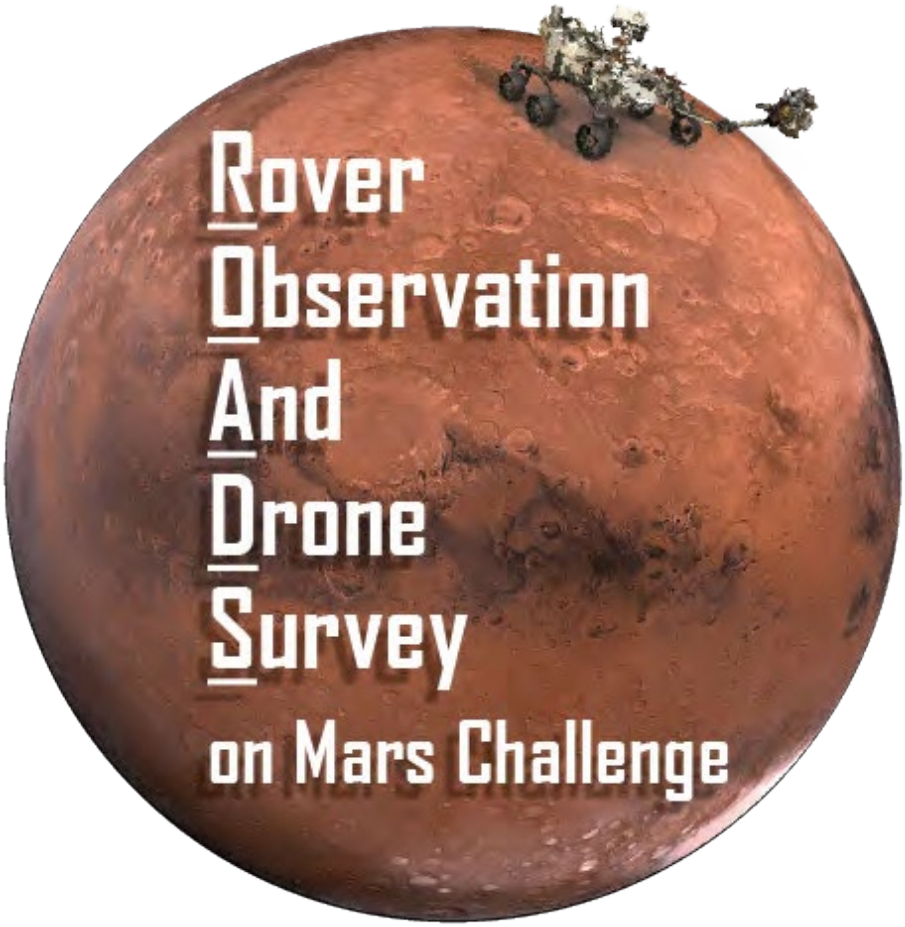


Southern California

Regional Supplementary Manual

Table of Contents

1 INTRODUCTION

1.1 About NASA California Space Grant Consortium

The California Space Grant Consortium (CaSGC) is California's implementation arm of NASA's National Space Grant College and Fellowship Program. It meets program objectives through a wide variety of aerospace-related activities that target pre-college to university level education and learning, research, workforce development, and public outreach. The CaSGC is comprised of colleges, universities, businesses, and other private and public sector institutions – all working to further aerospace education and career training through:

- Supporting student scholarships, fellowships, and traineeships for aerospace-related education;
- Providing support to faculty and students to develop career skills in aerospace-related fields (science, engineering, business, and education);
- Offering experiential learning opportunities aligned with NASA Mission Directorates (http://www.nasa.gov/)
- Stimulating public interest in aerospace-related disciplines and lifelong learning through community partnerships, thus increasing public appreciation for the direct and indirect benefits of the U.S. space program

The ROADS on Mars challenge leverages CaSGC expertise to engage students in technologies relevant for today's society. The challenge also gives students the opportunity to sense the spirit of achievement and exploration exemplified by all those working on the upcoming Mars 2020 mission.

