:
National Mineral Exploration Policy, 2016 mandated GSI to set up a National Geoscience Data Repository (NGDR) to collate, process and interpret all baseline and mineral exploration information generated by various central and state agencies, and mineral concession holders and maintain these on a geospatial database. GSI needs to devise a format, in consultation with stakeholders, for submission of exploration data by all exploration agencies. GSI floated a tender to identify a suitable knowledge based firm to formulate a DPR and to develop such facility. Work is in progress.

The National Mineral Exploration Policy (NMEP) spells out the strategy and outlines action plan that the Government shall adopt to ensure comprehensive exploration of country’s mineral resources (non-fuel and non-coal). The exploration strategy will include: i. The Government will make available pre-competitive baseline geoscience data of the highest standards. This data will be continuously updated and benchmarked with those of other jurisdictions. The government will specify the kind of data that will be provided to potential exploration agencies and the timelines for their publication. ii. The pre-competitive baseline geoscience data will be made available for open dissemination free of charge. iii. Government will create baseline geoscience data as a public good and fund the generation and dissemination of such data. Government’s objective is to facilitate, encourage and incentivize private sector participation in all spheres of mineral exploration. The Government intends to harness the technical expertise, technological capability and the financial resources of the private sector to discover and exploit the country’s vast mineral resources.

Government of India is taking initiatives to make multi-disciplinary, multi-thematic data available to its stakeholders through a single window. There are number of Government, PSUs and private agencies, viz. Indian Bureau of Mines (IBM), National Natural Resource Management System (NNRMS), National Remote Sensing Centre (NRSC), National Resource Development Management System (NRDMS), Ministry of Earth Sciences, DMG’s of different States, Tata Steel, NGRI, CGWB, MECL etc., which deal with geospatial mineral and non-mineral data and applications in the domains of natural resource, environment, sustainable development, etc. Many of these organizations are making separate endeavor to improve the discoverability and access to their information assets via the Internet. The prime focus of agencies is to develop earth science data repository which are interoperable across board. It becomes imperative that all member organizations have to align themselves to focus their endeavours in the service of the nation. Different earth science organizations deal with different types of thematic data and heterogeneity exists in different levels, such as semantic, schematic and syntactic. Organizational constraints are often roadblocks to effective data sharing and collaboration. For success of such initiatives, data-sharing policy is to be looked into from a strategic point of view.

It is therefore necessary to build an infrastructure for sharing information and collaboration among these organizations. Such an infrastructure need to be composed primarily of components like Infrastructure, Network (Geoscience Network) and Portal (National Geoscience Portal), the first providing the connectivity and infrastructure, and the second providing the interfaces and services for data sharing. It becomes imperative to use 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.

Ministry of Mines, GoI, has entrusted GSI to conceptualize, architect, design and program manage the implementation of the envisioned NGDR. The NGDR Project revolves around data of multi-discipline, multi-theme from multiple sources which is geospatial in nature. GSI with its considerable expertise in collation, analysis of data relating to geosciences is ideally equipped to provide technical thought
leadership (Subject Matter Expertise) to this project. Moreover, GSI’s learning in evolving OCBIS would be a robust enabler to provide subject related thought leadership to this project.

54. NCMT:
The National Mineral Exploration Policy (NMEP) also mandated GSI to establish a National Center for Mineral Targeting, an R&D for scientific inputs for identifying and delineating mineral resource of the country by various stakeholders. In this regard, GSIITI conducted a workshop at Hyderabad, involving several stakeholders. Based on output of the Workshop, a base document has been prepared and submitted to the Ministry of Mines for its consideration.

55. 35th IGC 2016:
Sixty-six officers from GSI participated in the 35th IGC held in Cape Town, South Africa from 27th Aug to 4th Sept, 2016 and presented their papers. A Volume on “Geo-tourism hot spots of Indian sub-continent” was prepared with active involvement and contributions from geoscientists of India and co-host countries viz., Bangladesh, Nepal, Pakistan and Sri Lanka. This volume was released and distributed from the Indian booth during 35th IGC. On the sidelines of 35th IGC, three Business Meetings were held with officials of British Geological Survey (BGS), Natural Resources Canada (NRCan) and Geoscience Australia (GA) at Cape Town.

