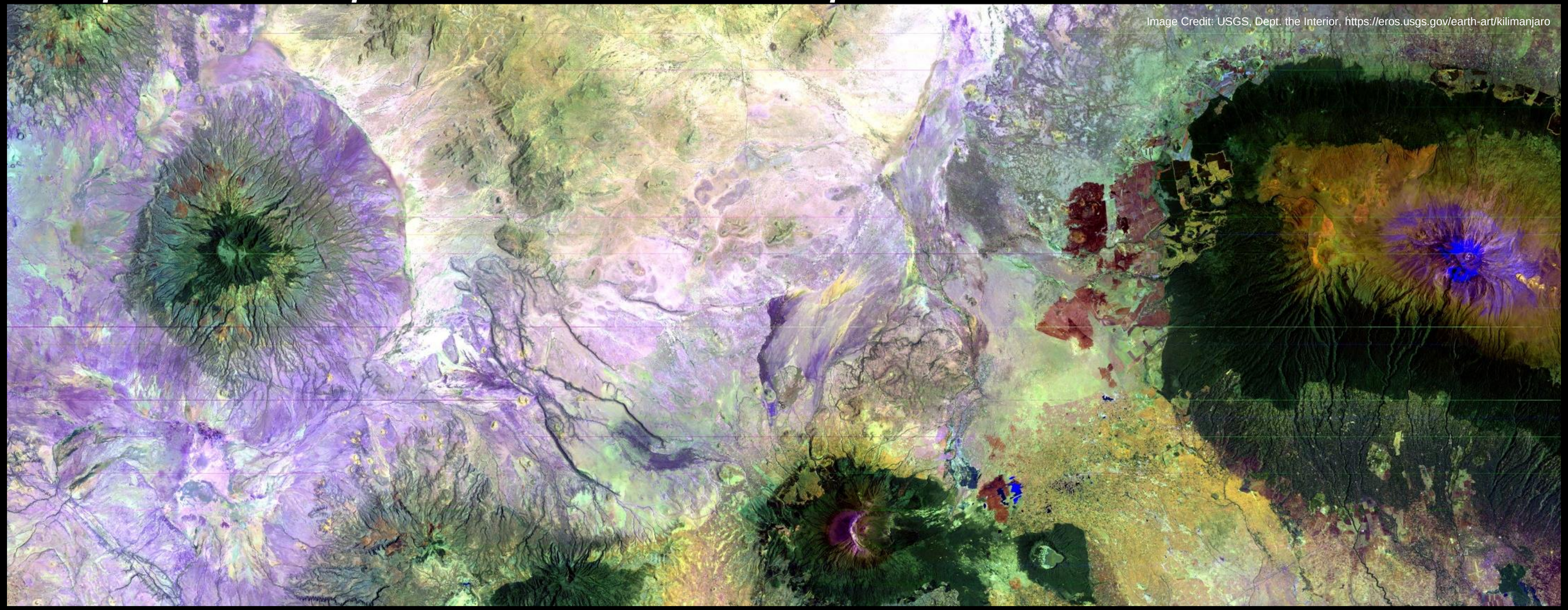
Models for universities to partner with government and entrepreneurs to apply space technology in support of the SDGs

Examples from the Space Enabled Research Group at the MIT Media Lab



William Sonntag
Research Affiliate
Space Enabled Research Group
MIT Media Lab

Danielle Wood, PhD
Assistant Professor, MIT Media Lab
Director, Space Enabled research group

Advancing justice in Earth’s complex systems using designs enabled by space

space enabled


1 NO POVERTY
2 NO HUNGER
3 GOOD HEALTH
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 RENEWABLE ENERGY
8 GOOD JOBS AND ECONOMIC GROWTH
9 INNOVATION AND INFRASTRUCTURE
010 011
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS
For Sustainable Development

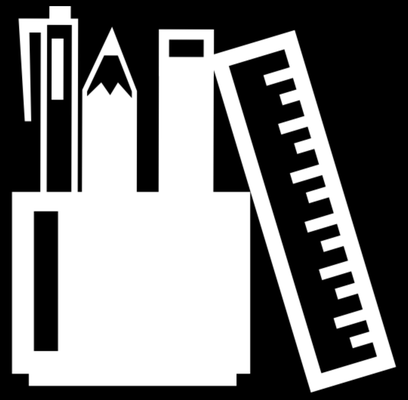
Space technology supports our global effort to reach the Sustainable Development Goals....

However, barriers remain that limit the impact of space on development progress

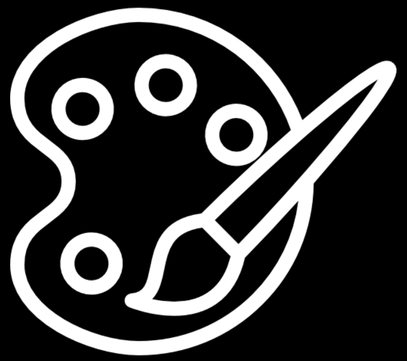
Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

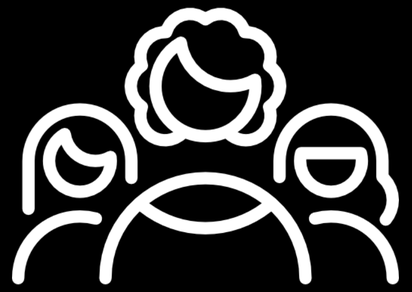
Space Enabled employs six research methods in support of the Sustainable Development Goals



