



**Building positive**

# human space futures





INTERPLANETARY  
INITIATIVE

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# Note

from the Managing Director and Co-chair

## Hello friends,

I hope you are all well and safe. We, along with the rest of the world, have pivoted and accommodated this spring in the face of the COVID-19 pandemic. We had just opened our new space hardware and software lab in February, and, once the crisis hit, we immediately put it to use creating PPE with our 3D printers.

Our years of innovation in how to teach teamwork and problem-solving in online formats became urgently relevant with the onset of the pandemic, and we immediately leveraged it for use in classes that had to move into a virtual format with only one week's notice. Our team instantly adapted to work on Zoom and Slack, checking in on each other, sharing the small joys of the day, and keeping each others' spirits up. Now we are beginning to implement plans to re-open in-person operations safely as we move into the fall.

In our three-and-a-half years of operation, we have created a new, interdisciplinary team-building research process (we'd love to share with your organization!), built and opened an innovative three-year, workforce-

facing Bachelor of Science in Technological Leadership, and seed-funded around twenty interdisciplinary projects, which have included over 250 active team members and 20 outside partners. Over the past three years, these seed-funded projects they have achieved a cumulative 8.7x return-on-investment from outside funding.

In December, 2019, our space hardware build-and-test lab opened, dedicated to projects with outside partners. In the coming year we will continue to test the team and education models, and build our partnerships.

Stay safe and well. Thank you for being part of this incredible community. We invite everyone to join our experiments to build positive space futures!

