NCAS
Fall 2014
Digital Model:
Jet Engaged Solar Sensory Extraction Rover
“The J.E.S.S.E.”

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September 24, 2014
I. **Rover Specifications**

a. **Dimensions:** Length: 3 meters; Width: 2.7 meters; Height: 2.2 meters; Mass: 899 kilograms

b. **Chassis:** Operating system

c. **Power Source:** Wind power generator, flexible solar panel sheets with nanoantennas, and pivoting solar panel with fins wind generator

d. **Backup Power Source:** solar panel with extendable side panels and backup rechargeable battery.

e. **Instrument Package 1:** CHEMN instrument, thermal and evolved gas analyzer (TEGA), dynamic of albedo neutron (DAN), instrument, and quadruple mass spectrometer

f. **Instrument Package 2:** Soil-rock analysis device

g. **Instrument Package 3:** Gas chromatographer

h. **Aviation System:** Retractable helicopter propeller/wind generator and reverse jets.

i. **Robotic-Mechanical Arm 1:** Two-prong design with two pivot points on arm for optical range, scoop, alpha particle x-ray spectrometer, and microscopic imager

j. **Robotic-Mechanical Arm 2:** Basic spectrometer and microscope

k. **Computer Hardware with Autonomous On-Board Control:** Novel hardware and software system for micro air vehicles (MAV)

l. **Program Navigation:** Stereoscopic charged-couple device (CCD) camera

m. **Communication Package:** High-gain antenna, low-gain antenna, UHF antenna, and Sensory data retrieval antenna.

n. **Sensory Package:** Aluminum alloy spherical sensors

o. **Additional Equipment:** Radioisotope thermoelectric heat and cooling exchanger, thermocouples, Piezo Actuators: PI Ceramic Supplies, independently operated wheels with separate motor

II. **Graphic Model**

a. **Front View 1:** Fully extended helicopter propellers and pivotal solar panel.
b. **Front View 2:** Fully retracted helicopter propellers and pivotal solar panel

c. **Bottom View 1:** Closed sliding trap door
d. **Bottom View 2:** Retracted sliding trap door with exposed aluminum alloy spherical sensors

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III. **Explanation of each specification in relevance the rover**

a. **Chassis**

b. **Operating system:** The operating system that will be used is Wind River's proprietary VxWorks commercial real time OS (Dadhich & Lakkimsetti, 2014).

c. **Power Source**

i. **Wind power generator:** The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity (Pan, 2014).

ii. **Flexible solar panel sheets with nanoantennas:** Durable and flexible plastic sheets containing billions of nanoantennas that collect heat energy generated by the sun and other sources (Dhankhar, Pal, & Singh, 219-220, 2014). N. (2014).

iii. **Pivoting solar panel with fins wind generator:** The fins catch the wind which rotates the panel counter clockwise which connects to a generator and makes electricity (Siddique, Titirsha, Sanjidah, Afrin, & Rabbani, 2014)

d. **Instrument Package 1**

i. **Chemistry and Mineralogy instrument (CHEMN):** The CHEMN instrument will identify and measure the abundances of various minerals on Mars
ii. **Thermal and evolved gas analyzer (TEGA):** The TEGA is made up of two components, a set of eight very small ovens that will heat samples of the ice soil mixtures from the trench to release imbedded gases and mineral decomposition products, and a mass spectrometer that serves as the analysis tool for the evolved gases, and also for measurements of the composition and isotopic ratios of the gases that comprise the atmosphere of Mars (Stern, Malespin, Mahaffy, Webster, Eigenbrode, Archer, & Trainer, 2014).

iii. **Dynamic of albedo neutron (DAN) instrument:** The DAN instrument is sensitive enough to detect water content as low as one-tenth of 1 percent and resolve layers of water and ice beneath the surface (Mitrofanov, Litvak, Sanin, Lisov, Kuzmin, Behar, & Tate, 2014).

iv. **Quadrupole mass spectrometer:** The quadrupole mass spectrometer identifies gases by the molecular weight and electrical charge of their ionized states. It will check for several elements important for life as we know it, including carbon, nitrogen, sulfur and oxygen contained in volatile molecules. (Sulzer, Hartungen, Hanel, Feil, Winkler, Mutschlechner, & Jordan, 1-5, 2014).

e. **Instrument Package 2**

i. **Soil-rock analysis device:** The soil-rock analysis device will analyze samples for organic compounds and environmental conditions that could have supported microbial life (Menlyadiev, Tadjimukhamedov, Tarassov, Wollnik, & Eiceman, 138-140, 2014).

