“To explore the Lunar Habitability through the harnessing of Lunar Energy.”

1. Short Description of the Project:

I envisage to carry out investigations of planetary habitability, articulating the Space Scientific investigations related to human exploration and with humans on Earth in reduced and normal gravity environment through the harnessing of Lunar-Mass-Energy, controlling the diurnal temperature-variation, exploration of water, plantation using plant catalysts and detoxification of Lunar toxins.

The Lunar Habitability would be explored through the study of Morphological and Dynamical properties of the Lunar Environment, by making use hypothetically derived ‘Goswami-Einstein Lunar Mass-Energy Equation (GEL)’. It aims to study climate dynamics of the Lunar Environment, Lunar air-land interaction, Physical/chemical processes of the Lunar atmospheric phenomena and related environmental issues like Lunar climate change, in order to develop forecasting techniques of severe weather phenomena over the Lunar surface along with Teleconnection of Lunar South Pole-to-Lunar North Pole Weather processes and exploration of Water for the future Lunar inhabitants.

Sun is hot with core temperature of 6000 degrees C) & Moon is Cold with temperature of (-233 Celsius), at night, (123 Celsius) during the day. Because the Moon has no atmosphere to block some of the Sun's rays or to help trap heat at night. The efforts are to draw plausible correlations of Lunar Energy and its dynamics with the few parameters e .g Diurnal variation of Lunar temperature(Lt),Lunar phases(L p),Lunar angles (La) i.e (degrees away from the Sun by making use of ‘GEL(Goswami-Einstein-Lunar mass-Energy)Equation’ and develop ‘Lunar Energy Habitability (LEH)-Model’

Since, the Estimated Composition (particles per cubic cm) of the tenuous lunar atmosphere contains Toxic Gases viz. Methane (CH_4) – 1000 & Carbon Dioxide (CO_2) apart from non-toxic gases viz. Trace Oxygen (O^+), Hydrogen (H_2) - 35,000, Ammonia – 1000 and the inert gases along with Possible Phosphorus (P^+), Sodium (Na^+), Magnesium (Mg^+).Hence ,the escape of Lunar Gases through Detoxification of Lunar Toxic Gases (LTG) would help to explore life on the Moon by making its atmosphere more livable by enhancing the Oxygen content, diminishing Methane, Carbon dioxide, controlling ‘Day Lunar Warming(DLW)‘Night Lunar Cooling(NLC)& harnessing Lunar, Solar, Planetary energy, to create water & minerals through catalytic chemical processes.It aims to use LRO & ‘CHADRAYAN-2/3’) data; to study formation of O_3, Lunar (Energetics, Radiation, dust grains, exosphere, ionosphere), solar storms and human activities through Lunar –Mass-Energy Equation) in order to get Moon inhabited.To find formation of O_3 in the atmosphere due to the series of complex photo chemical reactions energized by Moonlight & REDOX (Reduction-Oxidation to covert available Lunar Non-Toxic Gases (LNG) to plausible Oxygen & Water. The results of these investigation may be used for future Mars planet as well as other planetary systems to explore the possibility of life.

2.Introduction, Relevance to Previous Work & Methodology.

Space usually is said to begin about 100 miles above the earth. The space between the Earth and Moon is called Cislunar space (cis means on this side and lunar means of the Moon. As the Moon is approached through cislunar

space, Earth's gravity becomes weaker, and moon's gravity becomes stronger. The combined gravities of the Earth and Moon are effective to about a million's miles from the earth. Space to this distance is sometimes called trans lunar space. Space between the planets is called interplanetary space. The Cis -lunar space=10,000 miles. Moon = 100,000 miles & Trans lunar space= 1000,000 miles.

