

**Ongoing Projects under Space Technology Cells
(As of November 2021)**

IISc Bangalore

Sl. No.	Title of the Project
1.	Oxygen reduction reaction catalyst development for fuel cells using in situ Spectroscopy
2.	Multispectral and UAV image fusion by image Super-resolution using General Adversarial Network (GAN) Deep learning archit
3.	Leak Detection Tapes for Hydrogen Pipelines
4.	Shear banding dynamics in structural alloys under impact loading
5.	Synthesis of smart multifunctional nano-composites for corrosion sensing, proprotection and inhibition of metallic structures
6.	Development of Fast Response Cryogenic Temperature Sensors using Graphene nanocomposites for Aerospace Applications
7.	Tetrazole-based metal-organic hybrid and covalent assemblies as CO ₂ absorbents
8.	Nano-scale sensors for wall-shear-stress measurements through induced heat transfer in hypersonic flows
9.	Acoustic emission characterization of friction stir welded joints in aluminium alloy AA2219 used for aerospace applications
10.	Experimental investigation of supercritical injection and mixing of propellants at liquid rocket engine relevant conditions
11.	Edge-aware interpolation for terrestrial 3-D maps
12.	Fast equalization of batter stack by soft-switched multi-cell to multi-cell balancing
13.	Quality assessment of pansharpned images
14.	Design of high performance piezoceramics using relaxor ferroelectrics
15.	Photosynthetic stress detection through phase-stabilized Fourier transform spectrometers with single cell detection sensitivity
16.	Optimization of the production and separation of Dimetheyl ether for its use as green propellant
17.	Estimation of vulnerable soil-carbon and hotspots of carbon-efflux across different land-use in India: Development of soil

Sl. No.	Title of the Project
	respiration model using satellite remote sensing and in situ measurements
18.	Superresolution of hyperspectral remote sensing images
19.	High precision satellite image denoising in hardware
20.	Development of graphene-CNT-BN based hybrid polymer composites as efficient thermal interface materials
21.	Mechanics and materials related reliability of advanced microelectronic devices: Effect of sample length-scale on microstructural evolution and mechanical behaviour of Pb-free Sn-rich miniaturized solder joints
22.	Understanding the role of microstructural anisotropy on high temperature properties in additively manufactured Ni based IN718 superalloy
23.	Optimization of heat treatment and characterization of superalloys
24.	Exploration of NaSICON frameworks as cathodes for Ca-batteries using first-principles
25.	Investigation of sloshing induced pressure fall in LH2 and LOX tanks of cryogenic propulsion stage (C25) during flight
26.	Optimization of a ternary green propellant composition for space thrusters
27.	Measurement and modelling of wall pressure spectra in turbulent boundary layers subjected to pressure gradient and protuberances
28.	Highly sensitive IR detection using photogating by electrically defined quantum dot
29.	On the transfer of thermally unstable energetic molecules to gas phase using electrospray
30.	Computational discovery of catalysts and mechanisms for selective electrochemical CO ₂ reduction to CH ₄
31.	Multiwavelength investigation of WIMP Dark Matter in dSph galaxies
32.	Development of a locomotion controller for a legged rover for planetary exploration
33.	Research and development of MoS ₂ Quantum Dots based non-contact temperature sensor for applications in Indian Space Research programs
34.	Graphene van der Waals heterostructure based field effect transistor for gas emission monitoring
35.	Large area flexible metasurface based photonic devices

