



ISRO - UoP Space Technology Cell

Savitribai Phule Pune University

(formerly University of Pune)



ANNUAL REPORT : 2014-15



**ISRO Chairman Shri A S Kiran Kumar Visits
ISRO-UoP STC Cell**

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Space Technology Cell**

**Savitribai Phule Pune University
(Formerly University of Pune)**



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SUMMARY

This document presents the details of the activities of ISRO-UoP Space Technology Cell (STC) at Savitribai Phule Pune University during the year 2014 -15. A brief report on completed projects, giving summary of findings, is included in the document. Current status of ongoing projects is also presented. List of the new projects approved under ISRO-UoP Joint Research Programme, is given. Thrust areas in the suggested research topics have been included for the guidance of prospective Investigators.

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1. Introduction

Indian space program

Aim of the Indian space programme is to promote the development and application of space science and technology for the socio-economic benefit of the country. Indian Space Research Organization (ISRO) is the primary agency under the Department of Space (DOS) for executing space programmes. In addition, Physical Research Laboratory (PRL) at Ahmedabad, National Atmospheric Research Laboratory (NARL) at Gadanki (near Tirupati), North Eastern-Space Applications Centre (NE-SAC) at Umiam (near Shillong) and Semi-Conductor Laboratory (SCL) at S A S Nagar, (Near Chandigarh), all under DOS, are making valuable contribution towards the above goal. Antrix Corporation, established in 1992 as a government owned company, markets the space products and services. The major establishments of DOS and their area of activities in brief, are given in the following paragraphs:

Vikram Sarabhai Space Centre (VSSC/ISRO)

VSSC at Thiruvananthapuram is the major center of ISRO, where the design and development activities of satellite launch vehicles and sounding rockets are carried out and made ready for launch operations. The centre pursues research and development activities for associated technologies such as launch vehicle design, propellants, solid propulsion technology, aerodynamics, aero structural and aero thermal aspects, avionics, polymers and composites, guidance, control and simulation, computer and information, mechanical engineering, aerospace mechanisms, vehicle integration and testing, space ordnance, chemicals and materials. The Space Physics Laboratory at VSSC carries out research and studies in atmospheric science and other related space science activities.

ISRO Satellite Centre (ISAC/ISRO)

ISAC at Bengaluru, is the lead centre for design, development, fabrication and testing of all Indian made satellites. The Centre is engaged in the development of cutting-edge technologies of relevance to its satellites building activities and setting up of infrastructure for design, development, fabrication and testing of spacecraft.

Satish Dhawan Space Centre (SDSC SHAR/ISRO)

SDSC SHAR at Sriharikota, with two launch pads is the main launch centre located at 100 km north of Chennai. The Centre has necessary infrastructure for launching satellites into low earth orbit, polar orbit and geostationary transfer orbit. Apart from these, it has facilities for launching sounding rockets meant for studying the earth's atmosphere. It has production facility for large size solid propellant rockets and their static testing.

Liquid Propulsion Systems Centre (LPSC/ISRO)

LPSC at Valiamala (near Thiruvananthapuram) is responsible for research and development of Earth Storable and Cryogenic propulsion. The Centre delivers Engines, stages, associated control systems and components for Launch Vehicle and Spacecrafts. The LPSC's unit located at Bengaluru is responsible for Satellite Propulsion Systems, development of electric propulsion, propellant gauging for spacecraft, advanced transducers etc.

ISRO Propulsion Complex (IPRC/ISRO)

IPRC at Mahendragiri is responsible for assembly, integration and testing of earth storable and cryogenic engines/stages for launch vehicles. Production and supply of cryogenic propellants is also carried out by the Unit.

Space Applications Centre (SAC/ISRO)

SAC at Ahmedabad is responsible for design and development of payloads, societal applications, capacity building and space sciences, thereby creating a synergy of technology, science and applications. The activities include development and supply of communication, navigation, earth & planetary observation, meteorological payloads and related data processing and ground systems. National level application programmes in the area of natural resources, weather and environmental studies, disaster monitoring/mitigation are also carried out.

Development and Educational Communication Unit (DECU/ISRO)

DECU at Ahmedabad, is involved in defining, planning, implementing and conducting socio-economic research and evaluation of various societal applications. At present, the major programmes which support development, education and training are Telemedicine (TM), Tele-Education (TE) and other SATCOM Development and Applications, including Disaster Management System (DMS), Village Resource Centre (VRC) related activities etc.

ISRO Telemetry, Tracking and Command Network (ISTRAC/ISRO)

ISTRAC provides the tracking support for satellite and launch vehicle missions. Activities include estimation of the preliminary orbits of satellites injected into space, carrying out mission operations and maintenance of the ground segment. In addition, ISTRAC provides space operations support for Deep Space Missions, Search & Rescue operations and Disaster Management. ISTRAC has TTC ground stations at Bangaluru, Lucknow, SHAR (Sriharikota), Thiruvananthapuram, Port Blair Island, Brunei, Biak (Indonesia) and Mauritius.

Master Control Facility (MCF/ISRO)

MCF at Hassan in Karnataka and Bhopal in Madhya Pradesh monitors and controls all the Geostationary/Geosynchronous satellites namely INSAT, GSAT, Kalpana and IRNSS series of satellites. MCF is responsible for Orbit Raising of satellites, In-orbit payload testing and On-orbit operations all through the life of these satellites. MCF activities include round-the-clock Tracking, Telemetry & Commanding (TT&C) operations and special operations like Eclipse management, Station-keeping and recovery actions in case of contingencies.

ISRO Inertial Systems Unit (IISU/ISRO)

IISU at Thiruvananthapuram is responsible for design, development and production of Inertial Systems for both Launch Vehicles and spacecrafts. Design and development of Actuators and Mechanisms for spacecrafts is also undertaken.

Laboratory for Electro-Optic Systems (LEOS/ISRO)

LEOS at Bengaluru is responsible for design, development and production of Electro-Optic sensors and camera optics for remote sensing and meteorological payloads. The technology development programmes include miniature sensors, active pixel sensors, detectors, MEMS devices, high-resolution camera optics and optical coatings.

National Remote Sensing Centre (NRSC/ISRO)

NRSC at Hyderabad is responsible for remote sensing satellite data acquisition and processing, data dissemination, aerial remote sensing and decision support for disaster management. NRSC has a data reception station at Shadnagar near Hyderabad for acquiring data from Indian remote sensing satellites as well as others.

Indian Institute of Remote Sensing (IIRS/ISRO)

IIRS at Dehradun aims at capacity building in Remote Sensing and Geo-informatics and their applications through education and training programmes at postgraduate level. The Institute hosts and provides support to the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTE-AP), affiliated to the United Nations. The training and education programmes of the Institute are designed to meet the requirements of various target/user groups.

Physical Research Laboratory (PRL)

PRL at Ahmedabad is an autonomous unit of DOS engaged in basic research in the areas of Astronomy and Astrophysics, Solar Physics, Planetary Science and Exploration, Space and Atmospheric Sciences, Geosciences and Theoretical Physics. The Laboratory has also developed capabilities for detecting exo-planets from its Mt. Abu Observatory. PRL is actively participating in ISRO's planetary exploration programme.

National Atmospheric Research Laboratory (NARL)

NARL at Gadanki near Tirupati, an autonomous society supported by DOS, is a centre for atmospheric research with the vision "Developing capability to predict the behaviour of the earth's atmosphere through observations and modeling". In realizing this vision, NARL gives equal emphasis to technology development, observations, data archival, dissemination, assimilation and modeling.

