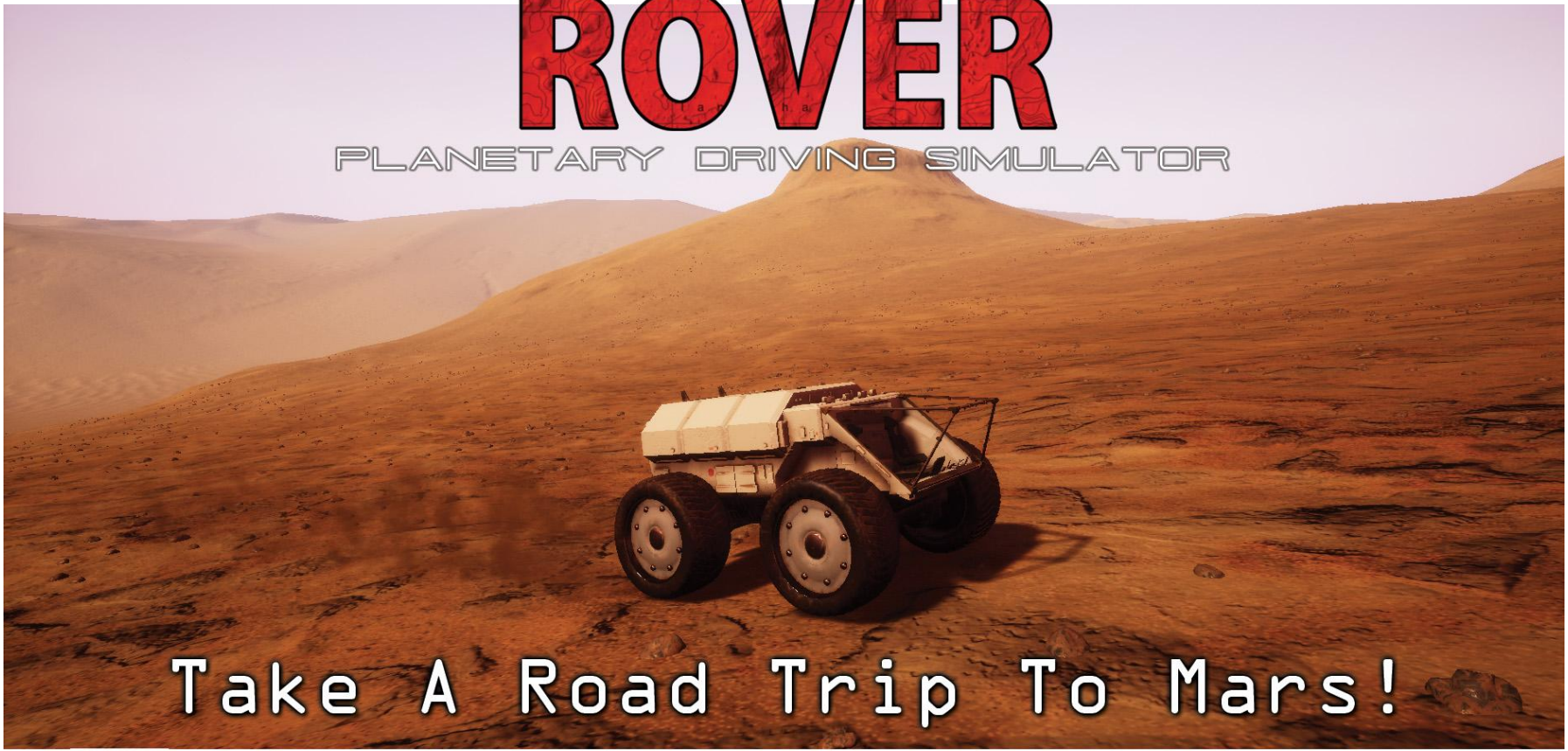
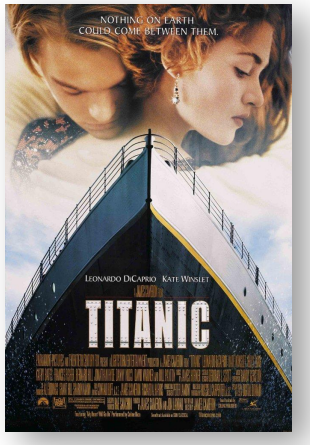
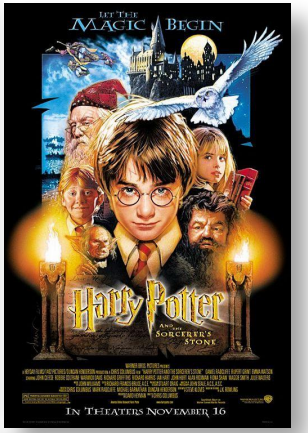


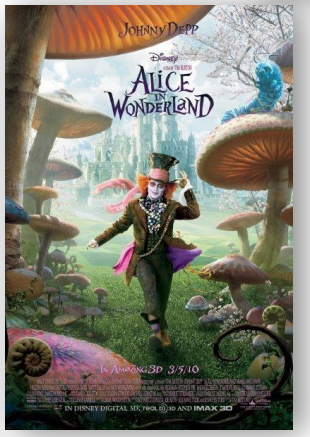
ALAN CHAN

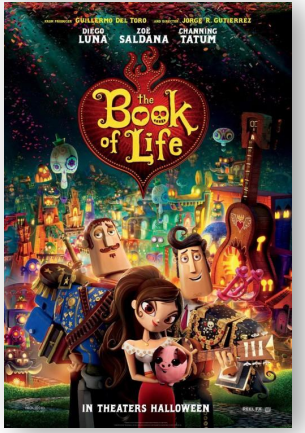
- space nerd
- Apollo generation
- Wannabe astronaut
- Went into filmmaking
- Played a lot of games

