

**Ongoing Projects under Space Technology Cells
(As of July 2023)**

IISc Bangalore

Sl. No.	Title of the Project
1.	Understanding the role of microstructural anisotropy on high temperature properties in additively manufactured Ni based IN718 superalloy
2.	Measurement and modelling of wall pressure spectra in turbulent boundary layers subjected to pressure gradient and protuberances
3.	Computational discovery of catalysts and mechanisms for selective electrochemical CO ₂ reduction to CH ₄
4.	Multiwavelength investigation of WIMP Dark Matter in dSph galaxies
5.	Development of a locomotion controller for a legged rover for planetary exploration
6.	Graphene van der Waals heterostructure based field effect transistor for gas emission monitoring
7.	Large area flexible metasurface based photonic devices
8.	Unsupervised semantic segmentation of high resolution satellite images
9.	Photon pair generation in hybrid metasurfaces of two-dimensional material - Dielectric sub-wavelength structures for quantum applications
10.	Generation and characterisation of entangled microwave photon states using a Josephson Parametric Converter
11.	Production of oxygen and hydrocarbons from the martian atmosphere for returning vehicles
12.	Irradiation-effects on Al alloys for space Applications
13.	Probing photon correlations in femtosecond laser-written photonic lattices
14.	Vibration isolation using bandgap metamaterials
15.	Improving the spatial resolution of GRACE TWS for India using remote sensing datasets and modeling approach
16.	Super-compatible shape memory alloy slender structures for space applications

Sl. No.	Title of the Project
17.	Photosynthetic stress detection by Fourier hyperspectral imaging with incoherent light
18.	Resuable aerogel from industrial waste for dual application in high efficiency HCL absorption and acoustic suppression
19.	Modified BMT ceramic for high-power space applications
20.	Near-future forecasting of transient weather phenomena using dynamic mode decomposition
21.	Microbial Anaylsis in Space (MANAS)

IIT Bombay

Sl. No.	Title of the Project
1.	Visible-NIR Electromagnetic Wave Concentration using Metallic Aperture for Photodetectors
2.	Development of a high-speed LVDS transmitter and receiver in SCL 180 nm CMOS technology.
3.	Development of a NIR laser based platform for emulating single event effects on integrated circuits due to radiation strikes
4.	Magnetogenesis: Linking Fundamental Physics and Astro-Physics
5.	Modelling of Water Quality Parameters for Coastal and Inland Water Bodies using Data from Multispectral and Hyperspectral Imaging Systems
6.	Launch vehicle base heating prediction due to reversed flow and nozzle wall ablation
7.	Modeling and Mapping of Supraglacial Debris Cover Thickness using UAS and Satellite Remote Sensing Data in selected Glaciers of Western Himalaya
8.	Simulations of Hypervelocity impact of bulk metallic Glasses for Spacecraft Shielding Applications
9.	Compton imaging in hard x-ray : A proposal to demonstrate the feasibility of using Compton imaging Techniques at hard x-ray energies
10.	Development of Numerical Model to Study the Condensation Heat Transfer and Pressure Drop in Millimeter-scale Tubes under Different Gravity Levels
11.	Development of wearable –nanotechnology based pressure/strain and physiological sensors for space-crew health monitoring
12.	Thermo-mechanical modeling and simulation of Laser-assisted Machining of Ti-alloys

Sl. No.	Title of the Project
13.	Metal Oxide/MOF/Graphene-based flexible asymmetric super capacitors for space applications
14.	Jet noise field for a supersonic under-expanded Jet Area-Vibro-Acoustics
15.	Novel Deep Learning Techniques based Multi-Modal Fusion for Remote Sensing Image Classification and Retrieval
16.	A Membrane-based Water Recycling System (MWRS) for Space Exploration
17.	Micro Aircraft for Mars-2 Development of Unmanned Aerial Vehicle (UAV) which can fly using solar power
18.	Numerical and Experimental Investigation of PEMFC Considering Hydrogen Crossover and Analysis of Degradation Mechanisms
19.	Mechanical and microstructure characterization under biaxial loading of aerospace materials and their weldments (AA2219/M250) for pressure vessel application
20.	CFD based design, development and demon- stration of a micro-channel reactor for Sabatier reaction for methane synthesis from carbondioxide
21.	Distributed spacecraft formation flight using limited information exchange
22.	Development of Bimetallic Cylinders through Friction Welding Route with suitable Inter layers
23.	Microstructure Property Correlation of Precipitation Hardenable Stainless Steels used in liquid propulsion applications.
24.	Development of whole field experimental technique for the coupled flow and heat transfer measurements in cryogenic two-phase systems.
25.	Skin friction measurement in hypersonic flows
26.	Self-immolative Polymer Backbones derived from Dialdehydes and Degrading Spacer units for Transient Electronics
27.	A Machine Learning Approach to Estimate Atomic and Molecular Properties Accurately for Space Applications

