युक्ति-संचिता 2021

YUKTI-Sanchita 2021

क्षमता निर्माण कार्यक्रम कार्यालय

CAPACITY BUILDING PROGRAMME OFFICE

युक्ति-संचिता | 2021
YUKTI-Sanchita | 2021

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Message

ISRO encourages the collaboration amongst Academia, R & D Institutions and Industry for developing innovative ideas in the domain of space science and technology and realising them for the benefit of the Indian Space Programme.

Today, a large share of our population is in the range of 20-35 years who aspire avenues to contribute their worth through innovative ideas and their talent. It is essential to engage their intellect, in developing newer technologies and realising highly reliable products for Indian Space Programme, thereby transforming them as future entrepreneurs.

With recent announcement of reforms in space sector, it is important to carryout capacity building in a transformative manner for phenomenal predictable growth in Space Sector in coming decades. The 100% self-reliance in Space Technology in tune of **"आत्मनिर्भर भारत Aatmanirbhar Bharat"** can only be achieved by creating a consistence confluence amongst minds of academia, expertise of R&D institutions and resources of industry.

I am delighted to note that Capacity Building Programme Office (CBPO) have expanded the academic interaction activities in Space domain by setting up of Space Technology Incubation Centre (S-TIC), Regional Academic Centre for Space (RAC-S), Academic Chairs and Space Technology Cells in every region of our country.

CBPO has brought forth **"युक्ति–संचिता YUKTI–Sanchita 2021" (Youth Upgradation by Knowledge Transformation through Incubators - Sanchita)**, a compilation of all Product Development / Innovative Project proposals from DOS / ISRO Centres / Labs / Units at a single place. These Product Development / Innovative Project proposals are open up for further processing and execution.

युक्ति–संचिता **2021** provides a better insight of the Product Development / Innovative Project proposals relevant to Indian Space Programme, that can be taken up at Space Technology Incubation Centre, Regional Academic Centre for Space, Start-ups by the academia / industries under the mentorship of Scientists and Engineers from ISRO.

I am sure that the academia / industries will utilise their expertise in arriving at innovative solutions to the above proposals in line with the objectives of the Indian Space Programme.

March 15, 2021

(कै. शिवन **K. Sivan**)

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Dr. P.V. Venkitakrishnan
Director, CBPO

Foreword

The Product Development is an exhaustive knowledge oriented domain, where the inter-disciplinary expertise is required to bring out a quality product in four 'D' phases viz. Design, Development, Demonstration, Deployment.

The Products relevant to Space Science and Technology are unique in the way that many of them can be tested in actual conditions only during the deployment phase. A detailed know-how of each aspect of envisaged Product, including need, design, fabrication, environmental factors and limitations is compulsory. The functioning and testing in all feasible simulated environmental conditions of the Product will only ensure the acceptability and clearance of developed product for real use.

As expansion of Space sector is inevitable in near future, it is important to have collaboration amongst the DOS / ISRO Centres / Labs / Units, academia and industries for developing the products used in conventional and futuristic space industry with a potential for techno-commercial exploitation in other areas as well for betterment of humankind.

With this background, a compilation of 108 Product Development / Innovative Project proposals from DOS / ISRO centres are provided in **"युक्ति–संचिता YUKTI–Sanchita 2021".** This will help the Space Technology Incubation Centre, Regional Academic Centre for Space, Start-ups and Industries to prepare detail project proposal and further execution of project under mentorship from the Scientists and Engineers of DOS/ ISRO.

I hope the execution and outcome of 108 Product Development / Innovative Project proposals will create a stepping stone towards "आत्मनिर्भर भारत **Aatmnirbhar Bharat"** in Space sector. It will also encourage and provide expertise to young minds for initiating Start-ups as budding entrepreneurs, in the domain of Space Technology.

March 15, 2021

(प. वें. वेंकिटाकृष्णन P.V. Venkitakrishnan)

CONTENT

Brief

Recognising the need for a broader academic interface with institutions across the country, a series of capacity building initiatives have been taken up to further strengthen the involvement of academia for ISRO programmes. The two major initiatives in this regard are setting up of Space Technology Incubation Centre (S-TIC) and Regional Academic Centre for Space (RAC-S) throughout our country.

ISRO has already set-up six S-TIC one each at National Institute of Technology – Agartala (for North-Eastern region), Dr. B.R. Ambedkar National Institute of Technology – Jalandhar (for Northern region) and National Institute of Technology – Tiruchirappalli (for Southern region), Visvesvaraya National Institute of Technology – Nagpur (for Western region), Maulana Azad National Institute of Technology – Bhopal (for Central region) and National Institute of Technology – Rourkela (for Eastern region).

The Space Technology Incubation Centre has been envisaged to attract and nurture the young academia with innovative ideas / research aptitude who can carry out research in the domain of Space Science and Technology and realise them towards indigenous development of the space-worthy products. In the process they can transform themselves as future entrepreneurs and contribute positively towards the Indian Space Programme.

Similarly, ISRO has already set-up five RAC-S one each at National Institute of Technology – Kurukshetra (for Northern region), Malviya National Institute of Technology –Jaipur (for Western region), National Institute of Technology –Surathkal (for Southern region), Gauhati University (for North–Eastern region) and Indian Institute of Technology (BHU)–Varanasi (formerly known as IT–BHU) (for Central region) for pursuing advanced research in the areas of relevance to the future technological and programmatic needs of the Indian Space Programme and act as a facilitator for the promotion of space technology activities in the region.

ISRO also strongly promotes and encourages the sharing of technical matters, related to space-worthy products for their indigenous development,with Industries and Start-ups in line with the theme "आत्मनिर्भर भारत **Aatmanirbhar Bharat".**

"युक्ति-संचिता YUKTI–Sanchita 2021" is a compilation of 108 Product Development / Innovative Projects proposal from all DOS/ISRO Centre / Lab / Unit at a single place. Each proposal comprises of a brief write-up about the topic with the email of its mentor from DOS/ISRO.

The proposals are classified as:

- Proposal Nos. **YS/PD-IP/301 to YS/PD-IP/346** are suitable to be taken up at Space Technology Incubation Centre as the outcome of these proposals have a good market potential and can lead to the initiation of a Start-up.
- Proposal Nos.**YS/PD-IP/347 to YS/PD-IP/387** are oriented towards research and suitable to be taken up at Regional Academic Centre for Space.

- Proposal Nos. from **YS/PD-IP/388 to YS/PD-IP/405** are suitable for indigenisation through industrial collaboration.
- Proposal Nos. from **YS/PD-IP/406 to YS/PD-IP/408** are best suited to be taken up by Start-ups.

The general instructions and Flow Chart, guiding the prospective Principal Investigator / co–Principal Investigator/s to prepare a detailed proposal, is provided.

The Proposal Format is provided in Annexure – 'A'.

The details of the S-TIC and RAC-S coordinators at various DOS/ ISRO Centre/Lab/Unit is provided in Annexure – 'B' and 'C' respectively.

The biodata of the Investigators has to be provided as per Form-A.

"युक्ति-संचिता YUKTI–Sanchita 2021" will provide a better insight towards harnessing the technical prowess of the confluence of the Academia, Industry and R&D Institution of our country in line with the objectives of the Indian Space Programme.

March 18, 2021

जीवन कुमार पंडित Jiwan Kumar Pandit

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/301

Geospatial Solution for Smart Parking

01 Mentor/s

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02 Objective

The objective of the proposed topic is to develop geospatial solution utilizing high resolution satellite imagery and the Visible / Thermal cameras for providing services to the citizens about the availability of parking spots in the designated parking areas in a city. This will avoid them searching for the suitable places and wasting fuel thereby reducing air pollution. Solution will provide citizens information on the availability of parking spot which they can book for designated time while making their travel plan.

03. Scope

- AI/ML based model for parking spot availability.
- Mapping of the designated parking areas of the local agencies taking one parking spot in the lead city as a use case.
- Indoor navigation for guiding to the parking spot.

04. Expected Results / Deliverables

- A trained AI/ML model for identifying the vacant / occupied parking spots.
- Geospatial solution for smart parking utilizing high resolution imagery and Visible/Thermal cameras for mapping including indoor navigation and vacant / occupancy identification respectively.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/302

AI (Artificial Intelligence) in Soil Management for Diversified Agriculture

01 Mentor/s

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02 Objective

(i) Generation of Geospatial data base of Farm and Farming System at Block Level/ Region **(Geo-Farm).**

(ii) Developing Smart Soil Management System for assessing Soil Fertility and Crop Productivity Potential using soil sensors and Machine Learning **(Geo-Smart Soil).**

(iii) Developing Smart Diversified Crop Planning System using Decision Criterion Method **(Geo-Crop Diversification).**

03. Scope

- Soil Fertility & Soil Quality Evaluation and identifying constrains of micro-nutrients in Optimizing Agricultural Production.
- Strategic Recommendation for promoting Diversified Agriculture to achieve Doubling Farmer's Income.
- Sustainable Use of Land Resources to address Land Neutrality / Degradation.

04. Expected Results / Deliverables

The project indents to develop methodology / procedure on digital platform in developing large data base of agricultural fields and farming systems including cost/benefit as well as soil constrains to analyse their suitability for various crops. Software's need to be developed for allocation of field of suitable crops to optimize yield for diversification of agriculture. Temporal UAV images will be obtained to identify soil fertility constrains and to recommend nutrients applications to maximize crop yield.

The project will develop modules for Crop Diversification Recommendation in the block / region:

(i) Geo-Farm module to create digital database of spatial and non-spatial data.

(ii) Geo-Smart Soil Module will be developed to analyse soil fertility using soil sensors and UAV images using AI techniques.

(iii) Geo-Crop Diversification Module will be developed to allocate suitable crops by analysing cost/benefit and recommendation of research from ICAR and other Institution.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/303

Design and development of Self-Bearing based Drive system

01 Mentor/s

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02 Objective

Traditionally, magnetically levitated motors use active magnetic bearing (AMBs) for levitation and a conventional motor for rotation. A self-bearing motor (SBM) integrates an AMB and an electric motor into a single device. In other words, an SBM is an electric motor that can simultaneously levitate and rotate a shaft. The major benefits of an SBM are compactness and economy. An SBM is more compact because of its reduced shaft length, yielding higher critical speeds and more stable operation of the rotating shaft. The aim of the project is to design and develop a self-bearing motor to operate at 1,50,000 rpm and deliver a torque output of 0.01 Nm. Motor is preferably a slot-less BLDC / PMSM motor. Drive electronics will be designed and developed for the high-speed self-bearing motor. Sensor less control techniques shall be explored for the motor control and emphasis shall be place on making the whole system compact and power efficient.

03. Scope

- Design and development of Self Bearing Motor.
- Design and development of suspension and control electronics for the Self-Bearing motor.
- Development of Actuator based on this drive system.
- Completed functional demonstration of the of the actuator.

04. Expected Results / Deliverables

- A full-scale prototype of self-bearings lot-less BLDC / PMSM motor with 1,50,000 rpm and 0.01 Nm of output torque.
- Power electronics drive and sensor less control of the prototype motor.
- Analytical and finite element based results, AUTOCAD drawings of the prototype motor, controller PCBs, technical reports and process control documents.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/304

Design and development of Electric Pump fed system Module

01 Mentor/s

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02 Objective

Objective of the project is to minimize propellant payload and obtain the flexibility of thruster for throttling through electric pump fed module.

03. Scope

- Development of electric pump-fed module system for upper stage engines.

04. Expected Results / Deliverables

A Brushless DC motor, power system, pump and command integrated together as a module which can be used for varying missions with minor changes. It shall be easily integrated with the system.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/305

Design and Development of Electronic Feeler Gauge (Electronic Small Gap Measurement Gauge)

01 Mentor/s

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Murugesan N, murugesan.n@iprc.gov.in

02 Objective

To Develop an Inductive or Capacitive based Electronic gap measurement Gauge (Range 0.05 to 1 mm), The gauge shall have LED / LCD display to show the approximate gap available between two metal plates.

03. Scope

- To device a gauge setup and electronics circuit for gap measurement.

04. Expected Results / Deliverables

- An Inductive or Capacitve based Electronic gap measurement Gauge (Range 0.05 to 1mm) with LED / LCD display for measured value.
- Characterstic determination of developed gauge.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/306

Design and development of Terahertz based noncontact coating measurement system

01 Mentor/s

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02 Objective

To design and realize Terahertz noncontact measurement system for measuring coating thickness and to study the feasibility of defect identification from data spectrum obtained during measurements.

03. Scope

- The proposed measuring system shall have Terahertz generator, probes for measuring coating thickness during the process and after the process, data processing and display unit.

04. Expected Results / Deliverables

A noncontact, accurate, online Coating thickness measurement system will be designed and realised. THz spectroscopy can also be used for non-destructively evaluation of coatings.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/307

Design and development of Augmented Reality Headset / Glass for assembly and integration applications

01 Mentor/s

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Md. Rameez Khasim, rameez@iprc.gov.in

02 Objective

The finished product will have wearable spectacles / Headset that will overlap the computer generated image and reality.

03. Scope

To develop an AR based wearable spectacles/Headset that will be helpful during assembly and integration, alignment and routing of the lines on article hardware or test stand. Will also be helpful in fault detection, if equipped with a high resolution camera.

04. Expected Results / Deliverables

A headset that can superimpose a computer generated image on the reality being seen through a camera.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/308

Development of Artificial Intelligence based performance assessment tool

01 Mentor/s

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02 Objective

The prime objective is to make a machine find patterns and form relations among the various parameters that assess the performance of a hardware thereby enabling the machine to identify possible reasons for anomalies and suggest the rectification actions to be carried out.

03. Scope

Will be helpful to assess from subsystem level to final flight assessment.

04. Expected Results / Deliverables

An AI/ML model that can form a correlation between the parameters of the system. An interactive software and database to use the output generated by the model and give the assessment of the system in an understandable manner.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/309

Development of Anti-jamming receiver for NavIC

01 Mentor/s

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02 Objective

- Develop an anti-jamming receiver for NavIC with supporting GUI.
- Provide combined L1, L5 and S band RF outputs or individual L1, L5 and S band RF output.

03. Scope

- Develop an anti-jamming receiver for NavIC with supporting GUI.
- Provide combined L1, L5 and S band RF outputs or individual L1, L5 and S band RF output.

04. Expected Results / Deliverables

Anti-jamming system for NavIC with hardware and software.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/310

Development of Multi-band geodetic grade antenna

01 Mentor/s

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02 Objective

- Design and simulate right hand circular polarized antenna system for L1, L2, L5 and S bands.
- To validate the designed antennas by fabrication and testing the prototypes.

03. Scope

- Design and simulate right hand circular polarized antenna system for L1, L2, L5 and S bands
- To validate the designed antennas by fabrication and testing the prototypes.

04. Expected Results / Deliverables

Multi-band geodetic grade antenna with radome for GNSS signals including NavIC.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/311

Development of NavIC RTK receivers (base-stations and rovers)

01 Mentor/s

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02 Objective

- Develop a real-time kinetic (RTK) receiver for NavIC with carrier-phase tracking.

03. Scope

- Develop a real-time kinetic (RTK) receiver for NavIC with carrier-phase tracking.

04. Expected Results / Deliverables

RTK receivers with NavIC capability for both base-station and rovers.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/312

Development of a prototype Spectrofluorophotometer for quantification of contaminations with fluorescent properties in cleaned Space components / systems

01 Mentor/s

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02 Objective

- The objective of development of an indigenised Spectrofluorophotometer is to have an in-house reliable equipment that can be utilised for verification / quantification of oil contaminations in cleaned Space components /systems.

03. Scope

- To develop an integrated indigenised prototype of Spectrofluorophotometer including software interface.
- To test and characterise the developed prototype with reference samples.