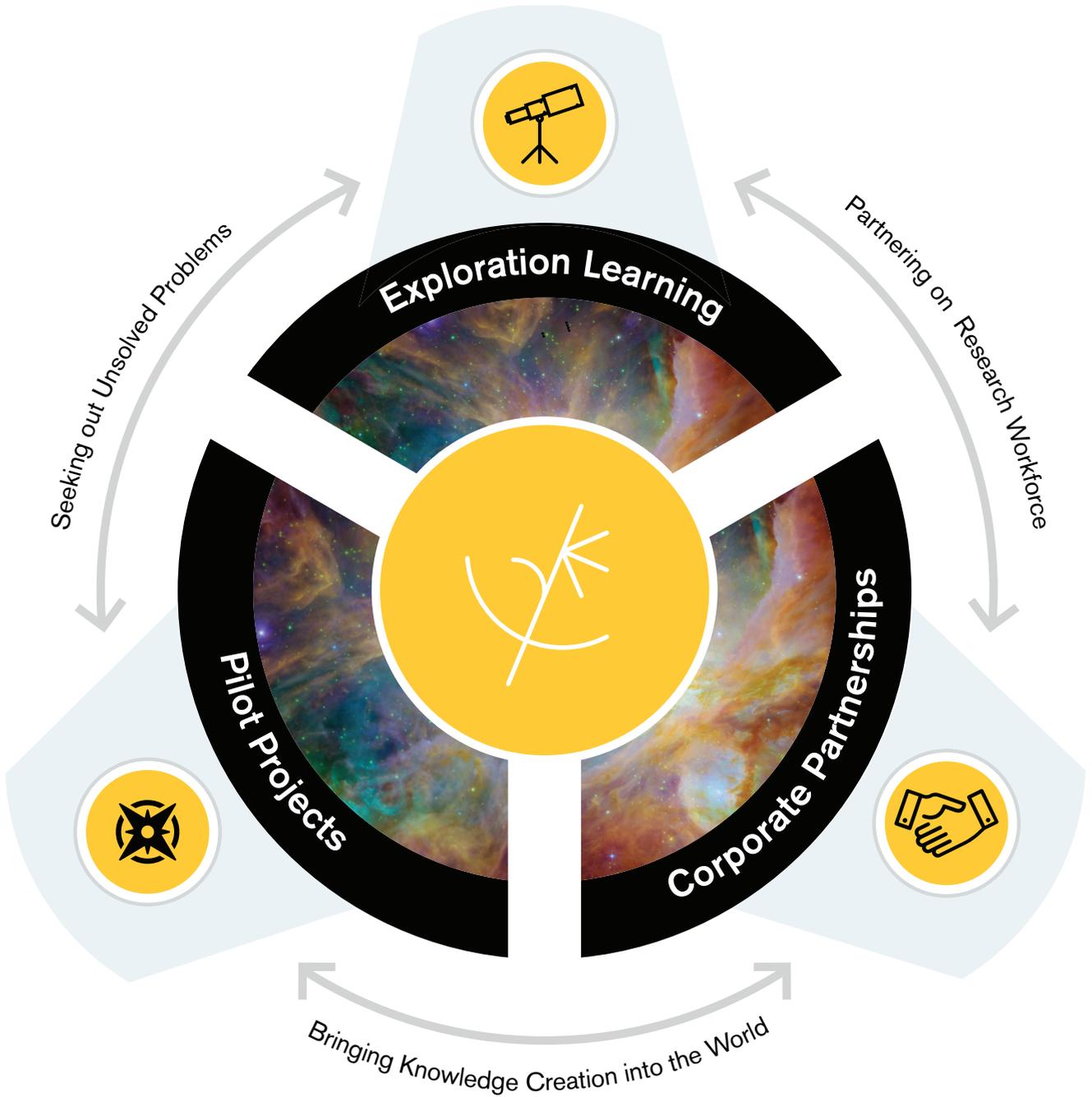
Lindy Elkins-Tanton

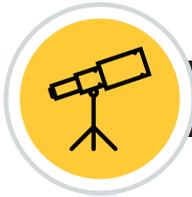


Principal Investigator, NASA Psyche mission  
Co-chair, ASU Interplanetary Initiative  
Co-founder, Beagle Learning

# Foundational pillars

to create our space future





## Exploration Learning

*Creating problem solvers  
and master learners*

- Bachelor of Science in Technological Leadership
- Workshops & Trainings
- Ideation Studio



## Pilot Projects

*Designing research  
for greater impact*

- Tackling big questions
- New space technology
- Education development



## Corporate Partnerships

*Partnering on research  
and workforce*

- Corporate internships
- Capstone research classes
- Interplanetary lab space

**Creating**

*New knowledge*

*Problem-solvers and Team Collaborators*

*Engagement Across:*

*university - government - private - public sectors*

# Social Media

Interplanetary reach and engagement



**402** 

**Social Posts**



**335,188**

**Views / Impressions**



**19,048**

**Total Engagements**



## Facebook

@InterplanetaryASU

**90** Posts

Views/Impressions: **48,777**  
Engagements: **12,575**

## Twitter

@II\_ASU

**146** Tweets

Views/Impressions: **306,514**  
Engagements: **4,940**

## Instagram

@ASUInterplanetary

**132** Posts

Views/Impressions: **19,787**  
Engagements: **1,305**

## LinkedIn

ASU Interplanetary Initiative

**34** Posts

Views/Impressions: **3,990**  
Engagements: **228**

# Events

Highlights and from 2019 - 2020 events

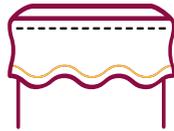


Public Events

+



Workshops



Tabling Events

+



Webinars



Collaborative / Intellectual  
Meetings

+



Social Gathering

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Over **20k**

people attended these  
events and collaborations!

## **Space to Thrive public panel**

Interdisciplinary teams pursuing answers to big questions around space exploration participated in a public panel Thursday, Oct 24, 2019 in front of a full house at ASU Marston Exploration Theater and 17K online viewers. The event consisted of Interplanetary Initiative project flash talks and a panel moderated by Dr. Cady Coleman, ASU's Global Explorer in Residence.

## **American Geophysical Union dinner**

A small, select group of leaders exploring the latest in space science collaborated with the Interplanetary Initiative at the American Geophysical Union Fall Meeting in San Francisco on December 12, 2019.

## **Mary Lou Fulton Teachers College workshop**

Mary Lou Fulton Teachers College hosted an inquiry methodology workshop in collaboration with Beagle Learning and the Interplanetary Initiative on Feb 14, 2020 at ASU West campus. The learning workshop was attended by 100+ individuals and presented new ways towards solving complex problems through inquiry cycles.