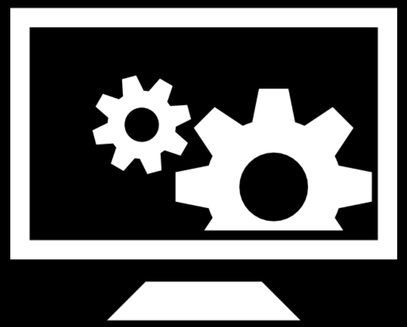
Design



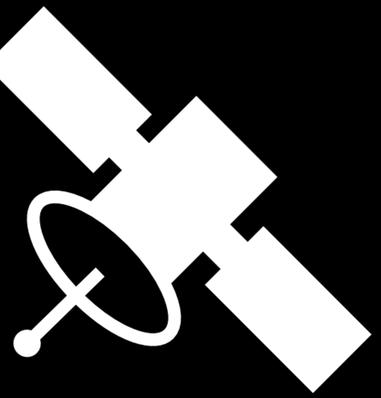
Art



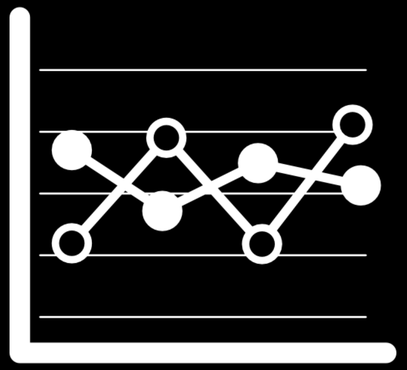
Social Science



Complex Systems Modeling



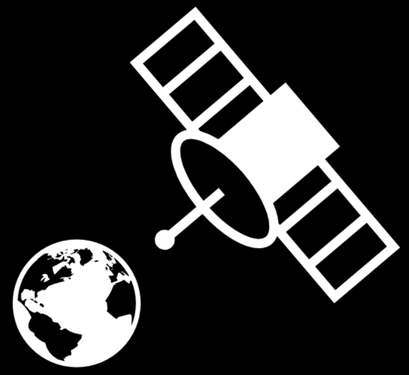
Satellite Engineering



Data Science

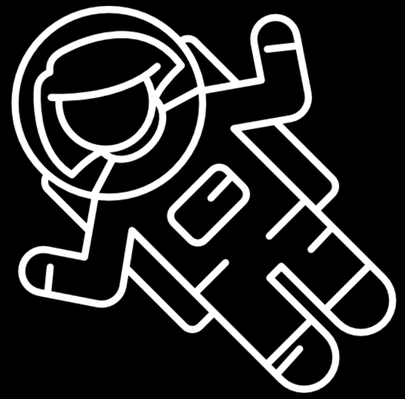
Image Source: https://freepik.com

Six space technologies currently support the Sustainable Development Goals

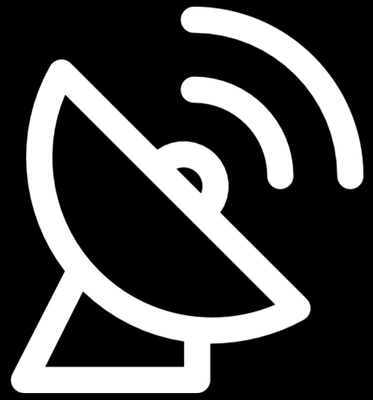


Satellite Earth Observation

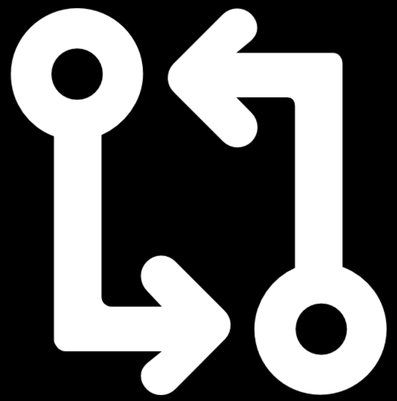
Satellite Positioning & Navigation



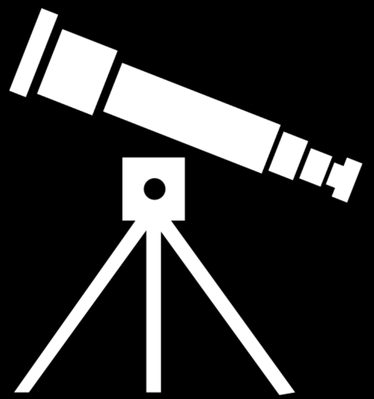
Human Space Flight & Microgravity Research



Satellite Communi-cation



Space Technology Transfer



Research Capacity

Image Source: https://freepik.com

Space Enabled applies the six Research Methods and the six Space Technologies in collaborative projects with organizations at four levels

- Multilateral Organizations
- National Governments
- Regional and City Governments
- Universities, non-profits and companies

Universities can contribute to the Global Space Partnership for SDGs

- Users Needs
  - Consult on methods to define and assess user needs
  - Document case studies and evaluations illustrating impact of space for SDGs
- Space Systems Capacity Coordination
  - Propose methods to use software-base modeling to inform design of coordination of space systems
- Access to Space Assets
  - Perform studies and assessments identifying barriers to access and examples of effective projects; Perform pilot projects demonstrating best practices
- Capacity Building
  - Host capability building programs, international research collaboration and personnel exchange
  - Study and evaluate capacity building outcomes

Universities support the application of space technology for sustainable development in many ways….

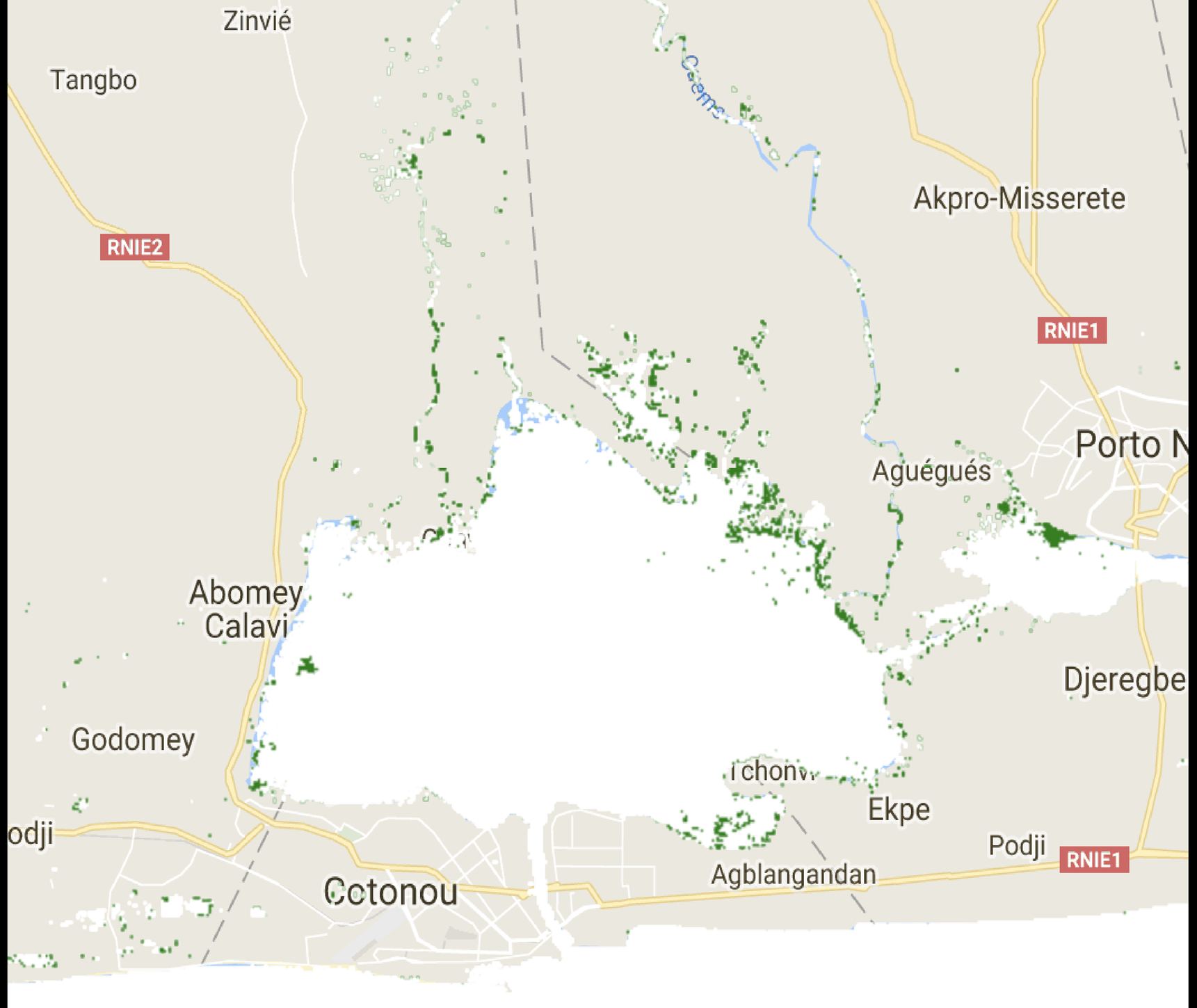
- **Creating and leading cross-sectoral teams**
- **Piloting space capabilities for development applications**
- **Researching policy and business trends**
- **Developing novel and accessible technology**
- Training future engineers, scientists, lawyers, artists, writers and policy makers
- Incubating new operational approaches

Universities can advance the use of space in support of the Sustainable Development Goals

- Creating and leading cross-sectoral teams
- Piloting space capabilities for development applications


Green Keeper
Africa


Niamey
Burkina Faso
Kano
Benin
Nigeria
Abuja
Togo
Ghana
d'Ivoire
oussoukro
Kumasi
Ibadan
Porto Novo
Lagos
Accra
Lome
Abidjan
Port Harcourt


Zinvié
Tangbo
Ouémé
Akpro-Misserete
RNIE2
RNIE1
Aguégués
Porto N
Abomey
Calavi
Djeregbe
Godomey
Ekpe
Podji
RNIE1
Agblangandan
Cotonou

Our products lines

All-liquids absorbents

Products for retail

GKSORB bag

Absorbent sock

Absorbent pillow

Spill kits

Small	Middle	Large
		

Special oil Absorbents

Products for retail

GKSORB bag

Absorbent sock

Absorbent pillow

Spill kits

Small	Middle	Large
		

A Flower Against Pollution

How we are collaborating with Green Keeper Africa to monitor an invasive plant that is used to clean oil-based waste

Green Keeper Africa

Green Keeper Africa is an entrepreneurial company based in Cotonou, Benin. They pay local community members to harvest the invasive water hyacinth plant and convert it into kits that absorb oil pollution caused by industry. Their work improves the environment and creates a new eco-friendly source of income.
Green Keeper Africa has invited Space Enabled to work together to create an Observation System for Invasive Plants to monitor the water hyacinth and its impact on the community.

Satellite Earth Observation

Space Enabled is working with Green Keeper Africa to use imagery and measurements from earth observation satellites to monitor the water hyacinth. We are combining information from government and commercial satellites that show how the water hyacinth grows and drifts through rivers and lakes.