IIT Kanpur

Sl. No.	Title of the Project
1.	Phase-field modelling of microstructure evolution in Ti-6 Al -4V alloy during annealing.
2.	Investigation of Combustion Characteristics of Carbon Coated Aluminium Nanoparticles

Sl. No.	Title of the Project
3.	Experimental identification of laminar to turbulent transition and separation locations using in-house made temperature sensitive paint in wings and launch vehicles
4.	Synthesis of pure LaB6 via solid state metallothermic reduction (Ca/Mg/Al + B2O3 + La2O3/LaCl3) and subsequent making of hollow tube of LaB6
5.	SPIRIT: A Post-Processing System for NavIC Signals for High-Precision Applications
6.	RTE-optical-tomography based mixed-phase cloud parameter retrieval
7.	Development of a coupled machine learning based approach for origami inspired deployable multi-functional metamaterials
8.	Effect of lensing phenomenon on doped fiber for high power lasers

IIT Kharagpur

Sl. No.	Title of the Project
1.	Design of SET Tolerant High-Speed Transceiver for Chip to Chip Backplane interconnect
2.	Development of Nano-structured CoNiCrAlY Bond Coat by HVOF Spraying for Thermal Barrier Coating Application
3.	Design, analysis and development of Nozzle Protection System (NPS) for sea level testing of CE20 engine with A/R 100
4.	Analysis of rocket propulsion test data using data fusion Techniques
5.	Tectonic modeling and spectro-mineral characterization of the Nagaland-Manipur Ophiolite Belt rocks using petrological studies integrated with imaging spectroscopy and spectral transformation of multi-sensor satellite data- Phase-II
6.	Improved Protocols, Techniques and Algorithms for Inter Planetary Networks-Phase II
7.	Design and Development of Substrate Integrated Waveguide (SIW) based Bandpass Filters
8.	Radiation Tolerant All Digital Wide-Tuning Range Fractional- N Phase-Locked Loop
9.	Direct ink 3D printing of SiC ceramic nanoparticles on complex space components
10.	Accuracy Estimation of INSAT-3D/-3DR Ozone, Temperature and Water Vapour Measurements: Application for AIR-Sea Interaction Studies

Sl. No.	Title of the Project
11.	Characterization, vaporization and combustion dynamics of gel-fuel and gel-nano-fuel droplets
12.	Development of technology for forming tailor welded blanks of C103 sheets
13.	Development of SDSS tools for addressing emergency/disaster management
14.	Design and Implementation of an efficient power management IC in sub-micron Technology for Space Application
15.	Development of Nano-polishing technology for Nickel plated and CVD SiC Hybrid Mirrors
16.	Quantum Resistant Cryptographic Protocols for Cloud Computing
17.	Improvement of temporal resolution (~weekly to daily) of Sentinel-1 based high spatial resolution surface soil moisture estimates
18.	Numerical investigation of the effect of fuel injection scheme on the performance of SCRAM jet combustor
19.	Control algorithm for high power PEM fuel cell systems
20.	Determination of marine ecosystem health in BoB using physical biogeochemical models and ANN
21.	Fabrication and Modelling of a hybrid composite antenna Reflector
22.	Development of High Performance GNSS-INS Integration Scheme for Accurate Navigation and It's Implementation in Embedded Platform
23.	Identification of reusable economic indicators using enhanced satellite imagery and multi-modal multi tasking deep learning method
24.	Mixed-Signal ASIC for NavIC Receiver