WHO | WHAT | WHY | WHEN | WHERE | HOW







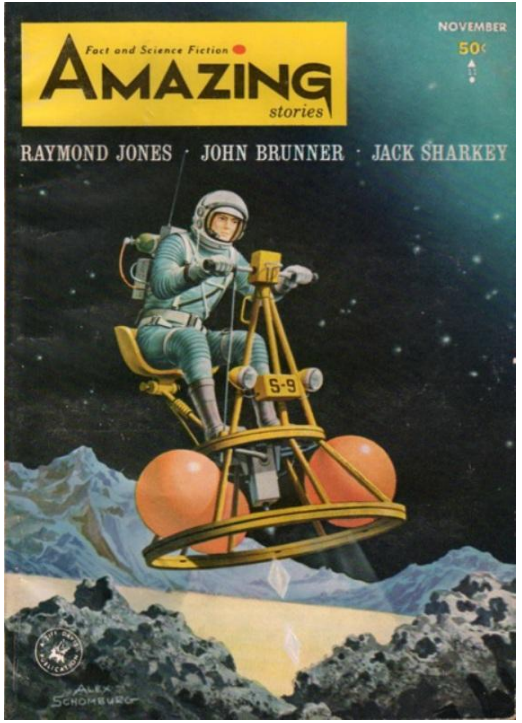


some of the movies I have worked on

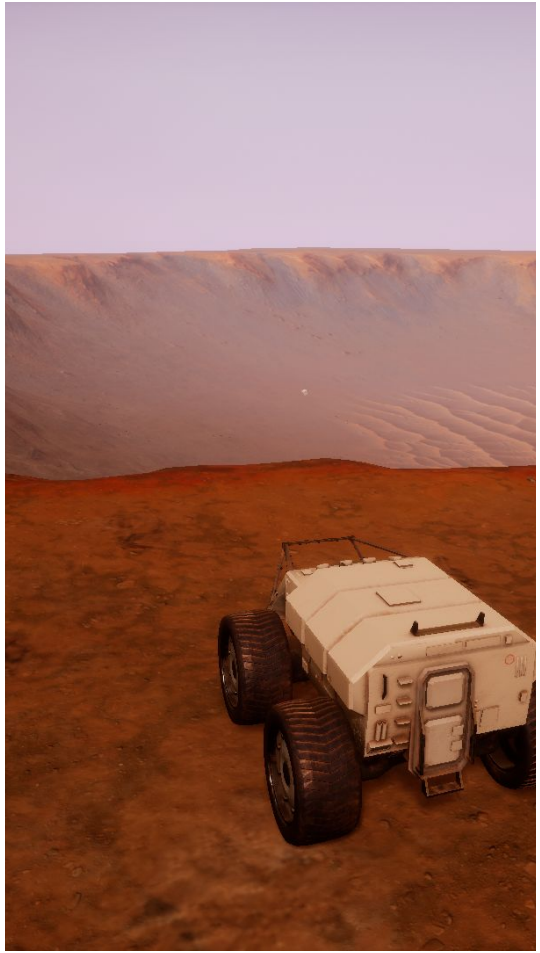
- I made *Red Rover*, a driving simulator for exploring Mars
- Uses Mars Reconnaissance Orbiter HiRISE data to generate game maps
- Each map is roughly 5km x 5km
- You can drive anywhere!

- I made *Red Rover*, a driving simulator for exploring Mars
- Uses Mars Reconnaissance Orbiter HiRISE data to generate game maps
- Each map is roughly 5km x 5km
- You can drive anywhere!
- (Bonus) In VR!

- Wanted to explore Mars
- Made a ‘game’ for myself, because I had the tools
- Now sharing my toy with fellow science explorers
- Gives me a chance to drive a rover on Mars!



18 maps from all over Mars



Victoria Crater

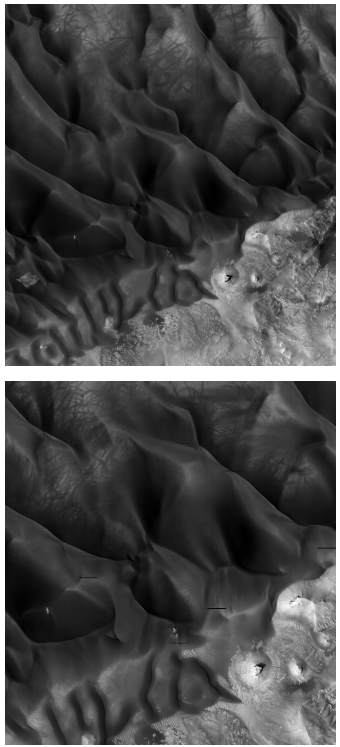
https://www.uahirise.org/TRA_000873_1780 http://areobrowser.com/#/id=ESP_021747_1780

Victoria Crater was the first large crater visited by the Mars Exploration Rover “Opportunity” on its journey across the Meridiani Plains of Mars. The crater is about the length of seven football fields across and is as deep as a seven story building is tall. Unlike fresh craters, Victoria Crater has an unusual rim with many “promontories” of rock sticking out into the crater and many alcoves cut back into the rim. It is thought that this shape was formed by wind erosion, which has also partially filled the crater with sand dunes.

Opportunity drove into this crater and around its western rim, photographing the cliffs which reveal the geological history of this part of Mars. When an asteroid hits Mars, it punches a hole in the surface, revealing the rocks underneath. What the Opportunity team learned at Victoria Crater was that the bedrock several miles from the rover landing site was made of sandstone from ancient sand dunes. The cross-bedded sandstone at Victoria contains tiny round pebbles which the team called “blueberries” from their appearance in the rover’s color pictures. These “blueberries” are a type of rock called “concretions”, which on Earth are formed in water. These particular concretions on Mars are rich in hematite, a form of iron. These rocks were seen both at the rover landing site and also at Victoria Crater, showing that this part of Mars was covered with groundwater when the rocks formed millions of years ago.

https://en.wikipedia.org/wiki/Victoria_(crater)