Aerial Earth Observation

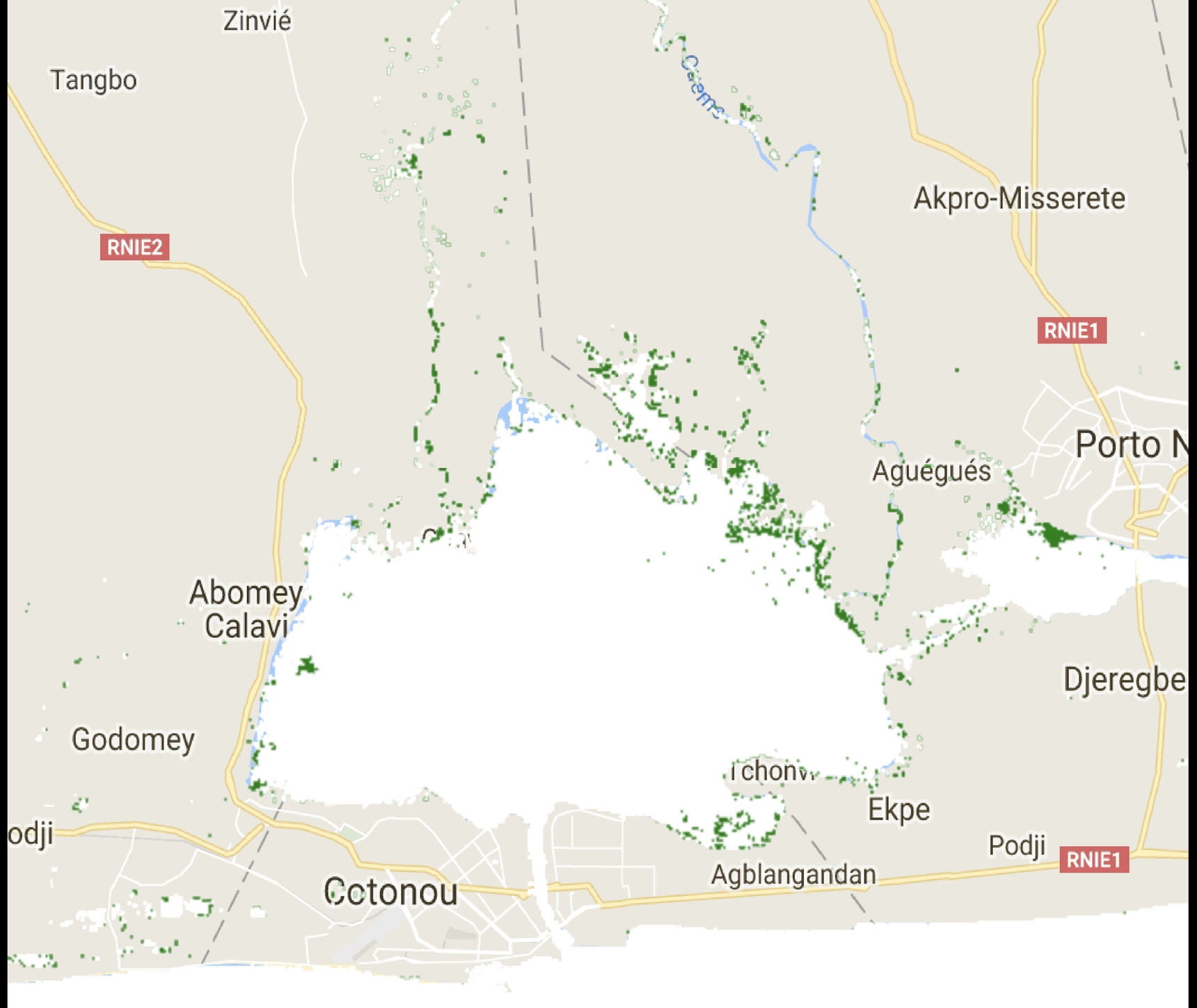
Space Enabled is exploring with Green Keeper Africa how they might use cameras mounted on radio controlled planes, drones, solar air balloons or kites to track the growth of the invasive water hyacinth plant.

Measuring

The growth of the invasive water hyacinth plant is impacted by environmental factors such as the temperature, salinity and nutrient content of the water as well as local weather patterns. Space Enabled is working with Green Keeper Africa to explore how they can use sensors placed in local water ways to measure environmental changes. In the long term, these measurements may help Green Keeper Africa predict where the invasive water hyacinth plant will bloom.

Sentinel 2

Oct. 24, 2017


Zinvié
Tangbo
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RNIE1
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Godomey
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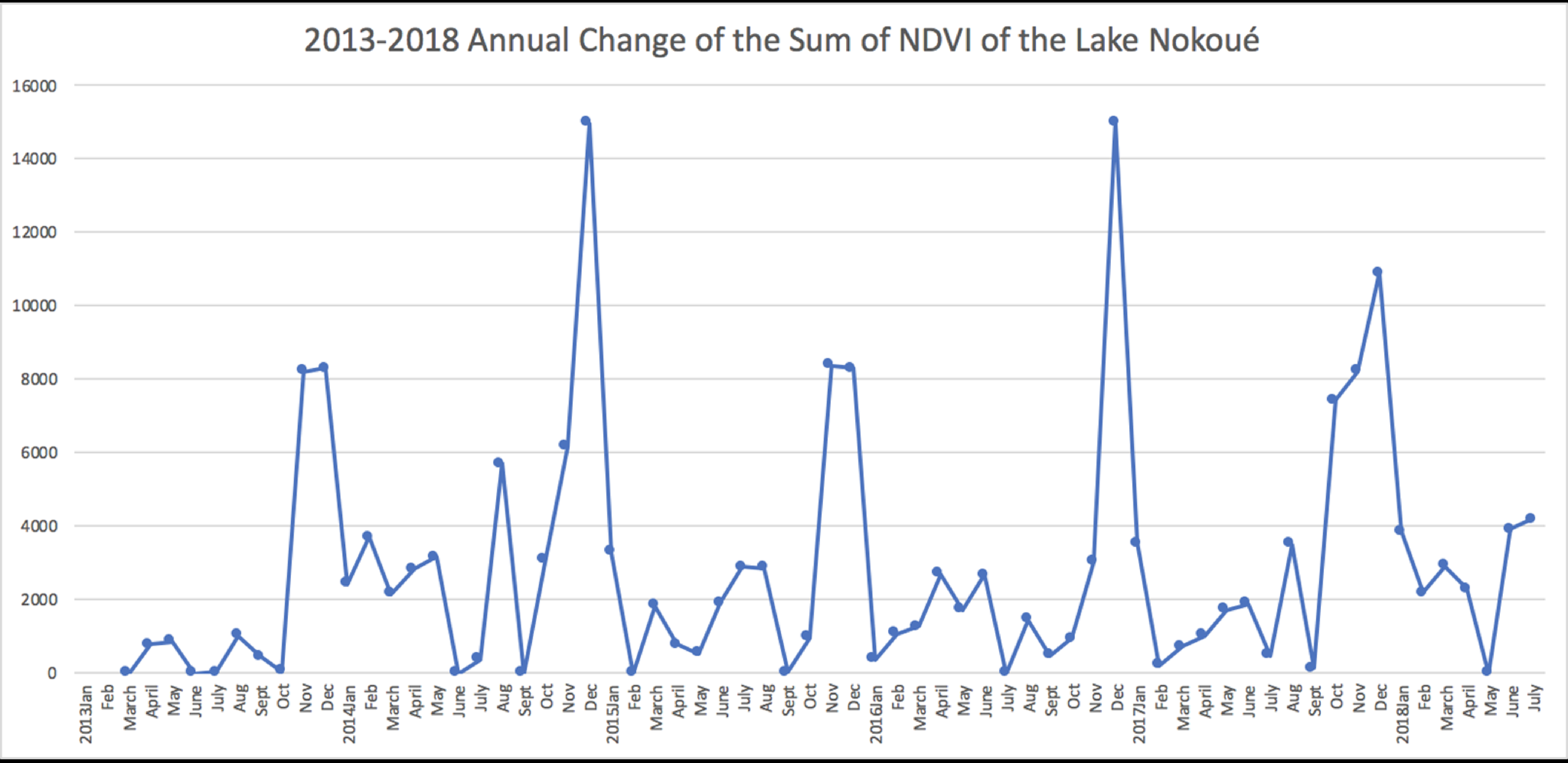
Podji
RNIE1
Agblangandan
Cotonou