04. Expected Results / Deliverables

The deliverables shall be prototype of the Spectrofluorophotometer. Spectrofluorophotometer is being used in R&D, medical and industrial applications and its suppliers are very few in the world. A business start-up based on Spectrofluorophotometer has a good potential to succeed. A business model can also be developed by providing the Spectrofluorophotometer testing services based on rental charges. The project will also provide expertise in the field of fluorescence spectroscopy, that can be utilised to develop new products based on this technology.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/313

Design and development of a prototype Urine Recycling System (URS) for zero gravity environment

01 Mentor/s

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02 Objective

The objective of development of a prototype Urine Recycling System (URS) is to make an efficient indigenised solution for processing cum recycling model for Urine in zero gravity environment like space station or human interplanetary mission. The resupply dependency of water for long term human presence shall be reduced by effective recycling of Urine.

03. Scope

- To develop a concept demonstration model for Urine Recycling System suitable for zero gravity environment.
- To design and develop a prototype of Urine Recycling System in terms of optimisation of weight, power requirements, chemicals used and recycling efficiency.
- To provide recommendations for suitable adaptations of spin-off technology for processing of urine at public urinals.

04. Expected Results / Deliverables

The deliverables of this Project shall be a concept demonstration model for Urine Processor suitable for zero gravity environment, a prototype of Urine Processor System in terms of optimisation of weight, power requirements, chemical used and recycling efficiency, and recommendations for suitable adoptions for eco-friendly processing of Urine in public urinals.

The project will also bring an advancement of membrane technology for effective recycling and utilising of waste water. The expertise obtained from the project can be converted for foundation of a start-up based on generation of fertilisers from Urine processing from public Urinals. It will also help to improve the quality of sanitation at public urinals in tune with objectives of " Swachchh Bharat" mission.

Start-up ideas can also be explored based on expertise obtained in membrane technology for conversion of sea water in to domestic supply / drinking water at industrial scale in cost effective manner.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/314

Design and development of VR based interactive Space Station module

01 Mentor/s

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02 Objective

To inherit space technology related awareness through interactive Space Station module understanding its concept and features based on "Learn with VR".

03. Scope

To design and develop VR based interactive Space Station module.

04. Expected Results / Deliverables

The project will deliver a VR based interactive Space Station module. The experience gained from these products can be utilised to develop more interactive module viz. planetary exploration module, deep sea experience module, edutainment tools for future generations. A start-up based on VR based product can be initiated based on the outcome of this proposal.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/315

Design and development of low cost Cesium atomic clock

01 Mentor/s

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02 Objective

The various objectives envisaged of this development project are as follows:

- Indigenisation of Cesium based atomic clock technology for ground applications.
- Reduction in dependency on foreign vendors.
- Better control on the production process and improved quality.
- Saving of foreign exchange.
- Capacity building through technology transfer to the Indian industries.
- Increased competition and hence reduction in overall cost.

03. Scope

- Design of a Cesium based atomic clock matching state-of-the-art technology.
- Fabrication of the end product to meet the ground applications.
- Optimisation of power consumption, size and cost.

04. Expected Results / Deliverables

Cesium based atomic clock matching state-of-the-art technology.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/316

SiC Based 0 to -70 kV(pulsed) High Voltage Switch Bank intended to fed pulse power to a wide range of Microwave tubes in a variety of applications up to 1% Beam Duty

01 Mentor/s

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02 Objective

In any Radar transmitter the H.V Switching circuit plays a vital role and offers a greater challenge to both designers and operators of the transmitter. The aim of this project to design a HV switch Bank is to provide a unique single step HV Pulse for any RF tube cathode pulsing as a form of hard switching up to 1% beam duty.

03. Scope

The scope of work is realization of -70 kV SiC Based Switching Matrix ranging from -70 kV to Ground voltage with 1% beam duty ratio that can cater for the requirements of S Band to X-Band DWR Transmitter. The work contents are detailed below.

- Realization of -70 kV switch matrix with controls and interlocks.
- Integrated performance demonstration with RF Tube as a microwave load.

04. Expected Results / Deliverables

The following items shall be delivered as part of this project:

Sl No	Subsystem Name	Quantity
1.	HV SWITCH BANK	1
2.	Control & Interlock system	1

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/317

SiC Based Pulsed Power supply modulator (PSM) with control and monitoring unit intended to operate a wide range of Pulsed Extended Interaction Klystrons (EIK) in a variety of applications like defence and civilian purpose high frequency radars (~95 GHz)

01 Mentor/s

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02 Objective

The proposed power supply modulator (PSM) intended to operate a wide range of pulsed Extended Interaction Klystrons (EIK) in a variety of applications. A Control and Monitoring Unit (CMU) provides modulation control and monitoring for the PSM. Synchronizing and triggering signals are generated within the control unit which also serves to monitor, protect and report on the status of the transmitter.

03. Scope

- Realization of PSM for Extended Interaction Klystron (Input 230 Volt).
- Realization of Control and monitoring unit (CMU) for the above modulator.

04. Expected Results / Deliverables

The following items shall be delivered as part of this technology development project:

- PSM- 1Nos.
- Control and monitoring Unit (CMU)-1 Nos.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/318

UAV-Aided Weather Radar Calibration

01 Mentor/s

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02 Objective

Weather radar is a tool for atmospheric observation as it obtains the information of atmospheric phenomena at a large volume within a short time. There is a requirement of weather radar data with sufficient measurement accuracy for accurate estimation of Weather Radar products.

Radar system bias can be introduced from any radar RF components, which adds uncertainty in radar measurements. This system bias should be quantified through radar calibration process, which aims to identify the unknown system error caused by the transmitter, receiver and antenna.

The radar calibration can be divided into two parts: the internal calibration and the external calibration.

It is more practical approach to evaluate and characterize the radar system as a whole using the external calibration. The external calibration involves the measurement of backscattering of a calibrator with known radar cross section (RCS), such as a metal sphere.

When conducting the external calibration, the calibrator needs to be positioned in the far field, which is difficult as some radars are located at the top of high buildings or towers. The proposal is to use unmanned aerial vehicle (UAV) as the platform to carry a metal sphere to achieve the external radar calibration.

03. Scope

- Unmanned aerial vehicle (UAV) consisting of GPS module & Metal sphere.
- Software for processing the data for Antenna pattern.
- Data processing for Radar constant.

04. Expected Results / Deliverables

The Radar Calibration will generate Radar constant by using external calibration mechanism. The outcome Radar constant value will be based on UAV movement by considering antenna pointing and GPS module for range calculation.

In addition, the proposed calibration technique can also be used for cloud radars (which have narrow Beam width).

This successful model can lead to start-ups in collaboration with S-TIC for production and marketing after technology transfer or other mechanism.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/319

Design and development of Tri Band (S, L1 & L5 Band) Microstrip Antenna

01 Mentor/s

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02 Objective

The various objectives envisaged of this development project are as follows:

a. Indigenisation of Antenna technology for ground applications of NavIC.

b. Better control on the production process and hence, quality of the end product.

03. Scope

- Design of a Tri band antenna with multipath and interference mitigation.
- Fabrication of the end product to meet the ground applications.
- Optimisation of power consumption, size and cost.

04. Expected Results / Deliverables

Tri Band Microstrip Antenna for S, L1 & L5 Band.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/320

Design and development of Software Defined Radio (SDR) based Telemetry, Tele-command and Tracking Processor (TTCP)

01 Mentor/s

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02 Objective

The Objective of this development is:

- To enable Indian industry participation in design and development of the state of the art TTCP system.
- Ensure a self-sustaining business model for Indian industry.
- Advanced technological requirement/challenges in terms of futuristic communication protocols are shared with Indian start-up.
- Usage of indigenously developed TTCP system across all ISTRAC centres. Opening possibility of targeting world TTC segment in long run.

03. Scope

The scope of the work is:

- Design of SDR based TTCP system.
- Development of prototype system.
- Large scale production of TTCP system on successful validation of the prototype system at ISTRAC Ground station. The Indigenous equipment to replace the expensive bought out equipment from foreign vendors.

04. Expected Results / Deliverables

- The developed SDR based TTCP system should be state of the art, catering to all the ISTRAC/Global CCSDS standards.
- The architecture of the development should be scalable in terms of futuristic modulation, data rates, coding standards required.
- The development should meet the defined reliability requirement.
- The equipment should conform to ISTRAC/ISRO ICD requirement.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/321

Design and development of Motorised / Miniaturised Servo Control System for DTH (Direct to Home) Antenna Terminal (MCS-DTH)

01 Mentor/s

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02 Objective

Presently, DTH antenna movement and optimisation is being done manually. In order to avoid physical alignment of antenna, it is proposed to move antenna system by using a simple Motorised/Miniaturised Servo Control System. This MCS-DTH system will be very much useful during DTH terminal installation, antenna position disturbances over a period of time and also terminal physical location change.

03. Scope

Demonstration, realisation and mass production of Motorised / Miniaturised Servo Control System for DTH antenna (MCSDTH) to avoid manual movement of antenna by work force.

04. Expected Results / Deliverables

Motorised / Miniaturised Servo Control system for DTH antenna (MCSDTH) will enable DTH service providers / Users to avoid manual orientation of Antenna system during First Time Installation, Geographical location change of terminal and antenna position disturbances over period of time, also avoid working on roof-top of high raised buildings which ensures human and system safety.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/322

Development of Sensors for Autonomous Navigation of Nano and Micro Satellites Constellations

01 Mentor/s

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02 Objective

The objective is to develop the sensors required for Autonomous navigation of Nano and Micro Satellites that fly in constellations. Nano and Micro satellites constellations are becoming common for both remote sensing and communication applications. On-orbit autonomous navigation including debris avoidance is a requirement for this type of mission. It is proposed to develop the sensors and systems for this application.

03. Scope

- Sensors design and development.
- Autonomous Navigation.

04. Expected Results / Deliverables

The outcome of this effort is to bring out a Sensor system for Nano and Micro Satellite applications. The system proposed to be developed shall be suitable for satellite constellation, which opens up new areas of development and indigenization. A large quantity requirement of such system enables industry involvement towards indigenization of some key elements.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/323

Development of Miniaturized Pressure Regulators (non-moving type) for low flow rate application

01 Mentor/s

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02 Objective

To develop and demonstrate fluidic type (with no moving elements) pressure regulators for low flow rate applications. The regulated outlet pressure shall be in the range 1.5 to 2.0 bar(a) with flow rate <100 SCCM of GN_2.

03. Scope

- Conceptualisation of fluidic pressure regulator.
- Design of the regulator.
- Realisation and proto development tests.
- Commercialisation/supply for ISRO programme.

04. Expected Results / Deliverables

Compact and highly reliable pressure regulators meeting the requirements for evolving technologies like Hydrogen fuel cells, electric propulsion systems and other applications handling low flow rates. Once developed, these devises considerably reduce the weight penalty of conventional pressure regulator with increase in reliability and life.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/324

Development of Spring energized C ring seals for flange joints

01 Mentor/s

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02 Objective

Development of spring energized C ring seal made of inconel X750 / 718 material spring and metallic jacket with soft material coating (silver, PTFE, gold etc). The proposed seal is for use in cryogenic pressure vessels & pipe lines and is currently being imported. The product should have the following properties:

- Application: Suitable for Internal pressure / external pressure.
- Operating pressure: 5bar-25bar (min).
- Coating Thickness range: 0.04-0.06mm.
- Temperature range: 20K-350K.
- Compatibility: LOX / LN_2 / LH_2.
- Material: Inconel X750 / 718 for inner spring & soft materials for outer jacket.
- Compression load varying from 145-350N / mm depending on diameter.
- Seal diameter: Different diameters from 5mm to 800mm Should be customizable.

03. Scope

- Design the seal by finalizing spring parameters and jacket thicknesses, which should also consider the need for customization.
- Generate a process for realizing the hardware and generate tooling and test fixtures that are flexible for incorporating customizing requirements.
- Develop the hardware and optimize for strength and leak tightness requirements.
- Qualify the seal in cryogenic fluids.

04. Expected Results / Deliverables

It is expected to develop a flight worthy aerospace quality product which can be directly inducted in launch vehicle applications.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/325

Design and development of Ultrasonic transducer

01 Mentor/s

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02 Objective

To perform design optimisation and develop manufacturing techniques for realisation of Ultrasonic sensor based on Piezo-electric technology. The crystals used for manufacturing shall be procured from Indian sources available and expertise shall be built in the assembly and testing of the Ultrasonic transducer using the crystal.

Design optimisation and improvisation in the manufacturing and assembly techniques shall be carried out in order to achieve a transducer with high stability and S/N ratio. The process shall be standardised for mass fabrication and automation.

03. Scope

- Design improvisation from the existing design.
- Optimisation and improvisation in the assembly and manufacturing techniques.
- Adapting the design for various frequencies and sizes of the transducer making it commercially viable.

04. Expected Results / Deliverables

Ultrasonic transducers of high performance and reliability are expected to be the outcome of this project. The transducer manufacturing shall be streamlined for design and manufacture of transducers in different frequencies and geometries. The start-up company would cater to the demands of ISRO as well as the Indian and global market with the proved quality and performance of the Ultrasonic transducers.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/326

Development of Computer Vision System for an AI assistant

01 Mentor/s

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02 Objective

The objective of this project is to develop a Computer vision system for an AI assistant. The computer vision system should enable the AI assistant with cognitive capabilities such as recognizing its co-workers and detecting their emotional state. It should also be able to interpret various gestures made by its co-workers. The features required for meeting this objective include Face recognition, Emotion recognition from facial expressions, Hand gesture recognition, Body posture recognition etc. The system should provide robust performance under varied lighting conditions and different face / hand / body orientations.

03. Scope

The scope of this proposal includes development of the following modules.

- Face recognition.
- Emotion recognition from facial expressions.
- Hand gesture recognition.
- Body posture recognition.

04. Expected Results / Deliverables

The expected result / deliverable is a computer vision system with cognitive capabilities of Face recognition, Emotion recognition from facial expressions, Hand gesture recognition and Body posture recognition. The modules should perform with a minimum generalization accuracy of 85% in different lighting conditions and multiple face / hand / body orientations.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/327

Development of frequency converters such as Up Converters, Down Converters and Test Loop Translators in C, Ext-C, Ku and Ka band

01 Mentor/s

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02 Objective

The objective of this Product development proposal is to design and manufacture Up Converters, Down Converters and Test Loop Translators for various microwave frequency bands such as L, S, C, Ku and Ka, which are commonly used for satellite communication. Currently, these products are procured from foreign vendors and only a small number of Indian vendors are there, whose product do not meet the requirement of 24X7 operations. This product development will enable indigenization of the above-mentioned products and development of relevant industry. These products are not only utilized by the various ISRO centres such as MCF, ISTRAC, URSC, SAC, VSSC but also by a number of service providers such as Doordarshan, All India Radio and users of satellite communication in the private industry.

03. Scope

- Design and manufacture of Up Converter.
- Design and manufacture of Down Converter.
- Design and manufacture of Test Loop Translator.

04. Expected Results / Deliverables

The deliverables are frequency converters, which can be utilized by the ISRO and other government and private industry working in the field of satellite communication and using the space segment.

Once the design and development are carried out, and the component is field tested successfully, the technology can be transferred to the industry for mass production. It can then also be exported, as there are many users for it throughout the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/328

Design and development of Frequency selective band limited power sensor

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02 Objective

Presently, Diode based power sensors are in use in earth station for measurement of CW power of uplink and downlink chain. These type of sensors are wideband in nature hence its dynamic range lower threshold is higher in nature (usually up to -70dBm). For measuring power level below -70dBm at selective frequency, receiver based band limited power sensor is required. By developing this type of power sensor, individual carrier power can be measured with high accuracy in uplink and downlink chain. This will be very useful for test and measurement purpose in uplink and downlink chain of earth station and other SATCOM application.

