



Mars VR Phase I – MDRS VR *Requirements Specification v1.1*

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Executive Summary

This document provides the specifications for a Virtual Reality platform that can be used for serious research and public outreach towards the goal of sending humans to Mars. The Mars VR Program will be a multi-phase effort designed to establish the Mars Society as a pioneer in the emerging field of VR “CrowdExplorers” as it applies to Mars surface operations. We aim to establish the need for earth-based VR assistance with the initial human exploration of landing sites.

Phase I of the Mars VR Program will focus on designing training simulations for use at the Mars Desert Research Station, providing direct assistance in the training of MDRS crew members. MDRS represents the flagship of the Mars Society’s Mars analog research program that acts as a test bed for the techniques that will be needed during initial surface operations of a multi-disciplinary human crew. Since 2001, the MDRS has been host to over 190 unique crews comprised of over 1200 crew members.

Goals (Numbered Requirements)

1. A software stack for rendering Mars-analog VR environments

- 1.1. The stack is optimized for the current high-end consumer VR environments - HTC Vive and Oculus Rift.
- 1.2. The stack should have a “downlevel” experience – a user can view & have basic interaction with the VR environment using keyboard/mouse on a standard Windows PC with a high-end graphics card.
- 1.3. For the “downlevel” experience, MacOS would be nice but is not a hard requirement.
- 1.4. We assume the use of the industry-leading Unity framework as the base software technology to build & run the software stack.
- 1.5. The software stack should be portable to multiple app store platforms (Steam, Viveport, Rift Experiences), including as an option NO APP STORE (offered via a direct download).

2. Creation of a set of official MDRS models for the facilities and the one square-mile radius of terrain around the MDRS.

- 2.1. Exterior model of the MDRS Hab
- 2.2. Interior model of the MDRS Hab, focusing on the key training scenarios built as part of Phase I.
- 2.3. Interior model of the Greenhab, which can integrate with its mission content.

Mars VR Phase I Specification – MDRS VR

- 2.4. Interior models of the Science Dome, Musk Observatory, and connecting tunnels (likely simple)
- 2.5. Exterior models of the GreenHab, Science Dome, Musk Observatory, MDRS Robotic Observatory, RAM, and other related exterior objects/environmental aspects.
- 2.6. Terrain Model of the Mars analogue terrain in a one square mile around the MDRS.
 - 2.6.1. The Terrain Model should be captured using high-resolution photogrammetry and render well within the software stack with minimum edges/render artifacts.
 - 2.6.2. The Terrain Model should be extensible to add/modify existing facilities.
 - 2.6.3. The Terrain Model should be expandable in the future beyond one square mile to accommodate longer “simulated EVAs” within the VR environment.

3. Open Sourcing of key elements of the “platform” (specifically #1 and #2 above).

- 3.1. The key elements of the platform should be able to be open sourced using GPLv2, MIT, or a similar open source license.
- 3.2. The Mars Society will distribute the open source version using Github and other cloud-based services we will set up for this project to allow easy download of assets.
- 3.3. Having key elements of the platform open sourced will not preclude the building of content & other functionality on top of the platform. These additional elements (such as the Mission Content described below) can remain proprietary and privately held assets of The Mars Society and its authorized partners, and productized for fundraising and other purposes.

4. Creation of MDRS Training Scenarios (aka “Mission Content”) for use by MDRS crew members and sold to the general public.

- Mission content is the “application” for the above element described above in #1 and #2 that compromise the “platform”.
- 4.1. Mission Content is designed to be installed separately from the “platform”.
 - 4.2. Mission Content can be offered via the Steam store (or similar app platforms) as a download unlocked via an access key (GUID-based serial number).
 - 4.3. Mission Content is planned to be provided free of charge to MDRS crewmembers prior to their rotation, and offered as a perk (eg. as part of the Kickstarter) to the general public.
 - 4.4. Mission Content can be sold by the Mars Society or its authorized partners to generate revenue/funds for additional projects.

Tentative Milestones

Date	Milestone	Notes
Today (2/15/2018)	Kickoff	Inform & Mobilize the Team
2/26/2018	Kickstarted Video Produced	Video produced by Jennifer Holt
2/28/2018	Kickstarter Start	1 week to lock final plan for Kickstarter
4/14/2018	Kickstarter End	Project is Funded! (Ends on a Saturday)
4/21/2018	Technical Design Review	Dev Team – Technical Design Review. Gives the dev team a full week to finalize the design post-funding.