56. 36th IGC 2020:
India along with Bangladesh, Nepal, Pakistan and Sri Lanka will host the 36th International Geological Congress in the year 2020 at Delhi. The event will be hosted jointly by the Ministry of Mines (MoM) and Ministry of Earth Sciences (MoES) with active support from Indian National Science Academy (INSA) and science academies of the co-host nations. All major geoscience institutions and organizations will be associated. GSI has been designated as the Nodal Agency for organising the IGC. The Union Cabinet had approved setting up of 36th International Geological Congress Society in March, 2016 for organizing 36th IGC in India. The Society has started functioning under the guidance of Governing body of the 36th IGC Society, with Secretary, Ministry of Mines and Secretary, Ministry of Earth Sciences as Chairman and Co-chairman. Subsequent to the Governing Body and Appropriate Authority meetings, the basic organizational framework of 36th IGC Local Organizing Committee (LOC) and Executive Committee (EC) for the society was defined.

57. Foreign collaborations:
Geological Survey of India and British Geological Survey have agreed to work together in a 4-year-long project: LANDSLIP (Landslide multi-hazard assessment, Preparedness and early warning in South Asia, Integrating Meteorology, Landscape and Society). An MoU between British Geological Survey of the Natural Environment Research Council of UK (BGS) and Geological Survey of India (GSI) will be signed along with an Implementing Agreement. GSI considers the collaboration with the BGS is a prestigious one as it supports the department through its various schemes by which many of our geoscientists will be inducted in the learning process of various techniques of disaster management and other related aspects. The LANDSLIP team will work together to develop enhanced landslide risk assessment and monitoring methods using two study areas: Darjeeling-East Sikkim in Himalayas of North-Eastern India and the Nilgiris district of the Western Ghats in southern India.

GSI and Geoscience Australia signed an MoU, and Terms of Reference (ToR). As part of implementation of ToR, Project UNCOVER India has been taken up and in the process, three Workshops on capacity building were conducted along with field visits.
Geological Survey of India (GSI) and Natural Resources, Canada (NRCan) are currently collaborating in an Interferometric Synthetic Aperture (InSAR)-based landslide monitoring and early warning research programme at two active landslides in India. NRCan is providing GSI the required technical advice, guidance and 20 scenes of RADARSAT-2 images of the study area for a period of 24 months, and also supplied trihedral corner reflectors for installation at site.

58. Deep drilling facilities:
GSI has about 70 drill rigs in its possession, out of them 32 rigs are being deployed in coal and lignite exploration of which 26 rigs have a de-rated capacity of >800 m while the rest have <600 m. Moreover, as the department has been in the domain for the last many decades, it has developed expertise in drilling and associated issues exclusively pertinent to exploration of coal and lignite.

Eleven high-technology drilling machines have already been procured. Multi-parameter Borehole Logger, Heavy-duty skid mounted Diamond core drills of 600m and 1000m capacity, Mud Pumps, Several other procurements especially with respect to drilling like wire line drilling and hydrostatic drilling are lined up to be procured as GSI is currently taking up G2-stage exploration for which GSI shall require large quantities of drilling with sophisticated equipment to take up exploration activities in a time-bound manner.

59. Estate:
As GSI has its offices in almost every State of the country, it has its own establishments at about 30 stations, barring a few, especially in NER and Dehradun and at few other locations. Efforts are on to acquire and establish own establishments almost at every station. In this regard, the new, state of the art construction made at Chennai and works in progress at Bengaluru and Shillong are worth mentioning. Of late, yet another proposal is made to construct a new, state-of-the-art, multi-storied building for GSI’s Central Headquarters at Kolkata. Preliminary Estimate for an amount of Rs. 232 crore has been received from CPWD authorities. Proposals needs requisite administrative approval & expenditure sanction of the competent authority.

60. Green Energy Commitment:
To achieve the objective of green energy commitment, GSI has taken up installation of roof top grid solar power plant. GSI has a pan-India presence with 60 buildings owned by it, distributed over 22 locations. The total roof-top area is calculated as 43,500 square meters. Of these 22 locations, in the first phase seven locations in Kolkata (Bhu-Bijnan Bhawan and Dharitri Building, 27 & 29 J.L. Nehru Road), Bhubaneswar, Lucknow, Nagpur and Hyderabad have been taken up for installation of roof-top solar panel through CPWD and SECI. The total potential of these seven locations is about 1.2 MW power. All the seven locations are expected to become operative by 31st March 2018. For the other 15 locations as per instructions of the Government, REIL has carried out assessment and submitted a preliminary report. It is expected that by September 2017 roof-top solar panels can become operative in all the 22 locations of GSI offices and will be able to generate about 2.8 MW of power.