North Eastern-Space Applications Centre (NE-SAC)

NE-SAC, located at Umiam (near Shillong), Meghalaya, is a joint initiative of DOS and North Eastern Council to provide developmental support to the North Eastern region using space science and technology. The centre has the mandate to develop high technology infrastructure support to enable NE states to adopt space technology inputs for their development. At present, NE-SAC is providing developmental support by undertaking specific application projects using remote sensing, GIS, satellite communication and conducting space science research.

Semi Conductor Laboratory (SCL)

SCL at SAS Nagar (Near Chandigarh) formerly known as Semiconductor Complex Limited, is presently a Society under DOS with the main objective to undertake, aid, promote, guide and coordinate the R & D in the field of semiconductor technology and Micro-Electro-Mechanical Systems (MEMS). Steps have been initiated to upgrade the facilities to fabricate devices in 0.25 micron or better technology.

The above Centres/Institutes/Laboratories through their various research and development programmes provide exciting opportunities to attract young Indian Research Scientists and students to space science arena. With the aim to encourage quality research in areas of relevance to the Indian space programme, ISRO has evolved a plan called RESPOND through which financial support is provided to academia in India for conducting research and development activities related to Space Science, Space Technology and Space Application. RESPOND plan has been effective in establishing strong links with academic institutions and in deriving useful outputs of such R&D to support ISRO programmes. Under this plan, a Memorandum of Understanding (MoU), initiating Joint Research Programme (JRP), was signed between Chairman ISRO and Vice Chancellor, Savitribai Phule Pune University (SPPU) on 21 January 1998. As on date, 151 research projects have been initiated and 129 have been successfully completed under the ISRO-UoP Joint Research Programme. Ongoing projects (22 numbers) are progressing satisfactorily.

2. Management of Joint Research Programme

Under ISRO-UoP Joint Research Programme, emphasis has been on promoting research and applications in Space Science and Technology. A Joint Policy Committee (JPC), constituted jointly by Vice Chancellor, Savitribai Phule Pune University (SPPU) and Chairman, ISRO with appropriate representation from both ISRO and SPPU supervises the overall management of the Interaction Programme, recommends the funds requirement for the approved and the planned programmes to ISRO HQs and suggests new areas of activities as and when necessary. The Hon. Director, ISRO-UoP STC, is responsible for the administration, fund utilization and day-to-day functioning of the STC. Following were the JPC Members during the year 2014-15 with Vice Chancellor, Savitribai Phule Pune University, as ex-officio Chairman.

Joint Policy Committee (JPC)

Prof (Dr) W N Gade, Vice Chancellor, SPPU	Chairman
Dr MYS Prasad, Director, SDSC/ISRO	Member
Dr G Nagendra Rao, Director, LEOS/ISRO	Member
Dr S Aravamuthan, Dy Director, PCM, VSSC/ISRO	Member
Dr Vikram Desai, Director, DECU/ISRO	Member
Dr CBS Dutt, Group Director, ESAG, NRSC/ISRO	Member
Shri MS Anurup, Dy Director, LVPO, ISRO HQs	Member
Dr K Ganesh Raj, Dy Director, RESPOND, ISRO HQs	Member
Prof S Ananthakrishnan, Adjunct Professor & Raja Ramanna Fellow	Member
Shri P P Kale, Director, VLSI	Member
Dr V B Gaikwad, Director BCUD, SPPU	Member
Dr Dilip D Dhavale, Head, Dept of Chemistry, SPPU	Member
Dr P Pradeep Kumar, Head, Dept of Atm and Space Sciences, SPPU	Member
Prof S I Patil, Head, Dept of Physics, SPPU	Member
Dr AD Sahasrabudhe, Director, College of Engineering, Pune	Member
Smt Vidya K Gargote, Finance & Accounts Officer, SPPU	Member
Shri M C Uttam, Hon Director, ISRO-UoP STC	Member Secretary

Preliminary Evaluation Committee (PEC)

The Preliminary Evaluation Committee (PEC) is a local Committee constituted to co-ordinate and assist in implementation of Joint Research Programme in Savitribai Phule Pune University. This Committee carries out preliminary evaluation of new research proposals and interacts with the Investigators to make changes in the proposed study. The proposals recommended by the Committee are examined by the Joint Policy Committee for final approval. PEC also has the responsibility to periodically review the progress of the ongoing projects and take corrective measures. Following were the PEC Members during the year 2014-15.

Dr S Ananthakrishnan (Adjunct Professor & INSA Senior Scientist)	Chairman
Shri PP Kale, Director, VLSI	Member
Dr (Mrs) Deepti Deobagkar, Director, Dept of Bioinformatics, SPPU	Member
Dr V B Gaikwad, Director BCUD, SPPU	Member
Prof S I Patil, Head, Dept of Physics, SPPU	Member
Dr P Pradeep Kumar, Head, Dept of Atmospheric and Space Sciences	Member
Dr Dilip Dhavale, Head, Dept of Chemistry, SPPU	Member
Dr A D Shaligram, Head, Dept of Electronic Science, SPPU	Member
Dr Vishwas Kale, Head, Dept of Geography	Member
Dr S J Sangode, Head, Dept of Geology	Member
Prof Sanjeev Sonawane, Head, Dept of Education and Extension	Member
Prof S A Gangal, ISRO Chair Professor	Member
Smt Vidya k Gargote, Finance & Accounts Officer	Member
Shri M C Uttam, Hon. Director, ISRO-UoP STC	Member Secretary

3. Completed research projects

Beginning in 1998-99, a total of 151 research projects were undertaken by the various departments of the University and its affiliated colleges under ISRO-UoP Joint Research Programme and 119 of these projects were completed in the previous years ending in March 2014. During the year 2014-15 studies in respect of ten more projects, as listed below, have been completed and final technical reports received from the Investigators. Summary of findings of these projects is given in subsequent paragraphs. In order to bring the results of the study to the notice of ISRO Scientists/Engineers, brief details along with summary of findings of the completed research projects are published from time to time. Copies of full technical reports of the completed projects are also sent to concerned libraries of ISRO Centres.

1. Novel electrochemical approach to prepare CuInGaSe₂ based solar cells using non-aqueous bath (Project No.116)
2. Design and development of an odor tracking system (Project No.117)
3. Study of interferometric data and its applications for subsidence monitoring (Project No.118)
4. Biodegradation of Ammonium Perchlorate by phytoremediation approaches (Project No.123)
5. Enhancing Rural Developmental through Improved Communication Case Study Western India (Project No.124)
6. Measurement of plasma temperature and identification of species during re-entry of Space Shuttle, using plasma emission spectroscopy (Project No.125)
7. Real time human detection using covariance matrix as human descriptor (Project No.132)
8. Metallic surface Plasmon phenomenon as a biosensor for the identification of biomolecules (Project No.133)
9. Sensor-less XY planar flexural scanning mechanism for precision applications (Project No.134)
10. Digital elevation model (DEM) fusion (Project No.135)

