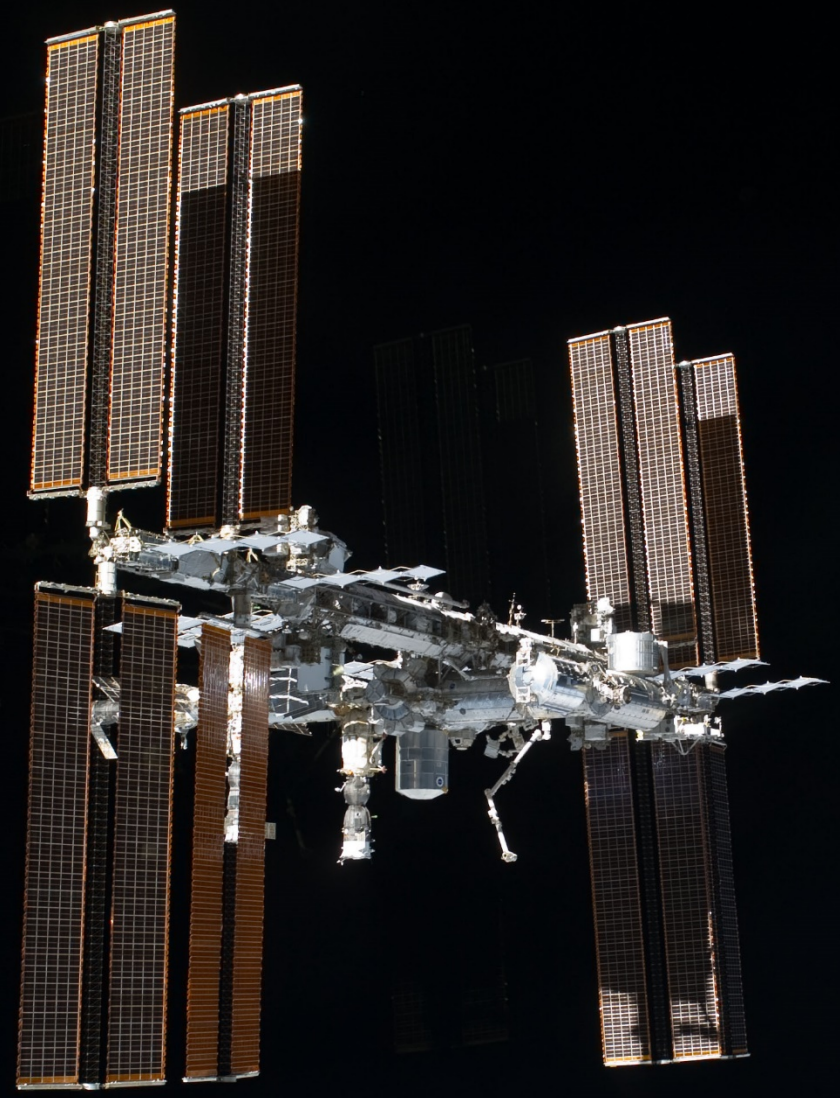


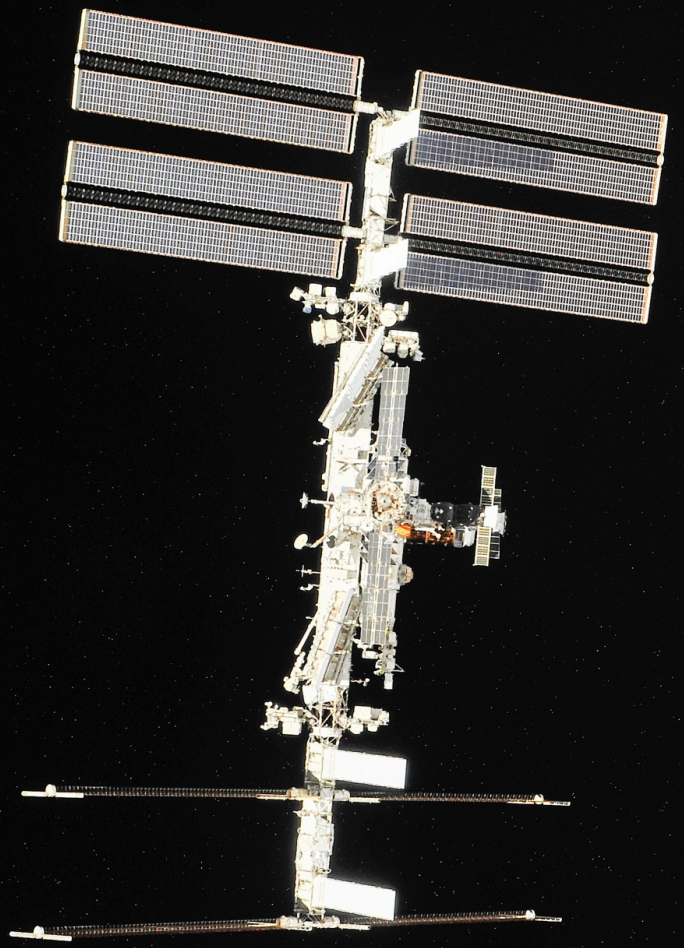
ISS
U.S. NATIONAL LABORATORY

BUILDING THE BUSINESS CASE FOR INDUSTRIALIZATION IN LOW EARTH ORBIT

Cynthia Martin-Brennan,
Director, Stakeholder Management
International Space Station (ISS) U.S. National Laboratory

Committee on Biological and Physical Sciences in Space

October 29, 2019