Visit our website: http://www.orangecoastcolllege.edu/stem/

2 REGIONAL EVENT INFORMATION

2.1 Professional Development

While it is not a requirement to attend a professional development workshop as the training is also available virtually, details on the competition, opportunities to gain skills in operating drones and robotics, and materials and supplies to support the ROVER challenge will be provided at the professional development workshops offered in Southern California. You will find all details at:

http://www.orangecoastcollege.edu/stem/

Workshops will be held

TBA

2.2 Support

Teams and organizations are encouraged to register even if they are unsure about whether they have funding available for materials or travel. Registration is the best way we have to gauge both interest in the Challenge and need for materials such as borrowed drones and robots. Registration does not obligate a team or organization in any way. Closer to the April Southern California Challenge date, each registered team will upload their challenge video, log, and scoresheet for a chance to receive an invitation to the Southern California Hub event. The Southern California Hub will invite as many teams as possible based on event space capacity.

2.2.1 Funding

Teams are encouraged to seek funding. Teams may choose to use the sponsorship letter template that may be found on the NESSP website to request funding from local businesses or entities.

Funding for stipends is available for summer camp programs in Southern California, particularly in underserved communities. Funding is limited to availability.

2.2.2 Supply Lending

Supplies are available for Southern California programs and teams that demonstrate need and strong student participation, particularly in underserved communities, and organizations with greater than 50% free and reduced lunch. These organizations will be considered for funding first. If you are unable to secure materials for your team and can demonstrate need, indicate at registration that your team requests assistance with these materials when prompted. When Southern California Hub staff are reviewing need requests, your team may be asked to provide basic information that will allow us to determine how to distribute materials across the state. If approved, supplies provided on loan to a team at no cost may include one Force1 U49W Blue Heron WIFI FPV Drone, one LEGO Mindstorms EV3 Education Edition kit with charger, one digital microscope, one combustible gas detector, and if a high school team - one mini drone. Items to lend are not guaranteed and based on availability.

2.2.3 Travel Support

Travel support funding is available for Southern California teams that demonstrate need and strong student participation, particularly in underserved communities, that are located 2 or more driving hours away from Orange Coast College, the location of the Southern California Hub. These teams will be considered first for support. Travel support may be requested once your team is invited to the Regional Challenge Event. Notifications of funding approval will be sent to teams when invitations are sent.

2.3 Regional Hub Challenge

2.3.1 Date and Location

The Southern California Regional Challenge Event will be held on April 25th at Orange Coast College.

2.3.2 Important Dates & Deadlines

SEP, 2019	Official announcement of ROADS on Mars Student Challenge
OCT, 2019	ROADS on Mars Kickoff Event, Manual released
NOV 15, 2019	Virtual meet a Mars Scientist
JAN 31, 2020	Southern California Regional Supplement Manual released.
JAN 31, 2020	School year registration closes
FEB 5, 2020	Virtual Meet a Mars Scientist
MAR 30, 2020	Environmental Mini-Challenge Submissions Due
MAR 30, 2020	Search for Life Mini-Challenge Submission Due
MAR 30, 2020	Mission Patch Submissions Due

MAR 1-15, 2020	Local Organization Challenges and Team Selection
MAR 30, 2020	Invitations to Regional Challenges Announced
APR 15, 2020	Search for Life Mini-Challenge Awards Announced
APR 20, 2020	Mission Patch Awards Announced
APR 25, 2020	SoCal Regional HUB Challenge
JUL 17-AUG 5	Grand Prize visit – Mars 2020 Launch at Kennedy Space Center

2.3.3 Summer Camp Schedule

Summer Camp teams may participate in the mini-challenges and mission patch submission during their summer camp program and may determine their own deadlines before the end of the summer.

JAN 1, 2020	Summer registration opens
JUL 1, 2020	Summer Registration Closes
JUN-AUG 15, 2020	Summer camp challenges undertaken with video submissions
SEP 1, 2020	Summer Camp Winners announced
LATE SEP, 2020	JPL Visit

3 REGIONAL EVENT INFORMATION

3.1 Support

3.1.1 Supply Lending

We have a limited number of loaner supply kits for Southern California programs and teams that can demonstrate need and strong student participation, particularly in underserved communities, and organizations with greater than 50% free and reduced lunch. Limited supplies include Force1 U49W Blue Heron WIFI FPV Drone, LEGO Mindstorms EV3 Education Edition kit, and Combustible Gas Detector. A limited number of vinyl 8' x 10' Mars mats are available for those attending a professional development.

