Navigating the World of Systems Engineering

Arno Rogg's Perspective from Student to a Leadership Role on a Lunar Rover Mission

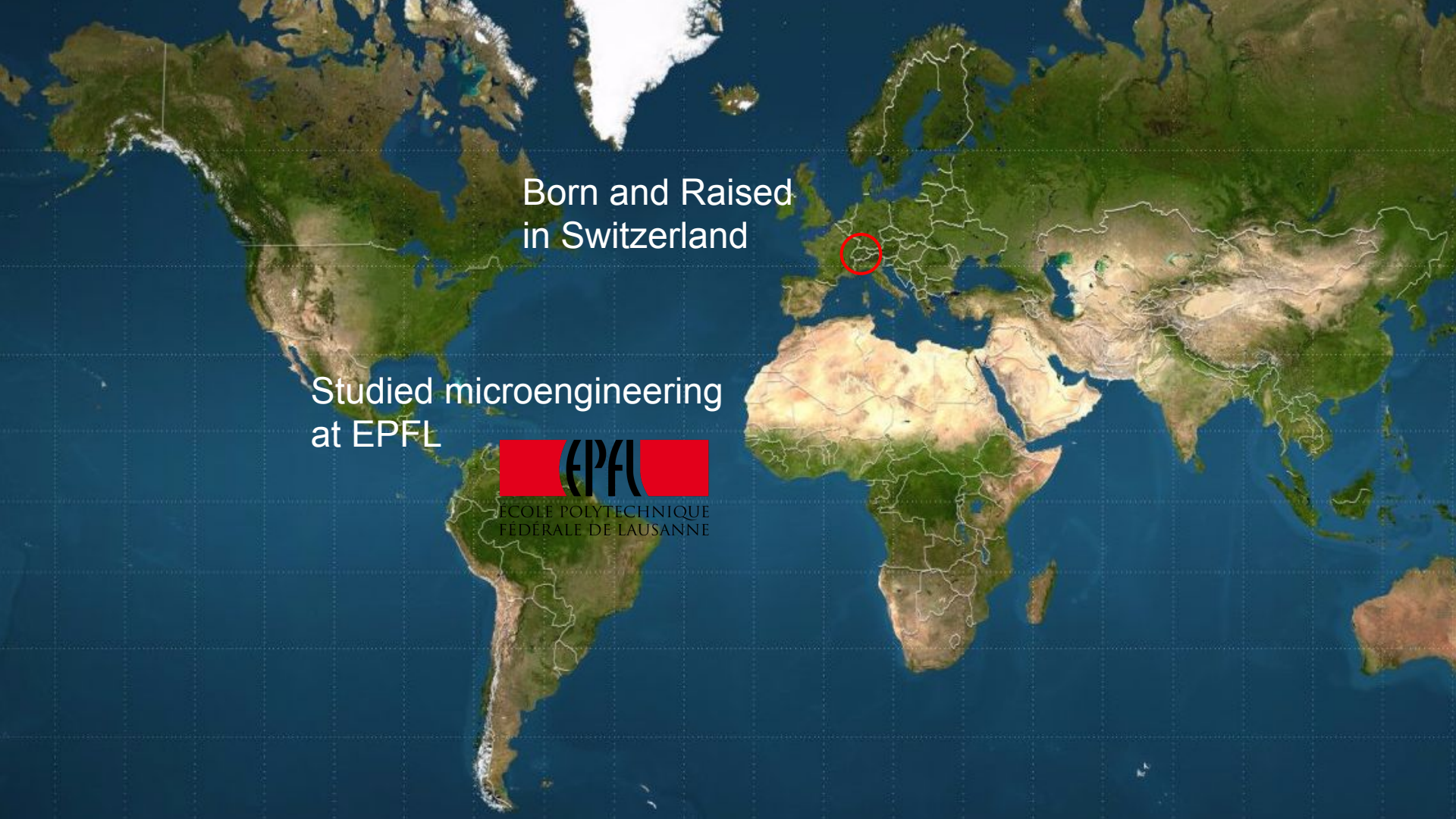
December 11th 2023

Introduction

Arno Rogg

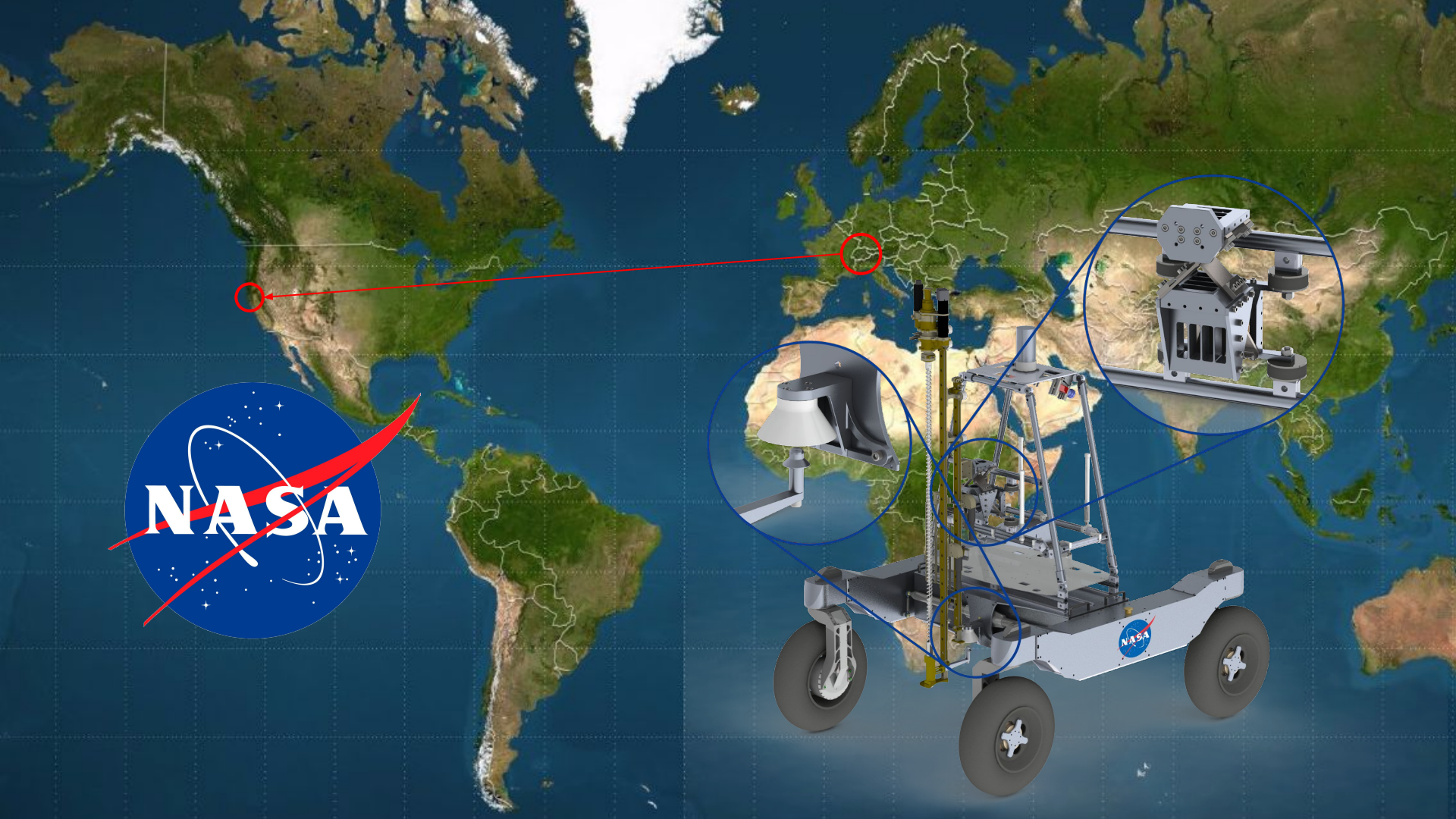