PROJECT NO	116
TITLE	Novel electrochemical approach to prepare CuInGaSe ₂ based solar cells using non-aqueous bath
INVESTIGATORS	Dr N B Chaure, Dept of Physics, SPPU
DURATION	2 years (Started on: July 2011)
BUDGET (₹)	12,68, 000
SUMMARY FINDINGS	<p>OF Aim was to deposit CuInSe₂ (CIS) and CuInGaSe₂ (CIGS) thin films by electrodeposition technique from non-aqueous bath for solar cell applications. At the initial stage of the project, window layers such as CdS, ZnS, ZnO and Al doped ZnO were deposited using different deposition techniques and optical, structural, compositional, morphological and electrical properties were studied. Cyclic voltammetry was used to optimize the deposition parameters to get the stoichiometric and highly polycrystalline CIS and CIGS thin films. CIS and CIGS thin film electrodeposited from non-aqueous bath was found to be highly crystalline with tetragonal structure without post deposition heat treatment as compared to the films deposited from aqueous bath. We observed that the preferential orientation of CIGS thin film deposited in non-aqueous bath can be changed from reflection plane (112) to (204)/(220) by changing the deposition parameters. Systematic shift in Bragg's angle 2θ, with increasing concentration of Ga into CIGS thin films has been also observed. All CIS and CIGS layers deposited from non-aqueous bath were void free, compact, uniform, with different morphology and adhering well with the substrates. Besides the growth of highly crystalline film, large size particles are electrodeposited in non-aqueous bath which have better prospects in high efficiency solar cell development plan. Superstrate configuration, Glass/FTO/CIS/Au and Glass/FTO/CIGS/Au was prepared for solar cell development. The Glass/FTO/CIGS/Au structure measured $V_{oc} = 370$ mV, $J_{sc} = 27$ mA cm⁻², FF = 0.49 and $\eta = 4.8\%$. Experiments to electrodeposit CIS and CIGS thin films on to flexible substrates have been also carried out.</p>

PROJECT NO	117
TITLE	Design and development of an odor compass (Direction Detector)
INVESTIGATORS	Dr (Mrs) DC Gharpure/ Dr AD Shaligram, Electronic Science, SPPU
DURATION	2 years (Started on: July 2011)
BUDGET (₹)	10,60,000
SUMMARY FINDINGS	<p>OF This work aimed at detection of odor direction towards development of an odor localization system. An odor compass, to detect the direction of the odor source, using a gas sensor array has been designed. The system uses the relation between the responses of different sensors in the array to determine the direction of odor source. The work started</p>

with the development of a PIC based data acquisition and analysis system using LabVIEW V.I. The system was used for gas sensor characterization and generation of odor data base for alcohols and spices. A PIC based E-nose for identification of Spices was implemented. Further experiments were carried out to study distribution of odor in the environment. An odor camera was designed for the same. A simple PIC based odor compass was designed and tested. The next step was implementing an Atmega 32 based odor compass. The Atmega 32 based odor compass system designed, consists of four gas sensors mounted along the four directions, to sense the ethanol odor. The sensor's response is acquired and analyzed to display the direction on the Graphic LCD. As odor source is placed at different locations, sensor responses are obtained and analyzed. Sensor in front of the source gives highest response and this fact is used to detect the direction. A number of experiments were carried out to test the performance of odor compass. The performance was tested in terms of angular resolution, distance from the odor source and the concentration of Ethanol odor. The results indicate that the odor compass designed has a resolution of 450. The odor compass works to a distance of 1 meter from the source for concentration of Ethanol as low as 100 ppm. As we increase the distance, the time required by odor molecules to reach the odor compass increases due to which the response of the sensors and the response time of odor compass increases. The increase in response time can be attributed to slow diffusion of the odor and time taken by the odor molecules to reach the sensors. This indicates that as the odor diffuses, the concentration of the odor also decreases. As we increase the distance, sensors response decreases. Odor compass gives 100% accuracy and repeatability over the distance range of "5cm to 1m" with humidity of surrounding up to 85% and 0.1m/s to 0.2 m/s wind speed. But when we increase the distance above 1m it shows some ambiguity in showing proper direction.

PROJECT NO	118
TITLE	Study of interferometric data and its applications for subsidence monitoring
INVESTIGATORS	Mrs Chaitali Abhijit Lulkar/Dr Vijaya Chamundeeswari, Sinhgad College of Engineering, Pune
DURATION	2 years (Started on: July 2011)
BUDGET (₹)	6,56,000
SUMMARY OF FINDINGS	Digital Elevation Model is an important tool for analyzing the surface of Earth. Generating the digital elevation model and calculating the height difference in the area under consideration by processing data serially is inefficient and time consuming. To overcome this issue, we proposed DEM generation on Hadoop Distributed File System which processes

data parallelly by dividing it into the chunks of same size. Starting with importing data module, we calculated baseline which gives orbital distance between two satellites. Coarse registration and fine registration of the images crops the images in several windows and registers them with respect to each other at the pixel level and tries to find correlation between them. If correlated, interferogram is generated and unwrapped phase is recovered using minimum cost flow algorithm. Height of the area is calculated from the unwrapped phase. Master node in the cluster regulates the big data processing by dividing chunks to the slaves and again sorting them. It is proved that this optimization of the algorithm improves time efficiency by 37%. Hadoop is an open source framework for large-scale data processing. The top-level Hadoop project has two main components Hadoop Distributed File System (HDFS) and MapReduce. HDFS is a filesystem that can store very large data sets by scaling out across a cluster of hosts. It has specific design and performance characteristics; in particular, it is optimized for throughput instead of latency, and it achieves high availability through replication instead of redundancy. MapReduce is a data processing paradigm that takes a specification of how the data will be input and output from its two stages (called map and reduce) and then applies this across arbitrarily large data sets. MapReduce integrates tightly with HDFS, ensuring that wherever possible, MapReduce tasks run directly on the HDFS nodes that hold the required data.

PROJECT NO	123
TITLE	Biogradation of Ammonium Perchlorate by phytoremediation approaches
INVESTIGATORS	Dr Rekha Gupta/Dr Vinay Kumar, Modern College of Arts, Science and Commerce, Pune
DURATION	3 years (Started on: July 2011)
BUDGET (₹)	10,52,000
SUMMARY FINDINGS	OF Present investigation focused on the influence of perchlorate on physiological and biochemical parameters of plants and also its accumulation in plant tissue and depletion from soil/water. Plants and soil also screened for the presence of perchlorate under natural conditions. Perchlorate found to be present in soil collected randomly from various sites. Terrestrial as well as aquatic plants show presence of perchlorate under natural conditions. In the present study, plants were treated with varying concentration of ammonium perchlorate from 1000 to 10000 ppm. Perchlorate inside the plant tissue and in soil was quantified at regular intervals. It is found that the plants are able to absorb and accumulate perchlorate ions inside their tissues under experimental conditions after ammonium perchlorate treatment. Amount of perchlorate inside plant tissue is found to increase with number of days after treatment and is proportional to concentration of perchlorate in soil. Detrimental effects of perchlorate stress are observed on germination and vegetative growth of the plants. Plants are able to tolerate the perchlorate

stress, though their growth is affected under stress. Physiological and metabolic activities of the plants are also affected under perchlorate stress conditions as compared with control. Morphological characters like shoot length, root length, number of leaf were observed to decrease with increasing concentration of perchlorate. The present study revealed decrease in chlorophyll and reducing sugar content in leaf tissue under varying concentration of perchlorate. Total protein, proline, and phenol content showed a gradual increase with increase in concentration of perchlorate suggesting increase in non-enzymatic stress parameters with increased level of toxicity. It can be concluded that perchlorate related influence on plants are both qualitative and quantitative and depends upon its concentration and duration of exposure. Uptake of perchlorate from water and soil by plants has led to depletion of perchlorate from soil and water where plants are growing and ultimately helping in removing it from the environment. Present studies also revealed biodegradation of perchlorate in the plant tissue (converting it into chlorate – chloride). Studies on Rhizodegradation of perchlorate ions in roots of different plant species are found to be promising. Perchlorate uptake was increased with the increase in mycorrhizal colonization in plants under treatment.