Mars Reconnaissance Orbiter takes photos of Mars with HiRISE camera



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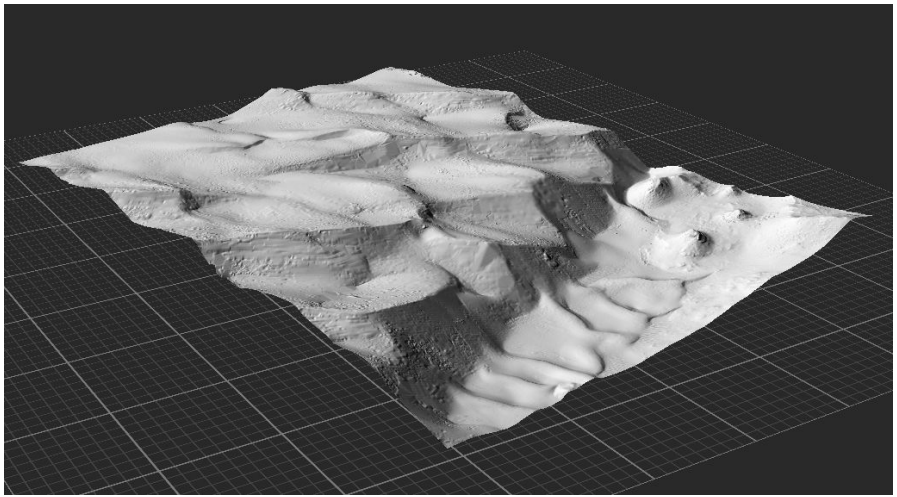
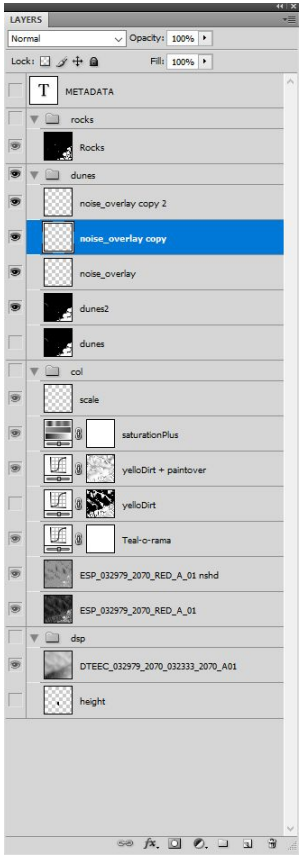


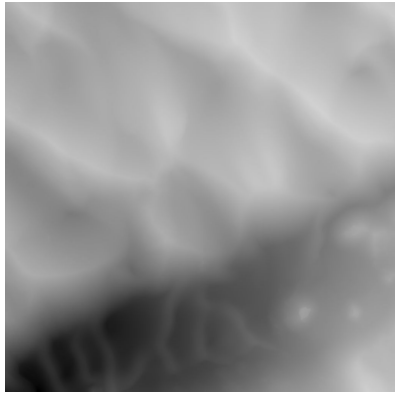
Using *stereo pairs* of nearly identical images, the University of Arizona uses voodoo witchcraft to compute the height of the terrain

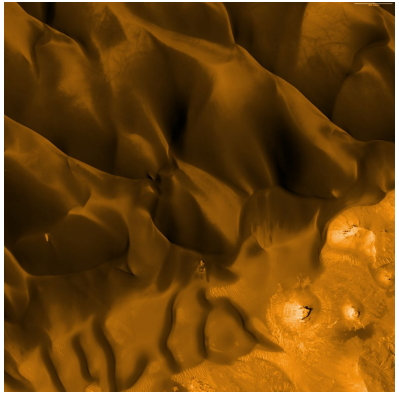
We download the Digital Terrain Map (DTM) and the associated imaging data and convert it into a more game-friendly format.

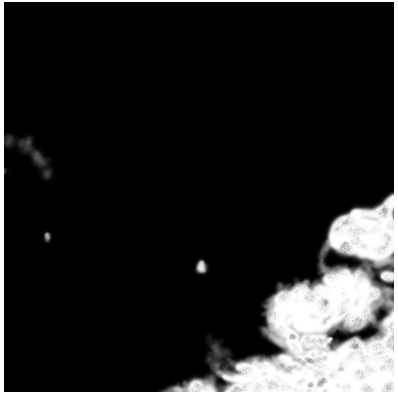
This involves a rigorous complicated process known as..



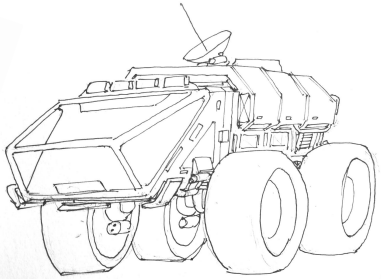
“PHOTOSHOPPING”

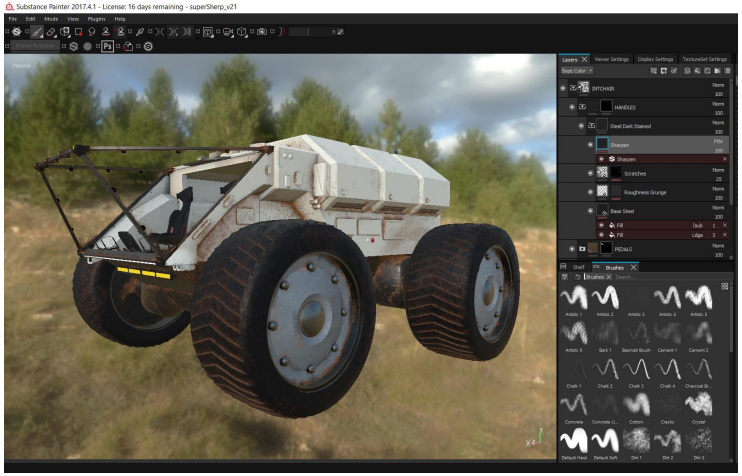






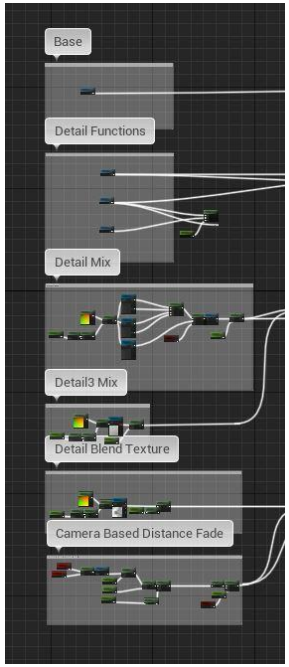
We generate height maps, “false color” terrain detail images, and additional surface detail maps that describe material types.