The Moon is a largest planetary satellite orbiting Earth. with Gravity: 1.62 m/s², Escape velocity: 2.38 km/s, and Age: 4.53 billion years. The moon is a sphere (Radius: 1,737.1 km), and it takes 27 days (orbital period) to rotate on its axis and in 27.3 days to travel once around Earth, showing always the same face without single "dark side" of the moon. As the moon revolves around Earth, it is illuminated from varying angles by the reflected sunlight (from the Earth). There seems to be correlation of the Earth processes with the processes on the Moon and both are interlinked with gravitational forces and tidal interactions. The tidal forces slowed down the earth's spin (from about 5- 24hour period), and these lunar tides brought marine life from seas to land which slowly evolved into land-species. Apollo's Earth-Moon distance measurements revealed that Moon is drifting away from the Earth by 3-4 cm every year. The orbital movement of the Moon around the Earth stabilizes the wobble of the Earth's orbit resulting the equitable climate inhibiting the extreme temperature diurnal variations.

The Moon is geologically quiet and dormant. ISRO'S polar Lunar orbiter mission (Chandrayaan-1), 2008-2009, studied Moon's environment and surface processes and inferred that the Moon has got a tenuous but active hydrosphere, volcanically active and geologically dynamic Moon with Global melting of Moon's surface regions and formation of magma oceans. H, OH, H_2O, CO_2, Ar etc. along with several young (~2 to100 Ma) volcanic regions were identified in the lunar atmosphere. Also, X-ray Spectrometer data showed anorthosite terrain with composition, high in Al, poor in Ca and low in Mg, Fe and Ti in a nearside southern highland region.

The mass spectra studies identified the presence of H_2O, and increased concentration of H_2O /CO_2 towards the lunar surface, with decreasing altitude, approaching towards the Lunar's South Pole. The US-LRO Mission analysed the material ejected as a plume from an artificial crater created by impacting a ~2.5ton object (a burnt-out engine) in Cabeus Crater near the South Pole of the Moon, and found CH_4, C_2H_6, CH_3OH, CO_2, NH_3, H_2S, OH, CO_2 etc. besides Water. Feldman et al. detected water in lunar polar regions based on the fluxes of fast and epithermal neutrons, measured by neutron detector board Lunar Prospector. They also estimated that the amount of water/ice, buried or mixed with soil, could be billions of tons, at each of the north and south poles of the Moon. Water-ice is normally expected to reside at the crater base inside the permanently shadowed craters. The water deposited at the poles is a mixture of three types of water viz. exogenous (impact), endogenous (degassing, volcanic) and water produced by reduction of lunar oxides by solar wind protons.

Also, in the Lunar environment, Lunar atmosphere-hydrosphere-surface exchange processes are taking place and lunar radiations, sunlight, solar wind, solar flares, galactic cosmic rays, X rays and proton induced X rays are present. The

Chandrayaan-1 X ray Spectrometer (C1XS) measured chemical composition (Mg, Al, Si, Ca, Ti and Fe) of highland rocks in the nearside southern hemisphere of the Moon, near Tycho.

Lunar Atmosphere consists of Lunar dust, the regolith particles ranging in size from tens of nano meters to microns. Lunar dust results due to complex interaction of the Lunar soil with multiple mechanical, electrical, and gravitational effects. It affects the environmental and anthropogenic factors as well as risk for toxicological health problems if inhaled., and hence, the perturbation, transport, and deposition of Lunar dust must be studied in order to mitigate its potentially harmful effects on exploration systems. Further, in order reduce the Lunar day time temperature; an innovative Lunar Carbon Sequestration Techniques (LST) may be developed by making use of 'ISRO-Chadrayan-2/3'/NASA Payloads data to capture the Carbon dioxide present in the Moon, by adding the evolutionary Lunar 's aerosols (La) e.g. Sodium aerosols (caused by Moon quake). Lunar Carbon dioxide (LCO_2) can also be mitigated by chemical reaction of Lunar Hydrogen to produce methanol as a liquid alternative transportation fuel for Lunar Cars to run on the Lunar surface in future Manned –Lunar- Mission. The Structure of Lunar Atmosphere (LA) yet to be explored to find out its different layers and the other Lunar Gases (e. g Lunar Ozone if any) responsible for the increase of daytime Lunar Surface Temperature (LST)?