PROJECT NO	124
TITLE	Enhancing Rural Developmental through Improved Communication Case Study Western India
INVESTIGATORS	Prof Sanjeev Sonawane / Smt Geeta Kamble, Dept of Education & Extension, SPPU
DURATION	2 years (Started on: July 2011)
BUDGET (₹)	10,12,000
SUMMARY FINDINGS	OF Focus of the present study was to find out the field based suggestions by villagers and investigators to improve and modify the existing rural communication policy, programme and training for effective rural development communication. In the first phase of the study objectives related to the policies of rural development communication were analyzed by documentary analysis method and various elements were identified that would contribute to rural development communication. The elements like newspapers, radio, television, mobile phone and the skills related to usage of mobile phone, schemes and government support and computer/laptop were identified. A semi structured interview schedule cum questionnaire was developed based on the elements and survey was conducted. All the rural population of Western India having Gram Panchayat had been selected as informants. This survey was conducted in three states Maharashtra, Gujarat and Goa and one union territory Div-Daman. Based on the findings of the survey, a Mobile Training Program was developed to enhance the skills of rural population. By adopting purposive sampling method, a village of Maharashtra-Sanaswadi was selected for the experiment, inclusion of new

advanced media. The information related to advanced communication media used by villagers for the purpose of rural development was elicited with help of responses given by the villagers. It was seen that rural population awareness level of communication media was low for traditional media of communication. Nearly half of the rural population is aware on current news. FM Radio is not preferred choice as a media of communication. Large number of rural population prefers television as a media of communication; however most of the TV watching is for entertainment purpose. Majority of rural population discussed family related issues on mobile phone followed by agriculture and business. The usage of Computer and Laptop by rural population as a media for communication is very low. The present study identified various ICT media skills for its effective use for rural development which are Television, Mobile phones, Computers. It was found that more than half of rural population reads newspaper themselves, since the education level of rural population is highest at primary level.

PROJECT NO	125
TITLE	Measurement of plasma temperature and identification of species during re-entry of Space Shuttle, using plasma emission spectroscopy
INVESTIGATORS	Dr V L Mathe / Prof Mrs S V Bhoraskar, Dept of Physics, SPPU/ Dr Indrani Banarjee, BITS MESRA
DURATION	2 years (Started on: July 2011)
BUDGET (₹)	12,16,400
SUMMARY FINDINGS	<p>OF Electron cyclotron resonance (ECR) plasma has been successfully generated to produce various plasma species viz. atomic oxygen, atomic nitrogen, oxygen molecule, argon hydrogen, nitrogen molecules, ionized molecules of oxygen and nitrogen oxide. Plasma density was found two of the order of 10^{10} to 10^{12} cm^{-3} and the electron temperature was about 5-8 eV. Ocean optics emission spectrometer (model 4000) was used to detect various species generated inside the plasma reactor. In order to study plasma-material interaction different plasma species were made to interact with different thermal protecting materials such as Dow corning Z6018 silicon intermediate, silica aerogel, silica fibers etc. The investigation indicates that the nitrogen and oxygen plasma are significantly interactive well above room temperature whereas argon plasma was found to be non interactive even at high temperature. The interaction of various plasma species with silica aerogel is found to be insignificant in the measured temperature. An indirect spectroscopic measurement of density of reactive species was used to determine recombination coefficient of reactive oxygen on to the transition element doped silica surface at room temperature. The recombination coefficient was found to be 0.003 at room temperature. Emission spectroscopic investigation of Ar plasma interaction generated inside thermal plasma reactor with DC-Z-6018 has been carried out. Even though in thermal plasmas electron temperatures are not as high as in ECR plasma, overall plasma temperature is of the order of 1-2 eV. Such high temperatures cause dissociation of epoxy into hydrocarbon species.</p>

PROJECT NO	132
TITLE	Real time human detection using covariance matrix as human descriptor
INVESTIGATORS	Prof S A K akade, IT Dept, P DEA's College of Engineering, Manjari (BK), Pune - 412307
DURATION	2 years (Started on: Jan 2013)
BUDGET (₹)	4,00,000
SUMMARY FINDINGS	OF The aim of the project is to develop and implement a robust method to detect human under dynamic environment, if present in video. We achieved a human detection system based on cascade of SVM and Adaboost classifiers using Histogram of Oriented Gradients (HOG) features. Shift based tracker used to track detected human to get their position in next frame. To train a human detector, large amount of training samples is needed to cope with the variability in the persons' appearance and all possible backgrounds. We used thousands of positive and negative images to train SVM and Adaboost classifier. Adaboost classifier is implemented with number of stages equals to 20, depth of decision tree equals to 3. Adaboost classifier is trained for different number of stages and depth of decision tree and checked for performance. To improve performance of system we obtained cascade of SVM and Adaboost classifier. In that we tried all possible combination to apply classifier to sub windows having motion pixels. Hybrid tracker based shift feature implemented to improve performance of system, it tracks detected objects from previous frame to current frame.

PROJECT NO	133
TITLE	Metallic surface Plasmon phenomenon as a biosensor for the identification of biomolecules
INVESTIGATORS	Dr V M Harpale, Dept of Physics, BPHE Society's Ahmednagar College, Ahmednagar - 414001
DURATION	2 years (Started on: Jan 2013)
BUDGET (₹)	18,50,000
SUMMARY FINDINGS	OF The study shows that Raman spectra of aqueous suspension of various types of biomaterials like bacteria, virus and Fungi can be obtained by mixing them with a nano colloidal suspension of silver or gold. Adsorption of the microorganisms on the silver quenches fluorescence and yields greatly enhanced spectra. In this research project we report on approach to biomolecule detection and characterization that combine aerosol technology, nanotechnology and inelastic scattering (Raman Spectroscopy) that may permit real time identification of biomolecules at relatively low cost and with compact instrumentation. Raman spectroscopy has been used extensively to study a wide range of viruses, bacteria and all types of biomolecules. It appears that SERS has a number of advantages over the methods of biomolecule detection because it can

be incorporated into a real time and potentially portable detection system. SERS occurs when the biomolecules are brought to the surface of metal particles called as metal colloidal. The particle size of these metal nano particles for the enhancement of the signal is within the range of 20nm-300nm. The preparation of silver (Ag) colloidal involves a reduction reaction of AgNO_3 with NaBH_4 . The bioanalyte is mixed with the colloidal solution and Raman spectra is obtained. All the scattering experiments are performed at laser wavelength 785 nm, because use of near infrared wavelength reduces the fluorescence background of SERS spectra. We have reported the SERS spectra of Botrytina Cineria gray mold fungi, Candida Albicans, Aspergillus Niger spores, Cocci bacteria and Bioaerosols. Chemical characterization of these biomaterials has also been done in support of the applications of SERS technique.

