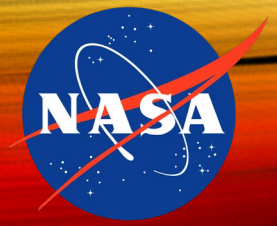

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Mars Sand Storm Proximity Alert System

Trieste, 20-21/10/18 - Nasa Space Apps Challenge - Eugenio Cosolo, Patrick Boschian & Gioele De Odorico

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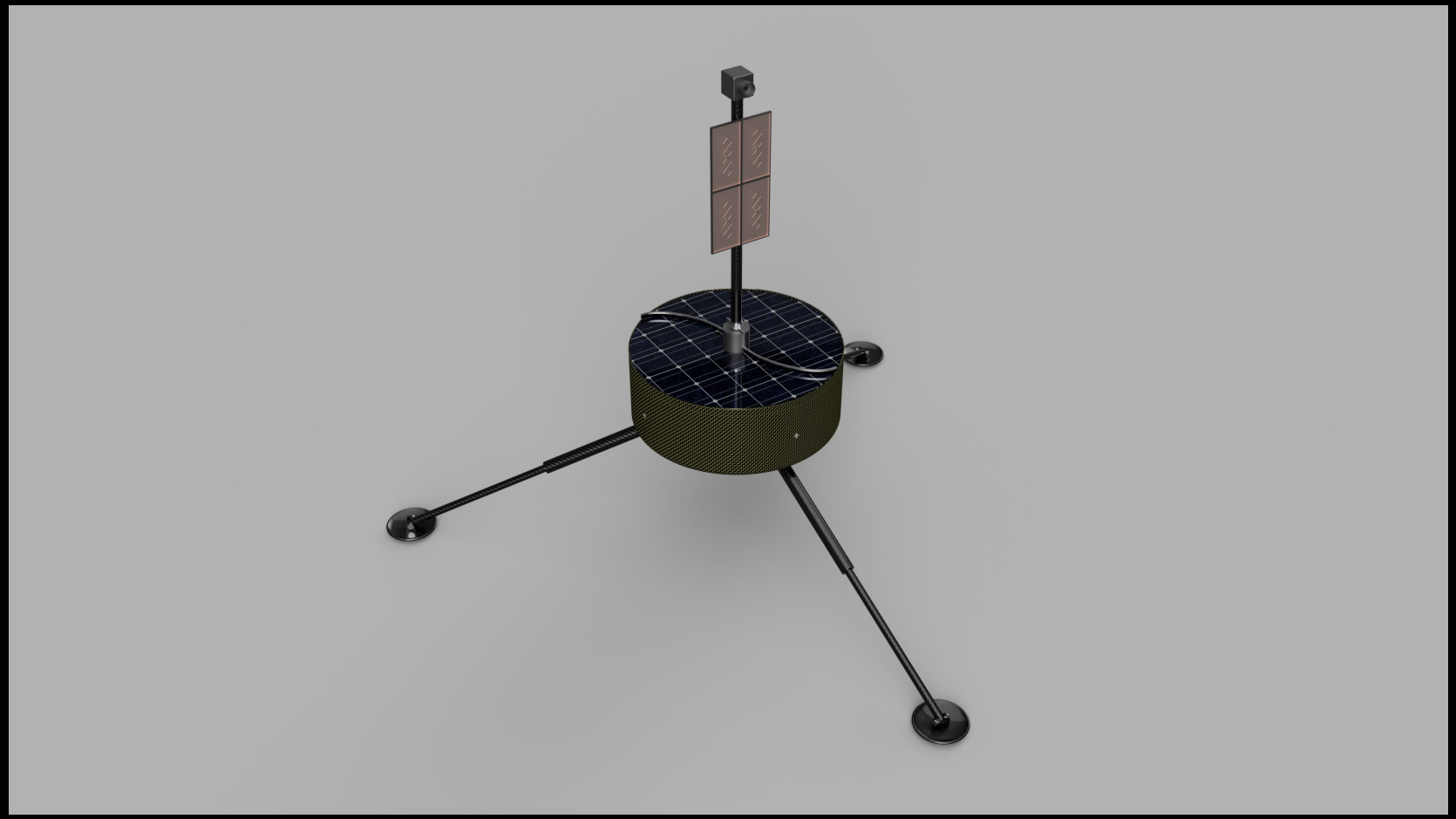
MARS SAND STORM PROXIMITY ALERT