2013-2018 Annual Change of the Sum of NDVI of the Lake Nokoué
16000
14000
12000
10000
8000
6000
4000
2000
0
2013Jan
Feb
March
April
May
June
July
Aug
Sept
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Nov
Dec
2014Jan
Feb
March
April
May
June
July
Aug
Sept
Oct
Nov
Dec
2015Jan
Feb
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2016Jan
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2018Jan
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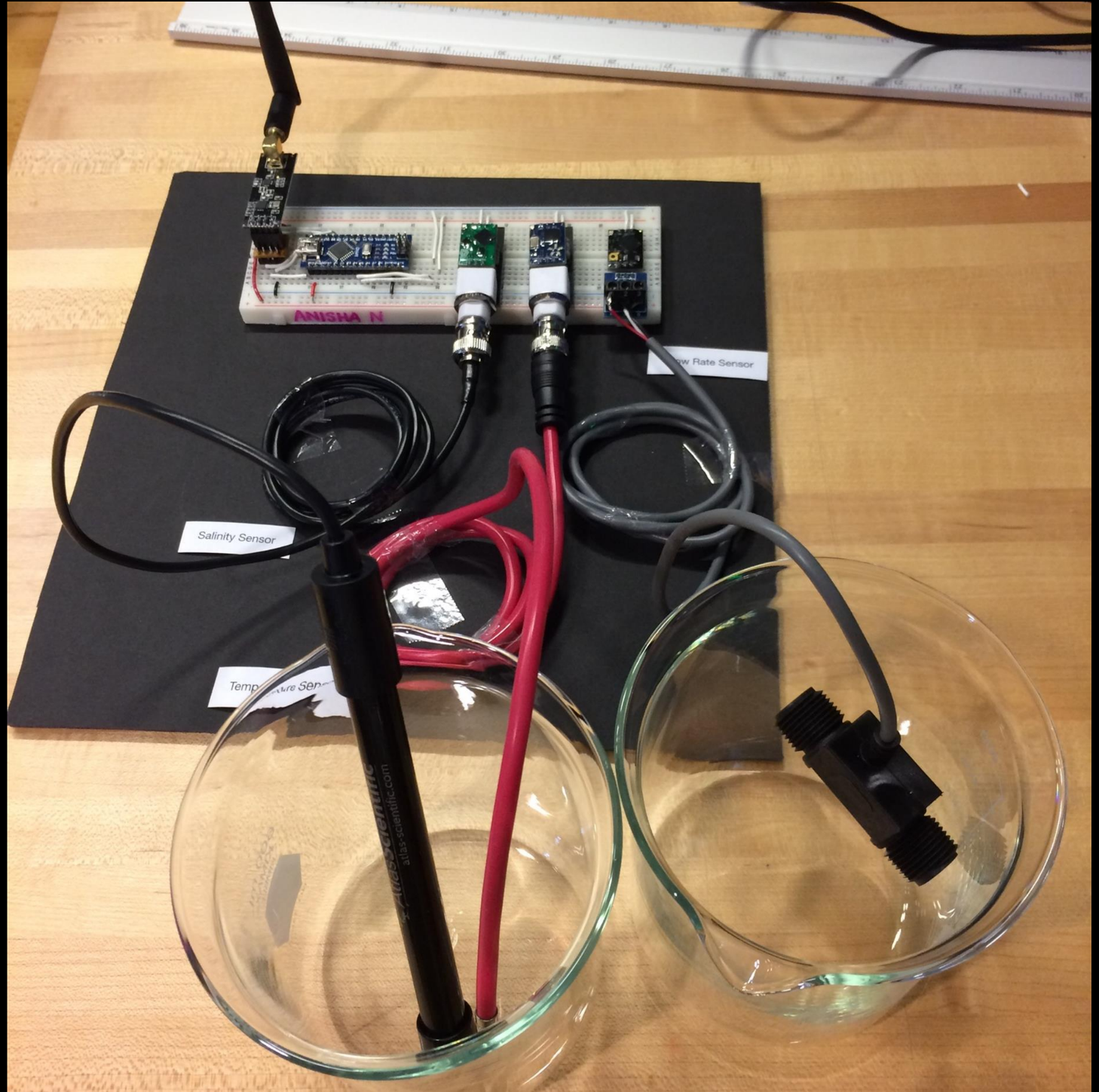
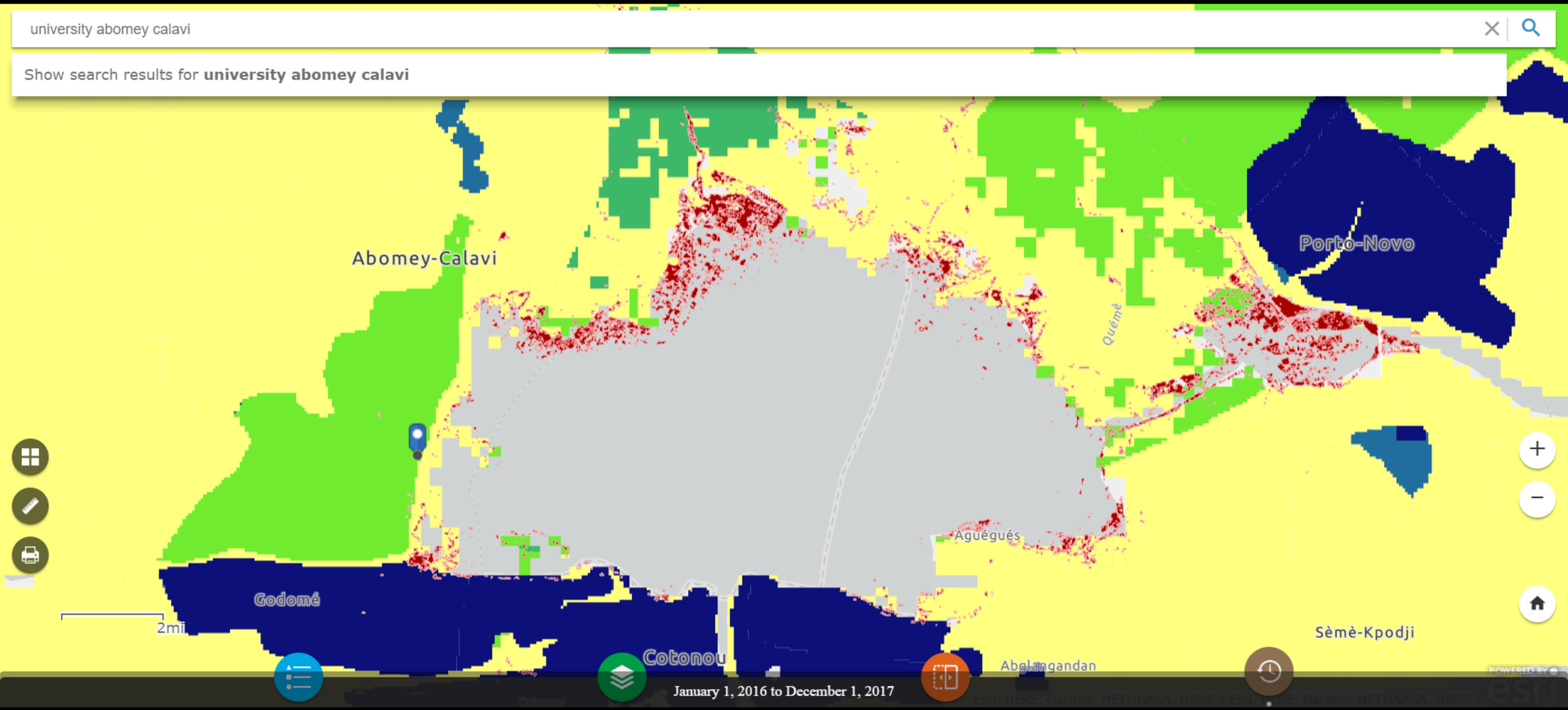
June
July


ANISHA N
Salinity Sensor
w Rate Sensor


university abomey calavi
Show search results for university abomey calavi
Abomey-Calavi
Porto-Novo
Ouémé
Aguégués
Godomé
2mi
Cotonou
Sèmè-Kpodji
Abglangandan
January 1, 2016 to December 1, 2017
Esri, HERE, Garmin, METI/NASA, USGS | Esri, HERE, Garmin, METI/NASA, USGS


La jacinthe d'eau est
fléau au Bénin


ENATEL


AMPHI
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Researching policy and business trends