IIT Bombay

Sl. No.	Title of the Project
1.	A Comprehensive Mapping of Flood Risk in Changing Climate : An Application to Jagatsinghpur District, Orissa
2.	Visible-NIR Electromagnetic Wave Concentration using Metallic Aperture for Photodetectors
3.	Growth and Characterization of AlGaIn/GaN Heterostructure by Plasma Assisted Molecular Beam Epitaxy Technique for High Mobility
4.	Microstructural modeling of aerospace titanium alloys during hot working
5.	Experimental Measurements and Theoretical modeling of Deformed Microstructures and Work Hardening Responses in Selected Aluminum Alloys
6.	Investigation of flow separation mitigation techniques under hypersonic shock wave boundary layer interactions for scramjet engine applications
7.	Development of a high-speed LVDS transmitter and receiver in SCL 180 nm CMOS technology.
8.	Development of a NIR laser based platform for emulating single event effects on integrated circuits due to radiation strikes
9.	Magnetogenesis: Linking Fundamental Physics and Astro-Physics
10.	Modelling of Water Quality Parameters for Coastal and Inland Water Bodies using Data from Multispectral and Hyperspectral Imaging Systems
11.	Development of a Structural Health Monitoring System for Condition Assessment of Large Composite Sandwich Panels Using Ultrasonic Guided Wave Technique
12.	Discrete mechanics and optimal control applied to reentry vehicles
13.	Understanding the interaction between transportation systems and landuse in Mumbai Metropolitan Region using satellite data
14.	Microstructural engineering in Niobium alloys for enhanced performance and Materials Science
15.	Mapping flood risk in data poor regions enforcing combined geomorphic and socio-economic indicators: An application to Jagatsinghpur District, Odisha
16.	Launch vehicle base heating prediction due to reversed flow and nozzle wall ablation
17.	Multi-Disciplinary Design Optimization Study of LTA Systems for Venus Exploration

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18.	Delayed cracking in maraging steel weldments: Material characterization and FE modeling Principle
19.	Physio-chemical conditions of formation of bole beds within Deccan basalt for Martian analogue
20.	A flood warning system for entire India-optimal utilization of satellite-based data and development of a computationally efficient flood-inundation model
21.	Comprehensive Simulation Engine for Type-II Superlattice based Barrier Infrared Photodetectors
22.	Modeling and Validation of Evapotranspiration from India Space Borne Thermal Sensors
23.	Modeling and Mapping of Supraglacial Debris Cover Thickness using UAS and Satellite Remote Sensing Data in selected Glaciers of Western Himalaya
24.	Simulations of Hypervelocity impact of bulk metallic Glasses for Spacecraft Shielding Applications
25.	Compton imaging in hard x-ray : A proposal to demonstrate the feasibility of using Compton imaging Techniques at hard x-ray energies
26.	Development of Numerical Model to Study the Condensation Heat Transfer and Pressure Drop in Millimeter-scale Tubes under Different Gravity Levels
27.	Effect of Acoustics on the Characteristics of Swirl Coaxial Atomizer
28.	Development of a 3D-DSMC code for simulation of rocket engine exhaust with lunar dust
29.	Development of wearable –nanotechnology based pressure/strain and physiological sensors for space-crew health monitoring
30.	Thermo-mechanical modeling and simulation of Laser-assisted Machining of Ti-alloys
31.	Metal Oxide/MOF/Graphene-based flexible asymmetric super capacitors for space applications
32.	Jet noise field for a supersonic under-expanded Jet Area-Vibro-Acoustics
33.	Novel Deep Learning Techniques based Multi-Modal Fusion for Remote Sensing Image Classification and Retrieval
34.	A Membrane-based Water Recycling System (MWRS) for Space Exploration
35.	Micro Aircraft for Mars-2 Development of Unmanned Aerial Vehicle (UAV) which can fly using solar power
36.	Numerical and Experimental Investigation of PEMFC Considering Hydrogen Crossover and Analysis of Degradation Mechanisms
37.	Mechanical and microstructure characterization under biaxial loading of aerospace materials and their weldments

Sl. No.	Title of the Project
	(AA2219/M250) for pressure vessel application
38.	CFD based design, development and demon- stration of a micro-channel reactor for Sabatier reaction for methane synthesis from carbondioxide
39.	Distributed spacecraft formation flight using limited information exchange
40.	Ignition Modelling of Semi Cryogenic Engine
41.	Development of Bimetallic Cylinders through Friction Welding Route with suitable Inter layers