The Rover gets more detail pieces and a new paint job!

We also tune the vehicle engine so that it’s fun to drive



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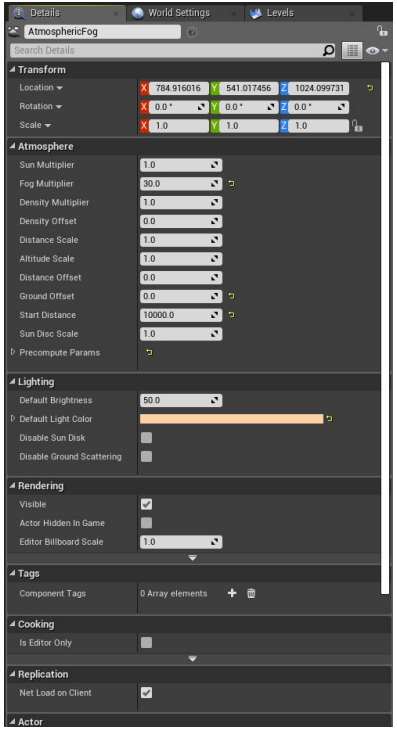

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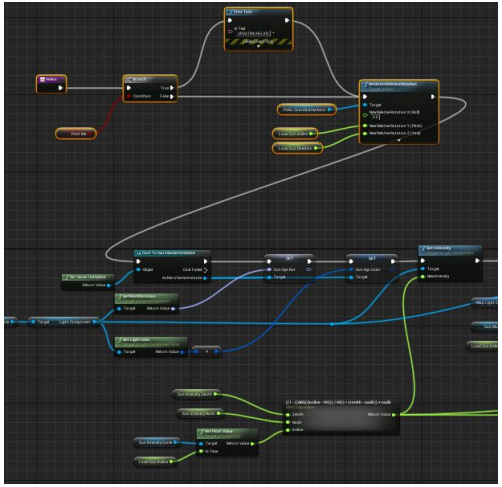
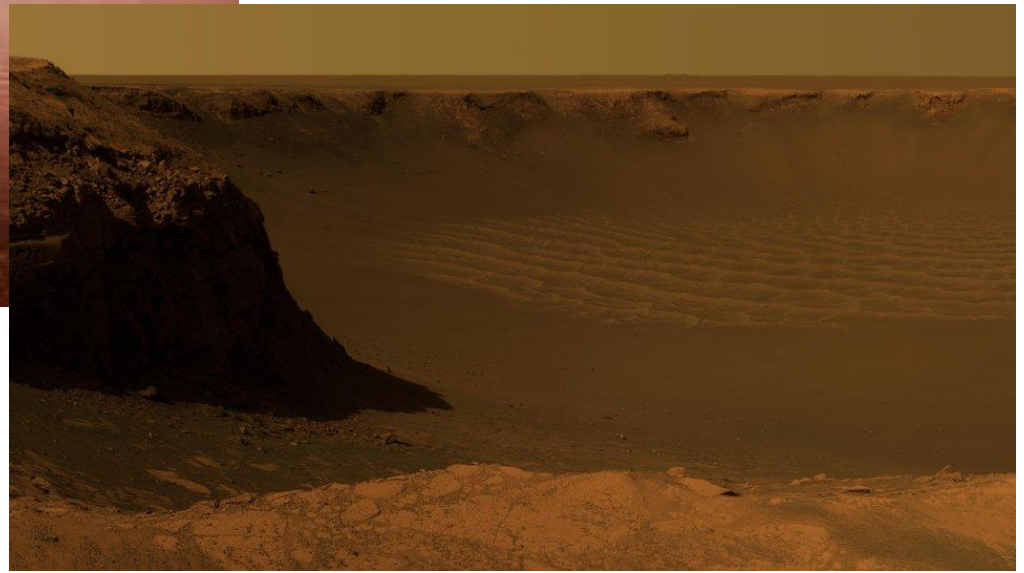


We add fancy terrain shader controls and use the game engine to create sunlight and environment haze

VOILA!*

* results may be oversimplified



Early in-game test view
vs
the real thing

South Olympus

https://www.uahirise.org/ESP_012429_1910 http://areobrowser.com/#/id=ESP_012429_1910

The South Olympus map is a satellite view of a small impact crater, about 10km in diameter (roughly 6 miles), situated about 230km (142 miles) south of the base of Olympus Mons, the highest point on Mars. Olympus Mons is an old shield volcano that rises over 21km, about two and a half times the height of Mount Everest.

Scientists and geologists use these 3D reconstructions of the terrain to examine and learn about how the Martian landscape of today formed. An impact crater like this, which is formed when an asteroid hits the surface, basically digs a hole in the ground, allowing geologists to see the layers of the rocks underneath the surface.

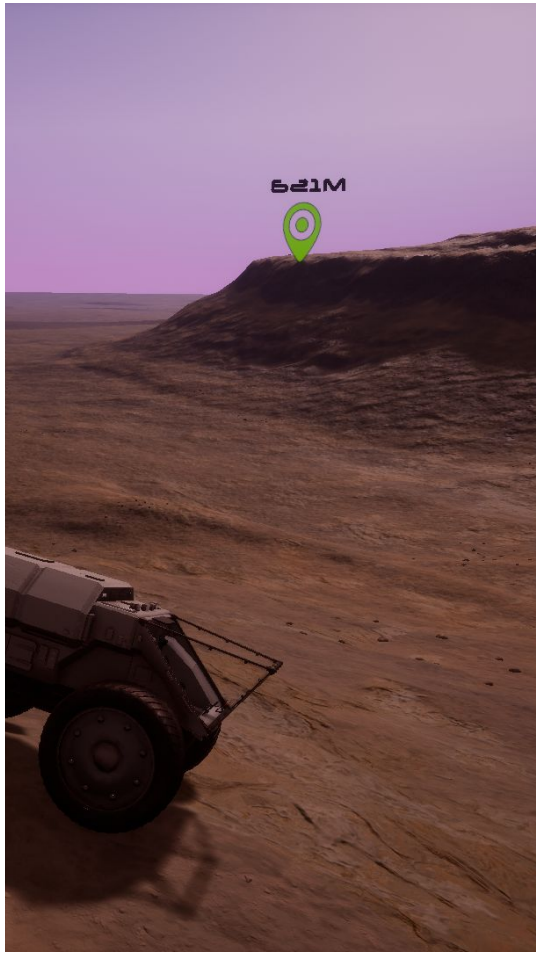
Hale Crater

https://www.uahirise.org/PSP_002932_1445 https://areobrowser.com/#/id=PSP_002932_1445

Hale Crater is approximately 125-150 km in diameter just north of the Argyre basin, and is thought to be about 3.5 billion years old - a young crater due to the the fact that the features on the crater are still very clear and well-defined. Our map only covers a small portion of the east side of the crater.