## **Steven Beschloss writing workshop**

The two-day workshop was held Feb 18-19, 2020 and provided insights and guidance on writing for a broad audience and expanding public engagement. Hosted by the Narrative Storytelling Initiative and the Interplanetary Initiative, this workshop was led by Steven Beschloss, a Senior Director for Narrative Development a Professor of Practice at the Walter Cronkite School of Journalism and Mass Communications, and the founding director of ASU's Narrative Storytelling Initiative.

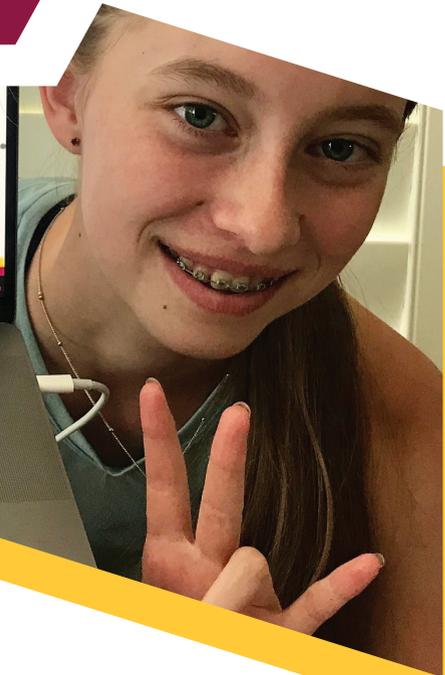
## **Technological Leadership Pearson presentation**

Interplanetary Initiative team members, Lindy Elkins-Tanton and Joshua Thompson, showcased a 45-minute Technological Leadership presentation to Pearson online recruiting services on Feb 21, 2019 at the Chandler Pearson location.

# Space

ASU interdisciplinary teams pursue the big questions of space exploration





## **Interplanetary Initiative Lab grand opening**

The Interplanetary Initiative celebrated their premier new lab space on Feb 27, 2020. ASU affiliates, external partners and the public were among the first people to preview the new lab space with self-tours of the different areas. The new research and development environment is dedicated to teams, including external partners and ASU faculty and students.

## **ET: The human impact of the search for life in the universe**

The School of Earth and Space Exploration and the Interplanetary Initiative co-hosted a New Discoveries Lecture “Finding E.T.: The human impact of the search for life in the universe” on March 5, 2020 at the ASU Marston Exploration Theater. The public event was moderated by ASU journalism fellow, David Baron, with ASU expert panelists Timiebi Aganaba, Steven Desch, Yul Kwon, Sara Imari Walker, and David Williams.

## **Technological Leadership launch webinar**

Hosting their first webinar event on April 8, 2020, the Interplanetary Initiative presented the Technological Leadership BS program to an audience of ASU student-facing staff members. Panelists Lindy-Elkins Tanton, Evgenya Shkolnik and Josh Thompson presented the program’s unique differentiators and learning methodologies.

## **Astronaut Cady Coleman “Ask Me Anything”**

The Interplanetary Initiative and The School of Earth and Space Exploration joined efforts on April 30, 2020 to host a live “Ask Me Anything” webinar featuring Dr. Cady Coleman, ASU’s Global Explorer in Residence. With moderator Meenakshi Wadhwa, Director of the School of Earth and Space Exploration, they answered space questions and inspired families and children, K-12.

## **Breakthrough Starshot Communications workshop**

Breakthrough Initiatives partnered with the Interplanetary Initiative to host a Breakthrough Starshot communications workshop on May 8-9, 2020. The virtual workshop gathered 80+ experts to exchange ideas that will help create a new era of interstellar exploration. Breakthrough Starshot aims to demonstrate proof of concept for ultra-fast, light-driven nanocrafts, and lay the foundations for a first launch to Alpha Centauri within the next generation.