IIT Kanpur

Sl. No.	Title of the Project
1.	Development of Controlled Expansion (CE) Al-Si alloys by packed rolling.
2.	Microstructural and Mechanical Characterization of High- Silicon Stainless Steel.
3.	Gigahertz and Terahertz antenna on photonic crystal substrate
4.	PDK Development and modeling support for ISRO's GaN HEMT Technology.
5.	Development of novel thermoelectric power generator for waste heat recovery in space.
6.	Impact Melt Cover on Central Peaks of Lunar Impact Craters: Evaluating its Implications for Deriving Sub-Surface Mineralogy using data from Chandrayaan-1 & other recent lunar missions
7.	Optical characterization of wetlands from Earth Observations.
8.	Parallel Electro-Magnetic Solver for Microwave, Infrared, and Optical applications (MIO-PEMS)
9.	Numerical Study of Flow-Thermal Response of a High-Speed Vehicle with Ablative/Non-ablative Thermal Protection System.
10.	Microstructure and Texture Analysis of Hot Forged Ti-6Al-4V Alloy.
11.	Integrating Lithium Oxychloride Based Solid State Electrolytes with Carbon Encapsulated Si/Ge Anodes and Li-Excess NMC Cathodes for Advanced Lithium Ion Batteries.
12.	Molecular size and mass sensitive Ultrasensitive Thermal Spectrometer Application.
13.	Stabilization of a 3D Platform for Space Applications Against Rolling and Pitching Excitations
14.	Characterization and Modeling of Membranes for Inflatable Space Structures
15.	Numerical and Experimental Framework for Laser Based Additive Manufacturing of High-Performance Aerospace Parts of Inconel 718 and Ti Alloys.
16.	Development of Product Based on High Entropy Alloys for Space Technology Applications
17.	Experimental and numerical investigation of aerospike nozzles for effective propulsion systems
18.	Conformal, Transparent and Lightweight Microwave Absorbers for Ground and Space Applications
19.	Development of Evaluation of Multiscale CNT/polymer composites

Sl. No.	Title of the Project
20.	Synthesis and Characterization Al-B and Al-B ₄ C alloys as Fuel in Solid Propellant
21.	Hydrogen Storage and Delivery System Based on inexpensive Industrially Scalable Hybrids
22.	Investigation of optical properties of metallic thin films mirrors by low energy plasma (ion) irradiation for space applications
23.	Investigation of near and far field acoustics due to the jet impingement on the flame deflector during rocket lift-off
24.	Development of Reconfigurable flat-panel Metasurface Antenna-Phase I
25.	Brazing of Ultra High Temperature HfB ₂ -ZrB ₂ Based Ceramics
26.	Phase-field modelling of microstructure evolution in Ti-6 Al -4V alloy during annealing.
27.	Development of solid electrolyte for sodium-sulfur battery.
28.	Investigation of Combustion Characteristics of Carbon Coated Aluminium Nanoparticles
29.	Experimental Investigation of Leading Edge Bluntness on Heat Transfer Rate and Flow Unsteadiness in Shock-Induced Boundary Layer Separation in a Scramjet Intake
30.	Experimental identification of laminar to turbulent transition and separation locations using in-house made temperature sensitive paint in wings and launch vehicles
31.	Synthesis of pure LaB ₆ via solid state metallothermic reduction (Ca/Mg/Al + B ₂ O ₃ + La ₂ O ₃ /LaCl ₃) and subsequent making of hollow tube of LaB ₆
32.	Biomechanical Aspects of Plant and Root Growth in Microgravity Environments
33.	SPIRIT: A Post-Processing System for NavIC Signals for High-Precision Applications
34.	Forward Error Control (FEC) Schemes for High Data Rate Optical Communications
35.	RTE-optical-tomography based mixed-phase cloud parameter retrieval
36.	Development of a coupled machine learning based approach for origami inspired deployable multi-functional metamaterials
37.	Effect of lensing phenomenon on doped fiber for high power lasers