IIT Madras

Sl. No.	Title of the Project
1.	A Lagrangian framework to define the spatio-temporal requirements of measurement of ocean surface currents from space-borne sensors
2.	Computational modeling of combustion instability in an oxidizer –rich staged cycle using LOX and kerosene
3.	Wind and Sea-swell spectral data assimilation to improve wind and wave prediction using satellite data

Sl. No.	Title of the Project
4.	Experimental study of flame Spread Under Convection in Micro-Gravity
5.	Experimental and computational study of microstructure evolution, residual stresses and mechanical properties in laser additive manufacturing of Ti alloys for launch vehicles
6.	Investigations on the effect of back pressure fluctuations on shock boundary layer interactions in isolator
7.	Aerosol- Cloud- precipitation interaction: A missing link between cloud droplet to rain droplet formation
8.	High Performance Computing (HPC) architecture for Autonomous Space Systems
9.	Development of Boron based ternary MAB phase material for thermal control in spacecrafts
10.	Thermo-mechanical response of polymer matrix composites under high heating rates
11.	Physics-based AI-ML models for predicting crop yield at different space-time scales
12.	Uncertainty Quantification of Turbulence Models through eigenspace perturbations of Reynolds stresses
13.	Optical characterization and detection of micro/macro plastics in oceanic waters using volume scattering function experiments and remote sensing techniques
14.	Dissociative Ionization and photo detachment of interstellar molecules and chiral anions
15.	Development of low temperature gas generator for filling CMUS inflatable floats
16.	Extension of ISRO Flow Solver PRAVAHA to Flows Involving Chemical and Vibrational Non equilibrium
17.	Optimization of the post-build heat treatment schedule to achieve balanced high-temperature mechanical properties while mitigating mechanical anisotropy in additively manufactured Inconel 718
18.	Development of therapeutic strategies to mitigate oxidative stress and cytoskeletal damage in astronauts for the Gaganyaan space mission

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

Sl. No.	Title of the Project
1.	Fabrication of a small satellite for monitoring radiations in different orbits of outer atmosphere where orbit maneuvering will be controlled by solar sail

Sl. No.	Title of the Project
2.	An investigation of tropical mesospheric echoes: causative mechanisms and application to study mesospheric turbulence
3.	Development of Optical Disdrometer
4.	Effects of simulated microgravity on expression profile of microRNA in human cardiomyocytes
5.	Applications of plasmonic nanoshapes in hybrid flexible solar cells
6.	Estimation of inter laminar transverse shear stresses in sandwiched structure using a higher order shear and normal deformation theory
7.	Effects of altered gravity on gene expression of Human Blood Mononuclear Cells and bone cell with special reference Immunity and differentiation
8.	Development of anti-erosion coatings on polymers for Low Earth Orbit Space applications
9.	Development of Nano- polishing technology for metal mirrors
10.	Synthesis and Characterization of Si based nanomaterials for lithium ion cells
11.	Design of accurate & efficient machine learning autonomous algorithm for guidance & navigation of space landing mission
12.	Fusion of thermal and optical image features in classification of space objects to identify debris using deep learning
13.	Simultaneous Generation of Hydrogen as a Fuel and Photoreduction of CO ₂ by Boron Nitride and its Composites
14.	Investigation of Physical and Electrochemical Properties of Phosphonium Based Ionic Liquids for Energy Applications
15.	Trends in the Glacier Recessions from Kanchenjunga National Park (India and Nepal): Studies based on Spatio-temporal variability and Paleoclimate signatures

IIT Roorkee

Sl. No.	Title of the Project
1.	Design and fabrication of MEMs structure for vibration sensing and energy harvesting
2.	A PDSOI (Partially Depleted Silicon -On Insulator) Analogy Cell Library Consisting 2 Stage OPAMPs and comparators designed considering Floating Body (FB) and Self Heating (SH) Effects
3.	Fracture and Fatigue studies in textile based auxetic composite