3.1.2 Travel Support

As funds allow, organizations and teams that are located 2+ driving hours away from professional development training and the regional competition in Costa Mesa, CA are eligible to apply for travel funds. Teams are encouraged to register even if they are unsure about whether they can participate because of material or travel needs. We cannot budget and identify team needs until registration is complete.

3.2 Southern California Regional Hub Challenge

3.2.1 Date and Location

The Southern California Challenge Event will be held April 25, 2020, in Costa Mesa, CA.

3.2.2 Additions to Submission Items for Regional Challenge

Mission Development Log

- As part of the submission for the Regional Competition teams must submit an electronic version of their Mission Development Log.
- The MDL may can be done electronically or hard copy.
  If teams do not have a digital MDL, you may scan or take pictures of your hard copy MDL and submit it as one document.
- As stated in Section 4.4 of the National Manual, teams are required to bring and present their Mission Development Logs to the officiating team at the Regional Challenge.
- The MDL should include:
  - Team Name and Team Members Names

- Evidence of the brainstorming process. This can be done in note/list form and will more than likely include rough sketches and annotations.
- Documentation of project progress
- Final sketch of design with overall dimensions. This may be a Multiview drawing to show all dimensions.
- Picture of final Mars experiments, testing, and device.
- Other documentation relevant to this design challenge is acceptable.
- If 3D printed, a screen capture of your design, open in the software you used, needs to be included.
- MDL rubric can be found in Appendix B

3.2.3 Hosting a Local ROADS on Mars Challenge

Teams are encouraged to host their own local challenges. These challenges will be organized and run by the local team. Winners from the local challenges will be eligible to submit their Mission Design Logs and apply to be selected for the Regional Challenge in Costa Mesa, CA in April. Any group that wishes to host a local competition will be listed on the Southern California website.

Any local ROADS on Mars Challenge must be completed by **March 30**, the deadline for all videos, scoresheets, and portfolios to be uploaded. All items should be uploaded to: https://forms.gle/JFLWsfWuXQZ3kq8ZA

Before the ROADS on Mars Challenge and Judging Begin

- ⌋ Utilize the http://www.orangecoastcollege.edu/academics/stem/Pages/K-12-STEM-Opportunities website and your own social media to advertise the event and to provide registration information.
- ⌋ Recruit and train judges and videographer.
- ⌋ Secure space large enough for 8' x 10' mat, secure area around the mat, table for team set up, and for the Mission Log review and testing. Where will teams and observers sit? Provide power strips for teams to charge robot and drone batteries in several locations in the room.
- ⌋ Set up Registration Table for Check In. Check with the team registration desk to ensure that all teams have checked in. Try to contact teams that are not checked in before removing them from the team registration list.
- ⌋ Provide an updated team registration list to the Challenge Manager.
- ⌋ Once the schedule and list of participating teams is established, Regenerate Challenge Schedule, if necessary.
- ⌋ Print Challenge teams for distribution to each team, the queue crew, scorekeeper, referees, judging teams, and key volunteers. If printing is not available, list teams and times on a flip chart or board.
- ⌋ Conduct a team meeting among volunteers prior to the start of the challenge.

During the Event

- ⌋ Ensure that snacks and beverages are available for all volunteers and lunch is provided for full- day of volunteering. Be sensitive to volunteer dietary restrictions. Follow venue food and drink policies. You may wish to have a group provide food, beverages, and snacks for sale if this is an all-day event or allow time for teams to go out for lunch, providing a list of places to eat in the area. Have a 12-1 break for lunch.

- Walk around to proactively resolve any issues, answer questions, and provide support, as needed.