f. **Instrument Package 3**

i. **Gas chromatograph:** The gas chromatograph will be used for separating, analyzing, and identifying substances contained in a volatile liquid or gaseous sample (Aslan-Sungur, Gaga, & Yenisoy-Karakas, 43-46, 2014).

g. **Aviation System**

i. **Retractable helicopter propeller:** A helicopter with a retractable rotor for transport wherein the rotor and its blades, the swash plate, the pitch change rods and support mast are lowered or raised in unison by the hydraulic flight control as commanded by the helicopter computerized flight control when being commanded by special rotor retraction/extension software (Stille & Weiner, 2014).

   1. **Wind generator:** As the helicopter propeller rotates the wind will turn the blade, which spin a shaft, which will connect to a generator and makes electricity.

   ii. **Reverse jets:** The reverse jets will help slow down just after touch-down, reducing wear on the brakes and enabling shorter landing distances. Such devices affect the aircraft significantly (Bouda, Babbou, & Harmand, 152-155, 2014). Reverse flow region associated to a heat transfer in a turbulent wall jet.
h. **Robotic-Mechanical Arm 1**
   i. **Two-prong design with two pivot points on arm for optical range:** This design stimulates an optimum pivot point height for a swing-arm type rear suspension such that the suspension motion is minimized (Coleman, 2014).
   ii. **Scoop:** The scoop will collect samples for further processing paths.
   iii. **Alpha particle x-ray spectrometer (APXS):** The APXS will measure the abundance of chemical elements in rocks and soils (Arvidson, Squyres, Bell, Catalano, Clark, Crumpler, & Wolff, 2014).
   iv. **Microscopic imager:** The microscopic imager will capture and filter magnets and a portion of the solar array will aid in the interpretation of behavior and morphology of the dust deposits (Núñez, Farmer, Sellar, Swayze, & Blaney, 150-153, 2014).

i. **Robotic-Mechanical Arm 2**
   i. **Basic mass spectrometer:** The basic mass spectrometer will examine characteristics of individual molecules, a mass spectrometer converts them to ions so that they can be moved about and manipulated by external electric and magnetic fields (Coon & McAlister, 2014).
   ii. **Microscope:** This onboard microscope has a mechanical and adjustable focus, which permit it to focus on things as close as 2.1 centimeters away or as far away as it can see.

j. **Computer Hardware with Autonomous On-Board Control**
   i. **Novel hardware and software system for micro air vehicles (MAVS):** MAVS is a lightweight message transport that serves as a multiple autopilot systems interchangeably which can be controlled from a distance (Sampaio, Hernandes, Becker, Catalano, Zanini, Nobrega, & Martins, 6-8, 2014)

k. **Program Navigation**
   i. **Stereoscopic charged-couple device (CCD) camera:** The CCD is a device for the movement of electrical charge, usually from within the device to an area where the charge can be manipulated, for example conversion into a digital value (Russell, Lieb, & Huibers, 2014).

l. **Communication Package**
   i. **High-gain antenna (HGA):** HGA is an antenna with a focused, narrow radio wave beam width (Meador, & Miranda, 2014)
   ii. **Low-gain antenna (LGA):** LGA is an antenna with a broad radio wave beam width (Meador, & Miranda, 2014)
   iii. **UHF antenna:** UHF is the ITU designation for radio frequencies in the range between 300 MHz and 3 GHz wavelengths range from one to ten decimeters (Meador, & Miranda, 2014)
   iv. **Sensory data retrieval antenna:** The sensory data retrieval antenna retrieves of data gathered collectively by sensor (Wei, Yang, Lu, & Kong, 741-742, 2014).
m. Additional Equipment


ii. Thermocouples: Thermocouples are designed to interact with radioisotope fuel heats where one of these junctions while the other junction remains unheated and is cooled by the space environment or a planetary atmosphere (Chen, Jiang, Zhao, Zhang, Liu, & Jiang, 249-250, 2014).

iii. Piezo Actuators: PI Ceramic Supplies uses micro and nano-positioning technology with in-depth knowledge in the fields of mechanics, electronics, sensor engineering and software (Xuan, Jin, San Ha, Goo, Kim, Bae, & Yoon, 2014).

IV. Works Cited


glider-quadrotor MAV for in-flight/V-STOL launching. In *Aerospace Conference, 2014 IEEE* (pp. 1-12). IEEE.