This is a rendering of the remote module.
Its characteristics are:

- Width(legs incl.): 55 in
- Height: 40 in
- Weight on earth: 31 lbs
- Weight on Mars: 12 lbs

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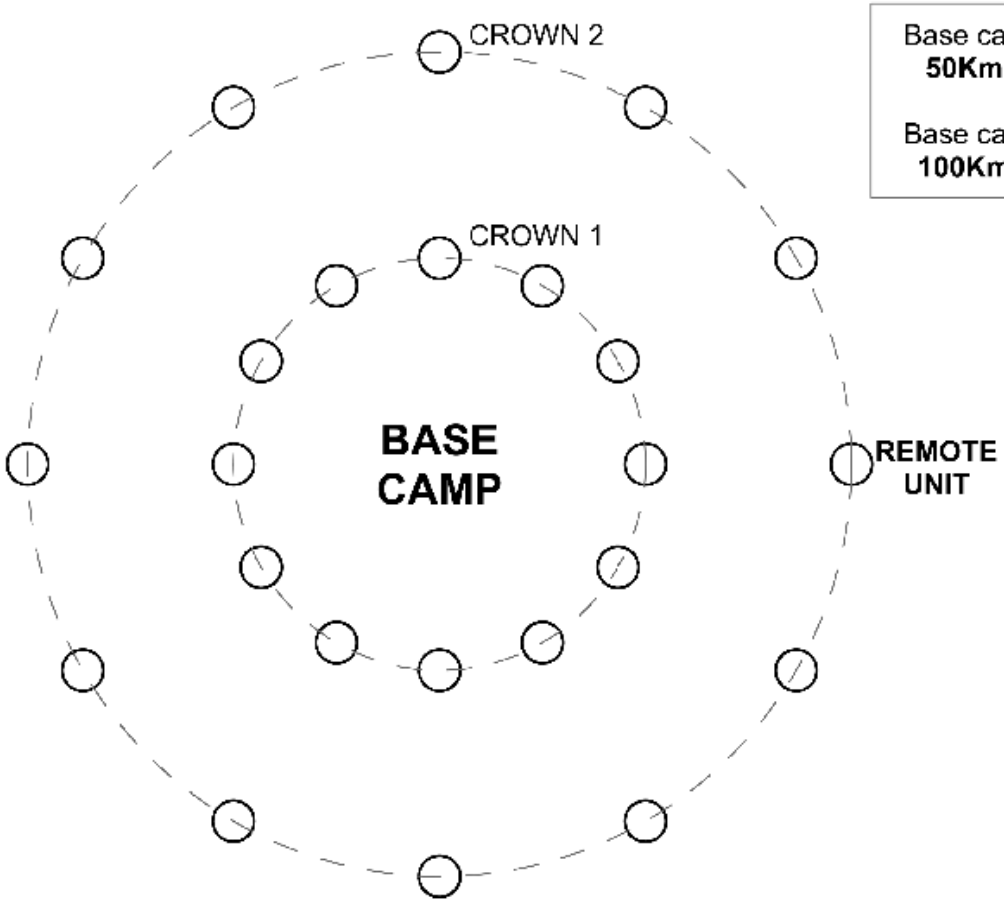

The network is composed by 2 – 12 stations clusters – arranged along the circumference of 2 concentric circles, all equidistant from each other; the first circle has a radius between 20 and 50 km from the nucleus, and the second 12 station cluster is positioned along a 25 to 50km radius circumference.