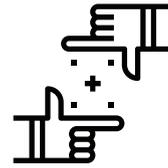
# Pilot Projects

Interdisciplinary teams pursuing answers to big questions

## How our projects are launched



1) Brainstorm big questions



2) Vote on most important



3) Volunteer into working groups



4) Decide on one-year milestones

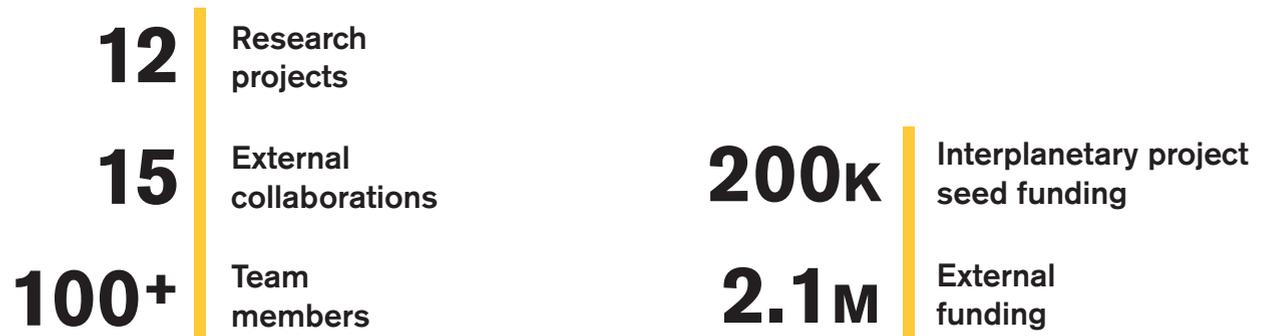


5) Choose a leader

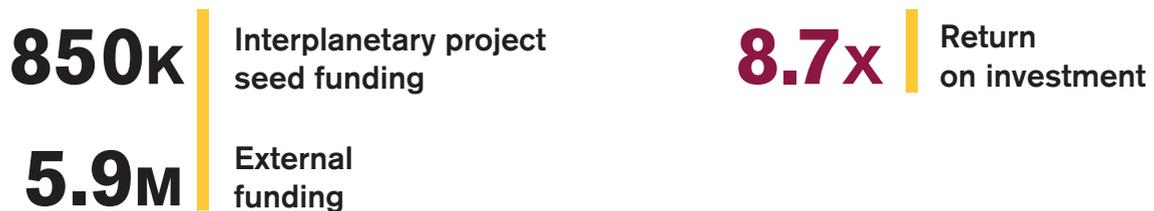


6) Place under project management

## Project research impact by the numbers (2019-2020)



## Cumulative return on pilot project investments (2017-2020)



# Projects

2019 -2020



## Earth Operations Center (EOC)

In collaboration with researchers at MIT and NASA, the EOC initiative is envisioned as a multi-disciplinary approach to understanding the ecological state of the planet and the options we have for ensuring planetary sustainability. Multi-disciplinary experts will work together to identify potential improvements in modeling, data-gaps and options for bridging them, and evaluating and modeling potential technological and non-technological solutions to the long-run challenge of planetary sustainability.

➔ Renewed for 2020-2021

## Exploration Learning

The Initiative continues to invest in education for the future by pursuing projects and building instruction centered on inquiry, project-based learning, and student-led studies to teach critical analysis of content, the research process, problem-solving, and professional perseverance.





## Five Senses in Space

How do we galvanize public and private support for space exploration?

Constructing a virtual reality + smell engine with earthly and spacey scents. The team unveiled the “Mars Exploration Mobile Unit,” which is a simulated Mars habitat that allows people to experience living and working on the surface of Mars. In collaboration with ASU NewSpace, they also took part in the Blue Origin New Shepard launch which included ASU student-led payloads. They have trademarked “Center of the Galaxy” and produced a lip balm under that name using scents from the Sagittarius B2 gas cloud near the center of the Milky Way.

→ Renewed for 2020-2021

## Humans and Robotics

How can we better connect robotics and human space exploration?

Designed and built an exoskeleton prototype that has applications for both astronauts and people on Earth. The exoskeleton includes software for human intention prediction, improving sensing and control.



## The Interplanetary Podcast

Building positive, inclusive space futures requires engagement by people with diverse skills, knowledge and creativity. The Interplanetary Initiative Podcast features innovators and thought-leaders designing the future of humans in space. The podcast is proposed to launch fall 2020 with 30 minute bi-weekly episodes.

→ Renewed for 2020-2021



## Moon Dialogs

The Interplanetary Initiative and Open Lunar Foundation are creating a series of policy development workshops for lunar stakeholders. The dialogs are informed by research provided by subject matter experts in both space and terrestrial policy.