03. Scope

In first phase, the developed product shall be designed and developed as per the need of TTC earth station, MCF Hassan. Later the product can be customized as per the user requirements from other SATCOM and Telecomm field.

04. Expected Results / Deliverables

The power sensor can be designed in various bands suitable for ISRO, SATCOM users and Telecom operators for measuring and continuous monitoring of very low level user carrier powers.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/329

Development of Coaxial components

01 Mentor/s

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02 Objective

The objective of this Product development proposal is to design and manufacture coaxial components such as N, BNC, SMA, K, TNC type connectors, Isolators, Circulators, Power dividers, Line amplifiers, cables, adapters, combiners, couplers, coaxial switches for various microwave frequency bands such as L, S, C, Ku and Ka which are commonly useful for satellite communication. Currently, these products are procured from foreign vendors. This product development will enable indigenization of the above-mentioned products and development of relevant industry. These products are not only utilized by the various ISRO centres such as MCF, ISTRAC, SAC, URSC but also by a number of service providers such as DTH, DSNG, VSAT users.

03. Scope

- Design and manufacture of various Coaxial components.

04. Expected Results / Deliverables

The deliverables are Coaxial components, which can be utilized by the ISRO and other government and private industry working in the field of satellite communication and using the space segment.

Once the design and development are carried out, and the component is field tested successfully, the technology can be transferred to the industry for mass production. It can then also be exported as there are many users for it throughout the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/330

Design and development of Switching Units

01 Mentor/s

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02 Objective

Objective for developing these units is to configure various uplink / downlink paths whenever there is failure in one particular paths or any other requirement like reconfiguration. Using these switching units we can reduce total reconfiguration and down time of the system since redundant or back up chain can be configured easily.

These switching also enable ground automation for redundancy management.

03. Scope

- Operate and Monitor the status of Waveguide / DPDT Coaxial Switches.
- Remote Monitoring and Control of the unit.

04. Expected Results / Deliverables

Switching units specific to customer requirement & corresponding web based software to monitor and control the switching units.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/331

Design and development of Uplink Power Control unit

01 Mentor/s

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02 Objective

The objective of this Product development proposal is to design and manufacture auxiliary uplink power control unit in L and Ku band which are commonly useful for satellite communication. Currently, these products are procured from foreign vendors. This product development will enable indigenization of the above-mentioned products and development of relevant industry. These products are not only utilized by the various ISRO centres such as MCF, ISTRAC, SAC, URSC but also by a number of service providers such as DTH, DSNG, VSAT users.

03. Scope

- Design and manufacture of auxiliary uplink power control unit.

04. Expected Results / Deliverables

The deliverables are UPC (uplink power control unit) which can be utilized by the ISRO and other government and private industry working in the field of satellite communication and using the space segment.

Once the design and development are carried out, and the component is field tested successfully, the technology can be transferred to the industry for mass production. It can then also be exported as there are many users for it throughout the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/332

Development of IF Switching Unit

01 Mentor/s

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02 Objective

Objective for developing these units is for Uplink and Downlink IF path switching to desired route whenever there is failure in one particular path or any other requirement like reconfiguration. Using these switching units, we can reduce total reconfiguration and down time of the system since redundant or back up chain can be configured easily. These matrix can switch the IF signal of frequency range 50-90 MHz. Currently, we are procuring these units from foreign vendors and no domestic players are there for this product.

03. Scope

- Design and manufacture of IF FAN IN Switching Unit.
- Design and manufacture of IF FAN Out Switching Unit.

04. Expected Results / Deliverables

The deliverables are IF Switch Matrix, which can be utilized by the ISRO and other government and private industry working in the field of satellite communication.

Once the design and development are carried out, and the component is field tested successfully, the technology can be transferred to the industry for mass production. It can then also be exported as there are many users for it throughout the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/333

Development of Photodetector for low intensity light levels in UV/VIS/IR wavelength regions

01 Mentor/s

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02 Objective

To develop photodetector units with amplification and gain control suitable for low intensity light level applications in 200-1100 nm wavelength region.

03. Scope

- Design of the photo detectors, Development of the detectors and Testing of the product.

04. Expected Results / Deliverables

- Design document including detailed schematics.
- Test procedures and results.
- Samples of developed product.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/334

Development of lightweight greenhouse gas sensors for Atmospheric Science studies

01 Mentor/s

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02 Objective

The main objective of the project is to:

- Develop light weight, high sensitivity and fast response sensors for major greenhouse gases viz, CO_2, CO, O_3, SOx and NOx.
- Calibration of the sensors and getting the sensors certified by appropriate organisation.
- Validation of the data collected by the sensors with standard data from at least three locations with different pollution level.

03. Scope

- Design, develop, and fabricate the sensor and ensure output following international standard.
- Calibration and validation of sensors with standard reference instruments.
- Collect data using the sensors over three locations with negligible pollution, moderate pollution, and high pollution and demonstrate the sensitivity of the sensors.

04. Expected Results / Deliverables

The product of the project is lightweight, high sensitivity, and fast response sensors to measure greenhouse gases like CO_2, CO, O_3, SOx and NOx.

The lightweight sensors could be integrated to make an automatic sensor system that can be used in land / ocean / air campaign experiment as well as to setup dense network of atmospheric science laboratory over remote locations. This type of development may meet the requirement of ISRO Geosphere Biosphere Program, where scientists / researchers study to understand climate change impact, sun-earth atmosphere coupling process, radiative balance process, etc.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/335

Development of lightweight Particulate Matter (PM1, PM2.5 and PM10) sensor system for Atmospheric Science studies

01 Mentor/s

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02 Objective

The main objective of the project is to develop light weight integrated Particulate Matter (PM1, PM2.5 and PM10) sensor system for Atmospheric Science studies. The lightweight on-board integrated automatic system will be used for further campaign mode scientific experiment, airborne balloon experiment, for vertical profiling, setting up dense observatories of climate change studies, Air quality monitoring/forecast, operational activity etc.

03. Scope

- The product of the project is lightweight integrated Particle Matter sensor system in various size spectrums (PM1, PM2.5 and PM10) for Atmospheric Science studies.
- The sensors will be calibrated and validated with standard reference instruments by collecting data over at least three different locations with contrasting pollution levels.
- Getting the sensor certified from standard organisation.

04. Expected Results / Deliverables

The product of the project is lightweight integrated Particle Matter sensor system in various size spectrums (PM1, PM2.5 and PM10) for Atmospheric Science studies.

The lightweight integrated automatic sensor system can be used in land / ocean / air campaign experiment as well as to setup dense network of atmospheric science laboratory over remote location also. This type of development may meet the requirement of scientists / researchers, who study to understand climate change impact, sun-earth atmosphere coupling process, radiative balance process etc.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/336

Development of mobile connected compact Bore well water level sensor

01 Mentor/s

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02 Objective

To design and implement a compact sensor based on appropriate frequency for measuring depth of water in a functioning bore-well for semi-empirical inventory.

03. Scope

Measuring bore water depth quickly can facilitate modelling of ground water levels.

Modelled ground water levels will help in water budgeting precisely. Water budgeting at local level would greatly help in better crop planning, hence eco-restoration.

04. Expected Results / Deliverables

Expected deliverable is the device measuring ground water level affordably, quickly and at desired precision. It is required that a fool proof mechanism is available with the device to nullify most of obvious errors in measurement, after due validation with standard equipment. Due disclaimers and safety guidelines for optimised frequency, if any should accompany the user guide. The device will be connected to a mobile preferably through a USB port and have maximum ease of access through the mobile app. It is preferable to have a bootstrapping dashboard to avoid extreme errors in measuring and reporting. Bootstrapping tests against the existing distribution of the reported measurement and alerts the personnel for extrema. Validation experiments can span various seasons and terrains to arrive at best possible error band. In turn measurements can feed a modelling approach, independently to derive subterranean water reservoir at a given micro site such as Gram Panchayat, Nano-watershed or village.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/337

Programmable Automated Field Deployable High Frequency Rainwater Sampler

01 Mentor/s

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02 Objective

Collection of the rainwater samples at desire time interval or cumulative sample over a certain time duration is an essential perquisite for modern hydro meteorological and environmental applications. Due to non- availability of commercially available, automated and programmable sampler many new scientific ideas are awaiting implementation.

The objective of this proposal is to design and develop a programmable automated high frequency rainwater sampler which can:

1. collect the rainwater sample accumulated over a certain time duration (few minutes to several tens of minutes);
2. continuously measure the amount of rainfall (cm) from volume of rainwater collected (cm3);
3. detect the isolated rain events and sample the rainwater for such events:
4. connect the outlet of the sampler with variety of sample containers and vials to store the accumulated rainwater:
5. be monitored and operated remotely with real time sampling programme through a computer:
6. be operated through battery or mains.

03. Scope

- Mechanical, Electrical, Computer Science, IT Students to develop this product.
- Hydro meteorological and Environmental aspects to be considered in design.
- Academic and research institute associated with meteorology and environment sciences will be the end users.

04. Expected Results / Deliverables

The final prototype of Programmable Automated Field Deployable High Frequency Rainwater Sampler delivers at the end of this project will be very useful for meteorological stations, agro-meteorological stations, universities, colleges, research and academic institutions interested in amount and intensity of rainfall and its chemical and isotopic composition together with time and duration of various rain events. The finally developed automated rainwater sampler can be stationed at numerous weather stations where other meteorological equipment such as Micro Rain Radar, ceilometer or disdrometer are already installed. This will help to relate the actual rain event in terms of its amount, intensity and chemical and isotopic composition with actual in-cloud processes inferred by meteorological observations.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/338

Design and development of active RF, microwave and mm-wave circuits

01 Mentor/s

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02 Objective

This proposal includes design and development of active RF, microwave and mm-wave circuits at frequency ranging from DC to 115GHz required for development of various RF subsystems, to reduce reliance on foreign vendors.

03. Scope

Scope of work includes design and development of the following circuits:

- Dielectric Resonator Oscillator (DRO) at Ku-Band.
- mm-wave Gunn Diode Oscillator at V, W and F-Bands.
- DC to 500 MHz Surface mount (HMC) compact packaged amplifier.

04. Expected Results / Deliverables

Design document, fabrication drawings and developed hardware of the following:

- Dielectric Resonator Oscillator (DRO) at 13.5GHz-15.5GHz.
- mm-wave Gunn Diode Oscillator at 50-60GHz, 75-85GHz and 105-120GHz.
- DC to 500 MHz Surface mount hermetically packaged amplifier.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/339

Development of Passive RF components

01 Mentor/s

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02 Objective

Indigenous development of RF passive components required for various subsystems of Microwave Remote Sensing Payloads.

03. Scope

Includes design and development of following:

- RF coaxial attenuators with medium/high power handling capability.
- High power and low power broadband single and dual directional coaxial couplers.
- mm-wave Directional couplers.
- Wideband square law diode detectors.

04. Expected Results / Deliverables

RF Coaxial attenuators:

- Medium Power handling (2W CW): up to 18GHz.
- High Power handling (100W CW, 400W peak): up to 12/18GHz.

Directional couplers:

- 250W peak, 70W CW power handling (Dual-directional): various frequency bands up to 18GHz.
- Coaxial 1-40GHz (Single-direction) and 0.5-18GHz (Dual-directional).
- WR-10, WR-8, WR-5, WR-4.3 directional couplers.

DC-40GHz Square-Law Wideband Diode Detectors:

- Wideband power dividers (1-20GHz).
- Quadrature Hybrid (DC-1 GHz).

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/340

Development of module for Ground Penetrating Radar (GPR) real time data processing and display

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02 Objective

To develop a system module which is capable of taking input of GPR serial data and processing it to display the generated radargram in real time.

03. Scope

- Real-time GPR data processing software development with GUI control.
- Development of hardware for carrying out the real time processing.
- Development of display system updating along with GPR movement.

04. Expected Results / Deliverables

- Real-time GPR data processing software development with GUI control.
- Hardware for processing and display system.
- USB output in the hardware for retrieving raw unprocessed data.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/341

Development of Portable Calibration System for Environment Sensors

01 Mentor/s

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02 Objective

Development of Mini calibration system for environment sensors.

03. Scope

Development of portable calibration system for calibration of the following gas sensors.

- Oxygen: 0 -70kPa
- Carbon Dioxide: 0-20000 ppm
- Carbon Monoxide: 0 -1000 ppm

Pressure variation from 0 -2.6 bar

Temperature variation from -15 to 50 C (best effort)

Total volume of the chamber (approx.): 300mm x 200mm x 150mm

04. Expected Results / Deliverables

The deliverables would include the assembled full calibration setup consisting of the following:

- Leak proof chamber.
- Gas Cylinders for all gases.
- Electronic control valves.
- Hoses for gas connections.
- Temperature control system.
- Humidity control system.
- Vacuum pump with pressure control system.
- Secondary standards for pressure, temperature, humidity and atomic mass spectrometer etc. for gases.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/342

Safe Ship Navigation

01 Mentor/s

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02 Objective

Develop a system for Safe Ship Navigation.

03. Scope

The scope of this project is to develop a system for safe navigation of ships and real time dissemination of shortest safe route to destination using Ocean State Forecast and other satellite based inputs.

04. Expected Results / Deliverables

Complete end-to-end system, which can be sold to cargo and ocean liners and commercial fleet operators:

- Shortest Safe Route Software: Software which takes ship track as input and generate ocean state forecast on the provided track and based on constraints, propose the shortest safe route.
- Alert Generation Software: This Software will use NRT data from satellites and generate alerts of extreme weather events.
- Ship Tracking Software: This will be a GIS based software, which will track the ship using IRNSS and 2 way MSS terminals.
- Data dissemination System: 2-way MSS based terminal for dissemination of data to ships.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/343

Integrated information system for agriculture monitoring and crop insurance

01 Mentor/s

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02 Objective

The objective of this TDP is to develop an integrated information system incorporating space based and UAV based remote sensing inputs to support operations of crop insurance providers and regulatory authorities. This information system will assist users in setting individualized risk premium rates, verifying, settling claims, and help regulatory, governing and monitoring authorities in formulating region specific premium rules.

03. Scope

- Provide data-driven tools for claim verification and settlement. This tool will provide advisory based on current and historical space based and UAV based remote sensing inputs, auxiliary agrometeorological data and other relevant information.
- Provide data-driven tools for individualized risk assessment based on historical assessment of crop failure risks and variability.

04. Expected Results / Deliverables

- A comprehensive risk assessment framework.
- Backend geo-processing and analytics service software.
- Front-end applications and website.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/344

Development of advanced two phase flow heat transfer devices: Flexible Heat Pipe

01 Mentor/s

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02 Objective

Design and development of Flexible Heat Pipe for space applications.

03. Scope

- Development of design and analysis code.
- Fabrication and charging devices
- Experimental investigations and characterization
- Space qualification

04. Expected Results / Deliverables

- Flexible heat pipe capable of handling 30W heat load, operating temperature range of -20 to 100 degC, Stiffness of heat pipe should be < 10 N/mm in all three directions, Allowable ΔT is 6 deg C.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/345

Development of Bi-Directional Battery Charge-Discharge Regulator (BCDR)

01 Mentor/s

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02 Objective

To develop a high efficiency DC-DC bi-directional converter which could be used as a battery charge and discharge regulator. High efficiency, high stability, compact and simplicity are the main goals. Galvanic isolation is not required as spacecraft bus and battery works on same ground.

03. Scope

- For low earth spacecrafts in space applications.
- For aerospace industries.
- For EV industries.