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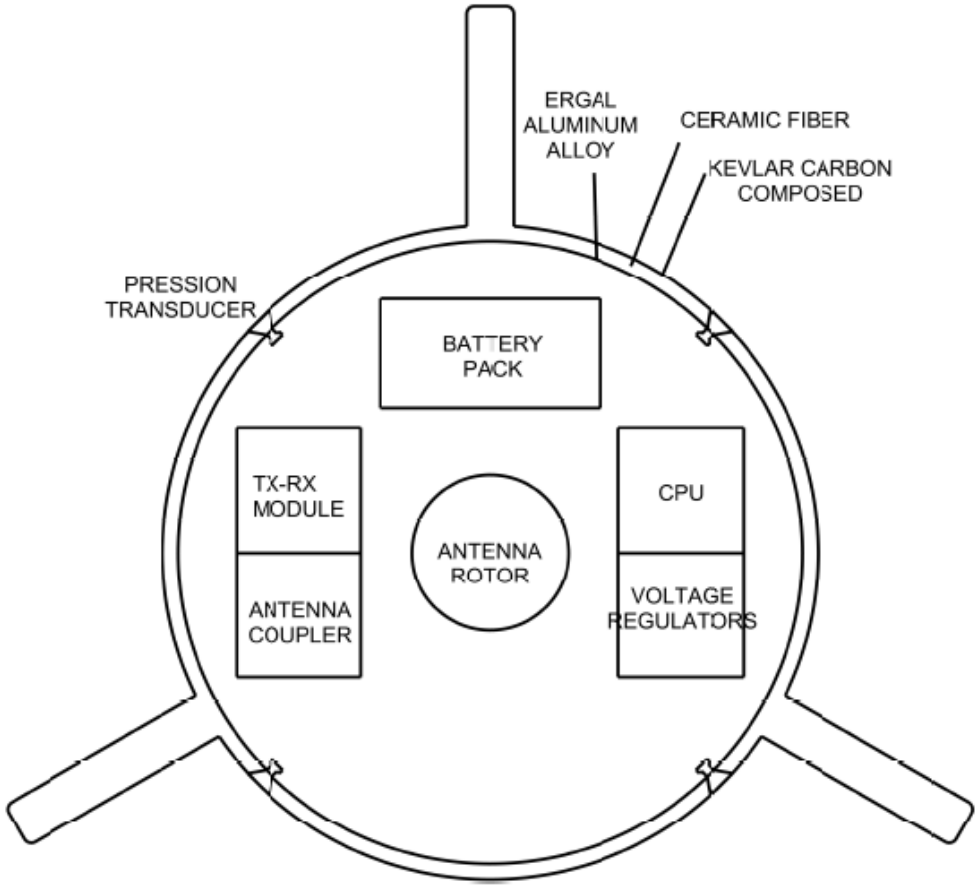

Inside there will be a motherboard + CPU, a battery, a digital SHF transceiver, a power supply regulation, and a watchdog system.
On the outside circumference there will be a thermometer, an opacimeter, the directional pressure sensors, and 2 omnidirectional antennas.
The platform will stand on 3 articulated carbon composite sticks, held by shape-memory alloy springs (Ni-Ti, Cu-Zn-Al or Cu-Al-Ni).