The ISS National Lab is maximizing ISS capabilities to stimulate utilization and to catalyze the development of new markets.

To achieve this goal, the ISS National Lab seeks out and pursues opportunities that drive sustainable demand and benefit humankind.

INTERNATIONAL SPACE STATION RESOURCE ALLOCATION

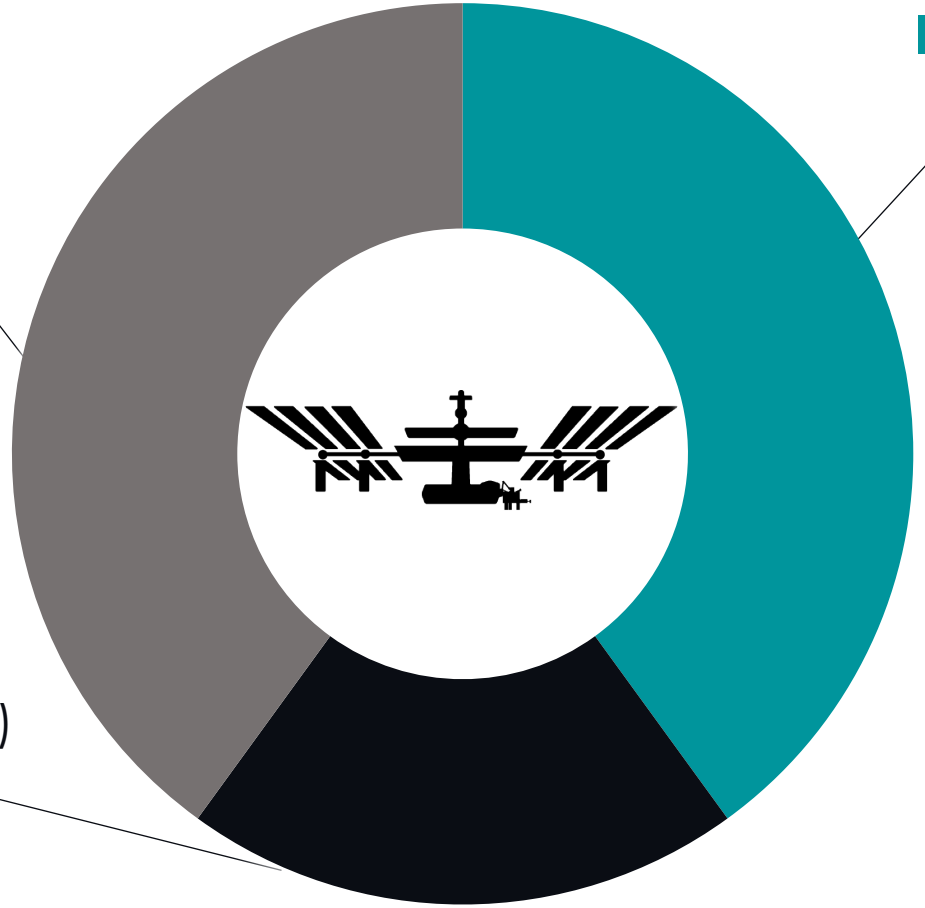
NASA Utilization (40%)