04. Expected Results / Deliverables

The product should be space grade with all qualified components, should meet the EMI/EMC standard & de-rating guideline set by ISRO. Full design document, software simulation files and working model which can be demonstrated at ISRO are the major deliverables.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/346

Development of Hybrid Polyhydroxy urethanes for aerospace applications

01 Mentor/s

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02 Objective

The objective of this proposal is to synthesis hybrid polyhydroxyurethanes/ Hybrid non-isocyanate polyurethanes (HPHU/HNIPU) form synthetic as well as by using bio-based molecules such as vegetable oils, fatty acids, terpenes etc., via. the synthesis of cyclic carbonate by the incorporation of CO_2 into an epoxy. Hybrid Coating Technologies is for developing a safer, bio-material based polyurethane for use on floors, furniture and in foam insulation. The technology eliminates the use of isocyanates, which cause skin and breathing problems and workplace asthma, thus safer for people and the environment. The synthesis of HPHU can be carried out by 1) the addition of epoxy into cyclic carbonate followed by reaction of polyamines and 2) monomer containing both the epoxy and cyclic carbonate and on reaction with polyamine results in HPHU. The HPHU synthesised by the above mentioned routes will be evaluated for physical, thermal, mechanical and morphological properties. The properties are to be compared with the conventional PU's. The application of the synthesised HPHU have been identified as coating material, adhesives or as sealants in the aerospace industry.

03. Scope

- Conventional PU's are synthesised from hazardous isocyanates posing serious concern to health and deterioration of mechanical property upon storage.
- Realization of polyurethane through eco-friendly approach is highly appreciable.
- Hydroxyl groups at the β- carbon atom of urethane unit after aminolysis of the CC offers opportunities for chemical post functionalization.

04. Expected Results / Deliverables

By adopting HPHU/HNIPU technology, it is possible to realize a greener and safer way of PU materials which include:

- Adhesives.
- Paints and coating materials.
- Foams.
- Propellant binder.
- Flame retardants.
- Super hydrophobic polymers.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/347

Radiation Shielding and Spacecraft propulsion using Magnetic Fields

01 Mentor/s

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02 Objective

Radiation shielding is essential to all future space exploration missions with longer exposure to space radiation. High Atomic Number and Energy particles (HZE) in Galactic Cosmic Radiation (GCR) presents one of the most difficult types of radiation to shield. The objective of this project is to solve this with the help of magnetic fields produced using superconducting coils.

03. Scope

- Space exploration.
- Satellite shielding.

04. Expected Results / Deliverables

Primarily, an effective, reliable active radiation shielding system with the secondary role of additional thrust provision.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/348

Realisation of Al Alloy AA2219 / AA2014 Integrally stiffened cylindrical structure through flow forming

01 Mentor/s

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02 Objective

To realise Aluminium alloy AA2219 / AA2014 cylindrical structure of Ø600 mm/ Ø1000 mm/ Ø2000 mm class with integral stiffeners (both longitudinal and circumferential stiffeners) through Flow Forming Process.

03. Scope

- Flow Forming of integrally stiffened cylindrical structure including design and development of Roller and Mandrel.
- Explicit Dynamic Analysis of the Flow Forming Process.
- Structural Test & Analysis, Validation and Result Compilation.

04. Expected Results / Deliverables

- Flow forming parameter optimisation.
- Micro structure characterization and mechanical property evaluation.
- Design & development of stress relieving methods / tools for the flow formed hardware.
- Delivery of 3 sets of flow formed structure of Ø600 mm/ Ø1000 mm/ Ø2000 mm class.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/349

Optimal sizing of raw material for realizing bi-metallic adapter through frictional welding route

01 Mentor/s

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02 Objective

- In this proposal a frictional weld is proposed for carrying out joint between AA2219-SS321 bi-metallic adapter.
- This manufacturing process will increase the yield rate of bi-metallic adapter and rejection rate will be minimal.

03. Scope

- The major challenge would be optimum selection of inner diameter (D>100mm), thickness and critical length.
- The Dm/t and Lca/Lcs are to be optimised based on the frictional welding machine capacity to avoid local buckling during frictional welding.
- Generation of mathematical empirical model based on experimental results.

04. Expected Results / Deliverables

- The bi-metallic adapters made through this route would be more reliable and rejection rate will be minimal.
- This process and product can be directly used in flight tanks of cryogenic / semi cryogenic stage.
- The fabrication process of bi-metallic adaptor can be indigenised and realised at the end of the projects.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/350

Development of new filler metal for super alloys with inoculants

01 Mentor/s

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02 Objective

- To develop suitable intermetallic based inoculants for superalloy system (Alloy 718, Alloy 706 and Inconel X 750).
- Addition of developed inoculants into the weld through filler metal.
- Demonstration of mechanical properties.

03. Scope

- Procurement of metal elements.
- Preparation of intermetallic particles.
- Characterization of intermetallic particles.
- Melting of filler alloy with the prepared intermetallic particles.
- Welding trials with inoculants added filler metal.
- Metallurgical and mechanical property evaluation.

04. Expected Results / Deliverables

- Development of filler metal for superalloys with inoculants resulting enhanced mechanical properties. The same shall be extended to stainless steels.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/351

Fracture properties enhancement for additive manufactured aerospace super alloys by Electron Beam based process

01 Mentor/s

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02 Objective

- To evolve an electron beam based process for additive manufacturing of super alloys for enhancing fracture properties as per aerospace quality requirements.

03. Scope

- Studies on Fracture properties of additive manufactured super alloys required for aerospace applications.
- Evolving an optimized Electron beam processes for additive manufacturing of super alloys for enhancing fracture properties.

04. Expected Results / Deliverables

- Electron beam melting based additive manufacturing process meeting fracture control and damage tolerance aerospace quality requirements.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/352

Design and development of solenoid coils for Liquid Helium applications

01 Mentor/s

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02 Objective

- Design, development and realization of a Solenoid valve to work for Liquid Helium applications.

03. Scope

The value design has to meet the following critical requirements:

- Sealing at Liquid Helium temperature.
- Design of Solenoid actuator with superconducting winding wires.
- Realisation of the valve and testing for LHe temperatures.
- Detailed mechanical and magnetic analysis of the valve.

04. Expected Results / Deliverables

- Complete design details and analysis of the valve.
- Hardware realisation.
- Test result compilation.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/353

Development of Stepper Motor for space application

01 Mentor/s

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02 Objective

To develop and demonstrate stepper motor of required specification and selection of materials as per space application requirements.

03. Scope

- Conduct literature survey for selection of design method and materials.
- Design, analyse, realize and test the stepper motor.

04. Expected Results / Deliverables

- Prototype of Stepper motors including realisation and testing.
- Documentation related to design, development, production and testing of Stepper motors.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/354

Development of high entropy alloy components for aerospace applications

01 Mentor/s

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02 Objective

Development, realisation and characterisation of high entropy alloy components for extreme (cryogenic or high temperature) applications.

03. Scope

- Development and realisation of HEA through additive manufacturing (AM).
- Characterisations of realised materials for (a) Mechanical properties (b) Thermal Properties (c) Metallurgical characterisation (d) Soundness of product quality through NDT.

04. Expected Results / Deliverables

- Process parameters and techniques for the realisation of HEA materials at large scale/ product level.
- Characterisation of HEA materials for mechanical properties (at RT, Cryogenic or High temperature as per application).
- Details characterisations (NDT, thermal, mechanical, metallurgical characterisation) of HEA alloy parts will provide confidence on the process and techniques.

Techniques and process developed shall be scaled up. This will provide opportunity to start-ups for product realisation and further tailoring for different HEA alloys, which have potential in aerospace, energy and nuclear industries.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/355

Development of functionally graded multi-material parts for aerospace applications

01 Mentor/s

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02 Objective

Development, realisation and characterisation of functionally graded multi-material having potential applications in aerospace through additive manufacturing (AM).

03. Scope

- Development and realisation of Multi-material system through AM.
- Characterisations of realised materials for (a) Mechanical properties (b) Thermal Properties (c) Metallurgical characterisation (d) Soundness of product quality through NDT and (d) Diffusion kinetics evolution.

04. Expected Results / Deliverables

- Process parameters and techniques for the realisation of functionally graded materials.
- Characterisation of multi-materials parts for mechanical properties (strength, hardness) to obtain strength similar to parent material or par with dissimilar parts realised through conventional joining process.
- Details characterisations (NDT, thermal, mechanical, metallurgical characterisation) of parts will provide confidence on the process and techniques.
- Techniques and process developed shall be scaled up. This will provide opportunity to start-ups for product realisation and further tailoring for different materials combinations, which have potential in aerospace, energy and nuclear industries in long run.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/356

Development of optimised hypergolic green bipropellants (H_2O_2 / ethanol based fuel or H_2O_2 / kerosene based fuel or any other alternative fuel combination) with ignition delay in the order of 20ms

01 Mentor/s

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02 Objective

To develop and experimentally demonstrate the hypergolic ignition of green bi propellant combination, which could replace the toxic earth storable propellant for satellite applications.

03. Scope

- Development of propellant combination.
- Demonstration of hypergolicity and measurement of ignition delay.
- Optimisation of Mixture ratio.

04. Expected Results / Deliverables

- Hypergolic green bipropellant combination.
- Cstar >1450 m/s.
- Ignition delay <20ms.
- Approximate 50kg of developed propellant.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/357

Development of Miniature Ultrasonic pulser / receiver

01 Mentor/s

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02 Objective

To design and develop a miniature Ultrasonic instrumentation system capable of pulsing and receiving from an Ultrasonic transducer, all in-situ mounted on the structure desirable for health monitoring.

The instrumentation shall be built on a platform using embedded electronics and VLSI. The instrumentation package shall be having a reader interface wherein the data shall be transferred wirelessly onto a reader for analysis and archival.

03. Scope

- Design a miniature Ultrasonic instrumentation and wireless reader with interface suitable for mounting onto metallic structures.
- Testing and prove-out of the performance of the design.
- Scheme for induction of the instrumentation commercially and into ISRO projects.

04. Expected Results / Deliverables

The outcome of the project is expected to have miniature instrumentation hardware capable of pulsing/receiving from an Ultrasonic transducer. The hardware shall also have an additional module capable of wirelessly connecting to the host in order to transfer the data and for analysis and archival. The whole system shall be battery powered with a definite time of operation.

A start-up marketing and selling such miniature equipment will have a broad market in Nuclear, Automotive and Aerospace industry and will be the first of its kind in the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/358

Spectrogeochemical models of Platinum Group of Elements and Rare Earth Elements Hosted Ultramafic and Alkaline Complexes for their space based detection

01 Mentor/s

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02 Objective

- The main objective of this project is to examine the relationship between the mineralogy, bulk geochemistry and spectral characteristics of (i) platinum group of elements (PGE) hosted ultramafic rocks from the Boula-Nuasahi and Sukinda complex and (ii) the alkaline province of the Rairakhol and Kankarakhol-Lodhajhari which has elevated concentration of rare earth elements (REE) in the visible to shortwave infrared and thermal infrared region. This study's finding will help to identify the PGE and REE mineralization from the mineral prospecting point of view using remotely based techniques.

03. Scope

- Development of geospatial database for the PGE and REE mineralization based on field work, analysis of mineralogy and bulk geochemistry of ultramafic and alkaline rocks.
- Collection of in-situ and laboratory spectral signature of rocks within visible to thermal infrared region.
- Linkage between spectral signatures and mineralogical variation of different rocks for future application of remote sensing-based exploration for PGE and REE mineralization.

04. Expected Results / Deliverables

- The spectral reflectance and emissivity spectra along with the mineralogy and chemical analysis will offer a deep understanding of the connection between the rock composition and spectral behavior which is the key point for targeting the PGE and REE mineralization. In-situ spectra reflectance measurements obtained on the ground and laboratory can be used to (i) gain insight into the spectral reflectance and emissivity characteristics of PGE and REE hosted ultramafic and alkaline rocks, (ii) calibrate remotely sensed data, and (iii) provide unique spectral data for improved information extraction using multispectral and hyperspectral remote sensing data.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/359

Wrist Wearable Wireless Communication Device for EVA (Extra-Vehicular Activities) in Space

01 Mentor/s

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02 Objective

Development of Wearable wireless communication device for EVA (extra-vehicular activities) in space.

03. Scope

The device should have capability to communicate up to a few meters for both audio and text channels with touch screen panel for chat facility.

04. Expected Results / Deliverables

The deliverables would include the following:

- Miniaturized Wearable wireless communication device.
- Test / programming setup.
- Supporting Software.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/360

Development of Personalized Health Monitor for Astronauts

01 Mentor/s

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02 Objective

Development of Personalized instrument for health monitoring of astronauts in human spaceflight missions.

03. Scope

Development of wearables for health measurement including the following parameters:

- Temperature.
- ECG.
- SPO_2.
- Blood Pressure.
- Pulse Rate.
- Exhaled Breath Analysis.

04. Expected Results / Deliverables

The deliverables would include the following:

- Wearable sensors for health parameters Blood Pressure, Oxygen Saturation, Pulse Rate, Exhaled Breath Analysis etc.
- Interface / checkout unit.
- Interface software.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/361

Flat Panel Beam Steerable Array Antenna System for Satcom-On-The-Move (SOTM) Terminals

01 Mentor/s

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02 Objective

Design and development of flat panel beam steerable array antenna system for Satcom-On-The-Move (SOTM) Terminals, offering wide angle conical beam steering capability with moderate/ high gain.

03. Scope

- RF design of wide-angle beam steerable planar array antenna and its active/passive back electronics including digital electronics.
- Lightweight mechanical design of integrated antenna for various moving positioners/platforms.
- Indigenous development of planar array antenna and back electronics.
- Integration, assembly and characterization of the flat panel array antenna with back electronics.

04. Expected Results / Deliverables

Major deliverable in this programme is the design and development of flat panel beam steerable antenna system as per SAC requirements.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/362

Development of In-Situ Gas Sensor in Visible and IR Range

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02 Objective

To develop gas sensor operating in visible and IR range for in-situ measurements of atmospheric gases.

03. Scope

- Design and development of a gas sensor operating in visible and IR range.
- Development of algorithm for gaseous concentration estimation.

04. Expected Results / Deliverables

The proposed sensor will significantly help in in-situ measurements of gaseous concentration for environmental monitoring and also have potential usage in human space programme.

Deliverables are design, prototype model and gaseous concentration retrieval techniques and algorithms. A full-fledged working instrument with capability of accurate gaseous concentration measurements is expected at the completion of project.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/363

Development of Multi-Spectral Polarimeter Sensor for Aerosol Measurement

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02 Objective

Design and development of a multi-spectral polarimeter sensor for aerosol measurement.

03. Scope

- Design and development of a multi-spectral polarimeter sensor.
- Development of algorithm for aerosol retrieval.

04. Expected Results / Deliverables

The proposed sensor will significantly help in in-situ measurements of AOD to enable vicarious calibration of imaging satellites.

Deliverables are design, prototype model and gaseous concentration retrieval techniques and algorithms. A full-fledged working instrument with capability of accurate estimation of AOD is expected at the completion of project.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/364

Development of Space Grade Heat Switches

01 Mentor/s

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02 Objective

Development of mechanical and magneto resistive (MR) heat switches.

03. Scope

- Development of design and analysis code.
- Fabrication of HS.
- Experimental investigations and characterization.
- Space qualification.

04. Expected Results / Deliverables

- A Mechanical Heat Switch, which should function in temperature range of 0-100 deg C.
- A Magneto Resistive Heat Switch, which should function in temperature range of (0.5K-20K).

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/365

Development of Variable data rate CCSDS compliant Direct Digital Demodulator

01 Mentor/s

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02 Objective

The objective of this project is to develop and demonstrate variable data rate demodulator having the capability to handle high Doppler rate and drift.

The demodulator should directly down sample the incoming S band modulated signal with minimum 30 dB dynamic range. The data rate variability should be tele-commendable from

ground. The demodulator should follow the CCSDS standard for frame length, modulation and coding standard.