Incumbents In the US Space Industry

Photo Credit: NASA

United Launch Alliance (ULA)

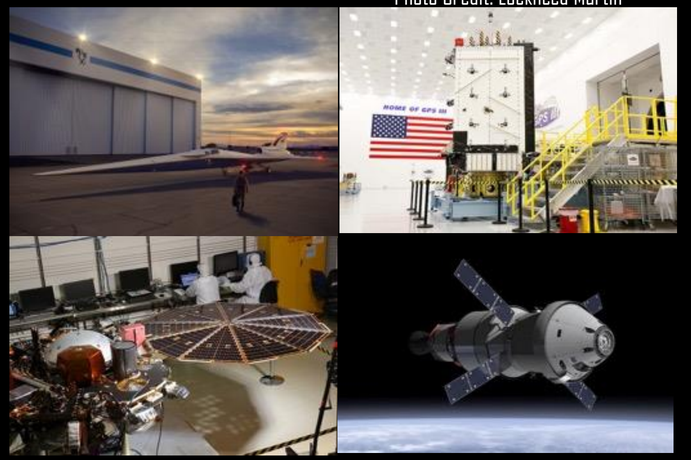
Photo Credit: NASA

Boeing

Photo Credit: NASA

United Space Alliance (USA)

Photo Credit: Lockheed Martin



Lockheed Martin

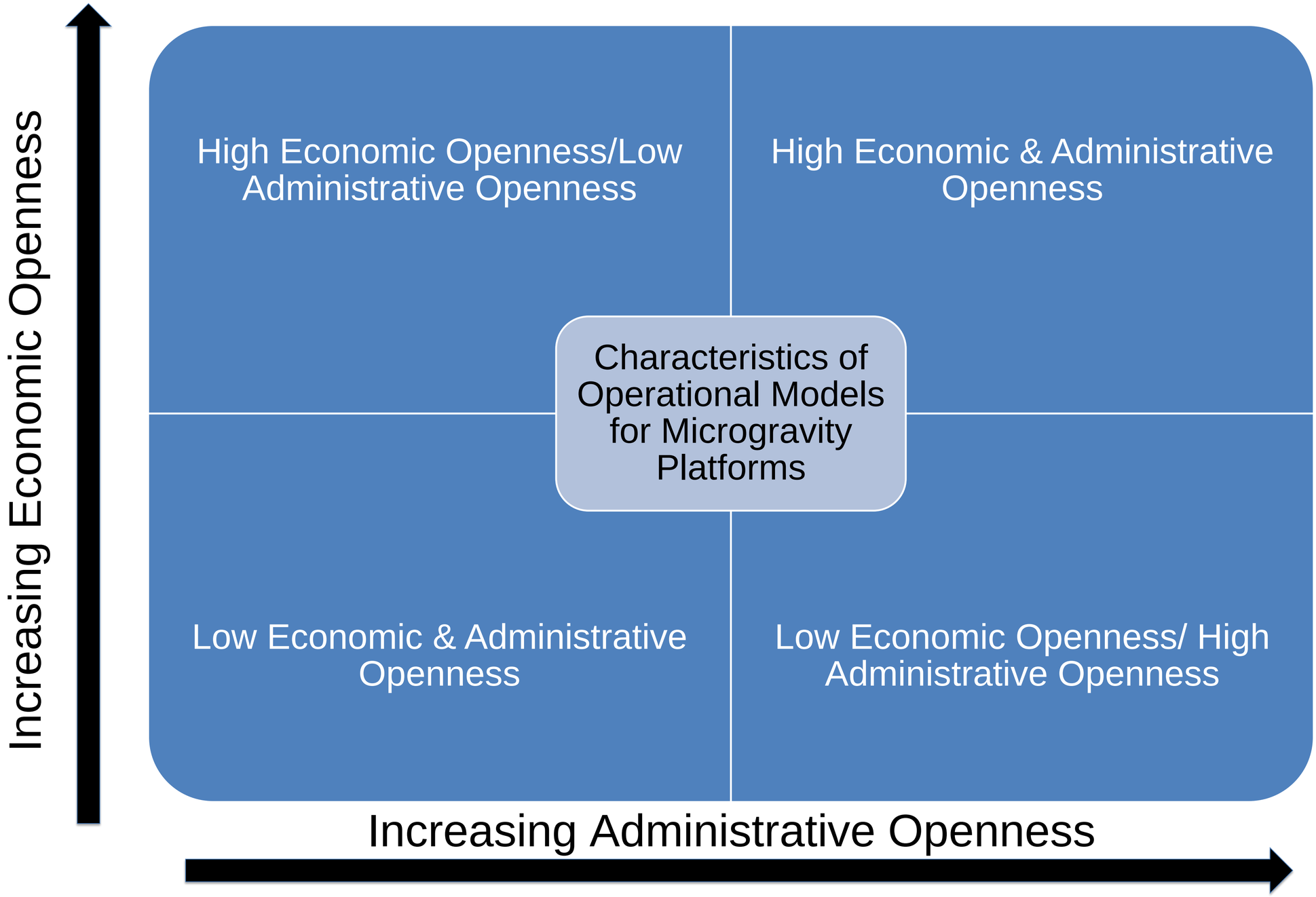
New Entrants in the US Space Industry

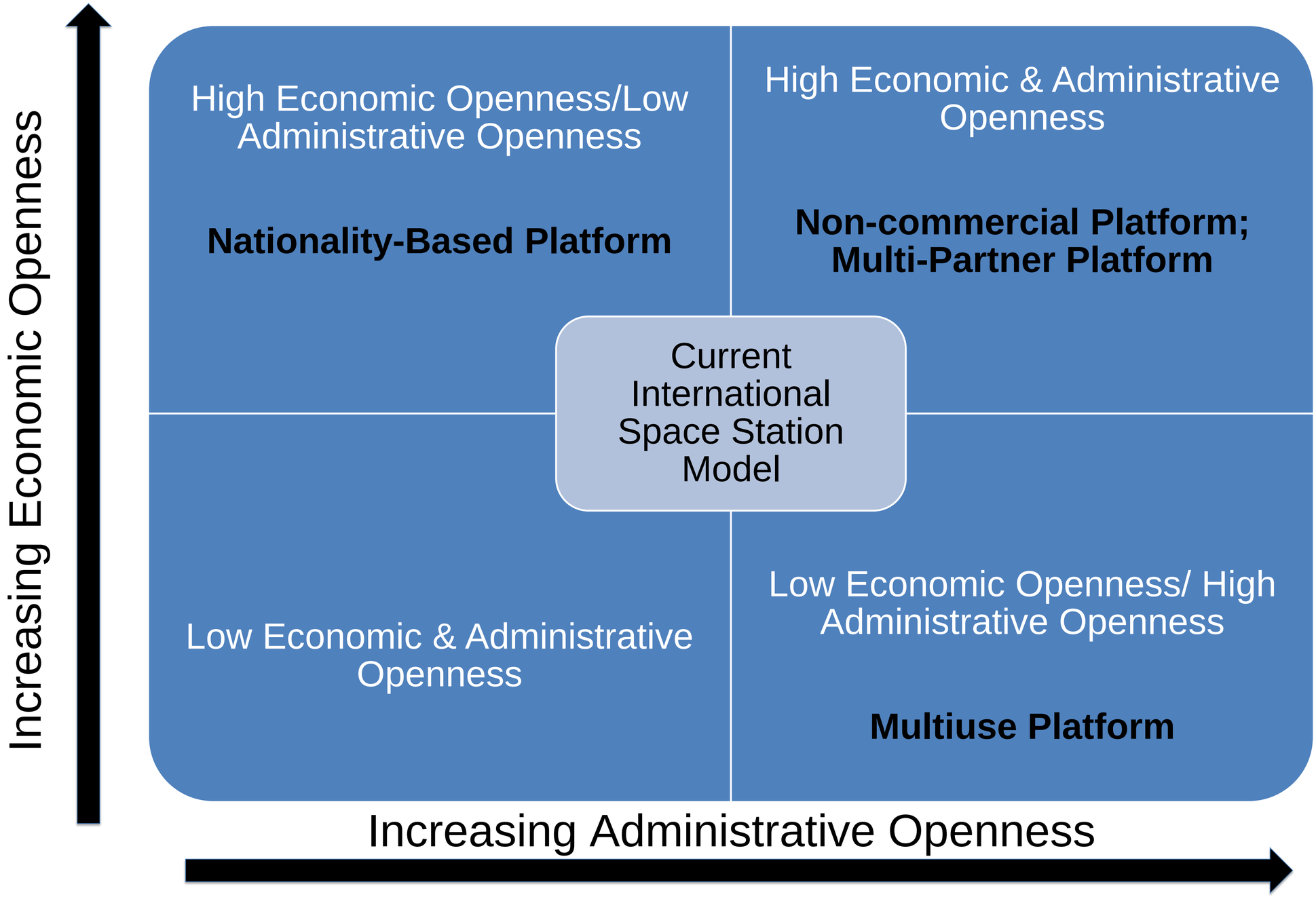
Photo Credit: NASA

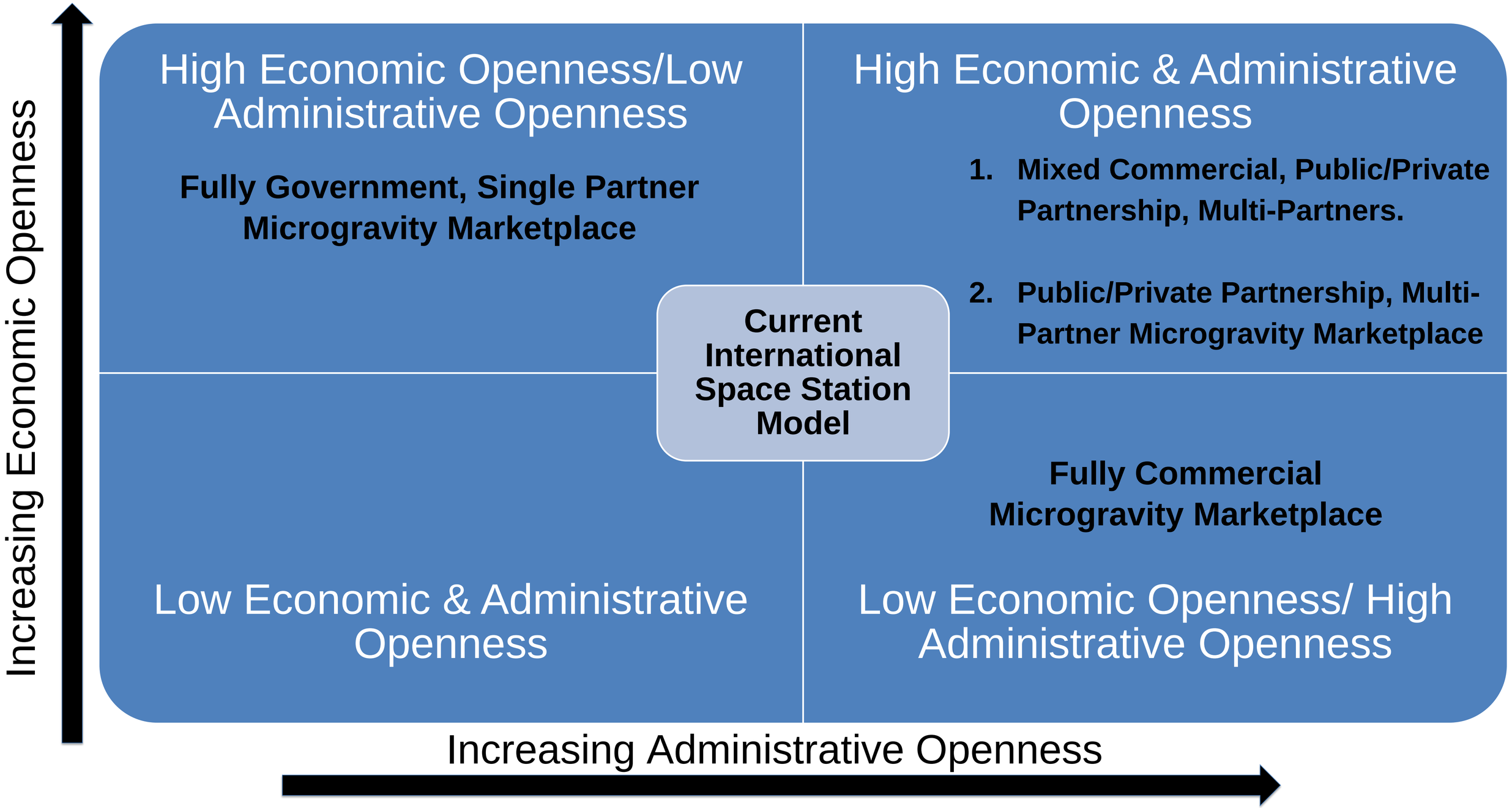
SpaceX

Photo Credit: Blue Origin

Blue Origin


Increasing Economic Openness
High Economic Openness/Low Administrative Openness
High Economic & Administrative Openness
Characteristics of Operational Models for Microgravity Platforms
Low Economic & Administrative Openness
Low Economic Openness/ High Administrative Openness
Increasing Administrative Openness


Increasing Economic Openness
High Economic Openness/Low Administrative Openness
Nationality-Based Platform
High Economic & Administrative Openness
Non-commercial Platform; Multi-Partner Platform
Current International Space Station Model
Low Economic & Administrative Openness
Low Economic Openness/ High Administrative Openness
Multiuse Platform
Increasing Administrative Openness


Increasing Economic Openness
High Economic Openness/Low Administrative Openness
Fully Government, Single Partner Microgravity Marketplace
High Economic & Administrative Openness
1. Mixed Commercial, Public/Private Partnership, Multi-Partners.
2. Public/Private Partnership, Multi-Partner Microgravity Marketplace
Current International Space Station Model
Low Economic & Administrative Openness
Fully Commercial Microgravity Marketplace
Low Economic Openness/ High Administrative Openness
Increasing Administrative Openness

Developing novel and accessible technology

Green Satellite Propulsion

Will candle wax become a safe and affordable fuel for small satellites?

The Space Enabled Research Group is investigating the use of candle wax, also known as paraffin wax, as an propellant to operate small thrusters on satellites. Thrusters are used to change the orientation or orbit of a satellite. Traditional satellite propellants are expensive and cause cancer when handled by humans. Candlewax is affordable and safe for humans to handle. It may also have the benefit of serving as a thermal insulator to protect satellites from the temperature changes on orbit as they are heated by sun or cooled in earth's shadow.

New Designs for Satellite Missions

How do we create a future with less space debris?

Space Enabled is rethinking the lifecycle of satellite missions and creating a future with less space debris. We are exploring modular satellite designs that will allow us to reconfigure satellite components and replace broken parts of satellites in space. This prototype shows a 3-Unit CubeSat that can demonstrate reconfigurability and paraffin wax propulsion.