HEOMD
- AES
- CSLI
- **HRP**
  - TRISH
- **ISS Tech Demo**
  - DoD STP
- SCAN
- **SLPSRA**

SMD
STMD

International Partners (20%)

CSA (2.3%)
ESA (8.3%)
JAXA (12.8%)



ISS National Lab (40%)

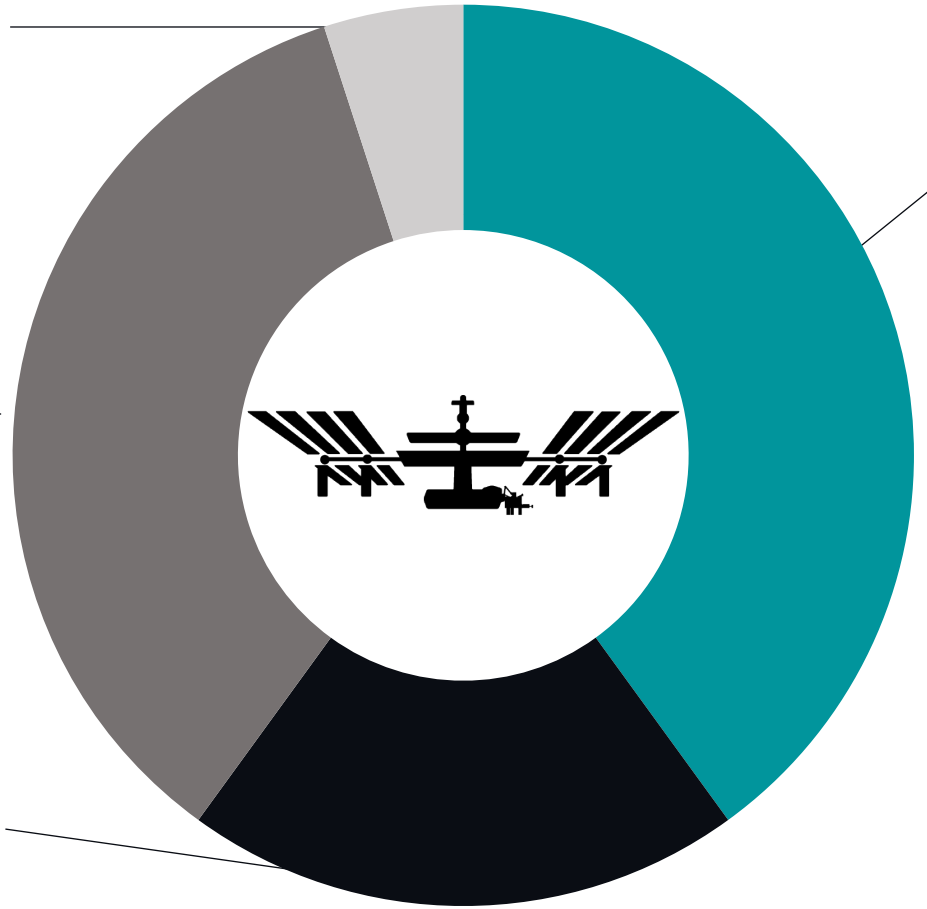
Allocation includes:
- *Upmass*
- *Stowage*
- *Electricity*
- *Downlink*
- *Astronaut time*
- *Downmass*

INTERNATIONAL SPACE STATION RESOURCE ALLOCATION

NASA Commercial Non-R&D (5%)

NASA Utilization (35%)

International Partners (20%)



ISS National Lab (40%)

Allocation includes:

- *Upmass*
- *Stowage*
- *Electricity*
- *Downlink*
- *Astronaut time*
- *Downmass*

ISS NATIONAL LAB: SPACE INTEGRATOR

DEMAND

ACADEMIC, NONPROFIT, & OGA PROJECTS (144)
MIT, MJFF, ORNL, Emory, etc.