→ Renewed for 2020-2021





### Port of Mars

What social systems, structures and practices can best sustain human communities in space?

Port of Mars is a game-based science experiment designed to find solutions. Players are citizens of Mars charged with working together for the sustained welfare of their community. Each game produces data to help us build successful societies in space and on Earth. Port of Mars isn't the future we seek. It's a rehearsal.

→ Renewed for 2020-2021



### Rapid Responsive Space Missions

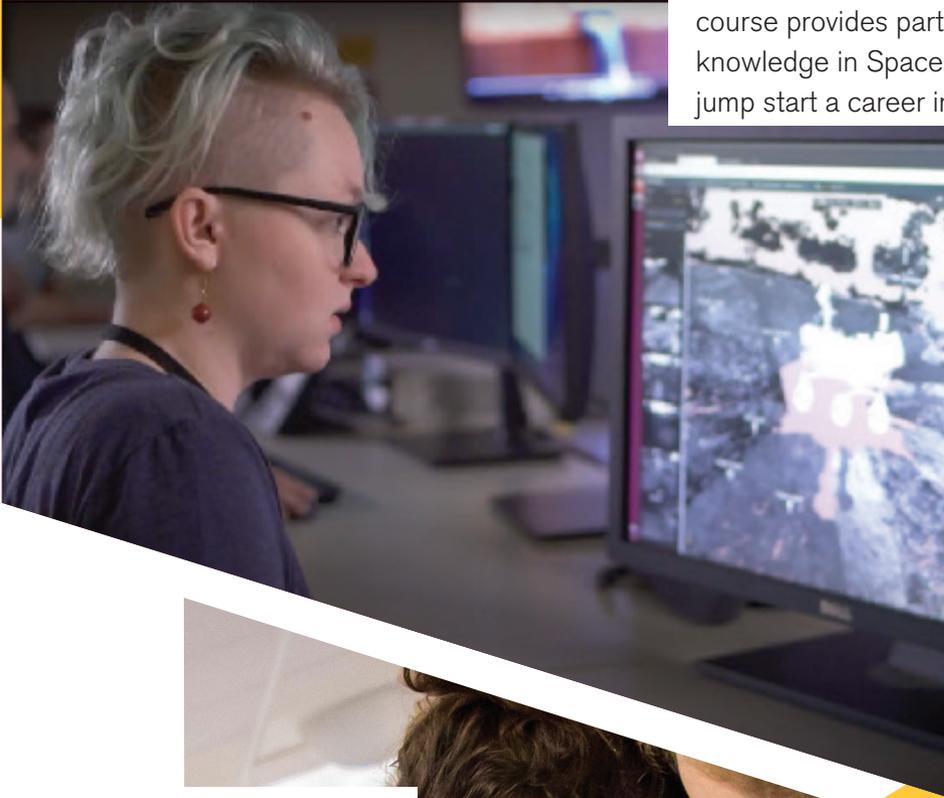
Are small satellites the key to rapid responsive space?

Developed multiple ways to design space missions capable of accommodating new needs that emerge during mission operations. Examples of such needs are: sustained attention, contact avoidance maneuvers and unscheduled spacecraft rendezvous. To broaden the applications of the developed mission designs, the team next envisions a software tool that designs and analyzes different types of missions. This software tool will use existing commercial small satellite technologies. The team developed the first version of the database for the software mission design tool.

## Satellite Operations Course

In partnership with Qwaltec, ASU Interplanetary Initiative launched Satellite online courses for the next generation of space professionals. The course provides participants with foundational knowledge in Space and Ground Operations to jump start a career in satellite operations.

→ Renewed for 2020-2021



## SpaceWorks

Uniquely preparing students for the STEM workforce through team projects in collaboration with NASA. Led to winning the student collaboration contract for the NASA Discovery Lucy mission, and is setting a new paradigm for effective undergraduate learning.



## Space Advisory

What does the future of space advisory look like to best support a prosperous and equitable future?

Investigating the market need for a dedicated legal clinic and advisory service for future space legal and policy issues as they relate to industry, government, and academia.



## Space Economy

Exploring the possibilities of a sustainable space economy beyond our current “anchor tenants,” such as NASA and ESA.