- ⌋ Ensure that trash containers are emptied and that the restrooms are clean and well stocked.
- ⌋ Have the scorekeeper periodically save a copy of your event file on a USB flash drive.
- ⌋ Periodically ensure that the Judges receive updated match results and rankings to support their evaluations of teams.
- ⌋ Return portfolios to teams after the judging team has completed their evaluations if hard copies were provided. Not necessary if provided electronically.
- ⌋ If you have numerous teams, do you want an Emcee, sound system, etc.? An Emcee could provide updates as teams are competing as to what is happening.
- ⌋ Encourage all teams, volunteers, and sponsors to participate in the awards ceremony, which celebrates the accomplishments of all teams and provides recognition.
- ⌋ When judging is complete, collect the list of award winners from the lead Judge.
- ⌋ Thank your volunteers, coaches, mentors, parents, and sponsors for their invaluable support!
- ⌋ Announce Challenge winners!

After the Event

- ⌋ Upload the top two middle and top two high school team scoresheets, videos, and portfolios to the following website no later than March 15. All items should be uploaded to: https://forms.gle/JFLWsfWuXQZ3kq8ZA
- ⌋ Take down all equipment and materials for safe storage and clean the venue, as required.
- ⌋ Establish a plan and a place for participants to pick up lost and found items.
- ⌋ Send a follow-up message of appreciation to your volunteers.
- ⌋ Share photos and/or news from the event with the media and your community.

Celebrate your accomplishments! Remember the smiles! Thank you for your support!

CHANGE LOG FROM NATIONAL ROADS ON MARS MANUAL

Version 1.1

- Pg 4, Part III – Southern California high school students will attempt to fly a mini-drone from their rover into the heart of a crater to take a picture of the crater wall for bonus points.
- Pg 6 – Only five team members and their coach are eligible to earn the trip to Kennedy Space Center.
- Pg. 6 – Teams that submit the required items for Part I and Part II are eligible to borrow EV3's, drones, or mats.
- Pg. 13, 3.2.2 Team Members – Only 5 team members and their coach are eligible to earn the trip to Kennedy Space Center even though additional student members may assist with the challenge.
- Page 33, MO5 – Entry, Descent, and Landing (Opportunity and Curiosity Divisions only)
- Page 34 MO8 Probing the Surface (Curiosity, Opportunity, and Sojourner Divisions)
- After dropping off the samples, the rover needs to drive to the white square and place a LEGO piece simulating a probe into the soil sample located at the white square.
- Page 34, MO11 Crater Exploration (Optional for all Divisions. Bonus points will be awarded if completed.)

Version 1.2

- Pg. 21, 4.4- The MDL will be presented and described to the officiating team after their have completed the Robotic Exploration Challenge event.
- Pg. 32, 5.4- The teams will have 15 minutes to complete the Challenge

APPENDIX A

Flight Crew Roles:

The Flight Crew consists of 5 team members who will be responsible for activities at the Challenge Events. The Flight Crew must be in grades 5-12 or under the age of 18 on the date of registration. At Challenge Events, the Flight Crew are the only team members allowed on the challenge field and should have the following roles:

- COMMANDER-Commander ensures that each team member is on task and completing their assigned job role. The commander listens to any verbal commands sent by CAPCOM and relays them to the team. The commander will monitor time and keep the team aware of time constraints.
- UAV PILOT-The UAV Pilot is primarily responsible for piloting the UAV in an orbit around Mars and landing on the blue target. The UAV pilot is also responsible for retrieving and swapping the drone/lander for the rover.
- EVA OFFICER- The Extravehicular Activity Officer, or EVA Officer, is the primary team member responsible for operating, adapting, and executing the Mars Rover programs.
- SCIENCE OFFICER- The Science Officer is mainly responsible for completing the two soil sample site challenges completed when the Mars Rover reaches soil samples sites one and two.
- CAPCOM- The Spacecraft Communicator, or CAPCOM, may give verbal or visual signals as guidance to the UAV Pilot during Mars Landing and the EVA OFFICER during Surface Navigation. CAPCOM is the only flight crew member allowed near the challenge mat after the rover has been placed on the mat. CAPCOM must stay in the CAPCOM designated area throughout the challenge.

Flight Crew should have some type of uniform so they can be easily distinguished. The uniform could be that of an astronaut or school colors or other culturally relevant attire. Be original and creative as it will be part of the team's overall score.