03. Scope

- To develop a suitable algorithm for variable data rate direct S band digital demodulator.
- Demodulator should be capable to handle high doppler rate and drift.
- Hardware demonstration of the proposed algorithm in digital hardware preferably on Xilinx Virtex 5 FPGA based digital hardware.

04. Expected Results / Deliverables

- Design of algorithms for handling high data rate doppler and doppler drift and able to handle 30 dB dynamic range.
- Xilinx Virtex 5 FPGA based direct digital demodulator board as per specifications.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/366

Development of CQD based SWIR Imaging Sensor

01 Mentor/s

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02 Objective

Primary objective of this proposal is to synthesize the high quality Colloidal Quantum Dots (CQD) having absorption spectra in SWIR (1-2 um) and subsequently fabricate the imaging sensor on commercial Silicon-Read-Out Integrated Circuit (ROIC).

03. Scope

CQD based IR imaging is the currently pursuing hot research topic and image sensors have been demonstrated at laboratory level. Advantage of CQD based IR sensors lies in selecting different materials for various wavelength bands and room temperature operation. They also got advantage in low cost chemical synthesis and processing, not requiring sophisticated equipment. High performance SWIR imaging sensors are applicable for space, medical, communication and military applications.

04. Expected Results / Deliverables

SAC will provide the characterization facilities. fabrication of imaging sensors has to be carried out in this project.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/367

Development of Si based Photonic Device Design

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02 Objective

Primary objective of this proposal is to carry out physical analysis / measurement of SAC developed Si photonics devices taking foundry specific layer stack-up of standard photonics based fabrication flow. This analysis will provide process and design parameter estimation like surface charge, sheet resistance, junction capacitance etc. Measurement values will be compared with the simulation model and subsequently TCAD based process and device design and simulations to be carrying out.

03. Scope

- Physical evaluation of Si based photonic devices developed at SAC.
- TCAD based process and device.

04. Expected Results / Deliverables

- SAC will provide test chips along with expected specification to the vendor for performing physical evaluation of device parameters. Project shall demonstrate physical evaluation results to closely match with specification values.
- Physical modelling of device with necessary fabrication process steps in TCAD with derived physical evaluation data. The outcome of the project shall also perform iterative TCAD simulations to estimate device electrical and electro-optical performance. SAC will review these results and compared with actual specifications / measured values and give final clearance.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/368

Development of space qualified vapour chamber

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02 Objective

Vapour chambers can be used as heat spreader for high heat flux devices (100-2000 W/cm^2) thermal management. This project deals with development of such vapour chambers which can operate in temperature range of -20 deg C to 100 deg C.

03. Scope

- Development of design and analysis code of vapour chamber.
- Fabrication and charging of vapour chamber.
- For improvement in its thermal performance wick surface modifications.
- Experimental investigations and characterization of vapour chamber.
- Space qualification.

04. Expected Results / Deliverables

Vapour Chamber capable of handling 100-2000 W/cm^2 heat flux in operating temperature range of -20 deg C to 100 deg C.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/369

Design and development of Perforated Plate Heat Exchanger (PPHE) for cooling of gaseous Helium by using liquid Hydrogen

01 Mentor/s

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02 Objective

Realizing the Perforated Plate Heat Exchanger.

03. Scope

a) Design and analysis of the full scale Heat exchanger to meet the following:

- Cooling of GHe from 300K to 25K.
- Flow rate : 100g/s.
- Pressure : 220 bar.

b) Design, analysis, fabrication and testing of a prototype model for technology demonstration (with same input data as that of full scale model but with a reduced flow rate @ 1g/s).

04. Expected Results / Deliverables

This developmental work is a technological demonstration of the indigenized design of Perforated Heat exchangers with very high effectiveness in heat transfer.

These Heat exchangers are of compact nature and will be ideal for launch vehicle requirements for deployment in on-board fluid circuits and also in space-constrained locations such as umbilical tower at launch pads.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/370

Development of Fluxless soldering process for Die attachment

01 Mentor/s

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02 Objective

Development of Flux less soldering process for Die attachment for realization of MMIC based modules & solder sealing of packages. The process would cater to attachment of high-power transistors.

03. Scope

- Development of Fluxless soldering process.
- Characterisation of the attachment for electrical, thermal and mechanical integrity.

04. Expected Results / Deliverables

The fluxless solder attachment shall lead to void free bond for improving reliability and performance of the die. The attachment shall be subjected to environmental tests like thermal cycling and constant acceleration for ensuring its reliability. The die attachment must be able to survive the thermo-mechanical effects of LEO and GEO environment.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/371

Design and development of Ferrite based microwave circulators & isolators

01 Mentor/s

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02 Objective

To develop ferrite-based Isolators at 8.2 GHz with bandwidth of 600 MHz, at 12.75 GHz with bandwidth of 1.5 GHz, both with isolation and return loss of 20 dB and insertion loss of 0.2 dB.

03. Scope

- Indigenization of a widely used component.
- Design can be modified to suit various centre frequency and bandwidth, thus catering to multiple requirements.

04. Expected Results / Deliverables

Isolators modules that meet functional requirements mentioned above and additional mechanical requirements for space qualifications would be the deliverables for this project.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/372

Direct bonding of Copper (DBC) to Ceramics and Thermal & Electrical Modelling of DBC Substrate

01 Mentor/s

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02 Objective

- Direct bonding of 0.2 – 0.3 mm thick Copper foil to two different Ceramic substrate materials (96% Alumina and Aluminum Nitride) of thickness 0.63mm.
- Thermal and Electrical Modelling of DBC Substrates.

03. Scope

- Development of process technology for direct bonding of copper to Alumina and Aluminum Nitride substrates and Thermal & Electrical Modelling of DBC Substrate.

04. Expected Results / Deliverables

Direct bonded copper substrates (Alumina and Aluminum Nitride) with Cu peeling strength (Cu thickness 0.3mm) ≥ 4.0 N/mm @ 50 mm/min.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/373

Development of White Conductive Thermal Control Material system

01 Mentor/s

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02 Objective

More electrically sensitive instruments increase the need of sophisticated advanced “Conductive Thermal control material system” with low absorbance, high emittance and good electrical conductivity. This proposal aims to study, develop, characterise, evaluate and qualify suitable conductive TCMS based on boron nitride nano tubes (BNNT) and boron nitride nano mesh (BNNM) systems for futuristic thermal control applications.

03. Scope

- Synthesize & development of boron nitride nano tubes (BNNT) and boron nitride nano mesh (BNNM) based pigments with suitable resin systems.
- The overall technical goal is to make a sprayable ESD conductive white conductive thermal control material.

04. Expected Results / Deliverables

- Synthesis of boron nitride nano tubes (BNNT) and boron nitride nano mesh (BNNM) based pigments.
- Identification of suitable resin system.
- Optimization of mixing proportions and making a sprayable coating material.
- Optimization of spray coating process.
- Conducting evaluation & qualification tests.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/374

Process Development for Decapsulation of electronic components for failure analysis

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02 Objective

To develop a chemical process formulation for decapsulation of epoxy encapsulated space grade electronic components such as ceramic chip resistors without affecting integrity of internal structure / interconnects.

03. Scope

- Development of unique chemical formulation process which is alternative to existing methods such as laser assisted cavitations, use of highly corrosive chemicals, mechanical flattering etc.
- Decapsulation without affecting overall integrity of failed components.
- Process should be safe, simple, economical and faster lead time to market.

04. Expected Results / Deliverables

Chemical process development for decapsulation of Epoxy encapsulted electronic components for failure analysis study is the major deliverable in this project. Approximately more than 100 components can be decapsulated per litre of various chemistry. The developed chemistry should have the following attributes.

- It can provide selective removal of epoxy based encapsulate without any residue on bare substrate.
- No chemical attack or damage to micro-interconnects during decapsulation process.
- Process enabling optical inspection and SEM analysis to identify the root cause failure of micro-interconnects in decapsulated components.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/375

Development of Metalized Carbon Composite core for CTE & Thermal Management in PCBs

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02 Objective

To fabricate a carbon composite / graphite core laminate with copper metallisation on both sides which can act as a thermal conducting mechanism while helping to control CTE variation in PCBs.

03. Scope

- Fabrication of carbon composite core laminate.
- Metalisation of copper on the laminate.
- Process optimisation for PCB fabrication.

04. Expected Results / Deliverables

- Development of thermal management product in PCBs using carbon composite/ graphite core.
- Technology for incorporation of carbon composite / graphite core into PCB fabrication process.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/376

Development of Point of Load (POL) Switching Regulator

01 Mentor/s

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02 Objective

To realise a Point of Load (POL) switching regulator to derive the required voltage at the user system. Input to POL is 3-7V and output is 1V-3.3V (settable), current up to 10A.

03. Scope

- Space satellite point of load supply for FPGAs, microcontrollers, data converters and ASICs.
- Subsystem of satellite, launch vehicle and payload.

04. Expected Results / Deliverables

- A space grade Point of Load (POL) converter with necessary features for over current, over voltage protection, under voltage lockout, sequencing and efficiency (η) > 90%.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/377

Development of Single chip core power system

01 Mentor/s

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02 Objective

Development of single chip core power system for space application.

03. Scope

- Provides power system regulation for satellites and Manned mission.
- Provides TMTC interface for power system.
- Provides protection logics for power system.
- Micro and Nano Satellites.
- For EV industries.

04. Expected Results / Deliverables

At the end of the project, we will be having a ready to fabricate design which shall meet all the standards of a space grade device. Full design document, software simulation files and working VLSI design shall be available indigenously.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/378

Development of Sliding Regulator for Battery Tied Power Bus

01 Mentor/s

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02 Objective

The battery tied bus is a popular power bus configuration used in Low Earth Orbit (LEO) spacecrafts. The battery charge regulator is responsible for battery maintenance in the battery tied power bus configuration. The Sliding Regulator (SR) for the battery tied bus is a programmable battery charge regulator operating from the spacecraft's solar array. It enables optimum charging and utilization of the battery which is a distinct advantage for nano and microsatellites. The zero input switching noise ensures excellent EMI / EMC compatibility in the spacecraft which is essential especially for sensitive payloads. The SR battery charge regulator is fully autonomous and does not require any ground intervention.

03. Scope

- Applicable for all battery tied spacecraft power bus configurations.
- Modular nature with easy capacity expansion capability renders it suitable for nano satellites to satellites requiring many kilowatts of power.

04. Expected Results / Deliverables

The expected result is the development of SR battery charge regulators of varying capacities. The miniaturized single string version weighing about 400g would delivery about 50W. Here the CC and CV values will be fixed thus simplifying the telecommand interface. The high power version will be capable of handling about 400W for a 40V power bus and 700W for a 70V power bus. The module weight will be about 1.6kg. The telecommand interface will allow variable setting of the CC and CV values. Modularity and expansion capability will be in terms of adding additional ON / OFF string control modules as per the need. Each module will handle about 1600W at 40V and 2800W at 70V.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/379

Development of Biosensors system for body vitals

01 Mentor/s

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02 Objective

Development of bio transducers and its electronics for monitoring various body vitals. This includes realization of biosensors with its signal conditioning, processing and data fusion. The system envisages a dedicated wearable machine learning module for analysis and perdition of individual health.

03. Scope

- Development of biosensors with integrated electronics.
- Expertise build-up in multi physics areas like micro-fluidics, bio analysis, low power VLSI designs, energy harvesting and machine learning methodologies.

04. Expected Results / Deliverables

- Biosensors with integrated electronics.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/380

Electromagnetic Radiation shield for CubeSat

01 Mentor/s

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02 Objective

To configure and develop an electromagnetic radiation shield for a CubeSat of 10cm x 10cm x 10cm. The primary focus is to demonstrate the capability of an electromagnetic shield to provide an effective radiation shield in outer space. The configuration of the shield including the configuration, structure, current and voltage ratings, the drive electronics for the same is in the scope of the work. Detailed modelling and simulation including the Electromagnetic simulations is also to be done for validating the design.

03. Scope

- For future missions which include long term human survivability in space.
- For advanced deep space missions.

04. Expected Results / Deliverables

Design, realisation and testing of the final shield model for radiation shielding the 10cm x 10cm x 10cm cube. The winding orientation, the electromagnetic simulation etc to be submitted to validate the design before proceeding with the realization.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/381

Development of Energy absorption system for impact / crash

01 Mentor/s

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02 Objective

Design, realization and concept demonstration of energy absorption systems for single shot operation during crash / impact. Effect of impact on the ongoing vehicle shall be minimal. Payload / passenger safety shall be the first priority.

03. Scope

- Concept generation, design and analysis.
- Testing and validating of the model.
- Primary features shall be minimisation of cost, modularity in design, easiness and adaptability for similar ground applications.

04. Expected Results / Deliverables

Final product of an energy absorption system with clean specification, totally made in India and shall be easily adapted to any similar commercial application in future is the required end result. Detailed design, analysis and testing of one proof of concept shall be made at the stipulated time.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/382

Development of Micro Thermo Electric Generator (Micro TEG)

01 Mentor/s

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02 Objective

Thermoelectric effect is the physical phenomenon of direct conversion of heat into electrical energy (Seebeck effect). The challenge of making thermoelectricity a future leader in waste heat recovery is aided by the integration of nanotechnology. Among different energy sources, thermoelectricity is currently emerging as a common and promising alternative one for the future. Thermoelectric materials have the specific capacity of converting a flow of heat into electrical energy (Seebeck effect). To extend the use of thermoelectricity, it is essential to manufacture standard thermoelectric modules of different sizes. Some of elements of type n and type p, electrically connected in series and thermally in parallel, and interposed between two ceramic

layers form a TEG stack. When a temperature gradient occurs between two junctions of such a stack, the TEG converts thermal energy into electrical energy according to the principle of the Seebeck effect. Fabrication with high figure of merit material by MEMS process will lead into efficient conversion of any waste heat into useable electricity.

03. Scope

- Waste heat energy from any system can be converted into electrical energy.
- As the heat of the human body is natural and stable, it could be used to supply some electricity very specific conditions, such as medical ones.
- On chip thermoelectric cooling by passing current through the module.
- Can be used to realize self-powered sensors and wireless sensor networks.

04. Expected Results / Deliverables

High efficient Micro TEG device is expected at the end of the project.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/383

Design, Development and Realization of High Efficiency Roller screws for Electromechanical Actuation System

01 Mentor/s

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02 Objective

Design, develop and realize the Test Roller screws as per requirement in an Actuator for rotary to linear conversion.

03. Scope

- Detailed design of Roller Screw.
- Test fixture development for various acceptance and Qualification and Environmental Tests as per VSSC requirement.
- Procurement of all necessary items for the development.
- Testing of the all the developed Proto Models.

04. Expected Results / Deliverables

- Technology development for the design and fabrication of high efficiency space grade roller screws.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/384

Design and development of Vibration Isolators using Negative Stiffness mechanism

01 Mentor/s

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02 Objective

To design and develop Negative Stiffness Vibration isolators for low frequency vibration isolation applications.

03. Scope

- Analytical modelling of the system and prediction of the performance.
- Realisation and testing.

04. Expected Results / Deliverables

- New metallic isolators as an alternative to existing isolators for Launch Vehicle applications.
- Low frequency isolations, not only for ISRO applications but also for industries where ground vibrations have to be isolated for sensitive instrument.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/385

Development of Reinforced Graphite for Throat Inserts

01 Mentor/s

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02 Objective

To develop Reinforced graphite which can function as throat inserts for solid propulsion.

03. Scope

The scope of project is as follows:

- Development of reinforced graphite having density 1.8 gm/cc.
- Testing & Characterisation to evaluate thermo-structural properties.
- Performance simulation under aero-thermal environment.
- Performance evaluation through TSM level test.