33 Years Old

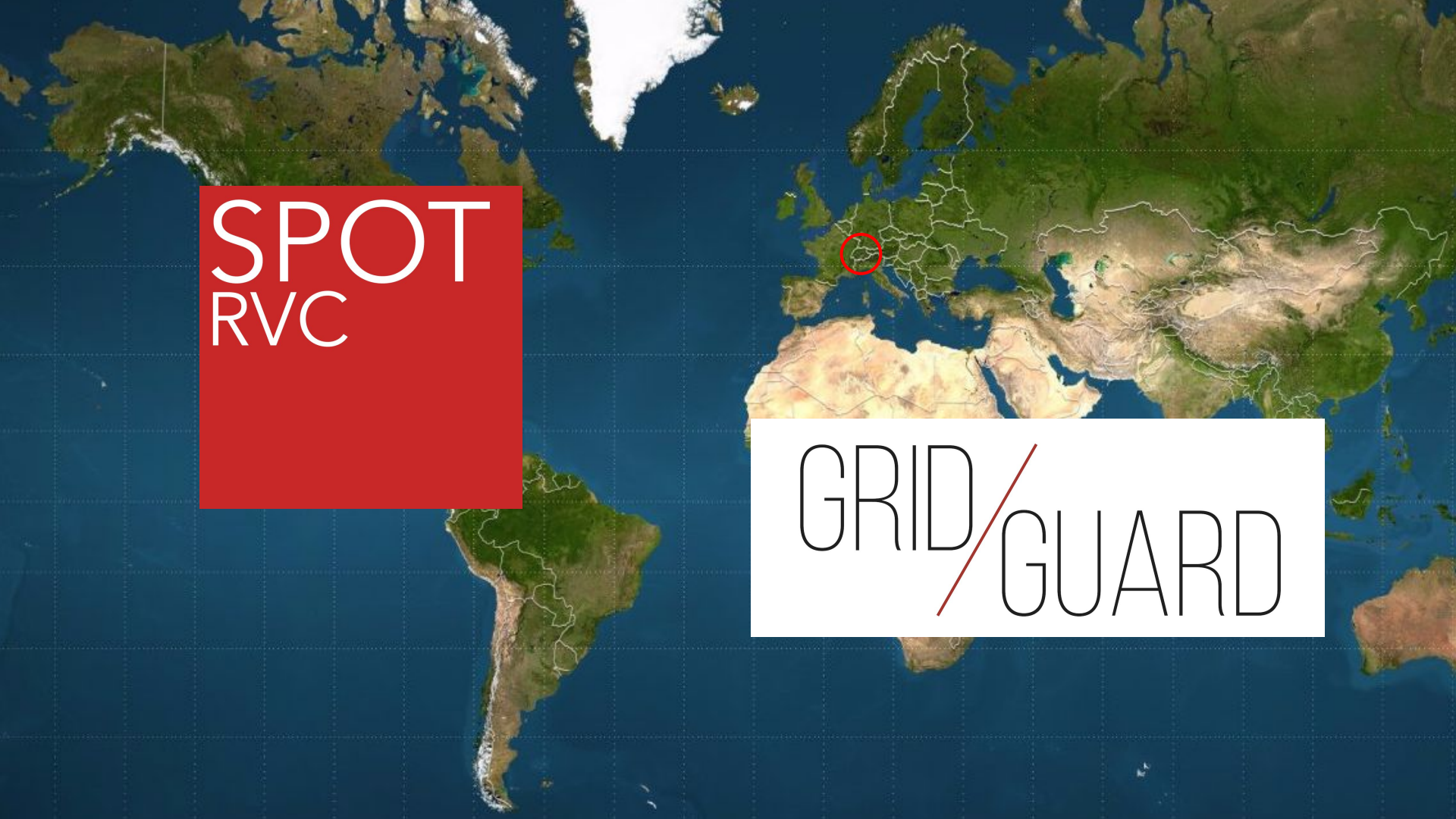
Swiss National

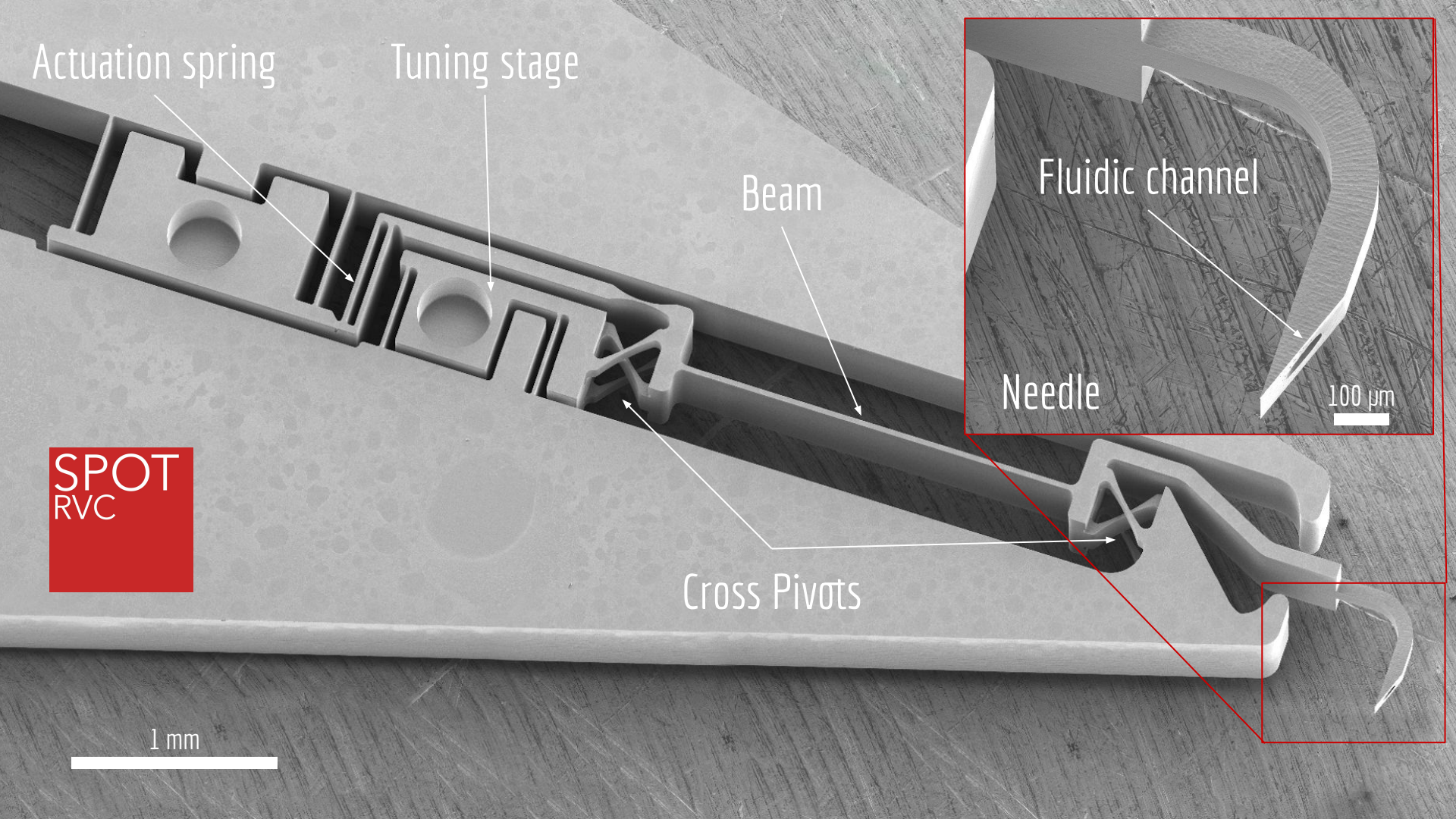

Born and Raised
in Switzerland
Studied microengineering
at EPFL
ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE


UNIVERSITY OF
WATERLOO

Masters in Applied Optics
Minor in Management of Technology and Entrepreneurship


NASA


SPOT
RVC
GRID/GUARD

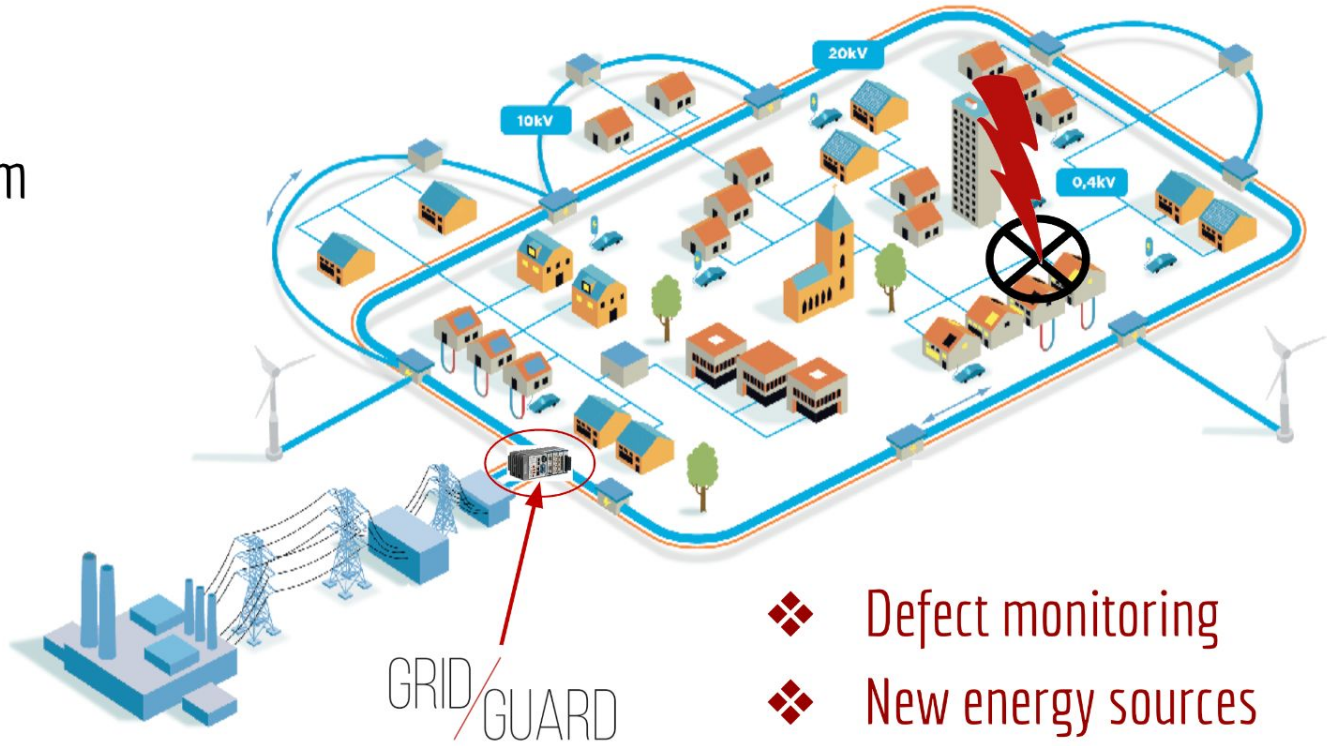

Actuation spring
Tuning stage
Beam
Fluidic channel
Needle
100 µm
Cross Pivots
SPOT
RVC
1 mm

Tomorrow: GridGuard

1 per feeder

Precision 5 m

5 min



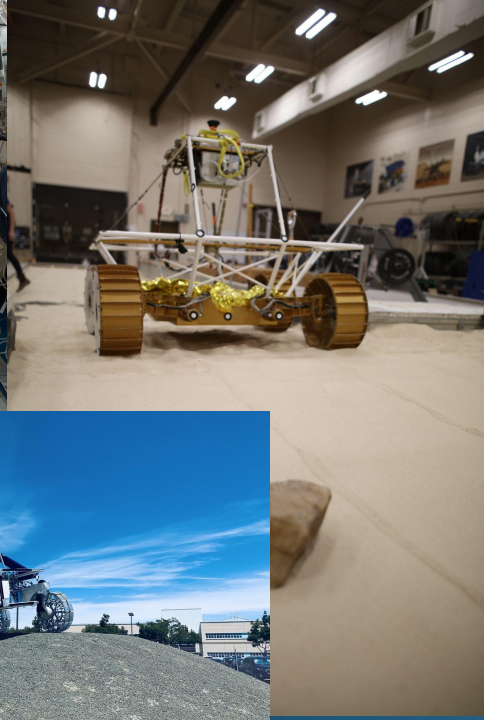
- Defect monitoring
- New energy sources