55
arianespace
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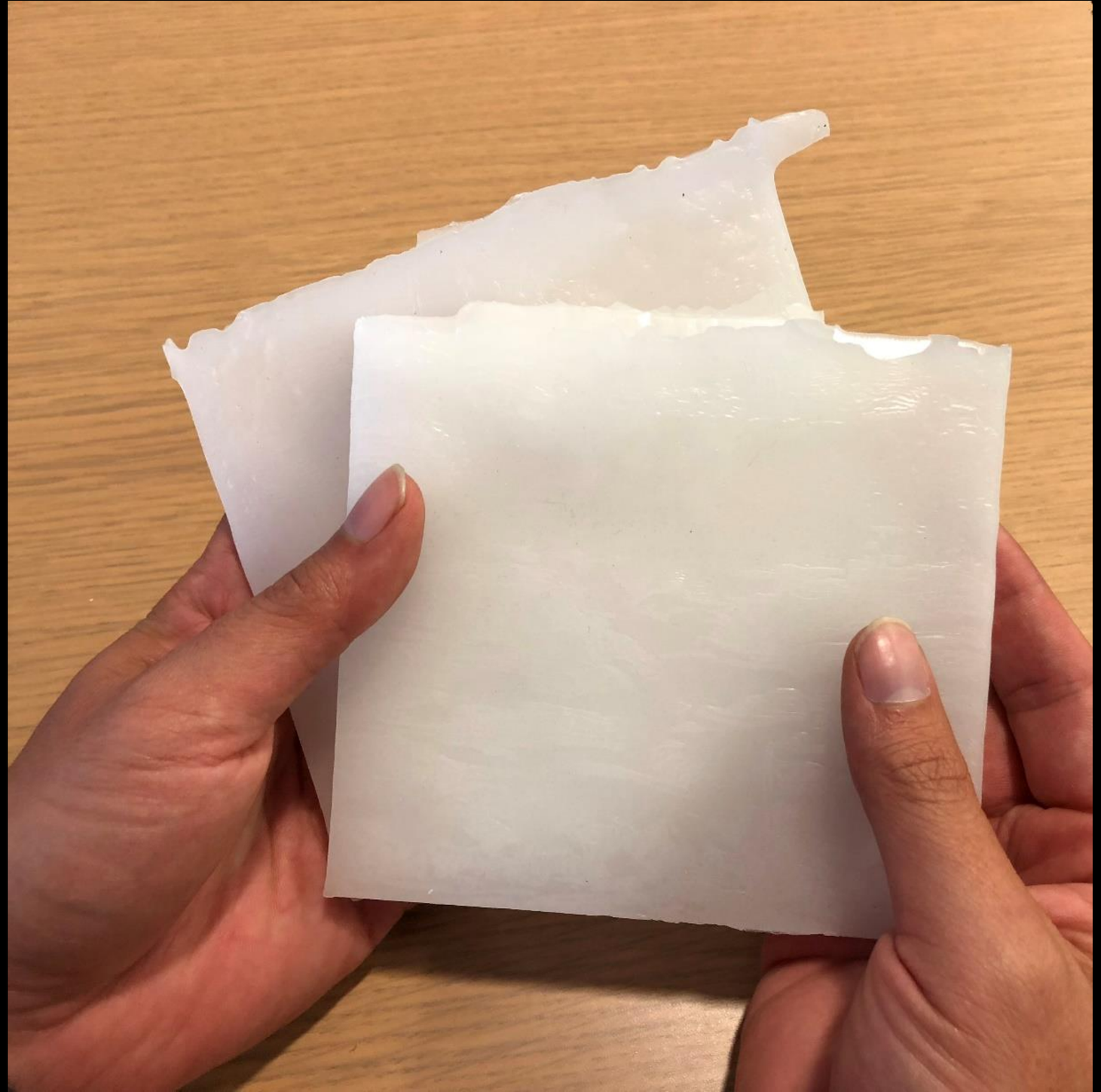

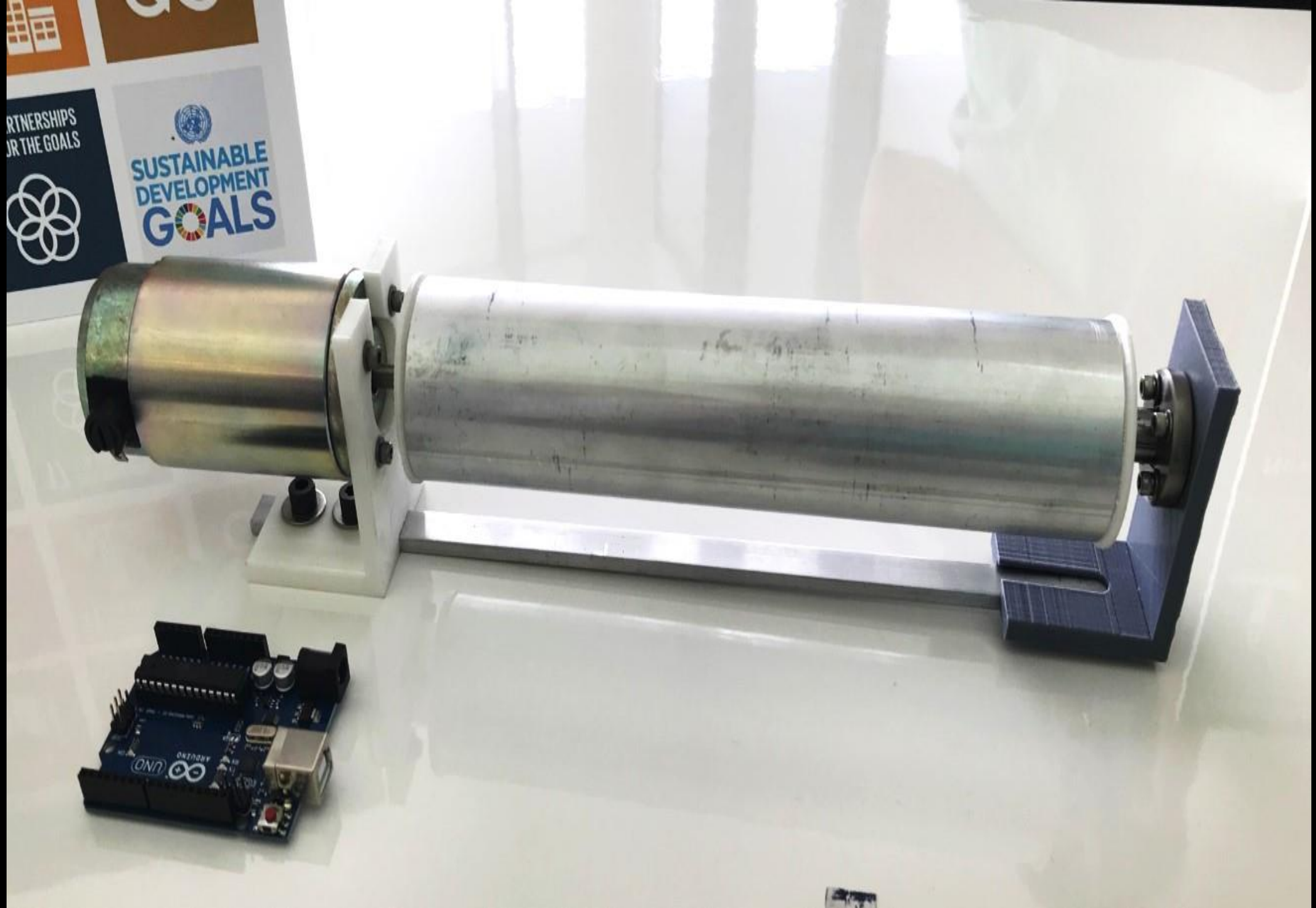
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R THE GOALS
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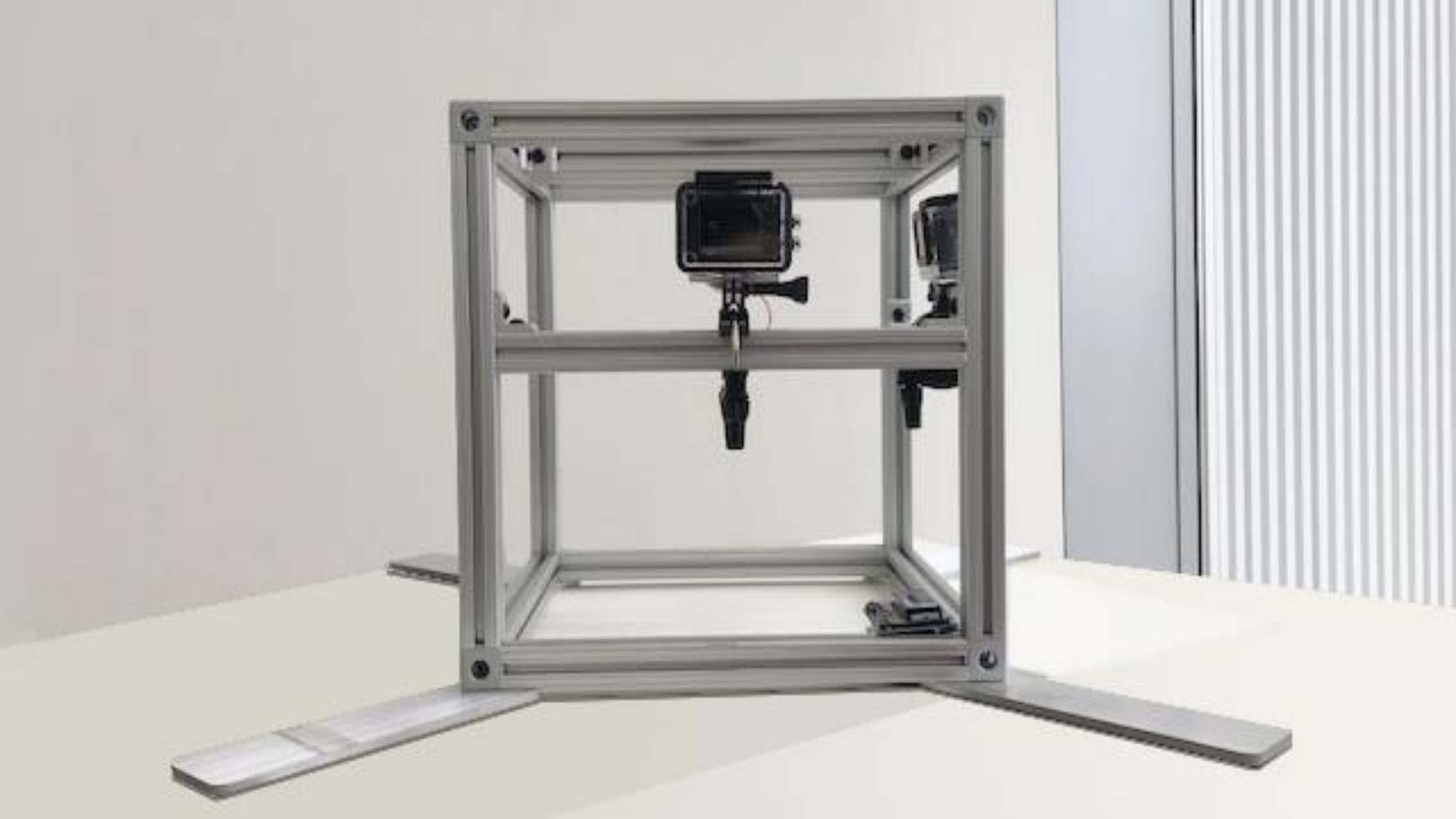