04. Expected Results / Deliverables

Development of reinforced graphite with density 1.8 g/cc which can be used as throat insert for solid rocket motors of Launch Vehicles.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/386

Development of Ultra High Precision Sub Micron Level Measurement Facility for the measurement of Coefficient of Thermal Expansion for Dimensionally Stable Composite Structures

01 Mentor/s

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02 Objective

The project is aimed at the establishment of a comprehensive Ultra High Precision Measurement Facility with Sub Micron level capability to measure the linear and angular dimension changes between critical interfaces of dimensionally stable composite structures exposed to temperature change.

03. Scope

- Conceptualization, design and realisation of metrology setup to measure sub- micron level deformation with respect to unit temperature change.
- Conceptualisation, design and realisation of thermal shroud capable of maintaining uniform temperature in the product (Within +/- 0.5 deg C).
- Integration / Installation of metrology setup with thermal chamber to measure the sub- micron level deformation with respect to unit temperature change and demonstration.

04. Expected Results / Deliverables

Establishment of Sub Micron Level CTE Measurement facility, a first of its kind in the country. The work can be extended for measurement of Coefficient of moisture expansion of hygroscopic structures and the technology can be transferred as a quality acceptance tool for various metallic material.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/387

Development of a positive head vacuum casting setup for solid propellant cartons for ultrasonic burning rate measurement system

01 Mentor/s

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02 Objective

Ultrasonic burning rate measurement system measures burning rate of solid propellant by utilizing specimens cut out from propellant carton (block). The cartons are cast from a small portion of propellant slurry cast from the main slurry using for the big motor casting. Hence it is considered that such cartons are faithful representation of the main motor propellant. The cartons cast usually in circular or rectangular containers. Casting should be done in vacuum (3-5 Torr) and the propellant slurry temperature is to be maintained at about 60 deg C by hot water circulation in order to keep the viscosity of the slurry low for free flowing during casting. For carton casting, standard facility is available in all the propellant plants, but it is noted if cartons are cast with small amount of propellant, say less than 15 kg, the height of the carton shall be small (<200 mm) and the cast slurry may not get sufficient head (compression) to settle well before releasing the vacuum. This problem can be avoided by casting bigger carton with sufficient head (>500 mm) but considerable amount of propellant is required.

Hence, the objective of the present development is to design a casting setup such that a positive head over the cast slurry can be applied with the help of a plunger at the end of casting before releasing vacuum. The standard carton casting setup is to be modified or redesigned to equip with a rotating table inside the vacuum chamber such that the table in one position, the propellant slurry can be poured into the container and after casting the table can be rotated to next position where necessary pressure can be applied over the cast slurry using a plunger. The whole operation (casting and plunger application) should done one after another under vacuum without any leak. This will ensure closure of all small pocket formed during slurry casting and good compaction and packing density is obtained.

03. Scope

- Design, realization and installation of carton casting chamber at solid propellant plants of ISRO.
- Conduct experiments on prototype and fine tune the design through burning rate and mechanical properties evaluation.

04. Expected Results / Deliverables

Realization and installation of positive head carton propellant casting setup / chamber with a provision of plunger application on cast propellant slurry before release of vacuum. The setup consists of double walled casting chamber with slurry hopper, hot water circulating system with temperature measurements, vacuum pump system with vacuum measurements and cast slurry level indication system. At the end of the project, detailed design, design drawings, sub-system requirements, detail specifications, sensors, measurement indicators and acquisition system, material specification and cost of the system can be available.

The first prototype can be indigenised with realization through industry participation, installation at VSSC propellant processing plant for experimental validation and fine tuning or improvements based on prototype results.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/388

Development of Precision Regulator

01 Mentor/s

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02 Objective

Development of indigenized precision regulator system for applications in Spacecraft modules and engine test facilities.

03. Scope

- Regulated Helium / N_2 are used in liquid propulsion systems. Regulators are used to do this process. Presently, imported makes are in use, which shall be indigenized.

04. Expected Results / Deliverables

The pressure regulators which are to be indigenized shall have the capabilities such as high accuracy, reliability, material compatibility, handling easiness and easy to mount, less weight, occupying less space, less cost and availability of spares easily.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/389

Development of Metal Ceramic Packages

01 Mentor/s

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02 Objective

To develop metal packages with ceramic feed-through for housing RF / Microwave dies / MMICs. The package should be hermetically sealable using a suitable compatible lid, which is also to be developed as part of the project.

03. Scope

- Design and development of metal ceramic packages and compatible lids (compatible for hermetic sealing) based on specifications/dimensions provided by ISRO.
- Design and development of ceramic feedthroughs that can serve as RF transitions suitable for use upto Ka band of frequencies.
- Delivery of developed prototype units to ISRO, for performance verification.

04. Expected Results / Deliverables

- Delivery of developed prototype units of metal-ceramic package to ISRO, for performance verification.
- Material details and Process Identification Documents (PIDs) of processes involved in realization of the packages.
- Hermetic Sealing and other necessary test reports.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/390

Development of Fabric reinforced rubber diaphragms

01 Mentor/s

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02 Objective

Design, development, manufacture and qualification of fabric reinforced rubber diaphragms indigenously.

03. Scope

- Identification and qualification of Fabric, rubber compound.
- Manufacturing of fabric reinforced diaphragm.
- Testing and acceptance.

04. Expected Results / Deliverables

- Developed fabric reinforced rubber diaphragms as per ISRO requirements.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/391

Development and experimental characterization of Soft seat for Thermal relief valves for Cryogenic applications

01 Mentor/s

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02 Objective

Design, development, manufacture of soft seat for thermal relief valves in Cryogenic applications.

03. Scope

- Selection of seat material for Cryogenic applications.
- Manufacturing of soft seat as per dimensions.
- Installation in the existing thermal relief valves.
- Testing and qualification.

04. Expected Results / Deliverables

- Delivery of developed soft seat for Thermal Relief Valves as per ISRO requirements.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/392

Development of Thermal Conditioning Unit (TCU)

01 Mentor/s

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02 Objective

Space environment simulation in terms of thermal and vacuum environment encountered by the spacecraft in space is simulated for testing space bound hardware. The vacuum conditions are simulated by evacuation of the enclosed space (chamber) housing the test object and thermal conditions are simulated by radiative cooling the test object through circulation of thermo-regulated nitrogen in the shrouds. The shroud, liquid nitrogen pump and blowers are connected

using loops of pressure and temperature sensors and gas flow is controlled using valves. Various designs can be used for achieving the required performance and efforts towards reducing the liquid nitrogen consumption can be made.

03. Scope

- Simulate the design of a thermal conditioning unit.
- Offer prototype paradigms for compact design with indigenously available resources.

04. Expected Results / Deliverables

- A simulation model forming the design basis of TCUs. As TCU requirement can be of different heat handling capacity and applications, this design basis should form a template for sizing of different machinery required for TCU.
- A working stand-alone system.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/393

Smart Fibers for Pressure, Temperature and Strain measurements

01 Mentor/s

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02 Objective

- To develop Fiber Bragg Grating based sensor at predefined locations in single mode optic fibre.
- To develop multiplexed FBG sensing system.
- Demonstration of measurements under harsh environments.

03. Scope

- Procurement of suitable fiber.
- Creation of FBG sensing element by UV ray technology.
- Development of hardware and software for multiplexed sensing device.

04. Expected Results / Deliverables

Complete sensing solution with a processing system to cater to all the measurement demands of test facilities and launch vehicles.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/394

Design and development of high precision three channel monopulse tracking receiver

01 Mentor/s

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02 Objective

The Objective of this development is:

- Tracking receiver, which helps in establishing auto tracking facility for ISRO launch vehicle and satellites is the most critical system used at any satellite TTC ground station. This system becomes core of any ground station used for satellite / launch vehicle tracking.
- So far most of the tracking receivers being used at different ISRO centres are imported one. With the availability of latest tracking receivers / technologies, there is a bright scope for an Indian industry to develop totally indigenous solution towards this.
- To enable Indian industry participation in design and development of the state-of the-art Tracking receiver system.
- Ensure a self-sustaining business model for Indian industry.
- Advanced technological requirement/challenges in terms of futuristic communication protocols are shared with Indian start up.
- Usage of indigenously developed tracking receiver system across all ISTRAC centres. Opening possibility of targeting world TTC segment in long run.

03. Scope

- Design of high precision 3-channel monopulse tracking receiver.
- Development of prototype system.
- Large scale production of 3-channel monopulse tracking receivers on successful validation of the prototype system at ISTRAC Ground station. The Indigenous equipment to replace the expensive bought out equipment from foreign vendors.

04. Expected Results / Deliverables

- The equipment developed should be state of the art, catering to all the ISTRAC standards.
- The architecture of the development should be scalable in terms of futuristic modulations required.
- The development should meet the defined reliability requirement.
- The equipment should conform to ISTRAC / ISRO requirement.
- Detailed inputs on the requirement will be shared in detailed at a later stage.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/395

Design and development of IF / L-band Satellite Modem

01 Mentor/s

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02 Objective

To design and manufacture satellite modems in IF and L-band frequency band.

03. Scope

- Design and development of IF Satellite modem.
- Design and development of L-band satellite modem.
- Modems should be configurable in various modes like SCPC mode, TDMA / DAMA / FDMA modes and MF-TDMA modes.

04. Expected Results / Deliverables

Once the design and development of satellite modems are carried out, and it is field tested successfully, the technology can be transferred to the industry for mass production. It can then also be exported as there are many users for all over the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/396

Design and development of Thermal Ribbon Temperature Sensor

01 Mentor/s

Patel Jaymeen Jayeshbhai
Space Application Centre, Ahmedabad, PIN 380 015
jpatel@sac.isro.gov.in

02 Objective

Indigenous Development of Profile based, fast responsive and sustainable Thermal Ribbon Temperature Sensors. These are accurate temperature sensing and fast responsive RTD type temperature Sensors.

03. Scope

- The Thermal Ribbon (coating film) development which is to be thermally sensitive, sustainable, water-proof and fast responsive.
- Profile development for minimal temperature deviation measured over the profile sensing through RTD element.

04. Expected Results / Deliverables

The developed profile and RTD sensing element are integrated with coating film for developing indigenized thermal ribbon temperature sensor which is to be capable of measuring air, liquid and surface temperature with high accuracy.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/397

Development of 16-Bit Bidirectional, 3.3 V/1.8 V Supply, Multi-Purpose Transceiver with 3 state Outputs

01 Mentor/s

Dr. Hari Shanker Gupta
Space Application Centre, Ahmedabad, PIN 380 015
hari@sac.isro.gov.in

02 Objective

Development of 54VCXH163245 device. These devices are being used as a high-speed CMOS, Schmitt trigger, 16-bit bidirectional, multi-purpose transceiver with 3state outputs. Device is widely used as an interface between a 3.3 V bus and a 1.8 V bus and vice versa in mixed 3.3 V / 1.8 V supply systems. it requires to achieves high-speed operation while maintaining the CMOS low power dissipation. All pins must have cold spare buffers to change them to high impedance when VDD is tied to ground. This IC is intended for two-way asynchronous communication between data buses. The direction of data transmission is determined by the direction pins.

03. Scope

Design, Development and testing of these devices in lab condition and qualification.

04. Expected Results / Deliverables

- Complete design details (front-end and back-end design, RC parasitic extraction related, SET simulation related parameters).
- Simulation files of all test conditions including process corners.

- Prototype devices: 25 samples.

The following details shall be provided for unlimited usage.

- Documents during various milestones.

a) Feasibility, b) trade off analysis and c) finalization of design topology, architecture and specifications for overall and sub-module level design against their requirement outlined above.

- Simulation results.
- Test reports.
- Failure / Deviation analysis reports, if any.
- Final datasheet along with packaging information.
- Feasibility study and analysis for qualification for space use.
- Test Setup detail: Package level evaluation and characterization test hardware & software.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/398

Design and development of Avionics Interface components

01 Mentor/s

Himanshu Patel
Space Application Centre, Ahmedabad, PIN 380 015
hnpatel@sac.isro.gov.in

B Saravana Kumar, saravana@sac.isro.gov.in

02 Objective

This proposal includes design and development of avionics interface transceivers for control and high speed data transfer applications. On board digital sub-systems uses various avionics interface standards like Mil-Std-1553, RS-422 / 485, LVDS, Space Wire / Space Fibre etc for communication of control (telecommand /telemetry) and high speed data transfer among multiple sub-systems.

03. Scope

Scope of work includes design and development of the following transceiver:

i. Mil-Std-1553 PHY transceiver.
ii. RS-422 / 485 transceiver.
iii. LVDS / Spacewire transceiver.
iv. Spacefibre transceiver.

04. Expected Results / Deliverables

Design document, design files and developed prototype hardware of the following:

- Mil-Std-1553 PHY transceiver.
- RS-422 / 485 transceiver.
- LVDS / Space wire transceiver.
- Space fibre transceiver.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/399

Development of Mixed-Signal Receiver ASIC

01 Mentor/s

Rajat Arora
Space Application Centre, Ahmedabad, PIN 380 015
rajatarora@sac.isro.gov.in

02 Objective

Design and development of receiver ASIC which can be used in Multiple input Size Weight and Power (SWaP) critical digital subsystems. It will cater for requirements of gain control, Analog to digital conversion, Selectable multi-rate digital down-convertor and high speed serializer.

03. Scope

- Front-end design of mixed signal ASIC.
- Back-end design of mixed signal ASIC.
- Radiation mitigation measures implementation in design.

04. Expected Results / Deliverables

GDS-II of indigenous Mixed Signal receiver ASIC.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/400

Development of silicon High voltage MOSFET for 20-40V

01 Mentor/s

B. Umapathi
Semi Conductor Laboratory, Chandigarh, PIN 160 071
uma@scl.gov.in

Amit Kumar Singh, aksingh@scl.gov.in

02 Objective

The goal of this development project is to design and develop silicon high voltage MOSFETs using TCAD for operation more than 20V.

03. Scope

This development programme involves design of high voltage NMOS and PMOS devices using TCAD, new layout design and process steps development for integration. A test chip may be layout for fabrication of these devices in SCL fab. Detailed characterization and qualification of the designed and fabricated devices will be carried out.

04. Expected Results / Deliverables

- TCAD analysis and simulated results of critical parameters such as Off-state breakdown voltage, ON resistance etc. of designed high voltage MOS.
- Test chip with high voltage devices and also structures for electrical isolation rules.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/401

Development of Lateral Insulated Gate Bipolar Transistors (IGBT)

01 Mentor/s

B.Umapathi
Semi Conductor Laboratory, Chandigarh, PIN 160 071
uma@scl.gov.in

Amit Kumar Singh, aksingh@scl.gov.in

02 Objective

To design and develop Lateral Insulated Gate Bipolar Transistors (IGBT) compatible with SCL 180nm standard CMOS process and having blocking voltage around 100V and input voltage (VCE) 5V.

03. Scope

This development programme involves design of Lateral Insulated Gate Bipolar Transistors (IGBT) compatible using for its integration in SCL baseline process. TCAD simulations are needed for initial process and device design for subsequent wafer trails of device development such as test chip layout, engineering fabrication, electrical characterisation etc.

04. Expected Results / Deliverables

- TCAD analysis and simulated results of critical parameters such as Off-state breakdown voltage, ON resistance etc. of designed IGBT.
- Test chip with IGBT DUT of different dimensions for detailed characterization.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/402

Development and Fabrication of electronic transmitter for O_2, H_2 & N_2H_4 gas sensor

01 Mentor/s

V. Kannan
Satish Dhawan Space Centre, Sriharikota, PIN 524 124
kannan@shar.gov.in

02 Objective

Indigenous design and development of O_2, H_2, and N_2H_4 gas sensors along with the electronic transmitters.

03. Scope

Design, development, fabrication, testing and qualification of gas detection sensor for hydrazine, oxygen and hydrogen along with transmitter for signal conditioning and interfacing.

