**MDRS Crew Application for 2020-2021**

**PART ONE**

1.  Team Member Names:

Charlie Nitschelm

2. Postal Address (All Home Addresses)

Charlie Nitschelm 30 Coe Dr., Durham, NH 03824

3. Citizenship Status:

Charlie Nitschelm: US Citizen

4. Email Address:

Charlie Nitschelm: [charlie.nitschelm@seds.org](mailto:charlie.nitschelm@seds.org)

5. Telephone Number:

Charlie Nitschelm: 603-923-9079

6. Birthdays

Charlie Nitschelm: 30 April 1998

7. Application Type:

Self-Organized Team

Team Name: Patamars

8. Applicant Type:

Charlie Nitschelm: Undergraduate Student

9. Available Rotation Dates:

Feb 6-21

Feb 20-Mar 7

Mar 6-21

Mar 20-Apr 4

Apr 3-18

10. ILR Level of English Language Proficiency:

Charlie Nitschelm: Native

11. Dietary Restrictions or Food Allergies:

Charlie Nitschelm: None

12. Valid Driver’s License:

Charlie Nitschelm: Yes

13. Past Analog/Expedition Experience:

*Charlie Nitschelm*: Experience in a four-day long canoe and camping trip down a river using basic wilderness techniques. Experience in surviving off the land with daily lessons in Outdoor Living Skills at a YMCA camp in New Hampshire for 8 years.

14. Declaration of Physical Fitness:

Charlie Nitschelm: I attest that I am sufficiently able-bodied to do all of these things.

15. Declaration of Medical Aptitude:

Charlie Nitschelm: I attest that I do not have, and have no history of, any of the above-mentioned health conditions.

16. Declaration of No Communicable Diseases:

Charlie Nitschelm: I attest that I do not carry any communicable diseases.

**PART TWO**

Team Role Assignment:

*Charlie Nitschelm*

Role: **Crew Astronomer**

Justification: Over my undergraduate career, I have focused on the founding of UNH SEDS, the first rocket organization on campus. First, we worked with off-the-shelf engines and used in-depth MATLAB simulations for trajectory and dimension optimization. Then quickly moved into the development of Runaway, our hybrid rocket engine. We are currently working towards qualifying Runaway so that we can integrate it into a rocket for the Spaceport America Cup in June 2020. In May of 2019, I was elected as the ‘Member at Large’ for SEDS USA, the presiding organization for all SEDS chapters nationwide. I have taken on the development of a SEDS Wiki which will be a repository of knowledge between the chapters. The goal is to create a more intimate community with chapters helping each other grow and prosper. I interned at Rocket Lab in California this past summer as a propulsion manufacturing engineer. Being the only engineering intern during the summer, I gained experience throughout the entire production process of the Rutherford engine for the Electron launch vehicle. I primarily focused on creating tooling to improve the quality and runtime of the engine’s thrust chamber. I have also been very curious about the universe, leading me to get a minor in Physics that allowed me to take Astronomy, Classical and Mechanical Physics, and Modern Physics, all classes that explore very interesting topics not touched upon in a mechanical engineering degree.

**PART THREE**

Team Member Skills and Prior Experience:

*Charlie Nitschelm*

**Lab Research:** Mechanical behavior of nickel-based super alloys in extreme conditions

**Leadership*:***Founded and currently the Lead Engineer of the University of New Hampshire’s Students for the Exploration and Development of Space (Rocket Team).

**Group participation showing a long-term commitment***:* Founded UNH SEDS almost 3 years ago, growing the group to the biggest and most popular engineering organization at the school

**Mechanical skills*:*** Rocket engines, machine design analysis, general maintenance.

**Electronic skills:** Soldering, Arduino, measuring and testing circuits

**Communication and collaboration with diverse cultural groups not centrally located:**Leading the development of the SEDS USA wiki by managing the knowledge input of people around the country with many different backgrounds.  
**Licenses/Certificates:** SolidWorks, National Association of Rocketry

**PART FOUR**

1. Team Member Resumes w/ References (Included at End of Document):

Dylan Dickstein: Submitted

Shayna Hume: Submitted

Ellie Hara: Submitted

Stephen Samples: Submitted

Charlie Nitschelm: Submitted

Samantha Breana: Submitted

Julio A. Hernandez: Submitted

1. Research Summary for MDRS Rotation (Included on Next Page)
2. Additional Paperwork (N/A)

**MDRS Research Summary for Team Patamar**

**Research Objectives**

Physiology: *Meditation and its Effect on the Astronaut Condition*

This experiment endeavors to qualify and quantify the effects of meditation on team cohesion, heart rate, and fatigue levels while in high-stress isolated conditions such as a Mars base camp.

Botany: *A Feasibility Study on Dietary Supplementation of High Caloric Plants in Hostile Substrates*

This experiment endeavors to quantify the minimum space required adequate dietary supplementation of rapidly harvested peas.