PROJECT NO	134
TITLE	Sensor-less XY planar flexural scanning mechanism for precision applications
INVESTIGATORS	Dr Suhas Deshmukh, Mechanical Engineering Dept, Sinhgad Academy of Engineering, Kondhwa (BK), Pune – 411048
DURATION	2 years (Started on: Jan 2011)
BUDGET (₹)	14,32,000
SUMMARY OF FINDINGS	<p>Current needs of precision scanning application are to carry out a research to design and develop a low cost flexural mechanism with high precision positioning accuracy. Research work was coined to achieve a specific objective of demonstration of dual use of voice coil motor (i.e as actuator as well as sensor) which eliminates need of sensor in precision scanning applications such as laser scanners, scanning optical microscopes, micro manufacturing etc. It was planned to design frictionless, backlash free 1-DOF flexural mechanism and experimentally demonstrate the dual use of voice coil motor. Based on this objective 1-DOF flexural mechanism is designed and developed an experimental setup. 1-DOF flexural mechanism consists of voice coil motor as actuator and LVDT as sensor for experimental validation. Developed mechanism is further integrated with PC via dSPACE DS1104 microcontroller and experimental identification is carried out to estimate system properties such as stiffness, damping and its damped natural frequency. These parameters are further used for development of transfer function of the system which is experimentally validated with due experiments. Position estimator algorithm is designed and developed. This position estimator estimates position of coil of voice coil motor by knowing voltage and current drawn by voice coil motor. Electronic circuitry is developed and due experiments are conducted to validate the position estimator algorithm and accuracy of less than microns is achieved in position estimation. PID Control system is designed (which uses LVDT as feedback element) and real-time implemented on 1-DOF flexural mechanism and its precision scanning experiments are conducted at</p>

different scanning speeds. Position accuracy of less than 1 micron is achieved successfully and at high speed of scanning positioning accuracy was 25 microns. Further, LVDT was removed from feedback loop and position estimator algorithm and its electronic circuitry was used in feedback loop for scanning purpose. With due experimentations position accuracy of less than 5 microns is easily achieved and sensor-less operation of scanning mechanism is successfully demonstrated.

PROJECT NO	135
TITLE	Digital elevation model (DEM) fusion
INVESTIGATORS	Dr P ratibha S hingare, Dept P IET's College of Engineering, Shivajinagar, Pune - 411005
DURATION	2 years (Started on: Jan 2013)
BUDGET (₹)	11,54,000
SUMMARY OF FINDINGS	The objective of the project DEM (Digital Elevation Model) FUSION is to automatically generate geometrically accurate new DEM surface by depicting the correct height information of the area, clean by eliminating blunders (spikes, holes etc.) and errors present in the initial data and complete by modeling all the area in the highest possible resolution. The fusion is carried out for any two DEMs which can be first registered to common reference system (UTM/WGS 84 etc.). After co-registration fusion of two DEMs in any software platform (Matlab) was developed. Further to improve accuracy several methods like Bundle block adjustments, Interpolation techniques used & final Result attempted to find with Horizontal accuracy to be approximately 4 meters while Vertical accuracy 5-6 meters. Hence final fused DEM data became more refined & all terrain can be clearly visualized.

4. Ongoing research projects

Presently there are 22 ongoing projects including eight projects sanctioned in August 2014. Progress of these projects is monitored through periodical progress reports and reviews by Preliminary Evaluation Committee (PEC) and Joint Policy Committee (JPC). Investigators are invited to make detailed presentation highlighting the technical milestones in their studies. Midcourse correction is suggested by PEC wherever necessary. Two PEC meetings chaired by Prof S Ananthakrishnan, were held to assess the progress of the ongoing projects and to make midcourse correction. JPC in its meeting held on 16 July 2013, reviewed the progress of the ten projects and suggested Investigators to have active interaction with ISRO scientists. Current status in respect of ongoing projects is given below. Progress review of the newly sanctioned Projects (No.144 to No.151) is planned after completion of six months period.

Sr No.	Project title, Name of Investigator, Project cost & Duration	Current status of the study
1	Hazardous nitrous oxide gas leakage detection and monitoring system using wireless sensor network (Project No.126) Dr Arunkumar K Walunj Budget: ₹ 8.06 lakhs Duration:2 years (Started on: February 2013)	Request for extension of project duration by six months, has been agreed to. PI reported establishing the Star Wireless Sensor Network, testing of Reliability and monitoring the performance characteristics such as range, repeatability and signal fading effects on network. Localization of CO ₂ gas leakage source using WSN along with the communication link being studied.
2	Development of conducting Polyaniline-ZnO nano particle composite paint coating for corrosion protection (Project No.127) Dr Praveen P Deshpande Budget: ₹ 9.50 lakhs Duration:2 years (Started on: January 2013)	Request for extension of project duration by six months, has been agreed to. More experiments are required to demonstrate data reproducibility. PI was advised to discuss with ISRO Scientist identified as isro-expert for technical guidance.
3	Impact of flood hazards on human settlement in Pune region (Project No.128) Dr Vijaya Khairkar Budget: ₹ 6.44 lakhs Duration:2 years (Started on: January 2013)	Request for extension of project duration by six months, has been agreed to. During progress review, it was suggested to add high resolution data to show human aspects and dam location using topo sheets related to the dam area.
4	Splitting of carbon dioxide into oxygen and carbon moiety using biomimetics of biological catalysts involved in photosynthesis (Project No.129) Dr (Mrs) Waghmode Shobha Budget: ₹ 9.13 lakhs Duration:2 years (Started on: January 2013)	Request for extension of project duration by 2 months has been agreed to. Ligand synthesis is completed. Synthesis of metal complexes is over. Reaction of H ₂ and CO ₂ and metal complex developed as catalyst has been studied. It gives good yield. Reaction of dry ice and metal complex as catalyst has been studied. It also gives good yield.

5	Development of transition metal oxide nanoparticle films for solar radiation protection and solar cells (Project No.130) Dr Jayashree Pant Budget: ₹ 10.00 lakhs Duration:2 years (Started on: January 2013)	Request for extension of project duration by 3 months has been agreed to. PI has completed the experimental studies. Final report is under preparation.
6	Preparation of Co_3O_4 films by using electrochemical and spray pyrolysis deposition methods for gas sensing applications (Project No.131) Dr Shelke Pandit Nivrattirao Budget: ₹ 14.25 lakhs Duration:2 years (Started on: January 2013)	Static gas sensing system is designed and built. Gas sensing characteristics with LPG and Ammonia gas have been studied. Work on gas sensing characteristics of Co_3O_4 films deposited by electrochemical and spray pyrolysis deposition methods is in progress.
7	Naphthoquinone containing metal polypyridyl complexes for solar cells: computational and experimental study (Project No.136) Dr Sunita Salunke and Dr Subhash Pingale Budget: ₹ 16.26 lakhs Duration:2 years (Started on: November 2013)	Theoretical study of Lawsone dye completed. Synthesis and experimental characterization of Lawsone dye completed. DSSC construction and analysis of properties in progress. Publishing a research paper in RSC Advances (2015).
8	Feasibility study on indigenous development of electrochemical based gas sensors and transmitters (Project No.137) Prof A D Shaligram and Shri M B N Murthy Budget: ₹ 29.60 lakhs Duration:2 years (Started on: November 2013)	Request for extension of project duration till September 2015 has been agreed to. Modeling and simulation of prototype cell and 3D printing in progress. Experiments regarding recovery of sensors in progress.
9	Development of microwave excess noise generator heads using gas discharge of reactive and non reactive gases (Project No.138) Dr (Ms) S A Gangal Budget: ₹ 13.50 lakhs Duration:2 years (Started on: November 2013)	Noise source testing completed. Solid state was tested using Spectrum Analyser. Party identified to make gas discharge tubes.
10	Development of graphite fiber reinforced Aluminium (7075) in the rolled sheet form (Project No.139) Prof Madhuri Deshpande Budget: ₹ 20.05 lakhs Duration:2 years (Started on: December 2013)	In Nickel coating of pitch carbon fibers, achieved uniform coating with more than 75% nickel deposition. Production of composite by powder metallurgy route at BARC with different volume percentages in progress.
11	Halophilic bacterial diversity of marine ecosystems from West Coast of India (Project No.140) Prof Rebecca S Thombre Budget: ₹ 16.04 lakhs Duration:2 years (Started on: January 2014)	23 Pigmented Halophilic Archaea and 87 bacteria were isolated and characterized. Three were sequenced and were found to be Haloarcula morismortui, Haloferax alexandrinus and Haloarcula volcanii. These three isolates will be used for further experiments.