04. Expected Results / Deliverables

Fully qualified and tested sensors along with the transmitter units need to be delivered along with all the documents.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/403

Development of Ka-band RF Connectors

01 Mentor/s

Kumar Sangam
U R Rao Satellite Centre, Bengaluru, PIN 560 017
ksangam@ursc.gov.in

02 Objective

To develop Ka-band RF Connectors, as per the specifications given by URSC, for qualification & subsequent use in flight modules.

03. Scope

- Design of RF connectors.
- Fabrication and characterisation of RF connectors.

04. Expected Results / Deliverables

Ka-band RF Connector qualified for use in future spacecrafts.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/404

Development of MMIC Packages for Space applications

01 Mentor/s

Srinivasaro Bollu
U R Rao Satellite Centre, Bengaluru, PIN 560 017
sbollu@ursc.gov.in

02 Objective

Indigenous design and development of MMIC Packages meeting the Space quality requirements.

03. Scope

- Electromagnetic simulation of QFN type MMIC package over given range of microwave frequencies.
- Fabrication and characterisation of the packages.

04. Expected Results / Deliverables

- Electromagnetically simulated design.
- MMIC packages meeting the space quality requirements.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/405

High Switching Frequency DC-DC converters using GaN device

01 Mentor/s

Anju Singh
U R Rao Satellite Centre, Bengaluru, PIN 560 017
singh@ursc.gov.in

Anup Kumar Agarwal, aka@ursc.gov.in

02 Objective

Simulation model of miniaturized DC-DC converter with higher switching frequency (1MHz) and single / multiple outputs suitable for space applications.

03. Scope

- To simulate the working design of DC-DC converter and carry out the study of various input parameters and various environmental conditions.

04. Expected Results / Deliverables

- Working simulation model of a general DC-DC converter using GaN technology. A portion of circuit can be fabricated as ASIC in any foundry.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/406

Design and Development of a Personal Hygiene Management System (PHMS) as a payload for space habitats

01 Mentor

K.G.Vinod
Human Space Flight Centre, Bengaluru PIN 560 094
kgvinod-hsfc@isro.gov.in

02 Objective

Personal hygiene management system is a multifunctional system used primarily to collect and process crew biological waste. The objective of the project is to develop a system with following functions:

- Collection of solid as well as liquid body waste in the form of faeces and urine for 7 days, 3-crew mission in microgravity condition.
- Processing of body waste either by anti-bacterial treatment (by adding some anti-bacterial agent to prevent the further growth of bacteria in it) or by chemical degradation (by converting the solid waste into stable compound by adding chemical reagent) or by storage in air tight container with proper handling devices.
- The system shall operate with a minimum power (< 40 W) requirement with a provision to manually operate in case of power failure and should have minimum mass and volume budget.
- The design shall be unisex and modular with a provision to fit into different types of space crafts.
- The system should be designed to withstand various environmental loads encountered during launch like vibration, acoustics, acceleration, shock etc. Loads will be provided later.

03. Scope

- To develop a Personal hygiene management system (PHMS).
- Testing and qualification of the system and to deliver as a qualified payload for launch.
- To make a flight ready model in 2 years.

04. Expected Results / Deliverables

A completely tested, qualified and operational waste management system for operation on-board a spacecraft should be delivered to ISRO.

Indigenization of critical technologies can be achieved by this project like:

i. Water collection and entrapment technology in microgravity using foam.
ii. Power efficient waste management system with less maintenance.
iii. Waste management solution with less / no water.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/407

Design and Development of LNA, LNBC & VSAT Antenna

01 Mentors

Hridesh Kumar
Master Control Facility, Hassan PIN 573 201
hridesh@mcf.gov.in

Madhura Bhanu Teja, bhanu23@mcf.gov.in

02 Objective

To design and manufacture LNA, LNBC & VSAT Antenna for various microwave frequency bands such as L, S, C, Ku and Ka which are commonly useful for satellite communication. Currently, these products are procured from foreign vendors. This product development will enable indigenization of the above-mentioned products and development of relevant industry. These products are not only utilized by the various ISRO centres such as MCF, ISTRAC, SAC, URSC but also by a number of service providers such as DTH, DSNG, VSAT users like financial institutions, ATM networks etc.

03. Scope

Design and manufacture of LNA, LNBC & VSAT Antenna.

04. Expected Results / Deliverables

The deliverables are of LNA, LNBC & VSAT Antenna, which can be utilized by the ISRO and other government and private industry working in the field of satellite communication and using the space segment.

Once the design and development are carried out, and the component is field tested successfully, the technology can be transferred to the industry for mass production. It can then also be exported as there are many users for it throughout the world.

युक्ति-संचिता YUKTI-Sanchita 2021: YS/PD-IP/408

3D printed PCBs Manufacturing System

01 Mentor

Ajay Kumar
Space Applications Centre, Ahmedabad PIN 380 015
ajay@sac.isro.gov.in

02 Objective

For the miniaturisation of the electronic sub systems, MLBs and HDI PCBs are being used. Fabrication time for MLBs and HDI are in weeks, hence new developmental activity and prototyping will take longer time. 3D printed PCBs has a promising feature for the quick prototype applications / new design development i.e. by using 3D printed technology, 10 layer MLB will be ready in half day and 20-30 layer MLB in a day, 50 layer MLB and HDI are also realised. 3D printed PCB is realized by simultaneous deposition dielectric and conductive nano particles using Ink-jet piezoelectric 3D printing technology and hence produces complex boards in short time.

03. Scope

- Identification / development of base material and equipment suitable for 3D PCB printing.
- Development of input methods for loading CAD designs.
- Development of component assembly.

04. Expected Results / Deliverables

- A prototype machine for printing PCB.
- Base materials and source for same.
- Technology document.

General Instructions

1. युक्ति-संचिता YUKTI–Sanchita 2021 comprises of the Product Development / Innovative Project proposal identified by DOS / ISRO Centre / Lab / Unit on the basis of upcoming programmatic requirements of Indian Space Programme. Each project proposal comprises of a brief write-up about the topic for the faculty of the academic Institutions to select and prepare the proposals.
2. An individual or group(s) of faculty members affiliated to any academic institution are eligible for submitting the proposals through the respective S-TIC / RAC-S Coordinator of their region.
3. The general Life Cycle of an approved proposal is provided in the Flow Chart.
4. The Principal Investigator (PI) must be a regular employee of the concerned institution. PI shall preferably be a domain expert in the area to which the proposal belongs.
5. There shall be at least one co-PI/s from the same / different institution(s) working on the proposal. The satisfactory completion of the project will be the responsibility of the PI and the institution involved.
6. It is mandatory to have at least one permanent faculty member from the host Institution hosting the Space Technology Incubation Centre / Regional Academic Centre for Space in the team of PI / co-PI for a particular proposal.
7. A Product Development / Innovative Project proposal shall have a single PI as a team leader for the project. However, there is no maximum limit of number of co-PI or students working on the proposal.
8. One PI can take up a single project proposal of युक्ति-संचिता YUKTI –Sanchita 2021 at a particular time. However, he/she can be the co-PI for multiple proposals.
9. The age limit for the PI is below 65 years (sixty-five) that includes the project completion period.
10. The prospective PI may interact with mentors from DOS/ISRO Centre through e-mail for clarification regarding requirement and approach towards the proposal and prepare the detailed PD / IP proposal as per prescribed format in Annexure–A and shall submit to the respective S-TIC / RAC-S of their region.
11. After review of proposal from host S-TIC/RAC-S, the same shall be submitted at originating DOS / ISRO Centre / Lab/ Unit for further review.
12. After the review of the proposal at DOS/ISRO Centre / Lab / Unit, the reviewed and finalised proposal shall be forwarded by Centre level S-TIC / RAC-S coordinator to CBPO / ISRO-HQ for final review by the competent Committee. The submitted proposal will be subjected to critical evaluation by the DOS / ISRO experts. The proposal will be evaluated on the basis of novelty, methodology, approach, experience of the PI in the subject area, duration of the project, budget etc.
13. The last date for submitting the proposal under “युक्ति-संचिता YUKTI–Sanchita 2021” is April 30, 2021.
14. CBPO, ISRO HQ can directly be contacted for the proposals classified as suitable for indigenisation through industrial collaboration and Start-ups.

Flow Chart: Life Cycle of Product Development / Innovative Project proposals

युक्ति-संचिता - YUKTI - Sanchita 2021

↓

Selection of suitable proposals by the prospective Principal Investigator (PI) from the Academia, based on their interest, expertise and facilities available at their Institute.

↓

A co-PI/s must be there for every proposal.

↓

Contact the respective mentor/s from DOS/ISRO, through e-mail and understand the objective and expected deliverables in detail, for the selected proposal.

↓

Please mark a copy of your email to the Institute S-TIC / RAC-S coordinator of your respective region, while contacting DOS/ISRO mentor/s

↓

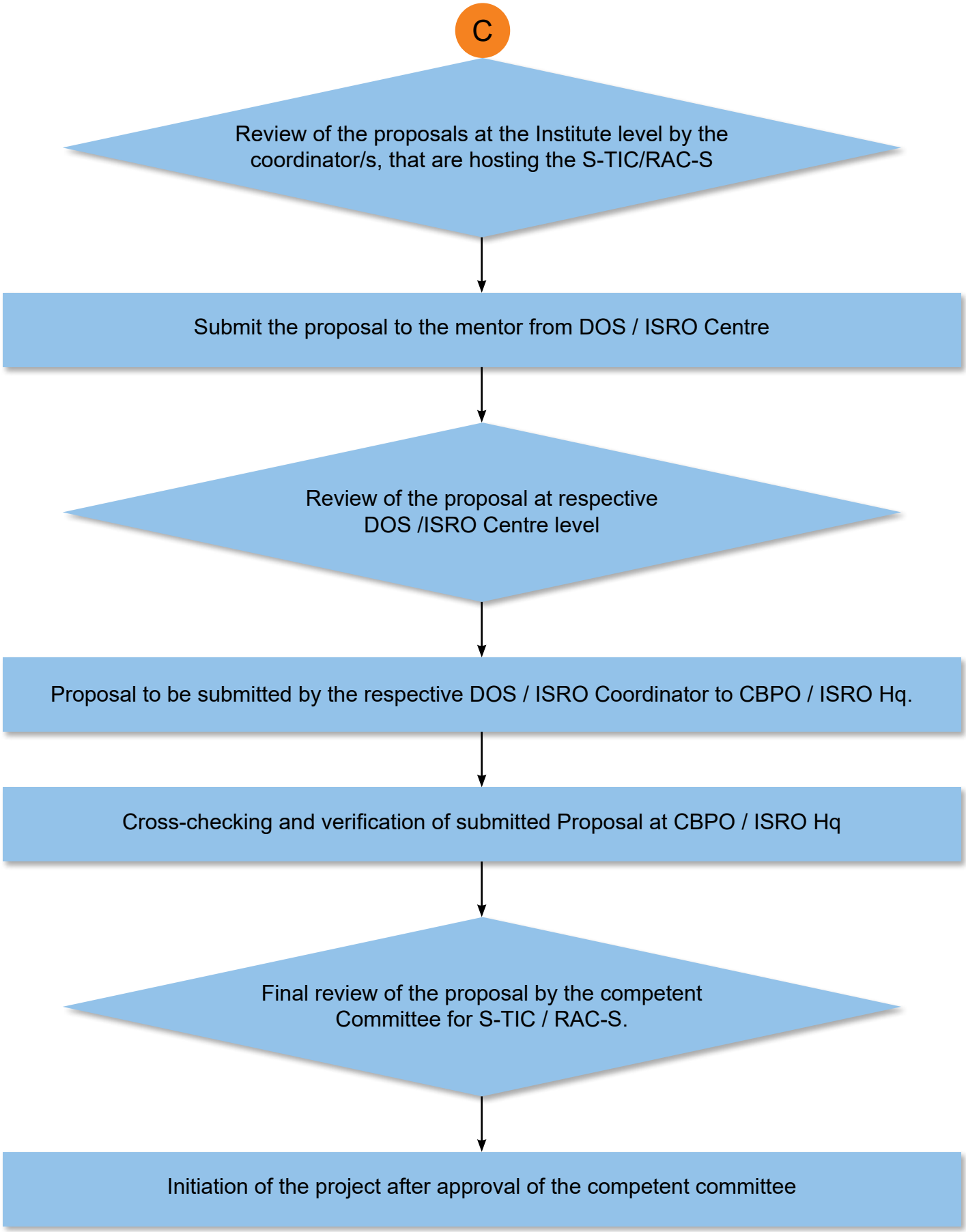
Prepare a detailed proposal as per the prescribed format in Annexure-A, in coordination and consultation with mentor/s from DOS/ISRO.

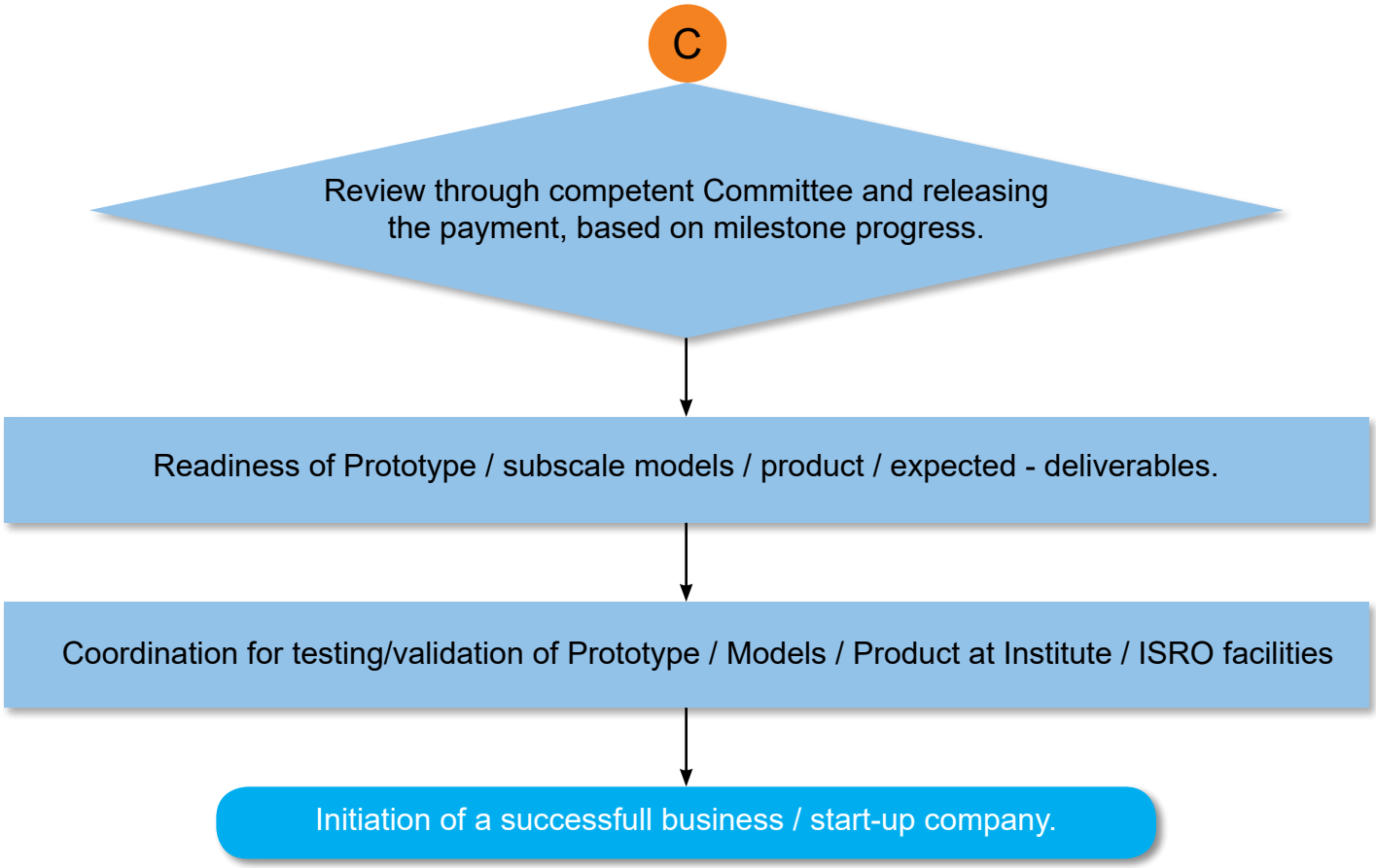
↓

There should be specific mention of 4 milestones - that describes the specific targets towards the progress / completion and requirement of the funds, for the proposal.