As having searched in the Google Search Engine, hardly any study is found on Lunar Energy, Lunar-Photons('Luton's'), Lunar Spectra, Lunar aerosols, Lunar Panels, Lunar-Mass-Energy-Equation'(LME)'Lunar Atmospheric Models (LAM),harnessing of Lunar Energy and its application in Control of Global Warming and climate variability. No elaborate study could be traced on Lunar Radiations, Lunar Cells, Lunar Lasers, Lunar Cooling Towers, Lunar Air conditioning, Lunar Refrigeration, Control of Day Lunar Warming (DLW) & Night Lunar Cooling (NLC) through chemical processes in order to get Moon planet inhabited.

However, there is a passing reference in the Wikipedia about "Project Apollo-1970", wherein, there is a mention of how the Lunar energy work with a mention of possibility to create photovoltaic cells and be placed on the Moon to transmit enormous amounts of energy to Earth. Dr. David Criswell from the University of Houston found that all the materials required in making up photovoltaic cells were present in the moon's dust and rocks. I'm of the view that Lunar Energy can be harnessed and used for Cooling and may be an alternative to replace CFC in Refrigeration and Air conditioning if, one is able to harness Lunar energy.

Lunar Cooling can be generated by either harnessing the Lunar energy through Lunar Panels alike Solar panels or developing the Lunar - Concentrator by using a parabolic trough like machine, perhaps complete with methanol and activated Carbon attached on the top. In all probability this proposed system of Lunar -Concentrator comprising methanol and activated Carbon should minimize Green House effect, thereby increasing the Cooling process. Hence, in my view, the Detoxification of Lunar Toxic Gases (LTG) would help to explore life on the Moon by making its tenuous atmosphere more liveable by enhancing the Oxygen content, diminishing Methane, Carbon dioxide and creating water & minerals through catalytic chemical processes.

Also, the mitigation of Lunar Methane (L-CH_4) to Lunar ethanol/Lunar Methanol by means of Catalytic Process should be useful for the development of Lunar-Cells (LC) to harness Lunar Energy (LE)

3.Computation of 'Lunar -Mass-Energy Equation'(LME) based on 'Einstein mass energy equation' & Harnessing of Lunar Energy:

<E = mc2 >, equation is Albert Einstein 's Theory of Special Relativity , expressing that mass and energy are the same physical entity and can be changed into each other.It states that, the increased relativistic mass (m) of a body times the speed of light squared (c^2) is equal to the kinetic energy (E) of that body, and mass and energy are no longer conserved but can be inter-converted. In this equation, velocity of light(c), serves as a constant of proportionality.

Presently, (LME) is a hypothetical equation based on' Einstein mass energy equation', <$E=mc^2$>, and acronym as 'Goswami Einstein Lunar mass energy equation'<'GEL' Eqn.>; has been conceived by me, needs mathematical computation and to be proved experimentally by making use of 'CHANDRAYAN -2/3 & NASA Payloads data. Assume L_E = Lunar Energy content, I_m = mass of moon, I_c =Lunar radiation velocity, then 'Einstein mass energy equation' can be written as: <$L_E = I_m.I_c^2$>…..(1) Eqn. say. <'GEL' Eqn.>.It shows that when velocity of Lunar radiation (I_C) is constant, then there is an exact equivalence between Lunar energy (L_E) and Lunar mass(I_m) with a possibility of releasing large Lunar energy by the conversion of Lunar mass (I_m).

3(a)Application of 'GEL' Eqn. in the study of detoxification of Lunar Toxic Gases (LTG) can be done by enhancing the Oxygen content, diminishing Methane, Carbon dioxide, creating water & minerals through catalytic chemical processes and calculating the thermal energy during evolution or absorption of heat, in chemical-reactions (exothermic & endothermic reactions) taking place at the Lunar Surface, by using 'GEL-Eqn.

3(b). Research Methodology for Harnessing of Lunar Energy by VG: Lunar Tracking Mechanism (LTM)& Lunar Trackers (LT).