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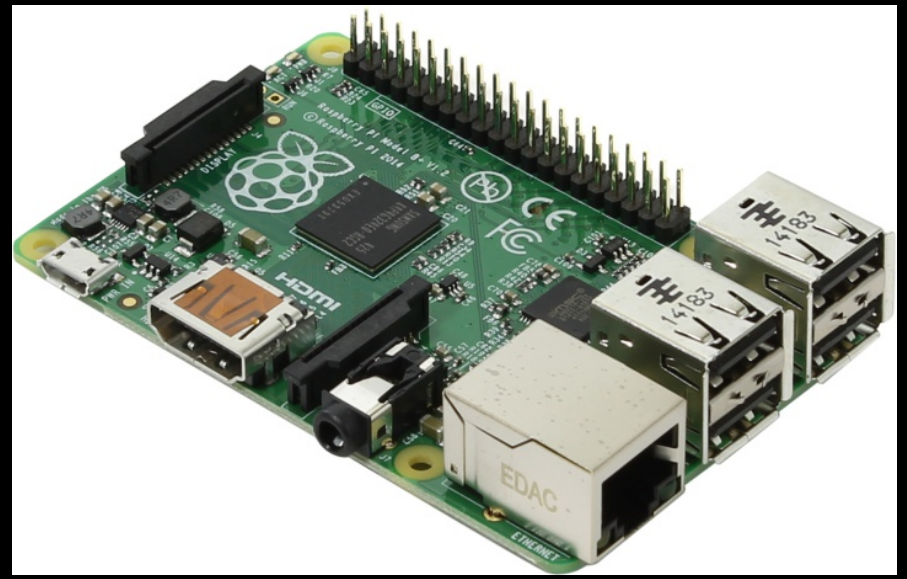
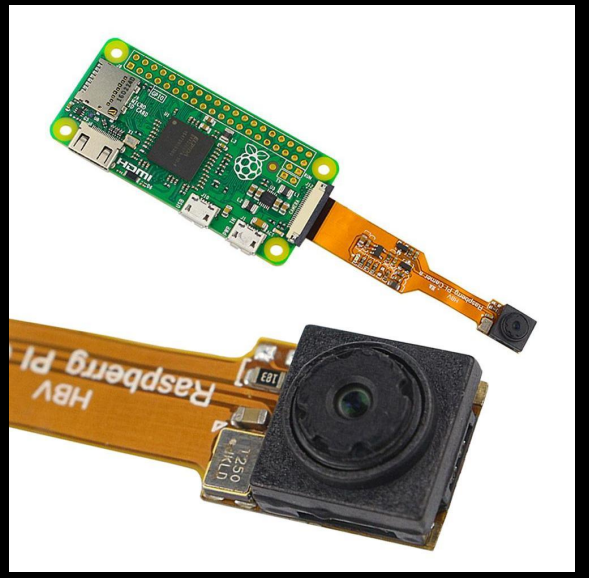
HARDWARE





We use 32-bit microcontroller like Raspberry for real-time clock, analog-digital interface, 100Mb/Gigabit ethernet card, stepper motor controller unit (antenna and camera movement, solar panel cleaning). We also need a 1-wire interfaced digital thermometer and one HD webcam.

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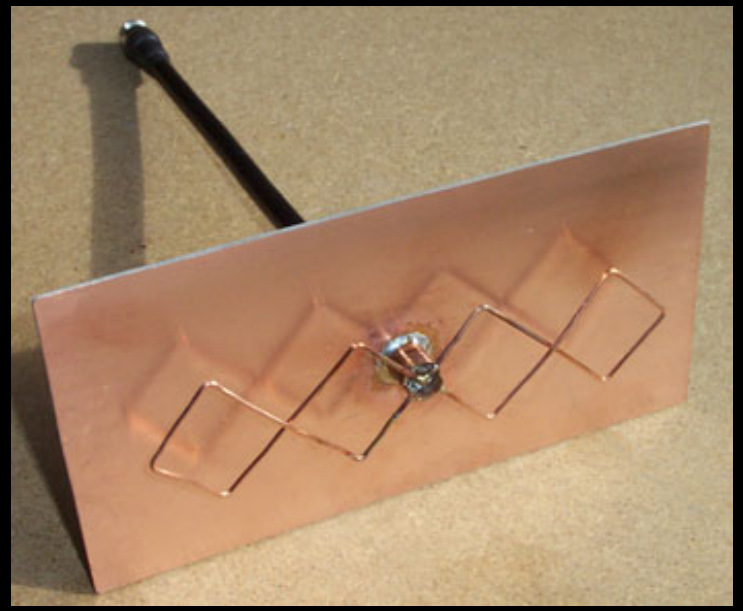
HARDWARE



The system includes 5,8 GHz digital transceiver, an high-gain dual bi-quad panel antenna and 4 differential pressure sensors to measure Martian wind speed.