Last stop: NASA in 2017
NASA

My Path at NASA

Research Engineer in the Intelligent Robotics Group (2017 to 2019)

- Integration of payloads on a NASA rover
- Field testing in Atacama Desert, Sierra Nevada, Lava Bed National Monument
- Integration Engineer on Astrobee
- Lead Mechanical Designer on Geocam space
- Terramechanics research on Resource Prospector



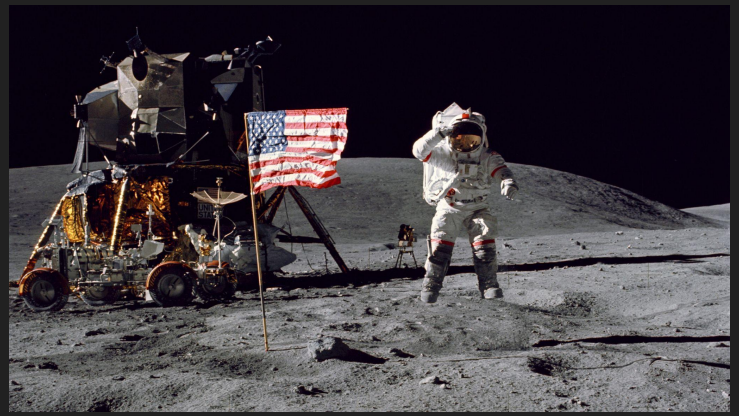
Systems Engineer on VIPER (2019 - today)

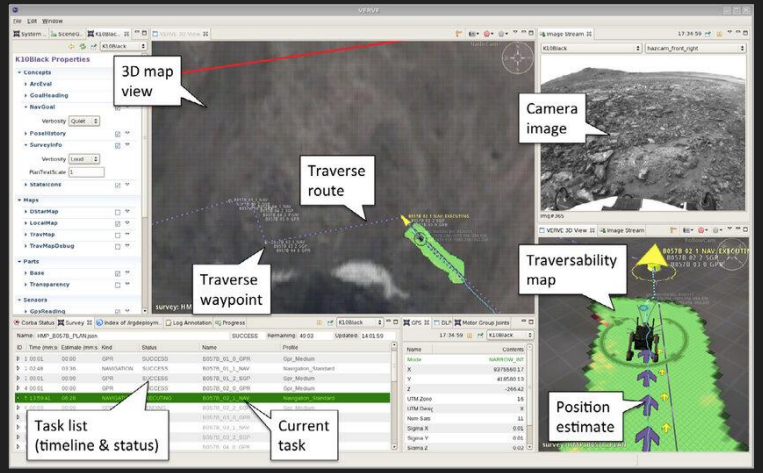
- Starting as rover and software systems engineer
- Lead for the mobility system and mobility system testing
- Lead for the navigation system and navigation system testing
- Now lead for rover system in the Mission Systems Engineering team





- VIPER Driver (2023 - today)





Outline

- Part 1: The Role of a Systems Engineer
- Part 2: The Gap Between School and Professional Life
- Part 3: Anecdotes and Lessons Learned
- Part 4: Q&A Session

Part 1: The Role of a Systems Engineer

It’s never really just one role

Interdisciplinary Approach

Systems Thinking

High Level Design and Decision Making

Adaptability and Problem-Solving

Communication and Collaboration

Trade Studies

Requirement Management

Documentation and Traceability

Lifecycle Management

Quality Assurance

Risk Management

Integration and Testing

The things to remember

“If it isn't tested, it doesn't work”

Or

“It works until you test it”

“Systems break at the interfaces”

… technical or not

“Test like you fly”

Part 2: The Gap Between School and Professional Life

I was never taught to be an SE at school

Lack of Clear Answers:

- Systems engineering often lacks clear-cut answers.