INDUSTRY PROJECTS (159)
AstraZeneca, Delta, Goodyear, Merck, etc.

SUPPLY

AEROSPACE ASSOCIATES
NASA, Airbus, Bigelow, Sierra Nevada, etc.

IMPLEMENTATION PARTNERS (38)
Teledyne, NanoRacks, Space Tango, MIS, etc.

INVESTMENT

MEMBER INVESTOR NETWORK (157)

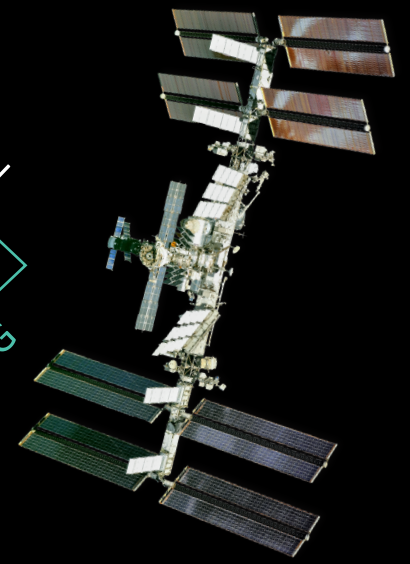
GOVERNMENT FUNDING PARTNERS
NIH, NSF, NASA, MLSC, DoD, etc.

COMMERCIAL FUNDING PARTNERS
Boeing, Apple, Target, etc.