zero

Design for a Citizen Science and Public Engagement Project

Celebrating Antarctica and the Southern Ocean

Liz de la Torre, Miles Lifson, Keith Javier Stober, Danielle Wood

Miles Lifson

Research Assistant

Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

Can we use Antarctic data and citizen science to make people care about Antarctica?

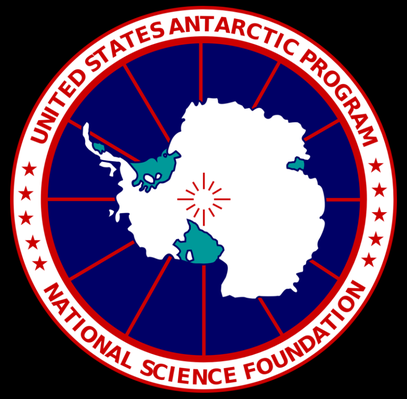
Miles Lifson

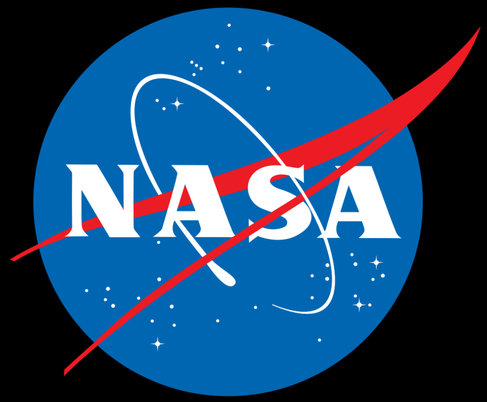
Research Assistant

Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

There’s a lot of data...





Miles Lifson

Research Assistant

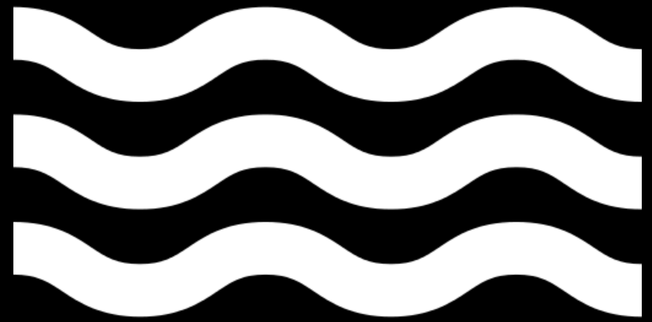
Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

Our Approach

Immersive Museum Experience

+



Ocean Citizen Science

Image Source: https://freepik.com

Miles Lifson

Research Assistant

Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

Immersive Museum Experience

Exterior

Interior

Miles Lifson

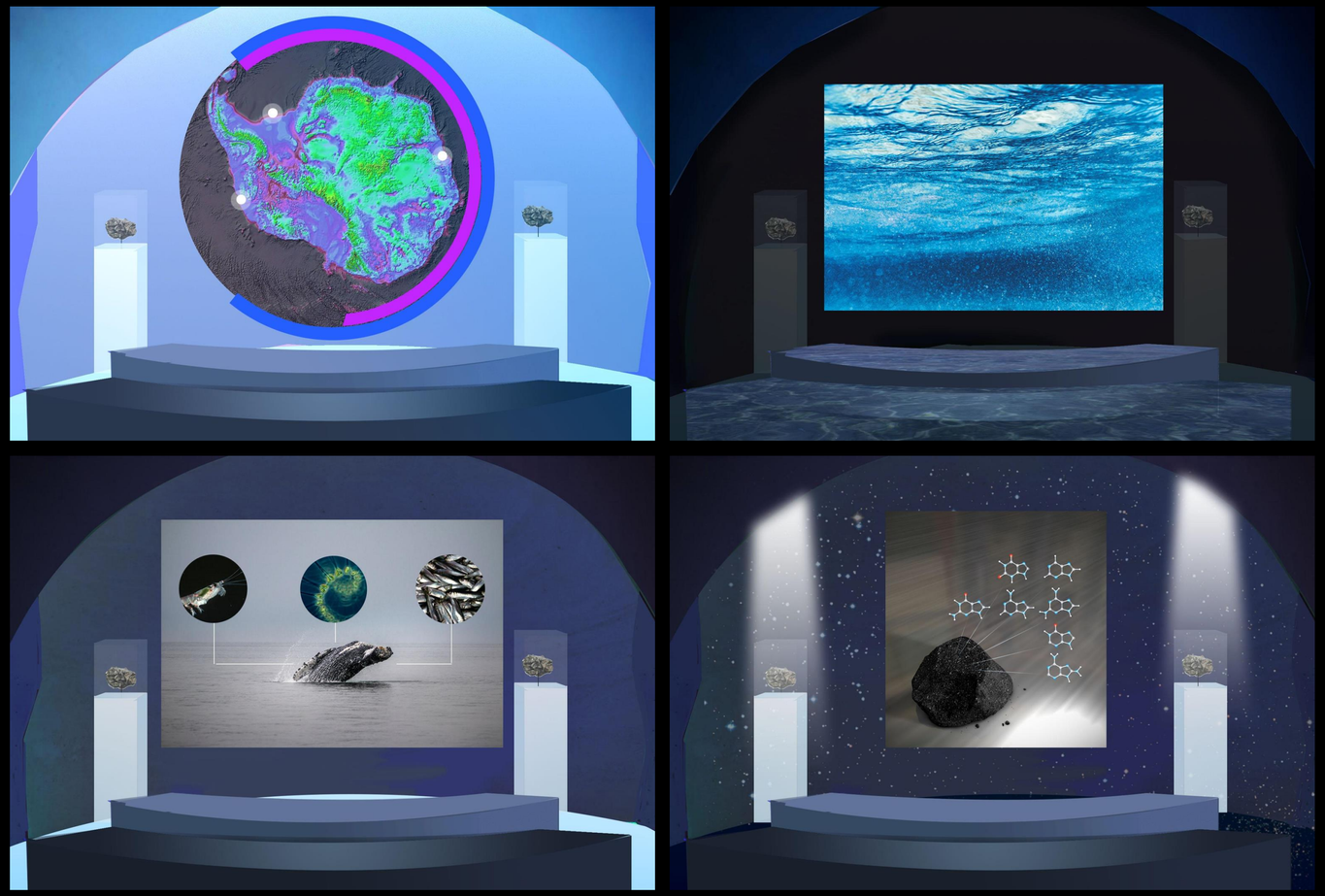
Research Assistant

Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

Immersive Experience Themes:

Ice
Life
Space



Miles Lifson

Research Assistant

Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group

Learn more:

spaceenabled.media.mit.edu

Watch Danielle Wood’s TED Talk

Twitter: @space_enabled

Instagram: @space.enabled

Danielle Wood, PhD

Assistant Professor, MIT Media Lab
Director, Space Enabled research group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media
lab