SUSTAINABLE EXTRATERRESTRIAL CONSTRUCTION AND INSTRUMENT DEPLOYMENTS AT NASA AMES

ARTEMIS

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With Support of Mentors Brian Glass & Sarah Seitz

NORTH DAKOTA SPACE GRANT CONSORTIUM

NASA

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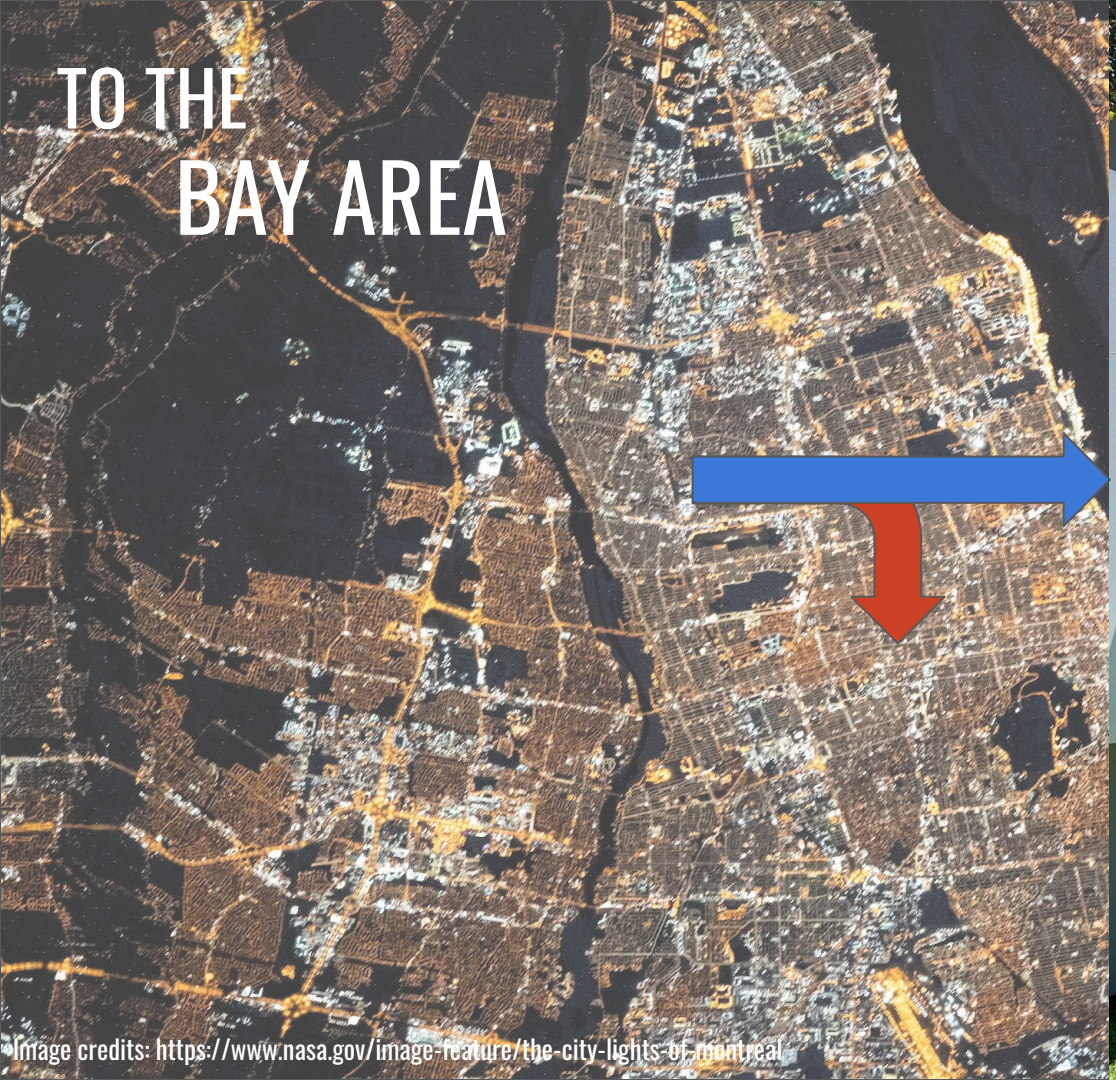
TO THE BAY AREA



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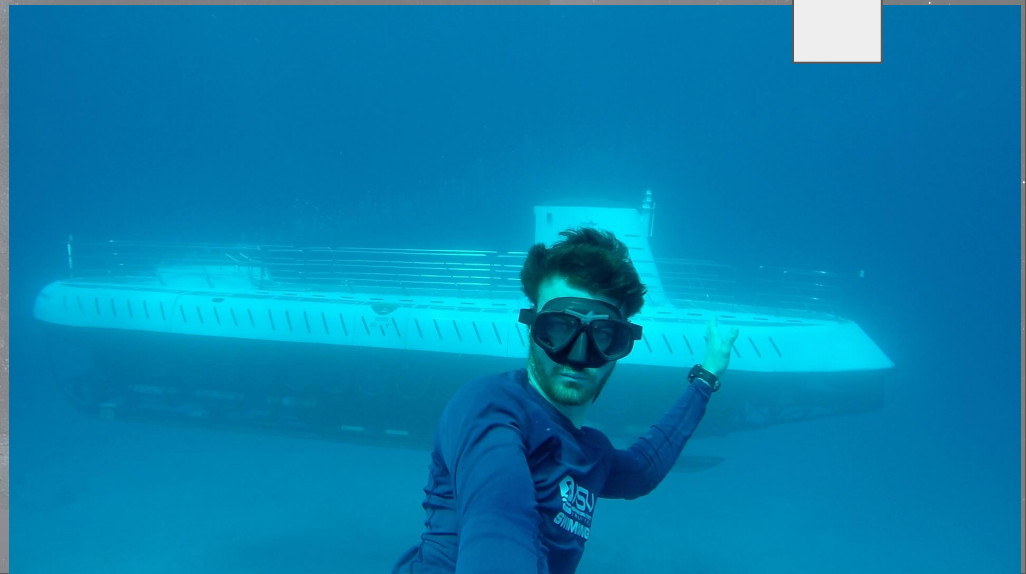
How Did I Get There?