Social Media Submissions

The social media post submission form is now ready for use! You can find it in the ROADS on Mars Team Portal, under the registration menu at nwessp.org. Here is the link:

https://wasp.ess.washington.edu/application_tool/NESSP_RoM/teams/

Sharing on social media

Please share your video on any of these social media platforms — Twitter, Instagram, Facebook, YouTube. Be sure you use the #ROADSonMars and #Mars2020 hashtags! Also make sure your post is public, or our team won't be able to view and score it!

Sharing with NESSP

To ensure that your team's submission is scored for the challenge, use the form below to tell us where we can see it. It doesn't matter which platform you use, but you are required to post it to at least one.

While it's not a requirement for scoring, we would also love to have a copy of your video! We may use these in, for example, highlight reels that we show during hub challenge events. For upload, your video should be in MP4 format and no larger than 1GB.

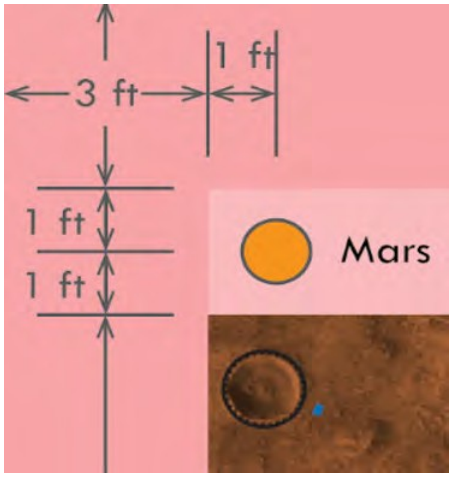
Details for submitting

To submit your team's mini-challenge submission, you must enter the 2 pieces of information that we use to identify your team in our system. These must match what we have on file in order for updates to be processed.

1. An email address associated with your team's registration. This could be either the email for the person who submitted your team's registration OR the contact email for the team.
2. Your assigned team number (team numbers take the format of two-character postal code and three numbers -- ex. WA001). You'll find this number in your registration confirmation email. If you've misplaced your confirmation, visit the Registration tab-team portal to Resend Registration Confirmation.

Approximate placement of Mars

All center points are measured from the top left corner of the mat by Jezero Crater. From the top left corner, the Mars globe will be positioned approximately one foot above the mat and one foot to the right. Mars will be placed on a stool. The height of Mars will be approximately 39 inches from bottom to top.



APPENDIX B: MDL RUBRIC

Mission Log Rubric pages can be found after Glossary.

Mission Log Requirements

Title Page:
Be sure to include the following on your title page:

- School or club name
- City and State
- Team name and number
- Project title

Team Information Page (include the following):

- Flight Director name and contact information
- School
- City, State
- Team members names, grade level, and job title

Table of Contents (include the following):

- Description
- Page number

Design Approach Overview:

- Describe the strategies/approach for creating your rover.
- What decisions were made for completing the task?
- What modifications were made throughout the process from your initial design to our final design?
- Explain your experience in creating our design. Be sure to discuss how you made our decisions. Discuss ideas that were considered for use or rejection.

Lander:

- Discuss why you created what you did and demonstrate that the EDP was followed.
- Shows/describes design iterations.
- Describes design deficiencies of initial designs.
- Describes why final design was chosen.
- Test results are clear and validate design decisions.

Communication Device:

- Discuss why you created what you did and demonstrate that the EDP was followed.
- Shows/describes design iterations.
- Describes design deficiencies of initial designs.
- Describes why final design was chosen.
- Test results are clear and validate design decisions.
- Design elements coherently clearly reflect the required competition components and their community.

Rover:

- Discuss why you created what you did and demonstrate that the EDP was followed.
- Shows/describes design iterations.
- Describes design deficiencies of initial designs.
- Describes why final design was chosen.
- Test results are clear and validate design decisions.
- Describe the characteristics and features of the task that affect how you built your rover.

Experimental Results:

- Discuss your trials for determining your code, process for pick up and deposit and times for completion of challenge
- Use graphs or charts to show our results.

Reflections:

- Reflect on our experience with this challenge.
- What would you do differently?
- Were there parts that you enjoyed or that challenged you?
- How do you think your new knowledge or experience will assist you in your future endeavors?