→ Renewed for 2020-2021



# New pilot projects

## Newly funded projects for 2020 - 2021

Because of COVID, laboratory-intensive research is postponed and this cohort of pilots contains more research and theory.

### **Commons in Space**

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In Spring 2021, a web-conference will be held on governance of shared resources in space from satellites and space debris increasingly occupying the atmosphere, to mining of celestial bodies. The interdisciplinary conference will explore how to solve collective action problems to ensure long-term sustainability of space exploration activities.

### **eLearning in Space**

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The “eLearning in Space” project will explore what methodologies, resources, delivery systems, and technology will be advantageous to provide an optimum learning environment in space. The project will optimize and adapt exploratory eLearning methodologies that are effective on Earth to the environment and learners whom we anticipate will be living in space settlements.

### **Toward Diversity, Equity and Inclusion**

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Advancing diversity and inclusion in the space sector by providing stakeholders with data-driven insights to provide clarity on the issue of diversity and inclusion. This project explores the conditions required for an accessible space future and also establishes objective criteria for a new industry award for actors who best exemplify commitment to this goal.

### **The Need for a Meta-Examination of the Interplanetary Initiative**

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There are many ways to imagine coordinating resources to support the exploration and use of interplanetary space (e.g., Public/Private Partnerships, Corporate, Governmental institutions, etc.). Using ASU's Interplanetary Initiative as a unique example, this project will examine the various ways to organize for interplanetary space and investigate the tradeoffs inherent in the different approaches.



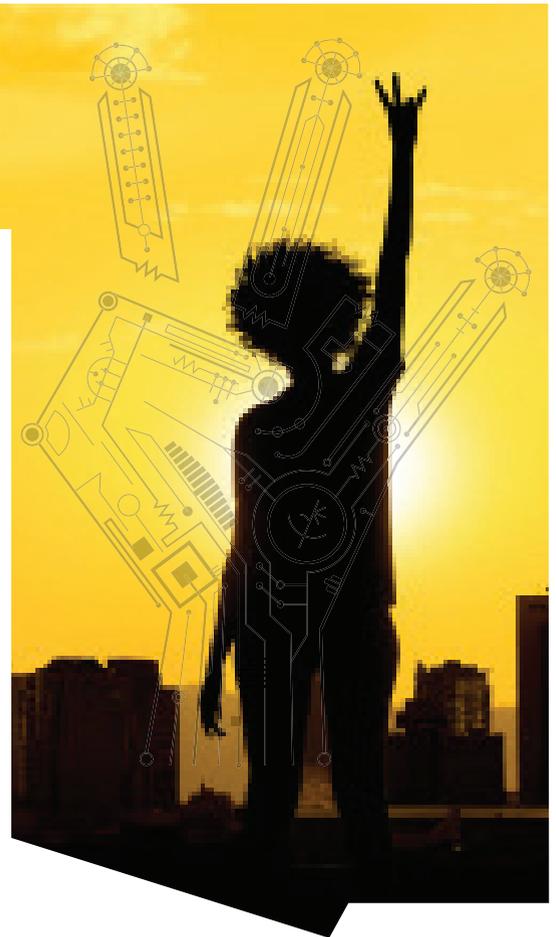
# Bachelor of Science in Technological Leadership

We're creating the innovative, problem-solving workforce the world needs to build positive futures and bolder, better societies

When today's college students graduate, more than half of the available career pathways will not have existed just ten years previously. Old models of education are inadequate for preparing students for this emerging and fluid landscape.

In fall 2021, the Interplanetary Initiative will launch its first degree program. Our Bachelor of Science in Technological Leadership features new approaches to education designed to prepare learners to drive forward our technological future. The degree encourages adaptive, life-long learning and problem-solving to meet the demands of a rapidly changing workplace.

In addition to on-the-job work experience through internships, this degree will provide students with essential skills in critical thinking and problem-solving, collaboration and teamwork, communication skills, coding, math, writing, speaking, presenting, and the foundations of leadership that will drive innovation and effectiveness in the burgeoning tech economy. Enrollment is open for online and in-person degrees, and courses begin in August of 2020



# Creating the future of education

Students gain the skills they need to solve big challenges in the world around them by practicing critical thinking and collaboration.