- Good question!
- Solid study habits and success network
- Major life-path transitions – never too late to start something new!
- Dedication
- Curiosity
- Great University and support
- Awesome professors
- Just darn applying!



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Where I Worked: Deployable Autonomy Technologies Group

- Within the Intelligent Systems Division at ARC
- Labs and competencies of the group marries automation, AI, and robotics technologies with prototype space systems
- Includes planetary surface instruments, drilling and sampling, modeling and visualizing the deployed environments, manipulating in-situ resources and robotic local construction
- Developed and researched novel solutions in planetary rover systems

Image credits: nasa.gov

ARADS and Previous Research Developed Upon

Image credits: B. Glass, S. Seits (NASA)

- The ARADS team has been developing an astrobiology and geology drilling and sampling planetary rover on a KREX2 platform
- This research has build on close to a decade of research, field studies, and real world testing
- Most recent field expedition to the Atacama desert, Chile 2019
- Specific capabilities are advanced percussion drilling and sampling, autonomous operation, sample caching, and in-situ analysis

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An estimate of number of pages to read by EOD 1?

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353!

- Not light reading either!
- This was just to get up to speed on the team's capabilities, current state of research, and other research teams preliminary methodologies
- "Welcome to the big leagues" my intern partner and I though...

Image credits: nasa.gov

Back to Planetary Rovers

- Data is cheap; analysis and insight is expensive

- What is the magnitude of difference in data collection across various rover systems?

Image credits: nasa.gov

Back to Planetary Rovers

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- What is the magnitude of difference in data collection across various rover systems?

For us close to x2,000,000!

With that, how in the world do diverse team members access needed data intelligently?

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Goals of Research & Development

- One centralized platform to host all various mission data
- Visualized and interpreted insights from this data in format accessible to team members of diverse functions
    - Geology investigators need different insights than the robotics team!
- A database management system designed with these above in mind as well as the various rover and mission data stream sources
- Situational aware platform ready for field deployment providing real-time insights

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Software Engineering, Systems Engineering, & Data Science

- My specific goals integrated these 3 above disciplines to develop a centralized planetary rover mission data synthesis and visualization platform
- GIS integration of data capture and analysis tools for situationally aware field operations
- Programming, prototyping, testing, validation of software tools
  - Python, ArcPy, ArcGIS API, Pandas, NumPy, Matplotlib, Jupyter
- Database and data management planning

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Other Work Functions

- Project Management
  - Generally self-directed researcher
  - Evaluated and made decisions on R&D directions based on findings and analyses
  - Managed project timeline, conferred with team and contractors
- Papers, Proposals, Abstracts
  - Contributed to preparing NASA mission proposals (VIPER Co-I), conference abstracts, and journal publications
  - Look for my abstract and journal publication at ASCE Earth and Space 2022 coming up end of April!

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My Main Takeaways: A Research Environment

- Research is called that because no one is doing what you have set out to do
  - No readily available resources, lots of unknowns
  - Exciting for this very reason! To boldly go where no one has gone before
- When the whole team is of high-caliber and finding new information, it can be easy to accomplish a whole lot in the wrong direction!
  - Many incredible things can be done but are they relevant and progressing the research in the best direction? Sometimes hard to tell!
- Group moral is best when everyone is comfortable being their full selves
  - Over formality helps no none. Be polite and respectful, but have fun; its space R&D after all, and everyone there has the same stoke to be there!

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What's Next?

- Software & Instrumentation Research Internship at

- Master of Science in Systems Engineering here at UND!

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After That?

- Who knows!
- Have had positive interviews for full-time positions starting in fall
- Photo taken at a recent interview for a rocket engineering startup company!

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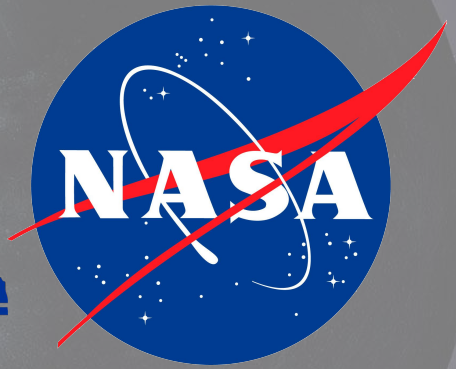
A Huge Thank You!

- Without the support from the North Dakota Space Grant Consortium, my wonderful experience would not have been possible



Thank you for helping me achieve a lifelong dream; I worked for NASA!

- An enormous thank you for the generosity of the NDSGC grant stipend, to my mentors Brian Glass & Sarah Seitz, and the NDSGC team who helped my all the way through the process

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What did you think?

QUESTIONS?

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