IIT Kharagpur

Sl. No.	Title of the Project
1.	Design and development of perforated plate heat exchangers for cooling of gaseous helium by using liquid hydrogen
2.	Assessment and implementation of complex image co-registration and phase unwrapping and Wavelet Based Phase Noise Reduction for interferometric SAR processing
3.	Design and Development of Closed-Loop MEMS Capacitive Accelerometer
4.	Exploration of vertical soil moisture profile by assimilating the surface soil moisture data retrieved from remotely sensed SAR data
5.	Shoreline change Analysis along Andaman and Nicobar Islands: Implication for Coral Conservation
6.	Targeted Evaporative Cooling of Hot Spots using Patterned Surfaces
7.	Development of forest health monitoring model based on Hyperion Data for Geo-Environmental Impact management in the Iron ore Mining Belts of Saranda Forest, Jharkhand
8.	Design of SET Tolerant High-Speed Transceiver for Chip to Chip Backplane interconnect
9.	Development of Nano-structured CoNiCrAlY Bond Coat by HVOF Spraying for Thermal Barrier Coating Application
10.	Hands-free Gesture Control for Immersive Image navigation (Phase-II)
11.	Establishment of Quantum Communication Link for Space Application
12.	Development of novel multi-oxide in-situ thermal barrier coating for high temperature oxidation resistance using thermal spray and self-propagating high-temperature synthesis (SHS) technique
13.	Uncertainty quantification on Textile Composites (3D)
14.	Two Phase Mechanically Pumped Fluid Loop (MPFL) with micro channel based evaporator for application to high power communication spacecraft, interplanetary mission and human space mission
15.	Theoretical and Experimental Studies on flow characteristics during Change-over of flow from Start-up tank to run tank during liquid Rocket Engine Testing
16.	Design, analysis and development of Nozzle Protection System (NPS) for sea level testing of CE20 engine with A/R 100
17.	Thermo-Structural analysis of 16" diameter, 130m long Liquid Oxygen pipeline during chilldown process

Sl. No.	Title of the Project
18.	Studies on establishment of collapse factor for pressurizing cryogenic liquid at different operable conditions for Ground tests of Cryogenic rocket engines
19.	Analysis of rocket propulsion test data using data fusion Techniques
20.	A Kalman Filter-Based Multi-Constellation GNSS Integrity Monitor
21.	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
22.	Development of Multi-stage Deep Drawing Set-up and Estimation of Formability of Cu-(0.5-0.8%)Cr-0.05%Ti-0.05%Zr alloy Sheets for Space Applications
23.	Development of software tool for multi-and hyperspectral data processing of earth science data for integration of spatio-spectral information for mineral identification and mapping using Deep learning neural network and Graph-cut based method
24.	Design and implementation of Fault Attack Resilient Encryption for Secure Communication
25.	Improved Protocols, Techniques and Algorithms for Inter Planetary Networks-Phase II
26.	Design and Development of Substrate Integrated Waveguide (SIW) based Bandpass Filters
27.	Radiation Tolerant All Digital Wide-Tuning Range Fractional- N Phase-Locked Loop
28.	Direct ink 3D printing of SiC ceramic nanoparticles on complex space components
29.	Accuracy Estimation of INSAT-3D/-3DR Ozone, Temperature and Water Vapour Measurements: Application for AIR-Sea Interaction Studies
30.	Characterization, vaporization and combustion dynamics of gel-fuel and gel-nano-fuel droplets
31.	Development of technology for forming tailor welded blanks of C103 sheets
32.	Development of SDSS tools for addressing emergency/disaster management
33.	Design and Implementation of an efficient power management IC in sub-micron Technology for Space Application
34.	Development of Nano-polishing technology for Nickel plated and CVD SiC Hybrid Mirrors
35.	Quantum Resistant Cryptographic Protocols for Cloud Computing
36.	Improvement of temporal resolution (~weekly to daily) of Sentinel-1 based high spatial resolution surface soil moisture estimates

Sl. No.	Title of the Project
37.	Numerical investigation of the effect of fuel injection scheme on the performance of SCRAM jet combustor