12	<p>Studies on nano-porous metal oxides via anodization and their applications in super capacitors (Project No.141)</p> <p>Dr Arif V Shaikh</p> <p>Budget: ₹ 11.76 lakhs</p> <p>Duration:2 years (Started on: January 2014)</p>	<p>Morphological study completed. SEM images show RuO₂ granular particles having porous type structure. Optical spectrum indicates the composite of RuO₂/CNT more conductive than its parent form. XRD analysis confirms the presence of CNT even after annealing effect.</p>
13	<p>The development of the F.C. Observatory - an autonomous robotic telescope (Project No.142)</p> <p>Dr Ms Raka V Dabhade</p> <p>Budget: ₹ 11.00 lakhs</p> <p>Duration:2 years (Started on: January 2014)</p>	<p>The project aims at developing a 9.25” class remote telescope facility and to fabricate a Solar telescope and amateur photometer. No significant progress made. PI has been advised suitably.</p>
14	<p>Multifunctional conducting polymer transition metal composite nano structure based sensor device for detection of NO₂, H₂S and NH₃ (Project No.143)</p> <p>Dr Vasant Vidyadhar Chabukswar</p> <p>Budget: ₹ 15.82 lakhs</p> <p>Duration:2 years (Started on: January 2014)</p>	<p>Aim is to utilize the potentials offered by nanotechnology for synthesis of conducting polymer metal nanocomposites for gas sensing applications. No significant progress made. PI has been advised suitably.</p>
15	<p>Development of Flexible and High Temperature Aerogels (Project No. 144)</p> <p>Dr N B Chaure</p> <p>Budget: ₹ 15.99 lakhs</p> <p>Duration:2 years (Started on: August 2014)</p>	<p>Literature Survey partially has been completed. The development of silica and carbon aerogels is in progress.</p>
16	<p>Occurrence and distribution of fluoride in groundwater of Terekhol river basin, Sindhurg district, Maharashtra: A remote sensing and GIS based study (Project No. 145)</p> <p>Dr S K Gaikwad</p> <p>Budget: ₹ 16.00 lakhs</p> <p>Duration:2 years (Started on: August 2014)</p>	<p>Literature Survey is completed. Morphometric analysis of the Terekhol river basin is completed. Members suggested focus on fluoride source.</p>
17	<p>Remote sensing application in Coastal geomorphology, changes in morphology in parts of West coast of Maharashtra, India (Project No. 146)</p> <p>Dr Milind Herlekar</p> <p>Budget: ₹ 11.05 lakhs</p> <p>Duration:2 years (Started on: August 2014)</p>	<p>Literature survey has been carried out. Details of equipment for purchase have been worked out. Identified historical shoreline of northern part of study area.</p>
18	<p>Study of precipitation characteristics using disdrometer and satellite datasets over Pune (Project No. 147)</p> <p>Dr Rohini Bhawar</p> <p>Budget: ₹ 8.41 lakhs</p> <p>Duration:2 years (Started on: August 2014)</p>	<p>Quality control of the disdrometer data for year 2012 and 2013 completed. Daily variability in Rain rate, reflectivity and number of particles obtained from disdrometer data completed. Reflectivity and rain rate plots to understand the monthly variation is completed.</p>

19	Optimization of low voltage DC micro-grid with intelligent Solar PV Utilization for a Computer laboratory (Project No. 148) Dr Vivek Aranake Budget: ₹ 21.39 lakhs Duration:2 years (Started on: August 2014)	Details of equipment for purchase have been worked out. Literature survey is completed. Measurement and study of load on dc buses in a computer carried out with Digital power scope and high frequency current probe. LED tube light working on 48 volts DC developed in house and is under field tests.
20	Processing of natural biopolymers – wild and domestic silk varieties of Northern Western Ghats: Fabrication of biopolymer film based technological substrate for advanced optical structures (Project No. 149) Dr R D Chaudhari Budget: ₹ 23.66 lakhs Duration:2 years (Started on: August 2014)	Literature survey is completed. Processing of silk cocoons to obtain silk fibres and study of their physic-chemical and mechanical properties has been initiated. Study of interaction of the fibroin protein solutions with other biomaterials such as DNA RBCs etc and nanomaterials such as gold and silver is in progress.
21	Stabilization of zirconia in tetragonal and cubic structure using various dopants for electronic application (Project No. 150) Dr M Y Khaladkar Budget: ₹ 15.02 lakhs Duration:2 years (Started on: August 2014)	Literature survey – in progress. Synthesis of YSZ in different mol % (5, 8, 15 mol %) using various precursors – Done.
22	Interaction of plasma with Thermal Protecting System (TPS) material during Re-entry of Space vehicle (Project No. 151) Dr V L Mathe Budget: ₹ 12.56 lakhs Duration:2 years (Started on: August 2014)	Literature survey has been carried out. Design and development of radiative heater is in progress. Interaction with VSSC Scientists is taking place.

5. New research projects

In response to ISRO-UoP ST C's call for new projects, 56 study proposals were received from various Departments and affiliated colleges of the University. These proposals were in different fields as given below:

Field	Number
❖ Atmospheric Sciences	1
❖ Biodiversity	5
❖ Image Processing	8
❖ Instrumentation	16
❖ Material Sciences	3
❖ Miscellaneous	8
❖ Optical Coatings & Sensors	6
❖ Remote sensing applications	5
❖ Rural development and Development communication	4
Total	56

PEC scrutinized these proposals and short listed 21 for technical presentation and interaction with the investigators. Investigators of these proposals were invited to make a presentation to PEC on 16th January 2015. At the end of the presentation, Committee made an assessment and recommended 13 proposals for the consideration of JPC. Investigators of these 13 proposals made a power point presentation to JPC on 4th February 2015 for further assessment based on the criteria that these studies must have end results such as application in ISRO's space programme, utility for the benefit of the nation, novelty of the study and publication of the findings in reputed journals etc. After completion of the presentation and interaction with the prospective investigators, JPC approved 8 study proposals, as listed below, for funding under ISRO-UoP Joint Research Programme.