61. Budgetary allotments:
GSI has been accorded budget sanction of Rs 1,027.87 crores for FY 2017-18. It is worth mentioning here that for the last three consecutive financial years, GSI is in habit of spending its budget allotments to the order of 99.5%, which is normally a rare phenomenon in government sectors. Further, it is also worth mentioning here that the Ministry has recently delegated modified and improvised financial powers down the line in the department, so that limits of financial sanctions to various notified posts are substantially increased.
62. Procurement of vehicles:
Nineteen A/c cars are procured from M/s Tata Motors Ltd through Government eMarketing for senior officers of GSI. These are new generation cars having latest safety features and comfort, with excellent fuel mileage. The cost of each car is approx 6.90 lakh inclusive of taxes with a total investment of approx Rs 130 lakhs. This is one of the major procurements of cars in GSI in the last 14-15 years, as GSI purchased only one car and 8 multi-utility vehicles for GSI TI during the period. This will definitely help in filling up a gap of good vehicles, for senior officers of GSI.

Vehicles play a vital role for successful completion of field activities and in fact procurement of 100 field vehicles which is also in the process will give major relief to our geoscientists and help them in carrying out their field work. To achieve this a systematic vehicle plan was prepared and got approved, followed by initiation of survey off all vehicles procured prior to 1989, and finally the procurement of field vehicles, against the condemned vehicles. After HPC, this is a major procurement of field vehicles. PO has already been placed for 65 vehicles through Government e Marketing and entire process for placing PO for remaining 35 field vehicles is also completed and its just a matter of availability of fund for which action has already been taken by Finance Division. These vehicles are Thar-28, Camper-37 and Bolero-35 nos, all from the Mahindra & Mahindra stable. The total investment is about Rs 700 lakhs. All these field vehicles are of four-wheel drive with advanced features. To meet the exclusive terrain requirement of Western Region, Mahindra’s Thar invariant are purchased and the vehicles will be part of WR fleet very soon. The process of procurement of field vehicles as per plan will continue in coming years also against the condemned vehicles and during next year it is planned to procure heavy trucks, Tata 407 for drilling fields and light vehicles against condemned vehicles of post-1998.

We have also got the approval for procurement of 7 nos geophysical logging van & efforts will be made to procure the vehicle along with the fabrication work to ensure that geophysical division can commission these vehicles without difficulty. All senior colleagues agree to the fact that this type of large contingency of procurement of vehicles in the department is a rare phenomenon and certainly a progressive sign.

63. ISO 9001:2015 (QMS):
Geological Survey of India, as a premier scientific organization of the country, has its credibility. However, in order to maintain standards and transparency on par with other organizations, the department also acquired ISO certification. In the process, GSI, Central Headquarters is now ISO 9001:2015 (QMS) certified, having been assessed by QFS Management Systems LLP for compliance, to be registered in the List of Registered Organisations with regard to the standard and scope of supply for Administrative Support System and Policy Support System, Mission-III, Mission-IV and NCEGR, Kolkata from their sites of 27 & 29 Jawaharlal Nehru Road, 15 A&B Kyd Street, Kolkata. Similarly, GSI, Eastern Region Office having its premises at Bhu-Bijnan Bhawan, DK-6, Sector-II, Salt Lake City, Kolkata is also now ISO 9001:2015 (QMS) certified, having scope for geoscience activities including five Missions i.e., Baseline Geoscience Data Generation, Natural Resource Assessment, Geoinformatics, Fundamental and Multidisciplinary Geoscience & Special Studies, Training & Capacity Building along three Support Systems viz., Scientific & Technical, Administrative & Policy Support Systems.

64. Synergy with other organizations:
GSI, the premier geoscientific organization has developed extremely cordial relations with related geoscientific and other scientific organizations through CGPB forums and regular interactions, enabling mutual co-operation and co-ordination at many fronts. It helps to avoid duplication of works and
supplementing and complementing the work load for a better perspective planning. In this regard, the synergy synchronized with the organizations is highly appreciated and worth to be placed on record. It is pertinent to list all of them here: NDMA, NIDM, MoES, DST, AMD, BARC, MECL, IBM, JNAARD, NMDC, NRSC, IIRS, ISRO, CWG, CE, DGH, NIO, NGRI, DTRL, ONGC, CBRI, CRRI, BRO, Coal India, CMPDI, CIMFER, NALCO, HCL, MOIL, NTPC, APMDC, TATA-- and Directorate of Geology and Mining of various State Governments; various Universities in the country, especially, ISM (IIT), Dhanbad, Calcutta University, Andhra University and Adikavi Nannaya University.