IIT Madras

Sl. No.	Title of the Project
1.	16 bit 5MS/S analog to digital converter
2.	Experimental Investigation of Ageing Related issues in composite solid propellants
3.	Development of Silicon Bicomos Technology for RF Applications
4.	Development of Rotocraft UAV for Operation in Martian Atmosphere
5.	Development Of Large Area (100cm ²) Organic-inorganic Hybrid Perovskite Solar Cells
6.	Design And Development Of An Advanced Carbon Fiber 3d Printable Printer
7.	A Non-linear Viscoelastic Constitutive Model For Solid Propellants And Studies On Effects Of Voids
8.	Energy - Efficient & Wide - Range 15mb/s-1.5gb/s Serdes
9.	Design And Development Of SPDT RF MEMS Switches For Ku Band Applications
10.	Development Of A Mixed Refrigerant J-t Cryocooler
11.	Numerical Study Of Performance Of Inducer And Pump Used In Cryogenic Engines Under Cavitating And Non-cavitating Conditions
12.	Estimation of thermal load due to mixing in 10T Vertical Mixer
13.	Experimental study of Combustion in Space Environment
14.	Miniaturized wideband analog phase modulator using phase looked loop
15.	Relation between pathogenic bio-aerosal and biotic stresses of crop – A case study for yellow rust fungus of wheat
16.	Feasibility studies and preliminary aerodynamic design of autorotation based venus descent system
17.	Development of Solid Propellant based low temperature gas generator for inflatable aerodynamic decelerator
18.	Meso-microporous core-shell carbon based materials and electroactive diluent for long cycle life and high energy density Li-S batteries
19.	Polymer derived Zr-B-C based Rare Earth Containing High Temperature Resistant Coatings for Space Applications
20.	A Lagrangian framework to define the spatio-temporal requirements of measurement of ocean surface currents from

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	space-borne sensors
21.	Analysis of passive recirculation system for LOX feed line of Semicryo stage
22.	Computational modeling of combustion instability in an oxidizer –rich staged cycle using LOX and kerosene
23.	Wind and Sea-swell spectral data assimilation to improve wind and wave prediction using satellite data
24.	Experimental study of flame Spread Under Convection in Micro-Gravity
25.	Smoke Characterization of Flaming and Smouldering materials in Micro-Gravity
26.	Experimental and computational study of microstructure evolution, residual stresses and mechanical properties in laser additive manufacturing of Ti alloys for launch vehicles
27.	Modelling of process parameters for 3D printing
28.	Synthesis and Characterization of Hexagonal Boron Nitride Ceramic Aerogels as Thermal Insulation Layer for Future Space Missions
29.	Investigations on the effect of back pressure fluctuations on shock boundary layer interactions in isolator
30.	Aerosol- Cloud- precipitation interaction: A missing link between cloud droplet to rain droplet formation
31.	High Performance Computing (HPC) architecture for Autonomous Space Systems
32.	Development of Boron based ternary MAB phase material for thermal control in spacecrafts

**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
2.	Design and development of work function measurement set up and its use to measure work function of thrusters
3.	Development of aluminium nitride and alumina based ceramics for high temperature electrical insulation
4.	Development of an NDT technique for through thickness measurement of non uniform residual stresses in metallic materials
5.	An investigation of tropical mesospheric echoes: causative mechanisms and application to study mesospheric turbulence
6.	Development of Optical Disdrometer
7.	Effects of simulated microgravity on expression profile of microRNA in human cardiomyocytes
8.	Applications of plasmonic nanoshapes in hybrid flexible solar cells
9.	Estimation of inter laminar transverse shear stresses in sandwiched structure using a higher order shear and normal deformation theory
10.	Data driven modeling of morphology and formation of impact craters in Basalt : A case study of Lonar
11.	Ab initio study of thermal properties of transition metal ceramics for thermal barrier coating
12.	Effects of altered gravity on gene expression of Human Blood Mononuclear Cells and bone cell with special reference Immunity and differentiation
13.	Development of anti-erosion coatings on polymers for Low Earth Orbit Space applications
14.	Process Development and Optimization of Novel Electro Discharge Machining variants for machining of super alloys (Titanium Ti6Al4V, Inconel 600/718, Haynes 25, Molybdenum, Columbium 103)
15.	Development of Nano- polishing technology for metal mirrors
16.	Synthesis and Characterization of Si based nanomaterials for lithium ion cells
17.	Design of accurate & efficient machine learning autonomous algorithm for guidance & navigation of space landing mission
18.	Fusion of thermal and optical image features in classification of space objects to identify debris using deep learning

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
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

IIT Guwahati

Sl. No.	Title of the Project
1.	Near real time urban flood forecasting framework based on satellite precipitation data
2.	Plasmonic metamaterials based filters for photonic application in space
3.	Development of low loss NI-Zn ferrite for high power circulators
4.	Development of transparent polyfluorinated polyimide films for space applications
5.	Online Diagnosis of Shock Induced damage in Future Reusable Launch Vehicles(RLV)
6.	Study of accretion ejection mechanisms around black hole X-ray binaries in the AstroSat era

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
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