List of the approved proposals:

Sr. No	Project Title/PI	Funds requirement (₹ in Lakhs)			
		Project Duration	Total requirement	Requirement in 2015-16	Requirement in 2016-17
1	Studies on biodiversity of poly-extremophilic bacteria for their probable use as test organisms in space research <i>Dr Neelima Deshpande, Abasaheb Garware College, Pune</i>	2 yrs	9.00	5.75	3.25

2	Fabrication of magnetoelectric energy harvesters by utilizing piezoelectric-macro fiber composite (MFC) and magnetostrictive Nickel/Metglas/Magnetic oxide materials <i>Dr R C Kambale, Dept of Physics, UoP</i>	2 yrs	10.00	7.30	2.70
3	Design, fabrication and testing of a compact and robust Monochromator <i>Mr Chandrashekhar S Garde, Vishwakarma Institute of Information Technology, Pune</i>	2 yrs	23.24	16.02	7.22
4	Space Radiation from the Optically Transparent Planar Microstrip Antenna Integrated with the Solar Panels of Small Satellites <i>Dr Jayashree Shinde, Sinhgad Academy of Engineering, Pune</i>	2 yrs	43.55	22.99	20.56
5	Design feasibility of PLL frequency synthesizer for Ku band <i>Mrs Shobha Nikam, Institute of Information Technology, Pune</i>	2 yrs	8.12	4.06	4.06
6	Development of coating/manufacturing technology for friction stir coating/welding tool for welding of 3 mm thick stainless steel <i>Prof Rajesh Chaudhari, Vishwakarma Institute of Technology, Pune</i>	2 yrs	23.02	14.76	8.26
7	Development of Nuclear Batteries using Radioactive Sources <i>Prof Sanjay Dhole, Dept. of Physics, UoP</i>	2 yrs	19.98	10.74	9.24
8	Access, Exposure and Impact of EDUSAT program: An Intervention Study of Stakeholders and Beneficiary <i>Dr Vaibhav Jadhav, Dept. of Education & Extension, UoP</i>	2 yrs	11.88	4.22	7.66
Total			148.79	85.84	62.95

6. Major events in the STC calendar

PEC meetings

The Preliminary Evaluation Committee (PEC) carries out preliminary evaluation of new research proposals and interacts with the Investigators to modify the proposals wherever needed. The proposals recommended by the Committee are examined by the Joint Policy Committee for final approval. PEC also has the responsibility to periodically review the progress of the ongoing projects and take corrective measures. First review meeting of the year took place on 18 & 19th June 2014. Investigators were invited to make technical presentation on the progress of their projects, highlighting the achievements and the difficulties, if any. While reviewing the progress of the projects, Committee stressed on the following points:

- i. Progress of the study with respect to overall goals as spelled out in the research proposal
- ii. Relevance of study with respect to developing new science/technology
- iii. Deliverable products as a result of the study
- iv. Publications of research findings in refereed journals
- v. Timely completion of the projects and submission of final technical reports

PEC held its next four meetings on 5th September 2014, 5th December 2014, 16th January 2015 and 19th January 2015 to review the progress of ongoing projects and also to carry out preliminary evaluation of new research proposals. The development of indigenous gas sensors and transmitters is an urgent requirement of ISRO enters and the ongoing project titled **Feasibility study on development of electrochemical based gas sensors and transmitters** (Project No.137) by Prof A D Shaligram, is meant to meet this requirement. In view of this commitment, Committee conducted two special review meetings to monitor the progress of this particular project.

JPC meetings

Joint Policy Committee (JPC) supervises the overall management of the ISRO-UoP Interaction Programme, recommends the funds requirement to ISRO HQs and suggests new areas of activities as and when necessary. JPC meeting was held on 4 & 5th February 2015 to take a stock of the ongoing projects and consider new research proposals for the year 2014-15. JPC approved 8 new research proposals and recommended a total budget of ₹196.82 lakhs for the year 2015-16.

A research proposal on SEAPS titled **Development of Prequal engineering model of “SEAPS” (300 KHz to 30 MHz) RF front end electronics and data acquisition system for low frequency space science studies** by Dr D C G harpure, Dept of Electronic Sciences, SPPU was earlier considered by PEC in its meeting held on 24 and 25th February 2014 and PEC had agreed to include this proposal on the basis of MOU proposed to be signed between SAC/ISRO and SPPU. Giving the background of the proposal, Prof S Ananthkrishnan explained the importance of the study to JPC Members and highlighted the role of Pune University in the joint venture with SAC/ISRO. The duration of the study period is 3 years and the projected cost ₹29.5 lakhs. JPC considered the recommendation and agreed to provide ₹10 lakhs as seed money which can be released only after signing of the proposed MoU between SPPU and SAC/ISRO.

Commencement of new projects

After the receipt of Grants-in-aid from DOS, for the year 2014-15, eight research projects, which were approved in the JPC meeting held on 11 & 12th March 2014, made a beginning in the month of August 2014 with the release of first installment of funds.

7. ISRO Proposal Format

Faculty Members of University of Pune and its affiliated colleges are required to follow the ISRO format as given in <http://www.isro.gov.in/scripts/srrespond.aspx> and reproduced below for making research proposals and seeking financial grant from ISRO. Requirement is that Principal Investigator(s) should be full-time employee(s) of the concerned institution and proposal is to be forwarded through Head of the academic institution. Research proposals from individuals not affiliated to any recognized institution of the University are not considered. Institutions proposing a project for support are expected to commit the use of the existing infrastructure available with them. ISRO provides financial grants to support fellowship, materials, consumables, internal travel, testing charges, data etc. Funds for purchase of essential minor equipments which are not available in the institution and would be useful for future projects are also provided. There is no provision for any kind of payment to the Principal Investigator (or other staff) belonging to the Institution. The allocated funds cannot be used for travel abroad for any reasons.

Generally invitation for making research proposals is sent in the month of September-October and processing of the proposals is completed in 4-5 months time. For any information/clarification, Faculty Members may contact the ISRO-UoP Space Technology Cell or visit our website www.unipune.ac.in/isro to get the required information.

Application for grant of funds

1. Application Institution
2. Title of the Research Proposal
3. Name of the Principal Investigator
4. Name(s) of other investigator(s) with the name(s) of their Institution
5. Proposed duration of Research Project
6. Amount of grant requested (in ₹)

	1st Year	2nd Year	Total
Staff			
Equipment and Supplies			
Others			
Total			

7. a) Bio-data of all the Investigators (Format-A).
 b) Brief description of the Research Proposal with details of budget (Format-B).
 c) Declaration (Format-C).
8. I/We have carefully read the terms and conditions for ISRO Research Grants and agree to abide by them. It is certified that if the research proposal is approved for financial support by ISRO, all basic facilities including administrative support available at our Institution and needed to execute the project will be extended to the Principal Investigator and other Investigators.

	Name	Institution	Designation
Principal Investigator			
Co-Investigator(s)			
Head of the Department/Area			
Head of the Institution			

Format A**Bio-data of the Investigator(s)***

1. Name			
2. Date of Birth (dd/mm/yyyy)			
3. Designation			
4. Degrees conferred (begin with Bachelor's degree)			
Degree	Institution conferring the degree	Field(s)	Year
5. Research/training experience (in chronological order)			
Duration	Institution	Name of work done	
6. Major scientific fields of Interest:			
7. List of publications:			
8. Email id and Telephone number of PI :			
9.	Email id of the Head of the academic institution:		

* Bio-data for all the investigators should be given, each on a separate sheet.

Format B**Proposal Preparation Format**

1. *Title of the research proposal*

2. Summary of the proposed research

A simple concise statement about investigation, its conduct and anticipated results in no more than 200 words

3. Objectives

A brief definition of the objectives and their scientific, technical and techno- economic importance

4. Major scientific fields of interest

A brief history and basis for the proposal and a demonstration of the need for such an investigation preferably with reference to the possible application of the results to ISRO's activities. A reference should also be made to the latest work being carried out in the field and the present state-of-art of the subject.