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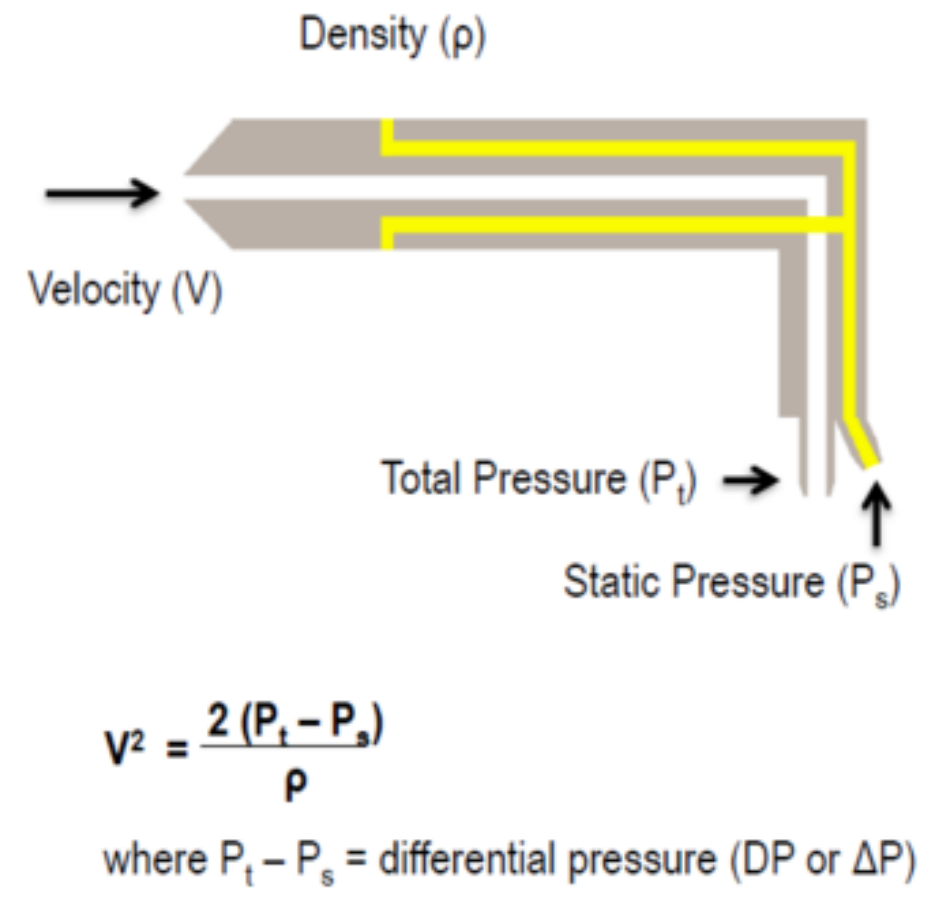
HARDWARE



The wind direction can be calculated from the relations between the pressure differentials, while the speed is calculated from the vector sum of the positive pressures. Everything is calculated by an algorithm derived from Bernoulli's law.

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HARDWARE

The system also includes a monocrystalline solar panels with a 20W peak power, with high hardness glass able to resist to the Martian abrasive dust. The energy storage will be made by lithium iron phosphate batteries, that now has the best performance in terms of duration, reliability, and power density. The power draw will be monitored by the CPU to grant good energy use, avoiding dangerous voltage drops under the safe limits.

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SOFTWARE

OPERATING SYSTEM

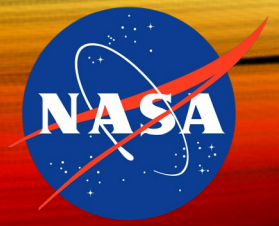
We have decided to use a LINUX based OS like RASPBIAN. The system does not require mass memories like hard drives but a simple 32/64 GB SD card.

SOFTWARE DEVELOPING LANGUAGE

The software will be developed with Python, because is even portable to other platforms and is free and Open Source.

NETWORK CONNECTION LOGIC

The data exchange between stations will be over TCP/IP.
Every remote module will have its own IP address.
The data packets will contain a flag to identify its source and will include an error control marker, flow control, congestion control.



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Project developed by:
Eugenio Cosolo
Patrick Boschian
Gioele De Odorico

THANKS FOR YOUR ATTENTION