Challenges:

- Morphology, Search for life, Craters
- Discuss your conclusions about the experiments your conducted.
- Be sure to use information from your video
- Include scientific language and concepts that demonstrate your understanding of the challenge and how the terrain of mars was affected.

Mission Patch:

- Picture of your patch design
- How did you design what you did?
- Mission patch or logo clearly reflects all three objectives: their team goals in the ROADS on Mars Challenge, their community, and NASA/Mars 2020 rover.
- Color palette enhances the meaning of the work.
- Explain the components and significates of each item and how it reflects all three reflects all three objectives: their team goals in the ROADS on Mars Challenge, their community, and NASA/Mars 2020 rover.

Overall Appearance:

- Work is organized and easily understood.
- Clean and neat appearance throughout the mission log.
- Design elements coherently reflect the competition scientific theme and their community.

GLOSSARY

Above Ground Level (AGL)

ROADS on Mars Challenge

Drone

Flight Crew

Autonomous

Flight Director

Guidance Officer

Communication Device

Mars

Mars 2020 Rover

Small Unmanned Aircraft System

Mission Log Rubric

General Information	
Includes all of the following elements on the cover page • School or club name • City and State • Team name and number • Project title • Image that represents community	All or nothing: • Required elements *0 or 5 points*

Score

Team Information	
Includes all elements: • Flight Director name and email address • Team members' names, grade levels, and ages.	All or nothing: • Required elements *0 or 5 points*

Score

Table of Contents	
Includes Page/Section Descriptions and page numbers	All or nothing: • Required elements *0 or 5 points*

Score

Team: _____

Score per section

General Information	
Pre-Challenges Part I and II	
Team Information	
Table of Contents	
Engineering Design Process	
Pre-Challenges Part I and II	
Graphics, Scientific and Engineering Terms, Appearance	

Total Score (Max. 100 points) _____

Notes:

Engineering Design Process (EDP) (Specific EDP steps do not have to be listed or specifically described, but the content should show the use of the process.)	**Excellent** *8 to 10 points*	**Good** *5 to 7 points*	**Fair** *2 to 4 points*	**Needs Improvement** *0 to 1 points*	**Element Score**
Communication Device	● All content clearly demonstrates that the EDP was followed. ● Shows/describes design iterations. ● Describes design deficiencies of initial designs. ● Describes why final design was chosen. ● Test results are clear and validate design decisions. ● Design elements coherently clearly reflect the required competition components and their community.	● Majority of content clearly demonstrates that the EDP was followed. ● Shows/describes design iterations. ● Does not describe design deficiencies of initial designs. ● Describes why final design was chosen. ● Test results validate design decisions. ● Design elements reflect the required competition components and their community but are not coherent between each other.	● While the content demonstrates the use of the EDP, it was not completely followed. ● Design iterations not completely shown/described. ● Does not fully describe why final design was chosen. ● Test results are unclear or do not fully validate design decisions. ● Design elements reflect at least one theme (required competition components or their community).	● It is not clear that the EDP was used. ● Design iterations are either not shown or are not completely described. ● Test results are either not shown or do not validate design decisions. ● Design elements are not coherent and do not match the required competition components or their community.	*10 points max.* _____
Lander	● All content clearly demonstrates that the EDP was followed. ● Shows/describes design iterations. ● Describes design deficiencies of initial designs. ● Describes why final design was chosen. ● Test results are clear and validate design decisions.	● Majority of content clearly demonstrates that the EDP was followed. ● Shows/describes design iterations. ● Does not describe design deficiencies of initial designs. ● Describes why final design was chosen. ● Test results validate design decisions.	● While the content demonstrates the use of the EDP, it was not completely followed. ● Design iterations not completely shown/described. ● Does not fully describe why final design was chosen. ● Test results are unclear or do not fully validate design decisions.	● It is not clear that the EDP was used. ● Design iterations are either not shown or are not completely described. ● Test results are either not shown or do not validate design decisions.	*10 points max.* _____
Rover and Programming Process	● All content clearly demonstrates that the EDP was followed. ● Shows/describes design iterations. ● Describes design deficiencies of initial designs. ● Describes why final design was chosen. ● Test results are clear and validate design decisions.	● Majority of content clearly demonstrates that the EDP was followed. ● Shows/describes design iterations. ● Does not describe design deficiencies of initial designs. ● Describes why final design was chosen. ● Test results validate design decisions.	● While the content demonstrates the use of the EDP, it was not completely followed. ● Design iterations not completely shown/described. ● Does not fully describe why final design was chosen. ● Test results are unclear or do not fully validate design decisions.	● It is not clear that the EDP was used. ● Design iterations are either not shown or are not completely described. ● Test results are either not shown or do not validate design decisions.	*10 points max.* _____