5. Approach

A clear description of the concepts to be used in the investigation should be given. Details of the method and procedures for carrying out the investigation with necessary instrumentation and expected time schedules should be included. All supporting studies necessary for the investigation should be identified. Necessary information of any collaborative arrangement, if existing with other investigators for such studies, should be furnished. The Principal Investigator is expected to have worked out his collaborative arrangement himself. For the development of balloon, rocket and satellite-borne payloads it will be necessary to provide relevant details of their design. ISRO should also be informed whether the Institution has adequate facilities for such payload development or will be dependent on ISRO or some other Institution for this purpose.

6. Data reduction and analysis

A brief description of the data reduction and analysis plan should be included. If any assistance is required from ISRO for data reduction purposes, it should be indicated clearly.

7. Available Institutional facilities

Facilities such as equipments, test instruments etc available at the parent Institution for the proposed investigation should be listed.

8. Fund Requirement

Detailed year wise break-up for the Project budget should be given as follows

	1 st Year	2 nd Year	Total
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8.1 Salaries:

8.1.1 Research Fellows/

Project Assistant

8.1.2 Supporting Technical Staff

8.1.3 Other staff, if any

Total:

(Note: please specify designation and rate of salary per month for each category)

8.2 Equipment

	1st Year	2nd Year	Total
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Total:

(Note: Please specify various individual items of equipment and indicate foreign exchange requirement, if any)

8.3 Consumables and Supplies

	1st Year	2nd Year	Total
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Total:

(Note: Please specify the items and indicate foreign exchange requirement, if any.)

8.4 Travel

	1st Year	2nd Year	Total
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Total:**8.5 Other project costs, if any (give details)**

	1st Year	2nd Year	Total
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a. Grand Total

9. Whether the same or similar proposal has been submitted to other funding agencies of Government of India. If yes, please provide details of the Institution & status of the proposal.

Format C**Declaration**

I/We hereby agree to abide by the rules and regulations of ISRO research grants and accept to be governed by all the terms and conditions laid down for this purpose.

I/We certify that I/We have not received any grant-in-aid for the same purpose from any other department of the central government/state government/public sector enterprise during the period to which the grant relates.

	Name	Designation	Signature
Principal Investigator			
Head of the Department/Area			
Head of the Institution			

Seal of the Head of the Institution

8. Supported areas of research

Keeping ISRO's space programme in mind, following thrust areas for research topics for the guidance of the prospective Investigators is given below.

Aerospace Engineering

Flight dynamics, orbital mechanics Wind tunnel studies, CFD, Flow field analysis, Aero thermal engineering

Launch Vehicle structures

Structural Analysis modeling and simulation stability analysis, structural dynamics & testing, honey comb structures, experimental mechanics etc.

Space Materials & Processing

Light Alloys, Super alloys, precision fabrication techniques, Heat treatment, surface treatment, welding technology, powder metallurgy, foundry technology, ceramics, materials characterization

Composite Materials

Composite Materials processing and control, characterization & testing, NDT, development of composite structure for launch vehicles and spacecraft carbon-carbon composites

Propellants, Polymers, Chemicals & Space Ordnance

Propellant processing, characterization, testing, thermal protection materials, adhesive ceramics/matrix products, thermal paints, polyimides, avionics batteries, fuel cell, space ordnance materials, characterization, nozzle design, advanced propulsion technology, CFD, Heat transfer, performance simulation

Avionics, Guidance & Control

Sensors & instrumentation, power electronics Data acquisition, signal processing, technology ASIC/FPGA, onboard inertial systems, servo mechanisms, guidance and control, trajectory simulation and analysis etc

Atmospheric Aerosols Clouds Chemistry and Radiation

Physical Characterisation of Aerosols, Chemical Characterisation of Aerosols, Studies on Trace gases using insitu and satellite based observation, Studies on Satellite Microwave Remote Sensing for land emissivity and surface characterization, Studies on Mesoscale Convective Systems, Microwave Radiometric observations, Microwave Propagation studies for GPS navigation and Communication applications, Studies on Soil moisture and temperature

Atmosphere Dynamics Branch

Atmospheric Waves and Oscillations, Lower-middle-upper atmosphere coupling processes, Low and High latitude coupling processes, Stratosphere-troposphere exchange processes, Tropical Tropopause Dynamics, Cloud Dynamics, Middle atmospheric modelling

Boundary Layer Physics and Atmospheric Modelling

Characterization of Coastal ABL Processes over Thumba, Numerical Weather Prediction through Atmospheric Models, Regional Climate Modelling, Improvements in Parametrization Schemes in Atmospheric Models, Ship-borne Field Experiments for studying Marine ABL Characteristics, Precipitation Studies (Disdrometer & Micro-Rain Radar)

Ionosphere-Thermosphere-Magnetosphere Physics

Equatorial Electrojet Studies, Spread-F, Total Electron content, Atmosphere-Ionosphere Coupling, Blanketing Es, E- region irregularities, Geo-magnetic storms, Space weather

Planetary Science Branch

Research on the Solar System objects (Planets, satellites, Comets), and their interaction with solar wind and solar radiation

Remote sensing and GIS

Multi-spectral data compression

Spatial database management and data mining

Design and development of Calibration site (optical / microwave)

Automated Data Quality Assessment techniques

Information fusion methods for multi-sensor data

Automated cloud detection algorithms

Calibration of aerial/HR /Lidar / GPS sensors

Automation in Aerial/HR data processing and DEM/Feature extraction

Data Compression and Archival

Spatial modelling for Peri Urban Areas

Surface and sub-surface data integration technologies for Archeology

Uncertainty in GIS database creation

Cognitive techniques in remote sensing data analysis

Development of automatic feature extraction algorithms (water spread, snow cover, crop and vegetation etc

Hyperspectral remote sensing for water quality

Ground water withdrawals using space data.

Hydrologic parameterization and modeling using space inputs

Altimeter data processing for estimation of water levels in lakes and rivers

Estimation of snow depth, snow water equivalent and snow pack characterization.

Upscaling/downscaling of gridded data (meteorological and thematic)

Spatial interpolation of AWS data

Spatio-temporal time series analysis and forecasting

Inter-sensor normalization techniques

Ocean and weather modeling and Forecasting

Satellite altimeter waveform data processing over oceans

Multi resolution segmentation approaches for classification of land use / land cover

Data mining for resource characterization and response patterns

Forewarning of disasters

Predictive modeling for early warning and Polarimetric radar for retrieval of geo / biophysical parameters

Processing of INSAR data for deformations and land subsidence

EO products & parameters for improved NWP

Integration of spectral indices from optical, thermal and microwave based for crop condition assessment

Forewarning of crop stress

Techniques for utilization of high resolution (ca. 5 m) data for natural resources assessment

Textural classifiers

Polarimetric decomposition techniques for Classification of crop / vegetation types

Interferometric water cloud model for vegetation height assessment

Assessment of climate variation / change and its impacts using EO data

Modelling (Landslide Susceptibility Modelling and Forecasting, Glacier Lake Outburst Flood Modelling & Snow Avalanche Modelling

Software (Indigenous software package for microwave/hyperspectral data processing, Integration of models to generate operational products using microwave / hyperspectral data and Climate data assimilation & analysis using satellite data derivatives

Rural development & developmental communication

Mapping information and communication practices in the tribal areas

A comparative study on media habits between rural and urban India

Community's felt and perceived information needs in the agriculture and health sector

Impact assessment of E dusat Network as supportive role in the field of formal education and teacher's training



JPC Members in a discussion

ISRO-UoP Space Technology Cell
Savitribai Phule Pune University



Scrutiny of new research Proposals by PEC



New Research proposals presentation during 21st PEC Meeting

Ganeshkhind, Pune 411007

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