Chemistry: *In-Situ Resource Utilization: Sabatier Process*

This experiment seeks to qualify the small-scale and low budget feasibility of the Sabatier process whereby carbon dioxide helps produce methane.

Aerospace: *Mars Reactor Assembly Study*

The procedural issues associated with the roll-out of a martian kilopower-class nuclear reactor will be investigated through the simulated assembly, installation, and operation of a small dummy/simulation reactor.

**Research Plan**

Physiology: *Meditation and its Effect on the Astronaut Condition*

Meditation is understood to improve mood, increase productivity, and alleviate pains. To test its effectiveness on the astronaut condition, three individuals assigned to EVAs shall undergo a range of meditative styles and durations. This shall compare against the control which is an EVA without prior meditation. Three meditative styles, facilitative, evaluative, and narrative shall be employed for 10 minutes, 30 minutes, and 1 hour each. Heart rate, fatigue, and mood with then be evaluated at different stages of fieldwork.

Botany: *Feasibility Study on Dietary Supplementation of High Caloric Plants in Hostile Substrates*

The design of a food supply system is a fundamental part of the future human exploration of space. In this study, we aim to quantify the impact of different soil properties on the growth of lettuce, Swiss chard, radishes, Chinese cabbage, peas, and other high caloric crops. The first group will be grown in nutrient-rich soil while the two remaining groups will be grown in soil with mass fractions of 25%, 50% and 75% of Mars Global Simulant (MGS-1), respectively. The fieldwork aspect will be heightened by another teammate placing the soils in navigable locations, requiring a third teammate to navigate to them and ensuring the soil properties match the intended sample. The caloric density of each crop will be measured in terms of the mass fraction of MGS-1.

Chemistry: *In-Situ Resource Utilization: Sabatier Process*

Proving the process of producing fuel while on the surface of Mars is fundamental to the goals of Dr. Robert Zubrin and the Mars Society as a whole. Thus, performing a simplified and low yield Sabatier process whereby reactant CO2 results in a CH4 product is a potential milestone for MDRS. To achieve the chemical equation CO­­2 + 4H2 → CH4 + 2H2O, water is garnered from electrolysis and carbon dioxide is supplied in canisters. In the name of fieldwork, the water shall be melted from frozen ice retrieved during an EVA. A pressure vessel heat source raises the CO2 and H2 reactants to 400℃ and maintains them at 11.2 psia. Note that this experiment shall be proven prior to MDRS to ensure safety and procedural fluency.

Aerospace: *Mars Reactor Assembly Study*

A small dummy reactor in similar dimensions to NASA’s kilopower will be delivered disassembled to the MDRS along with the crew. Over the first few days, the reactor will be assembled according to a predetermined procedure, and installed in the desert via a series of EVAs. Crew member exertion will be determined via heart-rate monitors to identify procedures which may require simplification in the future. Over the remaining days, the reactor will be maintained by periodic EVAs. To make this fieldwork more challenging and realistic, small changes will be made to the dummy reactor that fellow astronauts will need to notice and fix to keep it functional.

**Outreach**: The opportunity to be placed in an MDRS rotation is far more than the science and engineering performed during the two-week tenure. Outreach is crucial as it helps excite the masses and gives the mission a greater purpose. The team shall collect hand-made letters from underprivileged K-12 classrooms near members’ respective universities and bring them to the site. Reading of these letters shall be recorded on camera from the test site and sent back to these classrooms. The Students for the Exploration and Development of Space (SEDS) USA organization shall also publicize results and accounts of MDRS experiences.

**Education:** Given the combination of environmental uniqueness at MDRS, proposed fundamental science experiments, and the team’s strong collective journal citation count, there is great potential for MDRS to be acknowledged in journals such as the AIAA Journal of Propulsion and Power and IEEE Transactions on Nuclear Science. A couple members from the team shall apply for a TEDx talk following the rotation to discuss the experience and lessons learned.

**Media:** Further dissemination of updates and conclusions from MDRS will be accomplished via YouTube, Instagram, Facebook, and Twitter. Several of the individuals on the team are especially active on these platforms and have strong followings. Furthermore, most individuals have connections with major aerospace companies including, SpaceX, The Aerospace Corporation, Northrop Grumann, and others. This is valuable for gaining media coverage, future volunteers, and potential sponsorships for the MDRS program.

**Collaborators/Sponsors:** The individuals that comprise this team are incredibly well connected. Organizations including The Explorers Club, The Matthew Isakowitz Fellowship, and SEDS are some of the entities that would be interested in collaborating and even sponsoring the activities and research associated with this team.

**Institution Affiliation:** Regarding institution affiliation, the team is geographically diverse. Team members hail from UCLA, CU Boulder, University of Alabama in Huntsville, University of New Hampshire, and Purdue. With most regions of the United States covered, this team has the power to spread its passion for the human exploration of Mars to a wide audience.