The crater walls on this map have a lot of deep gullies, some of which have braided channels that suggest repeated flow from the seasonal existence of liquid water in Hale Crater. The gullies are believed to be relatively young, because they have few, if any, craters, and they lie on top of sand dunes which are young.

https://en.wikipedia.org/wiki/Hale_(Martian_crater)



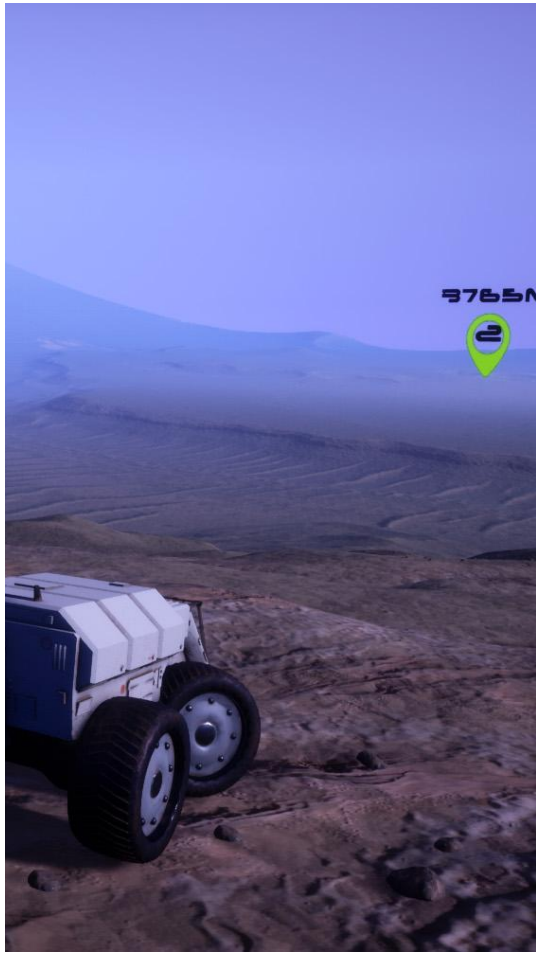
Becquerel Crater

https://www.uahirise.org/ESP_034419_2015 http://areobrowser.com/#/id=ESP_034419_2015

The Becquerel Crater map covers an area in Arabia Terra that has been studied by scientists who are interested in understanding how sand dunes interact with the topography of the area. Our map shows a dune field that ends at the south edges of the crater's interior layered deposit, where we can see such geographical features as staircase weathering, knobs and yardangs.

Yardangs are eroded landforms that often look like an upside down boat hull, and are formed as a result of abrasion caused by windblown sediment. Because of this, yardangs are often oriented in the direction of the prevailing winds in the region at the time when they were formed. The corridors between yardangs in Becquerel Crater can reach up to 70 meters, or 230 feet in depth - or something like a 16 storey building.

https://en.wikipedia.org/wiki/Becquerel_(Martian_crater)



Noctis Labyrinthus

https://www.uahirise.org/ESP_027526_1685 http://areobrowser.com/#/id=ESP_027526_1685

The Noctis Labyrinthus map covers an area located in the Phoenicis Lacus quadrangle, between Valles Marineris (the deepest canyon system on Mars) and the Tharsis upland. The area here is made up of steep valleys and canyons formed by faulting. Many of these valleys show classic features of grabens, where a portion of the surface of the upland plains is preserved on the valley floor. Scientists think that this faulting was triggered by volcanic activity in the Tharsis region.

https://en.wikipedia.org/wiki/Noctis_Labyrinthus

Jezero Crater

https://www.uahirise.org/PSP_002387_1985 http://areobrowser.com/#/id=PSP_002387_1985