Sl. No.	Title of the Project
4.	Deployment Mechanisms for 12m Diameter Spacecraft Antennas
5.	Dynamic modelling and simulations of human body subjected to mechanical loads during spaceflight and operations in space
6.	High Efficiency solar Cells Characterization Using Intensity Modulated Impedance Spectroscopy Analysis for space Application
7.	Development of cast components in high entropy alloys
8.	Heteroatoms enriched nonporous materials for high performance super capacitor applications in non-aqueous medium
9.	Novel processing to enhance ductility of cast AZ91 Mg alloy
10.	Development of Oxide Dispersion Strengthened (ODS) Nickel based super alloys by powder forging
11.	Development of 1.8/5V/10V/20V I/O pads in SCL's 0.18 μ m CMOS Process
12.	RF system-on-chip solution of Tri-band- for the IRNSS using CMOS/BICMOS Process
13.	Affordable Submillimeter/THz Components Using 3D Printed Dielectric Integrated Guides
14.	Water Security Assessment At The River Basin Level Using The Water Footprint Concepts
15.	Advanced Nanocomposite- Polymeric Membranes For Conversion Of Wastewater Into Potable Water And Revitalization Of Air In Space
16.	Development of super thermal insulating material (AEROGEL) based flexible blanket system for the inter- planetary missions with gaseous convective environments
17.	Development of solid electrolytes for high voltage and high energy density Li and Na-ion batteries
18.	Experimental and numerical analysis of light weight nanocomposites for static and dynamic loading
19.	Landslide monitoring, forecasting and mitigation system
20.	Computer Tomography (CT) Based Algorithm for Non-Destructive Quality Assessment of Ceramic Joints of the components used in Space applications
21.	Interlinked seasonal evolution of supraglacial lakes and ice velocity changes of glaciers in Greenland
22.	Development of a web- based GLOF information system. An integrated approach for quantifying flood hazards over Safed Lake, Uttarakhand
23.	Experimental and theoretical study of yield surface, stretch formability and edge stretching capability of Aluminium Lithium

Sl. No.	Title of the Project
	Alloy (AA 2195 alloy)
24.	Development of forest phenology model using Near Surface (PhenoCamand UAV) and Satellite Remote Sensing Data in Western Himalayan region
25.	Design of Ridge and Gap Waveguide-based Millimeter Wave Slotted Antenna Array
26.	Optimising the Mechanical Properties of 0.3 CrMoV steel flow formed sheet through texture and microstructure control
27.	Development of a design -through-analysis isogeometric module in FEAST: Towards structural analysis and optimization

IIT Guwahati

Sl. No.	Title of the Project
1.	Plasmonic metamaterials based filters for photonic application in space
2.	Development of low loss Ni-Zn ferrite for high power circulators
3.	Development of transparent polyfluorinated polyimide films for space applications
4.	Online Diagnosis of Shock Induced damage in Future Reusable Launch Vehicles(RLV)
5.	Design and development of efficient toolpath strategies for precision high-speed machining of monolithic thin-walled structures for construction of light-weight satellites and spacecrafts.
6.	Development of finite element model for coupled thermo-mechanical analysis of shape memory alloy actuated structure for space application
7.	Development of Photon Monte Carlo Code for Estimating gas Radiation for Interplanetary Entry Missions

IIT Delhi

Sl. No.	Title of the Project
1.	Establishing a Couple Indian Land Data Assimilation System (ILDAS) for identifying hydrologic extremes
2.	Classical Trajectory – Monte Carlo Simulations of the Plasma dynamics in electrode-less plasma thruster

Sl. No.	Title of the Project
3.	Low-Pressure Systems (LPSs) and their nonlinear interaction with other scales in atmosphere through the lens of Scale Energetics
4.	Analysis of variable stiffness composite honeycomb sandwich structures with embedded delamination
5.	Real-Time Flood Risk Warning Smart System Integrating Information from Satellite and Sensor Products
6.	Impact of satellite observations in a coupled system for predicting storm tides and its coastal inundation.
7.	Development of a Numerical Simulator for Micro-fabricated Electrospray Thrusters
8.	Designing Speciality Glasses Employing Machine Learning and Meta-Heuristic Optimization
9.	Microwave photonic devices for Space Applications
10.	Development of Signal Processing Chip for GNSS Anti-jamming Functionality
11.	Prediction of formability and failure of aerospace alloys subjected to large strains in metal forming processes using advanced material models in finite element simulation
12.	Novel interfacial- chemistry for the Glass- electrolytes to enable Highly-reversible and Long-life room temperature Sodium-Sulfur Battery
13.	Study of Atmospheric Carbon dioxide and Methane variabilities using Satellite data and atmospheric chemistry transport model over the Indian Sub-continent