Pre-Challenges Part I and II, Mission Patch	**Excellent** *5 points*	**Good** *4 points*	**Fair** *2 to 3 points*	**Needs Improvement** *0 to 1 points*	**Element Score**
Landscape and Morphology: Crater Formation	● Clear evidence of three or more different ways that craters are formed and provides insight into the processes that shaped other objects in the solar system. ● Slow motion video very clearly demonstrates the processes by which craters are formed and is posted on social media with team#. ● All stages of the process are clearly documented graphically and neatly labeled in the MDL.	● Evidence of at least two different ways craters form and provides insight into the processes that shaped other objects in the solar system. ● Slow motion video clearly demonstrates the processes by which craters are formed and is posted on social media with team#. ● All stages of the process are documented graphically and are labeled in the MDL.	● Evidence of one way in which craters form. ● Slow motion video demonstrates the processes by which craters are formed. ● Some stages of the process are documented graphically in the MDL.	● No evidence of ways in which craters form. ● Video does not demonstrate the process by which a crater is formed. ● No documentation of crater formation in the MDL	*5 points max.* _____
Landscape and Morphology: Delta Dynamics	● Had three or more conclusion developed with detailed justification to support what may have created the features within Jezero crater. ● Used three or more substances (as terrain) during their stream table tests, added other features (such as trees, houses, etc.) to their terrain. ● Time lapsed video was extremely clear and easy to follow. Video was uploaded to social media with team#. Included evidence of multiple terrains, added features, collaboration, showed clear evidence of conclusion. ● Able to relate to similar processes in community and possible solutions to stop erosion. Able to list places that would be best to search for past life.	● Had two or more conclusion developed to support what may have created the features within Jezero crater. ● Used three substances (as terrain) during their stream table tests and added a feature (such as a tree, house, etc.) to their terrain. ● Time lapsed video was clear and easy to follow. Video was uploaded to social media with team#. Included evidence of some terrains, added some features, collaboration, showed evidence of conclusion. ● Able to relate to similar processes in community and list a possible solution to stop erosion. Able to list one place that would be best to search for past life.	● Had at least one conclusion developed to support what may have created the features within Jezero crater. ● Used two substances during their stream table tests. ● Time lapsed video was difficult at times to follow. Included evidence of a terrain and evidence of a conclusion. ● Able to relate to a process that might be similar to help stop erosion.	● Did not have any conclusions to support the formation of the features within Jezero crater ● Used only one substance during their stream table tests. ● No Time lapsed video was recorded. ● Did not relate to a process nor give a solution to help stop erosion.	*5 points max.* _____