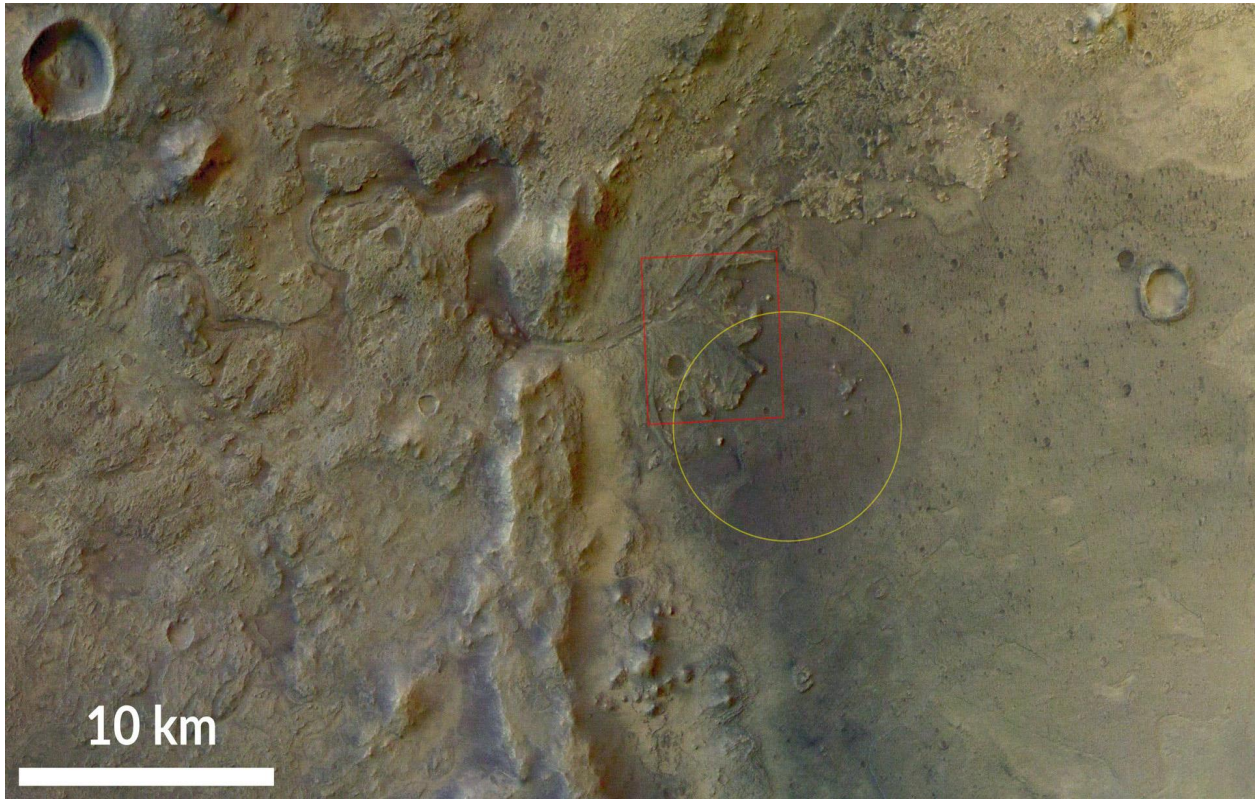
Jezero Crater is a 50km (30 mile) crater located at the edge of the Isidis Planitia Basin and is believed to have once been flooded with water. On the northwestern edge of Jezero Crater is a fan delta that scientists believe formed during a period in Mars's history when there was continual water flow into the crater.

Since a delta like this would have taken millions of years to form, the lake is believed to have been long-lived enough for life to develop in the waters of the lake. This is one of the reasons Jezero Crater was picked as the landing site for the Mars 2020 mission, which was just launched this past July 30th, and is expected to reach Mars in February of 2021. Geologists are hoping to study and examine the sediment layers of areas where water was once present on Mars.

https://en.wikipedia.org/wiki/Jezero_(crater)

Trivia - the Mars 2020 mission will be the first time a helicopter will fly on Mars!
https://www.youtube.com/watch?v=GhsZUZmJvaM

Jezero Crater



Mars 2020 Mission landing ellipse (yellow) and Red Rover Jezero Crater map (red)

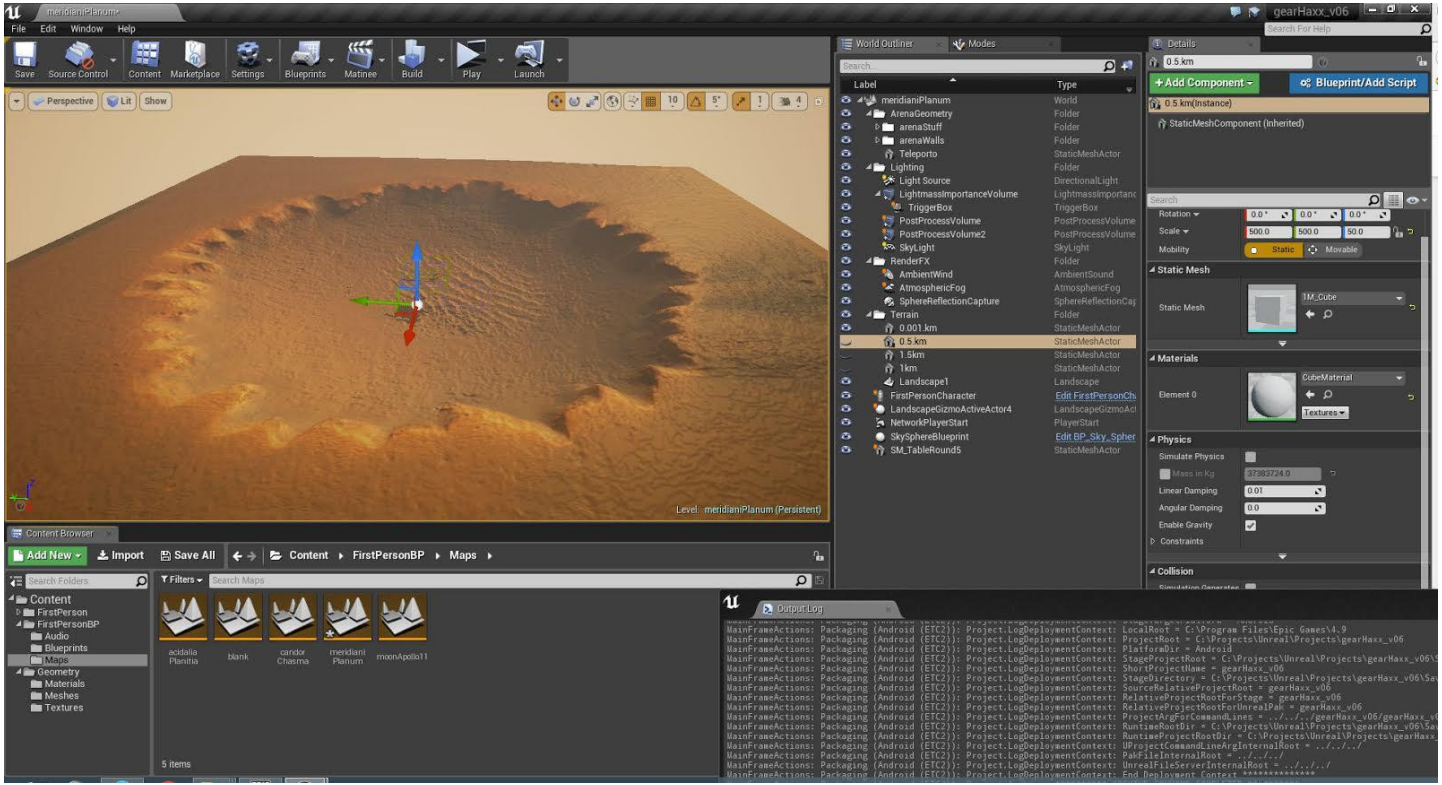
AMA!