↓

The PI should submit the proposal to the respective S-TIC /RAC-S Coordinator at the Institute level


C
Review of the proposals at the Institute level by the coordinator/s, that are hosting the S-TIC/RAC-S
Submit the proposal to the mentor from DOS / ISRO Centre
Review of the proposal at respective DOS /ISRO Centre level
Proposal to be submitted by the respective DOS / ISRO Coordinator to CBPO / ISRO Hq.
Cross-checking and verification of submitted Proposal at CBPO / ISRO Hq
Final review of the proposal by the competent Committee for S-TIC / RAC-S.
Initiation of the project after approval of the competent committee


C
Review through competent Committee and releasing the payment, based on milestone progress.
Readiness of Prototype / subscale models / product / expected - deliverables.
Coordination for testing/validation of Prototype / Models / Product at Institute / ISRO facilities
Initiation of a successfull business / start-up company.

Annexure-A

PR No. YS/PD-IP/2021/....

A Project Proposal

On

[Title of the Proposal]

In collaboration with

Space Technology Incubation Centre (S-TIC), Concerned Institute /

Regional Academic Centre for Space (RAC-S), Concerned Institute

Month Year

Group / Division

Centre / Laboratory / Unit Name

Indian Space Research Organisation

Department of Space

A Project Proposal

On

[Title of the Proposal]

In collaboration with

Space Technology Incubation Centre (S-TIC), Concerned Institute / Regional Academic Centre for Space (RAC-S), Concerned Institute

	Name, Designation	Signature	Date
Prepared by	Principal Investigator Name Designation Department & Institution Phone number and e-mail		
	co-Principal Investigator/s Name Designation Department & Institution Phone number and e-mail (Add more number of rows in case of more than one co- PI)		
	Mentor/s from DOS/ISRO Name Designation Division, Entity & Centre Phone number and e-mail (Add more number of rows in case of more than one mentor)		
Reviewed by	S-TIC / RAC-S Coordinator, Concerned Institute		
	S-TIC /RAC-S Coordinator, Concerned DOS/ ISRO Centre		
	S-TIC / RAC-S Coordinator, CBPO, ISRO Hq.		
Approved by	Co–Chairperson, JMC, S-TIC/ JPMC, RAC-S		
	Chairperson, JMC, S-TIC/ JPMC, RAC-S		

Contents

1.	**PD/IP Proposal Code**	**YS/PD-IP/2021/ ...**
2.	**Title of the Proposal**	
3.	**Detail of students working for this project**	Detail of students (including roll number, course & department, e-mail and contact number shall be mentioned).
4.	**Scope**	Scope of the project in 2 to 4 bulleted point shall be mentioned.
5.	**Objectives**	A brief definition of the objectives and their scientific, technical and economic importance.
6.	**Scientific / Technical Need Aspect with respect to Indian Space Programme**	Linkages to current and futuristic Indian Space Programme shall be mentioned.
7.	**Brief summary of basic literature survey for relevant execution of project**	A summary of latest work being carried out in the field and the present state-of-art of the subject with references shall be provided.
8.	**Brief outline of the project including envisaged approach / methodology**	A clear description of the concepts to be used in the development/ investigation should be given. Details of the method and procedures for carrying out the development / investigation with necessary instrumentation and expected time schedules should be included. All supporting studies necessary for the investigation should be identified. The necessary information of any collaborative arrangement, if existing with other investigators for such studies, should be furnished.
9.	**Available Institutional facilities**	Facilities such as equipment / software etc. available at the parent Institution for proposed execution of project should be listed.
10.	**Expected supports / facilities requirements from ISRO side for execution of project**	Supports required for experimentation, validation, testing of the prototype and any other support in limited manner from ISRO side shall be listed.
11.	**Expected Deliverables / Outcomes**	Deliverables / envisaged outcome of the project shall be clearly mentioned in bulleted points.
12.	**Project Duration**	The maximum duration of the project is two years. The duration has to be duly justified.
13.	**Budget detail**	The detail of budget required with breakup and justification shall be provided. The maximum cap of contingency and travel is ₹50,000/- and ₹1,50,000/- respectively for a project duration of two years.

<table>
<tr><td>14.</td><td>Milestone and fund requirements.</td><td>All the activities related to the completion of the proposal and providing the expected deliverables / outcomes, shall be distributed within 4 milestones.
Each milestone shall include all the activities for every 6 months for 2 years duration project, and 3 months for 1 year duration project.
The fund required to achieve the particular milestone shall be mentioned accordingly.
<table>
<tr><td>Milestone no.</td><td>Milestone</td><td>Fund required to complete the milestone</td><td>Justification for the fund required with particular milestone</td></tr>
<tr><td>1(1st half of 1st year)</td><td></td><td></td><td></td></tr>
<tr><td>2 (2nd half of 1st year)</td><td></td><td></td><td></td></tr>
<tr><td>3 (1st half of 2nd year)</td><td></td><td></td><td></td></tr>
<tr><td>4 (2nd half of 2nd year)</td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>15.</td><td>Whether the same or similar proposal has been submitted to other funding agencies viz. any Autonomous Body / R&D Institution / State Government / Central Government.
If Yes, please provide details of the Institution & status of the proposal.</td><td>YES/ NO</td></tr>
<tr><td>16.</td><td>The societal application part of the outcome of this project.</td><td>Applicable to the project envisaged for Space Technology Incubation Centre only.</td></tr>
<tr><td>17.</td><td>Product / Service marketability including start-up / business potential</td><td>Applicable to the project envisaged for Space Technology Incubation Centre only.
The start-up potential / business model envisaged on the outcome of the project / product shall be preferably detailed in quantitative term.</td></tr>
<tr><td>18.</td><td>Describe how it will help students to become future entrepreneurs.</td><td>Applicable to the project envisaged for Space Technology Incubation Centre only.</td></tr>
<tr><td>19.</td><td>Other details (if any)</td><td></td></tr>
<tr><td colspan="3">The brief Biodata of the PI & Co-PI/s in the enclosed format “Form A” shall be submitted along with the proposal report.</td></tr>
</table>

Form A

Biodata of the Investigator(s)

(Biodata for **all the Investigators** should be given, each on a separate sheet)

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 (Only the journal papers to be listed)	
8.	Email id and Telephone number of PI with STD Code	
9.	Email id of the Head of the academic institution	

Annexure-B

S-TIC Coordinators from Centre / Lab / Unit of DOS / ISRO

A soft copy of the reviewed proposal from host S-TIC shall be sent to respective S-TIC Coordinator at Centre / Lab / Unit of DOS/ISRO with a copy to CBPO / ISRO HQ.

Sl. No	ISRO/DOS Centre	Name & Designation	E-mail detail
1	VSSC	Sri V. T. Robin Vikram Sarabhai Space Centre, ISRO PO Thiruvananthapuram :695 022	vt_robin@vssc.gov.in
2	SAC	Dr. Parul Patel Space Applications Centre Ambavadi Vistar PO Ahmedabad: 380 015	parul@sac.isro.gov.in, research_sac@sac.isro.gov.in
3	URSC	Sri Basavaraj.S Akkimaradi U R Rao Satellite Centre HAL Airport Road Vimanpura PO Bengaluru: 560 017	basu@ursc.gov.in
4	NRSC	Dr. Rajashree V. Bothale National Remote Sensing Centre, Hyderabad: 500 037	rajashree_vb@nrsc.gov.in
5	LPSC	Sri Ajith S Liquid Propulsion Systems Centre, Valiamala PO Thiruvananthapuram: 695 547	s_ajit@lpsc.gov.in
6	IPRC	Sri Nagarajan C ISRO Propulsion Complex Magendragiri Thirunelveli dist. 627 133	nagarajan.c@iprc.gov.in
7	PRL	Prof. R D Deshpande Physical Research Laboratory Navrangpura, Ahmedabad 380 009	desh@prl.res.in
8	SDSC SHAR	Sri Gopi Krishna P Satish Dhawan Space Centre 524 124 Sriharikota, Andhra Pradesh	gopi@shar.gov.in
9	SCL	Sri Sudhir Thakur Semiconductor Laboratory Sector 72, SAS Nagar – 160 071 (Near Chandigarh) Punjab	sudhir@scl.gov.in

10	IISU	Sri K S Nandhakumar ISRO Inertial System Unit (IISU), Vattiyoorkavu PO Thiruvananthapuram: 695 013 Kerala	ks_nandhakumar@vssc.gov.in
11	IIRS	Dr. Vandita Srivastava Indian Institute of Remote Sensing, 4 Kalidas Road Dehradun - 248 001 Uttarakhand	vandita@iirs.gov.in
12	NESAC	Dr. Shyam S Kundu North Eastern Space Application Centre, Umiam 793 103 Meghalaya	ss.kundu@nesac.gov.in
13	NARL	Dr. T. V. C. Sarma National Atmospheric Research Laboratory Gadanki-517 112, Pakala Mandal, Chittoor District, Andhra Pradesh	tvcsarma@narl.gov.in
14	ISTRAC	Dr. Brinda V ISRO Telemetry Tracking and Command Network , Plot No. 12 & 13, 3rd Main, 2nd phase Peenya Industrial Area Bengaluru – 560 058	v_brinda@istrac.gov.in
15	LEOS	Dr. Rafiqul Islam Laboratory for Electro-Optics Systems (LEOS) First Cross, First Phase Peenya Industrial Estate Bengaluru – 560 058	rafiq@leos.gov.in
16	MCF	Sri Prakash Achar Master Control Facility (MCF) PB No. 66, Salagame road Hassan - 573 201	prakashachar@mcf.gov.in
17	HSFC	Ms. Ramya V. Human Space Flight Centre, ISRO-HQ Campus, New Bel Road, Bengaluru – 560 094	ramya-hsfc@isro.gov.in
18	ISRO HQ	Sri Nishant Kumar ISRO-Headquarters, Antariksh Bhavan, New Bel Road, Bengaluru – 560 094	nishantkumar@isro.gov.in

Annexure-C

RAC-S Coordinators from Centre / Lab / Unit of DOS / ISRO

A soft copy of the reviewed proposal from host RAC-S shall be sent to respective RAC-S Coordinator at Centre / Lab / Unit of DOS / ISRO with a copy to CBPO / ISRO HQ.

Sl. No	ISRO/DOS Centre	Name & Designation	E-mail detail
1	VSSC	Sri S Sridharan Vikram Sarabhai Space Centre, ISRO PO Thiruvananthapuram :695 022	s_sridharan@vssc.gov.in
2	SAC	Dr. Parul Patel Space Applications Centre Ambavadi Vistar PO Ahmedabad: 380 015	parul@sac.isro.gov.in research_sac@sac.isro.gov.in
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9	SCL	Sri Ashwani Kr. Tuknayat Semiconductor Laboratory Sector 72, SAS Nagar – 160 071 (Near Chandigarh) Punjab	gh_ppg@scl.gov.in
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14	ISTRAC	Dr. Brinda V ISRO Telemetry Tracking and Command Network , Plot No. 12 & 13, 3rd Main, 2nd phase Peenya Industrial Area Bengaluru – 560 058	v_brinda@istrac.gov.in
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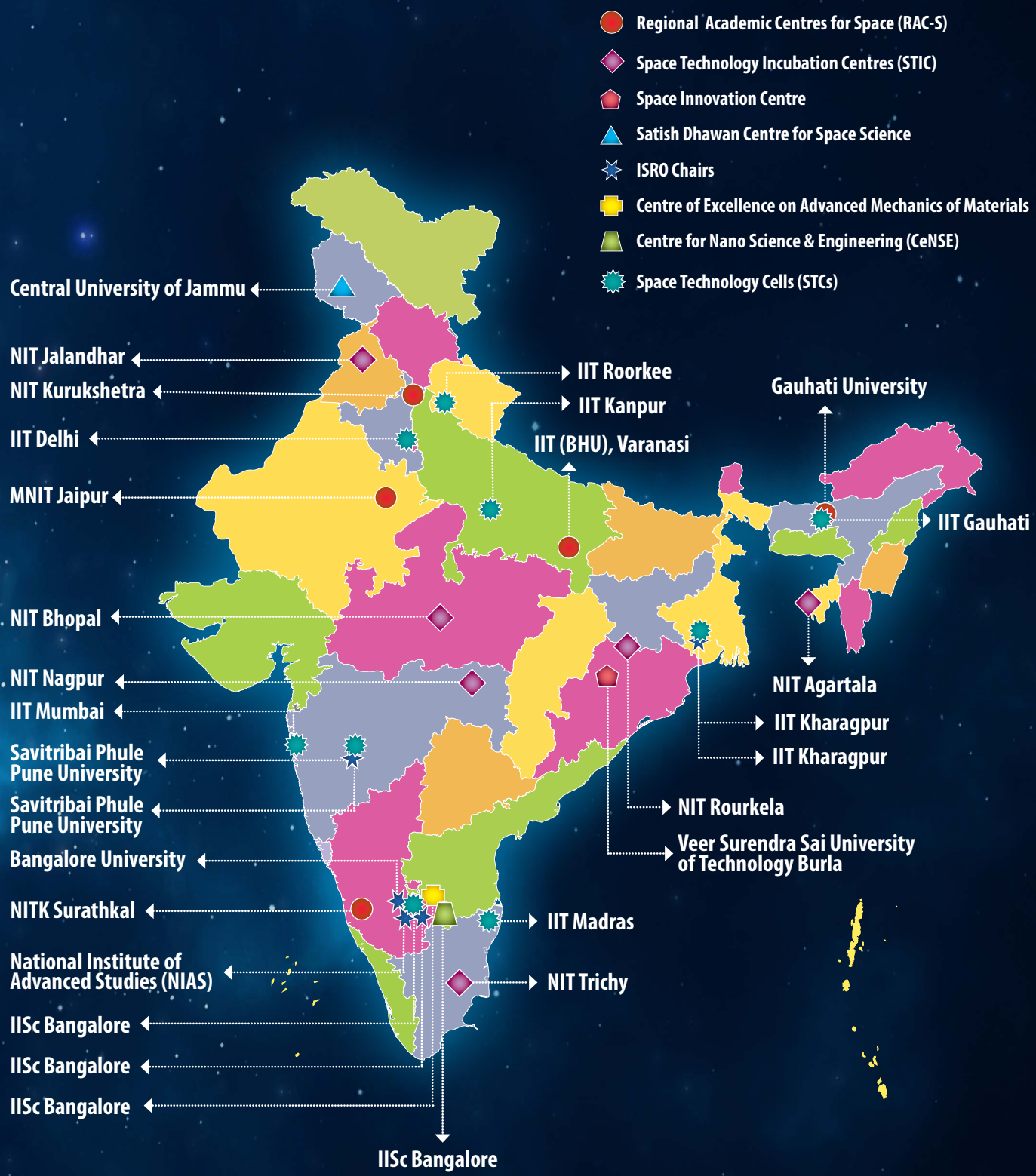
16	HSFC	Ms. Ramya V. Human Space Flight Centre, ISRO-HQ Campus, New Bel Road, Bengaluru – 560 094	ramya-hsfc@isro.gov.in



क्षमता निर्माण कार्यक्रम कार्यालय
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