Search for (Terrestrial) Life	● Included extensive details and relevant examples in MDL ● Extensive use of data such as graphs, charts, photographs, images, sketches, video, and/or local maps to display information. ● Terminology made the ideas in the project clear. ● All team members visibly and actively participated and/or contributed. ● All information was accurate and delivered effectively.	● Included details and relevant examples in MDL ● Use of data such as graphs, charts, photographs, images, sketches, video, and/or local maps to display information. ● Terminology made the ideas in the project clear. ● Most team members visibly and actively participated and/or contributed.	● Information related to the topic in MDL, but documentation needed more details and examples to fully support ideas ● Use of minimal data such as graphs, charts, photographs, images, sketches, video, and/or local maps to display information. ● Used wrong terminology to describe challenge ● Work showed very little student understanding	● Information not related to the topic in MDL. ● No use of data such as graphs, charts, photographs, images, sketches, and/or local maps to display information. ● Used wrong terminology to describe challenge ● Work showed very little student understanding	*5 points max.* _____
Mission Patch Design Process	● Mission patch or logo clearly reflects all three objectives: their team goals in the ROADS on Mars Challenge, their community, and NASA/Mars 2020 rover. ● Message is bold, compelling and possibly multilayered. It goes beyond the obvious. ● Design elements coherently reflect the competition scientific theme and their community. ● Placement of elements is precise so that reader can clearly perceive what is important and what is connected. ● Color palette enhances the meaning of the work. ● Work has no evident imperfections. Work is clean and neat. ● Shows/describes design iterations.	● Mission patch or logo reflects at least two objectives: their team goals in the ROADS on Mars Challenge, their community, and NASA/Mars 2020 rover. ● Message is clear and compelling. It may not be as subtle as it could be. ● Design elements reflect science and their community but are not coherent between each other. ● Text and graphics are strategically spaced so that related elements are close together. It is clear what is connected. ● Colors are used appropriately and do not clash with one another or clutter the work. ● Work may have slight imperfections, but they are not immediately obvious. ● Shows design iterations.	● Mission patch or logo slightly reflects at least one objective: their team goals in the ROADS on Mars Challenge, their community, and NASA/Mars 2020 rover. ● Message is clear but fails to go beyond something simple or obvious. ● Design elements reflect at least one theme (science or their community). ● Text and graphics are spaced so that related elements are close together. ● Colors are mostly effective although there may be minor clashing. ● Work has imperfections that create minor distractions. ● Shows design, but no design iterations.	● Mission patch or logo **does not** reflect the objectives: their team goals in the ROADS on Mars Challenge, their community, and NASA/Mars 2020 rover. ● Message is slightly confusing, absent, or contradictory. ● Design elements are not coherent and do not match the science or their community. ● Elements are not put together or separated in any organized fashion, creating a chaotic look. ● Color choices clash at times and/or clutter the work. ● Imperfections are highly distracting and take away from the overall effectiveness. ● Does not shows design or design iterations.	*5 points max.* _____

Graphics, Scientific and Engineering Terms, Appearance	**Excellent** *8 to 10 points*	**Good** *5 to 7 points*	**Fair** *2 to 4 points*	**Needs Improvement** *0 to 1 points*	**Element Score**
Graphics (Sketches, CAD drawings, photos, diagrams, charts, and graphs)	● 100% of design iterations are described using graphics. ● 3 or more types of graphics are included. ● Test results include the use of graphics. ● Descriptions are clear and lead to a complete understanding of the graphics.	● 90% design iterations are described using graphics. ● At least 2 different types of graphics are included. ● Test results include the use of graphics. ● Most descriptions are clear and lead to a complete understanding of the graphics	● 50% design iterations are described using graphics. ● Test results do not include the use of graphics. ● Most descriptions are unclear or lead to an incomplete understanding of the graphics.	● 25% or less of design iterations are described using graphics. ● No explanation of graphics.	*10 points max.* _____
Scientific and Engineering Terms	● At least 6 engineering and scientific terms are used throughout the mission log.	● Between 4 and 6 engineering and scientific terms are used throughout the mission log.	● Only 1 to 3 engineering and scientific terms are used throughout the mission log.	● No engineering or scientific terms used.	*10 points max.* _____
Appearance	**Excellent** *8 to 10 points*	**Good** *5 to 7 points*	**Fair** *2 to 4 points*	**Needs Improvement** *0 to 1 points*	**Element Score**
Overall Appearance of MDL	● Organized and neat appearance throughout the mission log. ● Design elements coherently reflect the competition scientific theme and their community. ● Work has no evident imperfections. Work is clean and neat.	● Organized and neat appearance in the majority of the mission log. ● Design elements reflect science and their community but are not coherent between each other. ● Work may have slight imperfections, but they are not immediately obvious.	● Organized and neat appearance in less than half of the mission log. ● Design elements reflect at least one theme (science or their community). ● Work has imperfections that create minor distractions.	● Very sloppy throughout the mission log. ● Design elements are not coherent and do not match the science or their community. ● Imperfections are highly distracting and take away from the overall effectiveness.	*10 points max.* _____