Sample Questions:

- How are you able to keep your hair looking like a Brillo pad all the time?
- What is the airspeed of an unladen swallow?

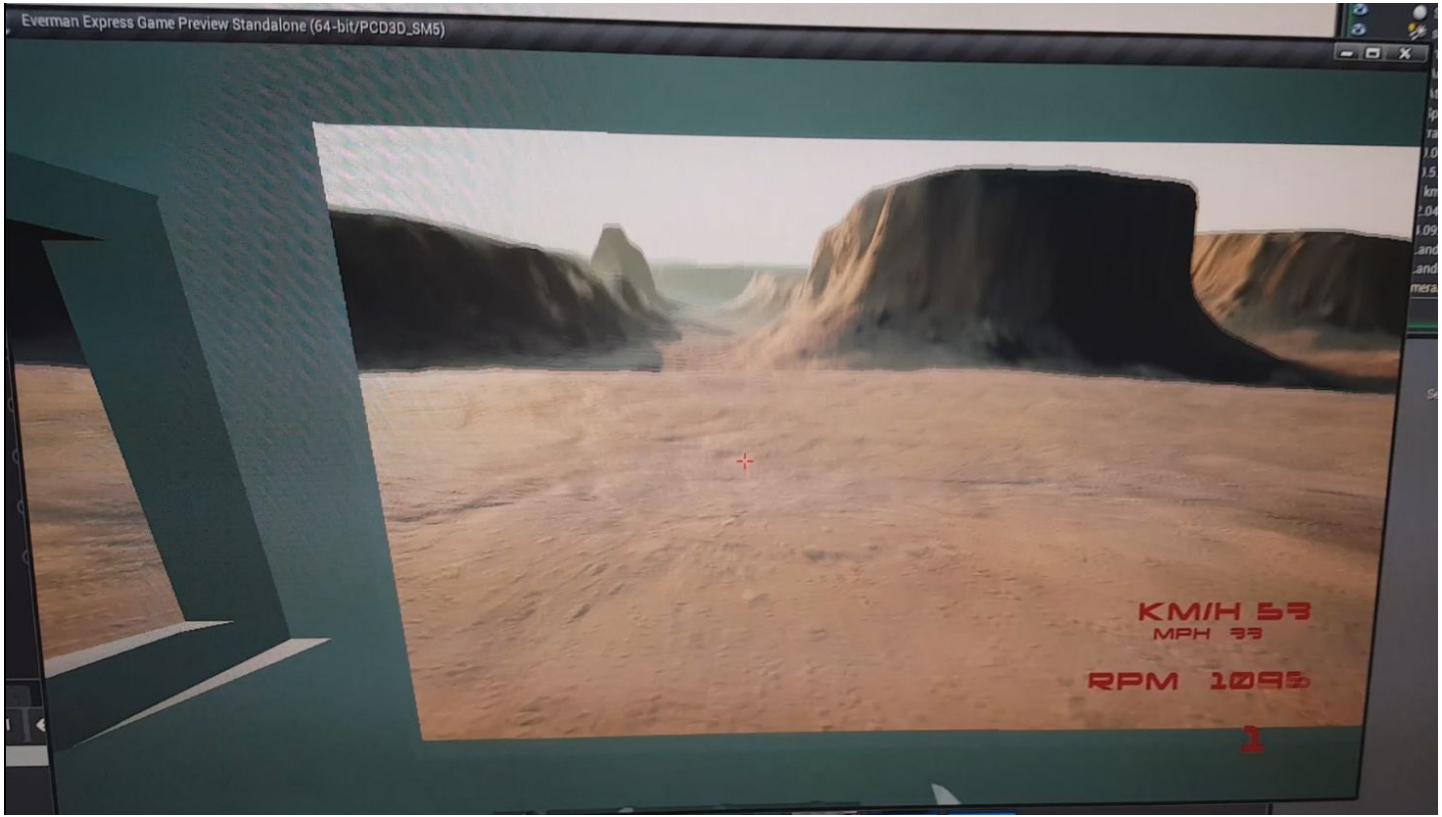
ADDENDUM

(please read in a Space Explorer voice)