Foundation in Engineering:

- Understand engineering basics before diving into systems engineering.

Appreciation with Experience:

- Full appreciation of systems engineering may come when tackling larger, real-world problems.

The Importance of Stakeholders

School vs. Real World:

- In school, fewer stakeholders with limited significance.

Real World Complexity:

- Understand stakeholders, their interests, needs, and backgrounds.

Complexity Warning:

- Too many stakeholders can lead to added complexity and project failures.

Organization and Structure

Shared Workloads:

- Remember that your work will be accessed and used by more than just yourself.
- Not everything can stay in your head; externalize and document your work.

Documentation and File Management:

- Take diligent notes and establish a clear system for naming and organizing files.
- Think of your work as if you might need to present it to someone at any given moment.

Proactive Documentation:

- When someone asks a question, provide a prompt answer.
- If a second person asks the same or a related question, document your response for future reference.

Soft Skill

Effective Communication:

Develop strong communication skills to establish and maintain communication pathways.

Bridge the Gap:

Beware of underestimating differences in background, knowledge, age, and culture.

Avoid assuming that people understand; clarify and ensure comprehension.

Saying “no”

Setting Boundaries: "No" helps set boundaries.

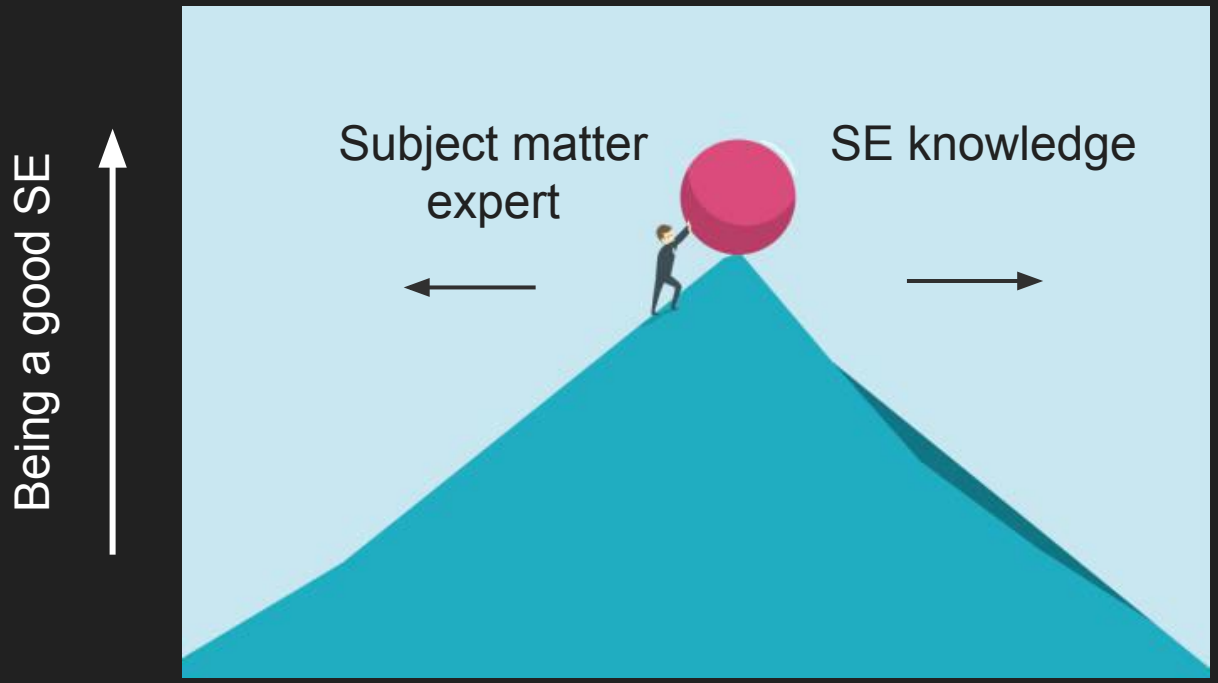
Prioritization: Use it to focus on what matters.

Respectful Communication: Say it politely and assertively.

Clarity and Honesty: Be clear about your limitations.