Mars VR Phase I Specification – MDRS VR

3/1 – 4/30	March/April Sprint	During this sprint, the team will manage the Kickstarter, receive the funds, and create & review the technical design, and incorporate any feedback post-review.
4/30	Sprint Review & May Sprint Planning	1 day of planning to review current progress and ensure platform is ready for Mission Content Dev.
5/1- 5/31	May Sprint	During this sprint , the team will begin building the VR software stack and plan out the activities needed for the June Onsite Mapping Mission at MDRS.
5/31	MDRS Field Season Ends	Tentative date based on end of field season & end of curated art contest.
6/1 – 6/15	June Onsite Mapping Mission	Onsite photogrammetry & mapping by Mars VR team. (Need to specify exact dates based on schedules)
6/16 – 7/7	Post-Mapping Integration	Finalize Facility Models & Terrain Models based on June Onsite Mapping Mission
7/2	July Sprint Planning	Tentative (ideally +1-2 weeks after Onsite Mapping)
7/1 – 7/31	July Sprint	During this sprint, the team will assemble the gathered assets into a VR environment of the MDRS.
7/31	July Sprint Review / August Sprint Planning	Tentative (towards the end of July)
8/1 - 8/31	August Sprint	During this sprint, the team will create & finalize the mission content
Mid/Late Aug	Beta Release	The VR Environment is in Beta and some mission content is available.
Mid Sept	Gold Release	The VR Environment is Gold and all mission content is complete.
Sept-Oct	MDRS Special Crew Rotation for Kickstarter VIPs	5 Days, 4 Nights at the MDRS for Kickstarter VIPs (dates need to be locked prior to Kickstarter based on program schedule)
Oct	Field Season #18 Begins at MDRS	We are training the crews using MDRS VR!

Kickstarter Levels

\$3 – Mars VR sticker with mission patch (same as at top of this document) – Anticipated Delivery in June (max 250?)

\$50 – Mars VR Metal Medallion (design TBD) – this is popular among the VR crowd – Anticipated Delivery in July (max 200?)

\$30 – Steam Key to unlock Mission Content – Anticipated Delivery in Sept (no max)

\$100 – early access to beta of open source platform & invite to exclusive beta participant forum – Anticipated Delivery in August. (no max)

\$400 – Core Developer Platform Access – become a core developer and join us for a special developer-focused online workshop & early-access to core developer forum – Anticipated Delivery in August. (max 100 seats)

Mars VR Phase I Specification – MDRS VR

\$1000 – Lunch at the MDRS – 1 day experience at the start or end of the special crew rotation (20 seats max – 10 at beginning of rotation & 10 at end of rotation). – Sept/Oct (exact dates posted on Kickstarter). This does not include your airfare, hotel and transportation to MDRS.

\$5000 – Jump the Line! – You get to go to MDRS as part of the special crew rotation run by MDRS Program Director Shannon Rupert (10 seats max). – Sept/Oct (exact dates posted on Kickstarter). This does not include your airfare and transportation to MDRS.

Donate – donations encouraged at any level – donors are emailed a special letter & certificate from Dr. Zubrin.

List of Initial Training Scenarios (“Mission Content”)

- Crew member completions will be awarded via badges and can be audited prior to their MDRS crew rotation.
- Mission Content will be distributed separately from the open source VR environment.
- Mission Content will be added to after the initial release (and likely revised each field season).

1. Guided Tour of MDRS

You are taken on a guided tour of the MDRS including all the facilities. There is information presented inline within this experience about the program and each facility.

2. EVA Preparation & Egress/ingress procedures

Preparation

1. Put on the flight suit including boots (likely click to put everything on). Includes gators on the lower parts of their legs.
2. Put on the backpack
3. Put on the Radio, Earpiece, microphone. Comm check.
4. Helmet

Egress

1. Get into Airlock
2. Make sure you have all your supplies. - black & white case (for gardening tools).
- Camera

Mars VR Phase I Specification – MDRS VR

- Maps
 - GPS device
 - sample containers (urine containers - easy to handle with gloves and don't leak)
 - digging tools
3. Wait - 5 Mins. Hab Comm. Get permission from internal crew. Confirms internal door is closed.
 4. Exit out of airlock

3. Rover / ATV procedures

1. How to turn on & start Rover
2. How to drive
3. Where to park
4. How to plug back in & confirm it's charging.

4. GreenHab

Generalized procedures for tending to plants.

- how to water a plant
- harvesting lettuce
- transfer of pollen
- transplanting pots
- environmental controls

5. Cooking with freeze dried food

Generalized procedures for cooking food, using pots & pans. Rehydrating food.

Kickstarter Stretch Goals

If extra funding is generated by the Kickstarter, we will scope out & work on the additional items:

1. Mars First Landing site environment (fictional but based on latest thinking of Human Mars exploration and real NASA imagery)
2. Mars First Landing mission content
3. Additional MDRS Mission Content:

Stretch Goal for Mission Content:

6. Show repair of a spacesuit fan in the RAM

- take suit apart for a fan that's broken. Solder back together.
- this would be more detailed than the other procedures.

Additional Information

For additional information on the project, please visit our website **MarsVR.marsociety.org**

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