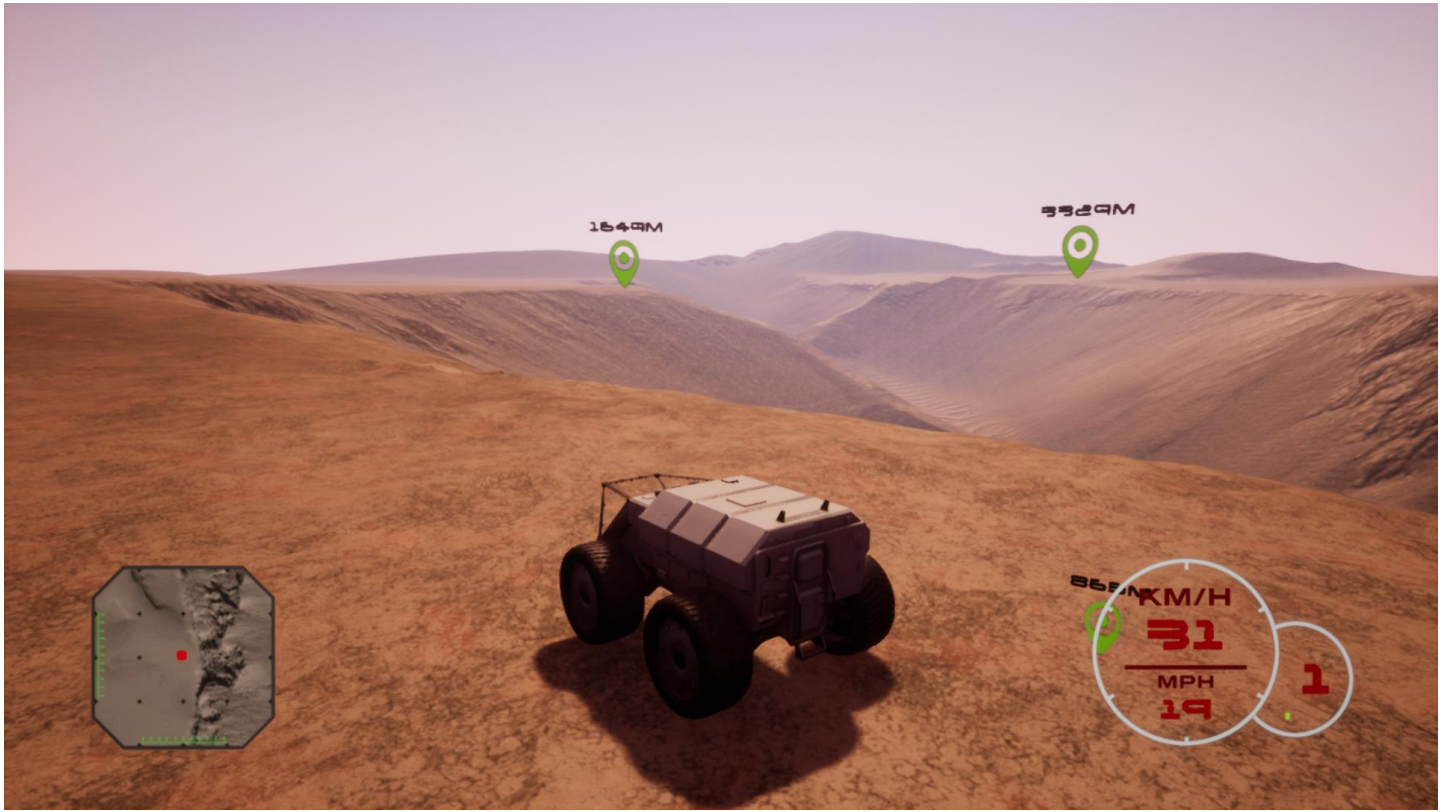
2016 - experiments with getting satellite data in Unreal Engine

early 2017 - vehicle test

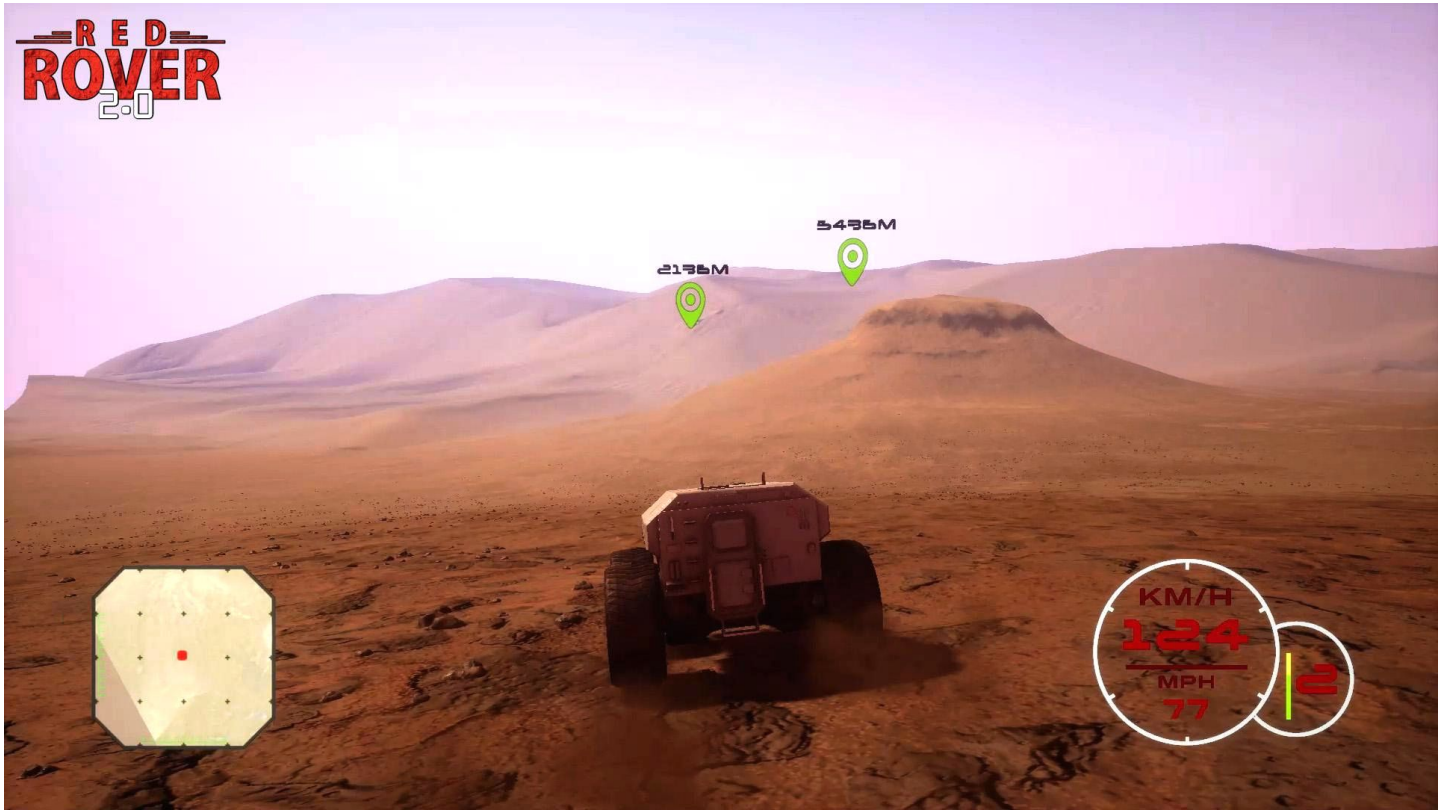


SHERP cockpit view

mid-2017



mid-2018 (v1.0)



2019 (v2.0)

Paying tribute to the explorers

2.1 Update - Telemetry support for motion simulators


RED
ROVER
PLANETARY DRIVING SIMULATOR