The Initiative works to create a world in which lifelong learners continuously solve problems to advance human progress. Exploration Learning skills are critical in achieving this goal as they empower students to systematically and effectively design solutions to the interdisciplinary challenges of creating human space futures.

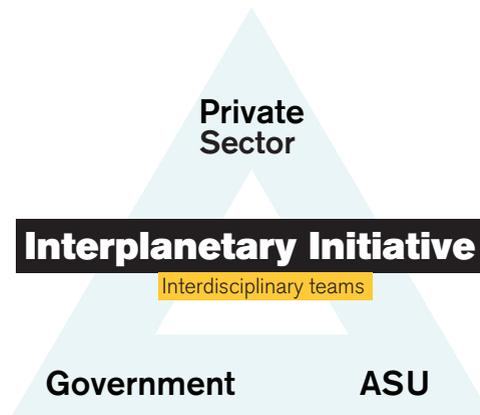
*Credit: Beagle Learning*



# Partner with the Interplanetary Initiative

To help fully realize this potential, the Interplanetary Initiative is collaborating with companies to drive future space exploration opportunities

Arizona State University contributes to one of the most robust and interconnected environments for innovation in the world. To help realize this full potential, the Interplanetary Initiative is partnering with companies to drive future space exploration opportunities. A successful space future requires a new level of collaboration among the private sector, universities, and governments. In the coming year Interplanetary will begin developing a new organizational structure so that we can most efficiently connect these stakeholder sectors to fulfill the essential needs for space exploration research.



**Together, we can harness unique strengths and growth potential to:**

Develop a problem-solving workforce

Produce cutting-edge research

Join economic sectors across institutional boundaries

To get involved, please contact:  
Lindy Elkins-Tanton

lelkinst@asu.edu  
interplanetary.asu.edu



## Research and development lab

*Discover how private partners and ASU students are designing projects in the new Interplanetary build-test-fly lab for space hardware and software.*



### Benefits

- In-house design, build and test capabilities
- R&D cost-savings with students and postdocs on teams
- University allows external collaboration on site for partner projects
- Centrally located on the Tempe campus with nearby amenities and faculty

### Features

Prototyping space ▪ vacuum testing ▪ AV-enabled meeting room  
electronics lab ▪ ground station ▪ collaborative workspace  
test equipment ▪ clean room ▪ secure storage

### Management

Staff engineers are onsite for management, security and team mentorship

# Interplanetary team

Our team is built on character as well as expertise



**Michael Crow**  
ASU President  
Co-Chair,  
ASU Interplanetary Initiative



**Lindy Elkins-Tanton**  
Managing Director and Co-chair,  
ASU Interplanetary Initiative  
P. I., NASA Psyche mission  
Co-founder, Beagle Learning



**Tess Calvert**  
Portfolio Manager



**Carly Kramer**  
Student Assistant



**William Campbell**  
Interaction Designer



**Alex Minotto**  
Student Assistant



**Ernest Cisneros**  
Satellite Command and Control



**Jaime Sanchez De La Vega**  
Engineer Associate



**Laura Craft**  
Business Operations Specialist



**Evgenya Shkolnik**  
Associate Director



**Lance Gharavi**  
Associate Director



**Sona Seely**  
E.A. to the Managing Director



**Kevin Hubbard**  
Graduate Student



**Taryn Struck**  
Manager of Marketing and Publicity



**Danny Jacobs**  
Associate Director



**Joshua Thompson**  
Academic Success Coordinator



**Sheri Klug Boonstra**  
SpaceWorks



**Abigail Weibel**  
Project Manager



## **We need your support**

The Interplanetary Initiative relies on your philanthropy and invites you to participate in our unique and exciting mission. Drawing upon the strength, breadth, and intellectual diversity of ASU's resources, we are accelerating research and interdisciplinary education in a pan-university effort to build positive human space futures.

Your financial generosity will help advance our mission and make a lasting impact on efforts to respond to the most fundamental and challenging questions of our time.

To learn how you can support the Interplanetary Initiative, please contact us. We look forward to hearing from you!

Lindy Elkins-Tanton  
lelkinst@asu.edu  
interplanetary.asu.edu