Practice and Balance: Maintain a healthy work-life balance.

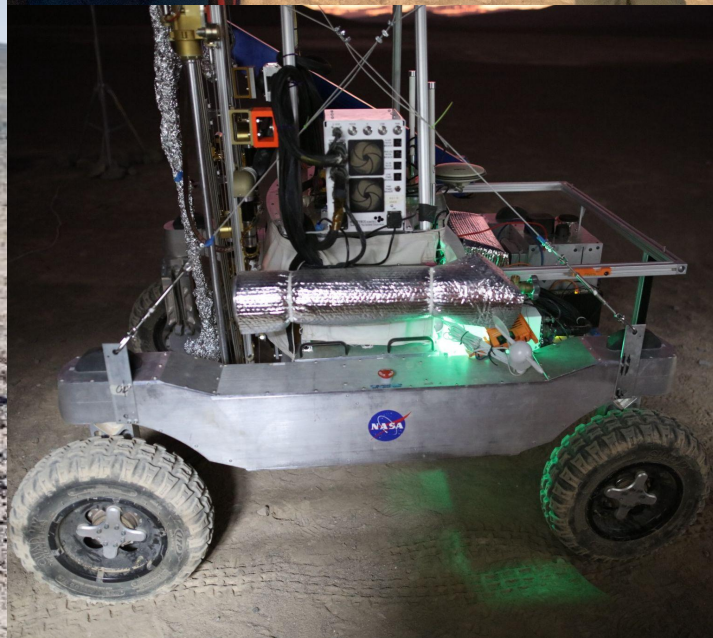
The Right Balance



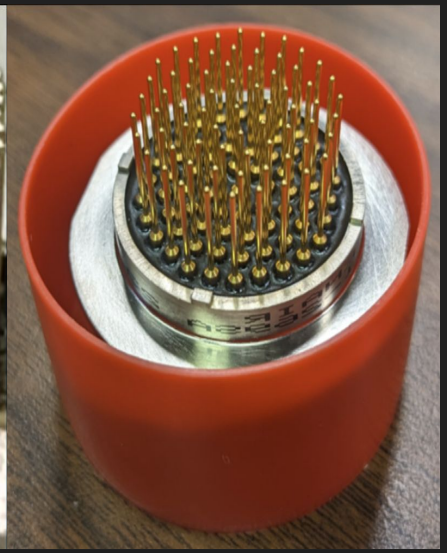
Part 3: Anecdotes and Lessons Learned

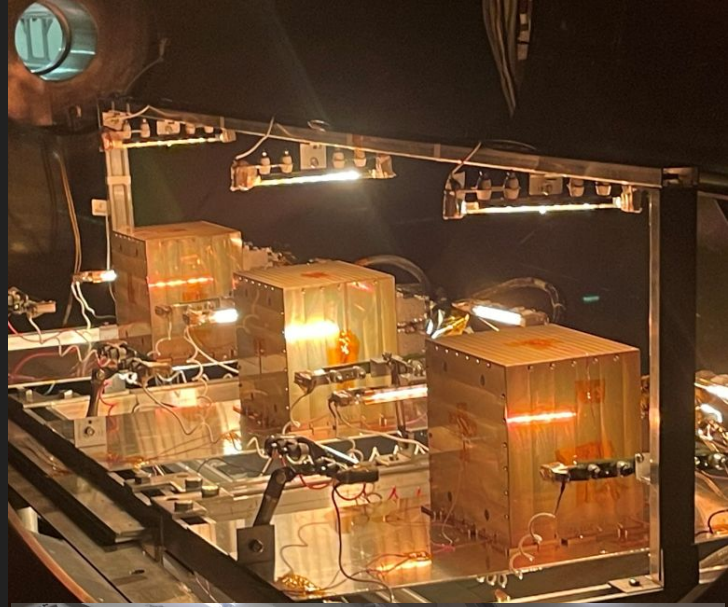
“Systems break at the interfaces”

“Test Like You Fly”



Combo:
“Systems break at the interfaces”
“If it isn't tested, it doesn't work”
“Test like you fly”





Part 4: Q&A Session