The proposed methods may be either based on the use series of concave lenses and get converged the Lunar rays by powerful telescopic instrument or Lunar-Shine Recorder (LSR) as well as the instruments based on tracking mechanism. The Lunar-Shine Recorder (LSR) or Lunar Terminator Light Recorder (LTLR) comprising temperature recording device, may be developed based on CLASS (Chandrayaan-2 Large Area Soft X-ray Spectrometer) & XSM(X-Ray Solar Monitor)& Synthetic Aperture Radar (SAR); to get converged/concentrated on a unit area characteristics of Lunar radiations specially reflected and scattered radiations along the Terminator to measure the duration and temperature rise/fall if any on the unit area as well as to observe X-rays emitted if any, from the Moon and lunar corona from the sunlit portion of the Moon along the Terminator.

Also, it's proposed to develop proposed Lunar Photo Voltaic System (LPV) system to harness Lunar Energy and convert into electrical energy. Next, Lunar Trackers (LT) could be developed to increase the receptance of incident rays from the Moon and convert into electrical energy by using Lunar Trackers (LT) which would be a source of power generation for future inhabitants on the Moon. The proposed Lunar Tracking Mechanism (LTM) has been developed wherein; Lunar Tracker may convert the Lunar

energy to electrical energy. The proposed Lunar Tracker (LT) is programmed in such a way that it gets tilted to follow Moon's movement accurately throughout the night. It is assumed that the generated output power with the said Lunar tracking should be higher in comparison to the fixed proposed Lunar Photo Voltaic System (LPV) system.

3.(c) Research Methodology to Study Morphological Characteristics of Lunar surface: Lunar Energy may be harnessed by studying the morphology of Moon through certain modifications in Chandra's Surface Thermo physical Experiment (ChaSTE), to study the thermal properties of lunar surface near sub-polar ,mid-regions and lower regions can be explored and this may lead to determine Horizontal Structure of the Lunar Atmosphere like that of Earth's atmosphere as graphically Moon is also in circular shape and does consist of Moon rocks, craters, Moon quake and volcanoes like earthquakes, mountains, volcanoes on the Earth. There seems to be possibility of two lunar hemispheres viz. Lunar Northern & Lunar Southern Hemisphere i.e. L(NH) & L(SH) respectively.

3(d) Research Methodology to Study Chemisorption/Absorption of Lunar rays & catalytic effects: The characteristics of Lunar radiations specially reflected and scattered radiations may be studied through Chadrayaan-2 payloads viz. CLASS (Chandrayan-2/NASA Large Area Soft X-ray Spectrometer) & XSM (X-Ray Solar Monitor), with certain modifications, to observe X-rays emitted if any, from the Moon and lunar corona from the sunlit portion of the Moon along the Terminator. Next, the chemisorption /absorption of Lunar rays be studied by established Methods to investigate the catalytic effects.3.(e) Research Methodology to Study of Lunar Spectra by using the Solar Spectra Techniques: In my view ,CLASS (Chandrayaan-2 Large Area Soft X-ray Spectrometer) with certain modifications can also be used to study any change in spectrum of the light along the Terminator(the line separating the sunlit and dark side of the Moon)Similarly, XSM X-Ray Solar Monitor))may also employed with certain modification to observe X-rays emitted if any, from the Moon and lunar corona from the sunlit portion of the Moon along the Terminator.3.(f) Research Methodology to Develop Lunar Lasers / Laser Technology: The modified version of Laser-induced breakdown spectroscopy (LIBS) may be used to develop Lunar Laser technology by detecting and quantitatively/qualitatively studying the 17 major elements (Na, Mg, Al, Si, K, Ca, Fe, Cr, Mn, Ti, H, He, C, N, O, P & S) that commonly found in lunar-rock forming minerals. Laser-induced breakdown spectroscopy is a total multi-elemental analytical technique based on atomic emission spectroscopy.3.(g) Explore the new methods of Mitigation of GHG to control the Earth's Global Warming through Lunar Energy by means of Lunar Panels ,Lunar Cells, Lunar Storage Batteries System (LSBS) for Lunar Energy Storage.3.(h) Research Methodology for Chemical Analysis of LunarSoil : By using the Alpha Particle X-ray Spectrometer (APXS) on-board ISRO-chandrayaan-2 rover; the Chemical Analysis of the elemental composition of lunar soil and rocks, would be taken up to detect elements such as Mg, Al, Si, K, Ca, Ti, and Fe through characteristic X-rays emitted from particle excitation and X-ray fluorescence processes.