65. Vastness of the department:
GSI is a vast organisation having its spread of offices across the country making its presence and having its impact in all States of the country; having huge strength of S&T officials to the order of 3,517 besides a strength of other streams to the order of 3,282, totaling filled in strength of 6799 (as on 31.05.2017); taking up more than 800 regular coded items from Mission-I to V (during FS 2017-18); having its expertise in five Missions; having its domains on land, airborne and off-shore; having close working relations, regular interactions, MoUs with many sister and related organisations in the country; having MoUs and Implementing Arrangements with organisations of foreign countries; having state-of-the-art scientific instruments, laboratories in different Regions of the department; having responsibility of proper utilisation and maintenance of available vast scientific facilities and procurement of latest and updated scientific equipment from time to time; meeting requirements of Central Geological Programming Board, State Geological Programming Boards, State DGMs, National Disaster Management Authority; meeting the requirements of managerial, administrative, personnel, HRD, stores, transport, drilling, financial, legal, vigilance related issues etc.; meeting demands, directions, commitments, suggestions of the Ministries of Govt. of India and State Governments received from time to time, addressing issues posed by Parliamentary Committee meetings, Parliament questions, Reviews; having a budget allotment of more than Rs 1,000 crore (FY 2017-18) and commitment for its effective utilisation; and the list is only indicative and not exhaustive.

While dealing with such a large array of issues, though many things happen transparently and most of them are visible in portal, many people may not have proper access to details of issues, by which they tend to develop a feeling that things are not in order and express their anxiety in the form of RTIs, court cases, representations, enquiries etc. It is quite possible that even serving employees also may not have proper perception about all issues in progress at a time, which may also lead to mistrust or misunderstanding. Service Associations do their best here in the larger interest of welfare of employees. There is also a possibility that things get delayed or missed due to human error intentionally or by oversight, or due to lack of clarity at the time of interpretation of rule position etc., which need to be addressed and rectified. The department needs to attend almost all things at a time simultaneously.

66. Work culture of GSI:
Government expects GSI’s work culture to be improvised to the extent of corporate sector. The type of work culture inherited in the department for the last several decades may not hold good in the present situation. By general assumption GSI will not be able to meet the pace of output the government is expecting. As GSI officials are of more independent in nature, they take liberty of taking time to follow and implement directions received from higher authority and Ministry. May be to some extent, they are correct. At this stage, I need to urge all my fellow employees, to react swiftly to attend all directions, suggestions received from higher authorities and from the government to overcome and uproot misconceptions. Inordinate delays occur at headquarters in distribution of fund from National Mission Heads to field parties, recouping contingent fund for field officers, and passing TA bills of individuals are some of the areas of common unrest among employees. Regional headquarters and State Units may
please focus on these areas. Further, if the department can attend promptly to grievances and petitions, probably, it could have avoided many RTI queries, grievances and legal obligations. Also, I would request that actions of office at every stage should be swift and transparent to the extent possible. It will certainly help to minimise unrest and build confidence among affected employees.

The growth of the department and roles & responsibilities to be attended by the department are distinctly increasing day by day. Of late, with the introduction of tough pads and GPS, field geologists need to work on them right from field and enter field data therein, which will be transmitted to OCBIS for a regular follow-up by their superiors. Though, it is an advanced facility, one can understand the checks and controls that prevail upon a working field geoscientist. It is also to be noted here that the swiftness in getting promotions to various hierarchical echelons has also increased remarkably. Accordingly, expectations from the department by the government and people are also ever increasing simultaneously. There is no comparison of these issues with those of even the last decade. In order to meet requirement of the day, willing participation and proactive role of all officials of the department is the need of hour. In case of any shortcomings noticed, I would urge my colleagues help to correct them in right earnestness. I would also urge all my colleagues not to support any negative propaganda against the department. All grievances need to be addressed within the framework of rules. The superannuated employees are the strength, honour, name and fame of this great organisation. The department does not work against any individual, instead, always endeavors towards welfare of its employees while in service and even after their superannuation. With the experience of functioning of government departments in the country, it can be emphatically placed that the functioning of the department is more democratic, systematic and scientific. Let us all join hands together to uphold dignity of the department. With all progressive and developmental activities narrated, everyone will agree with me that GSI is on pathway to success.

GSI, with its dedicated team of geoscientists, engineers, drillers, administrators, financial wizards, asset procurement wizards, surveyors, draughtsman, and drivers and many other supporting personnel and along with about 166 years of legendary legacy background committed to perform and excel. In fact, it has become habit to it to excel and perform par excellence. GSI’s success is India’s pride. I distinctly notice that the GSI shines year on year. So, while bidding farewell to the department on my superannuation, as a committed soldier and captain, I salute this great organization with profound respect. Long live GSI. Long live India. Jai Hind.

M. Raju
Director General
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