ISS NATIONAL LAB INTEGRATION

17
COMMERCIAL LAB FACILITIES

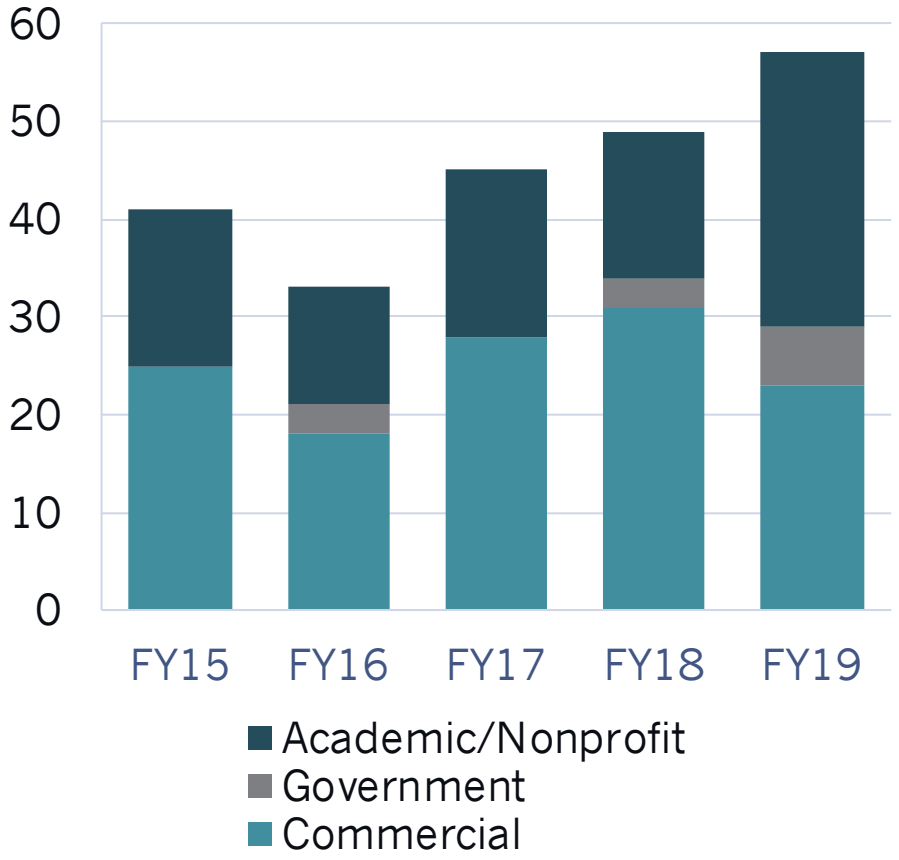
ISS NATIONAL LAB FUNDING

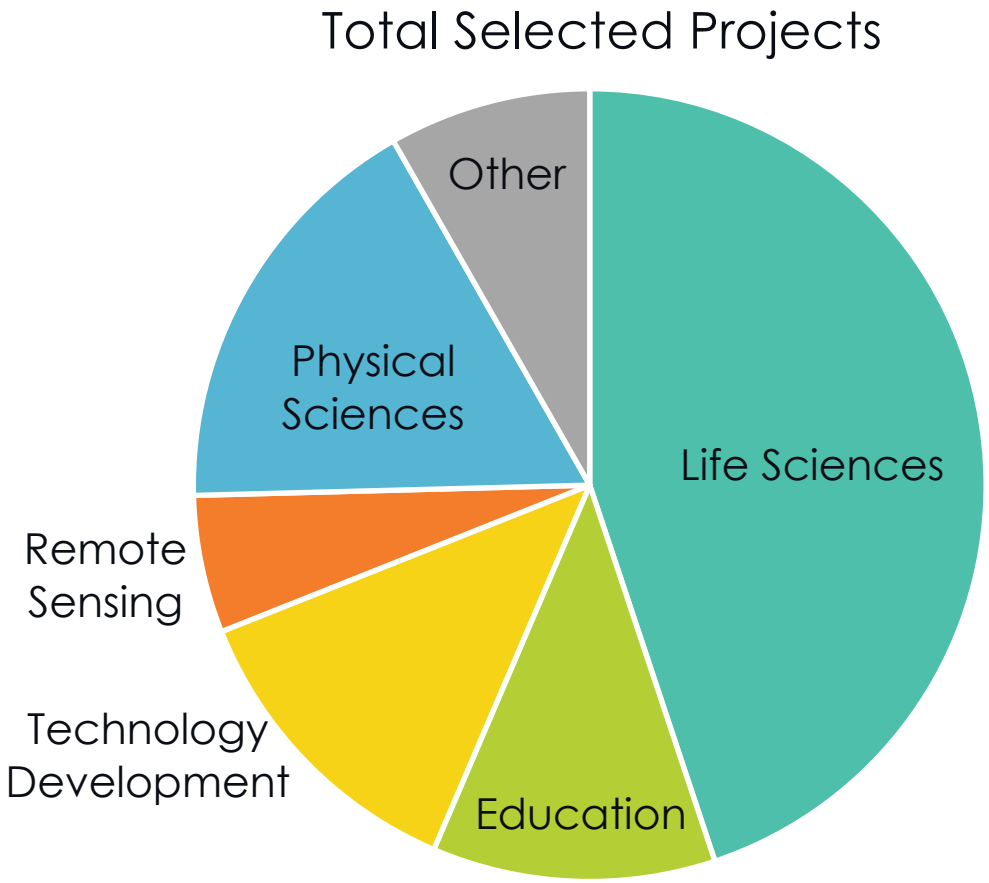


ISS NATIONAL LAB FUNDAMENTAL OPERATING OBJECTIVES

1. Make ISS R&D platform available to the U.S. taxpayer
2. Support emerging low Earth orbit (LEO) economy by building the business case
3. Improve the natural R&D iteration cycle time
4. Focus on promising R&D areas
5. Support high-quality fundamental science
6. Optimize & improve microgravity platform utilization

ISS NATIONAL LAB CUSTOMERS





Other = facilities and programmatic initiatives to utilize those facilities

SPACE COMMERCIALIZATION VS. LEO INDUSTRIALIZATION

The ISS National Lab does not commercialize anything.

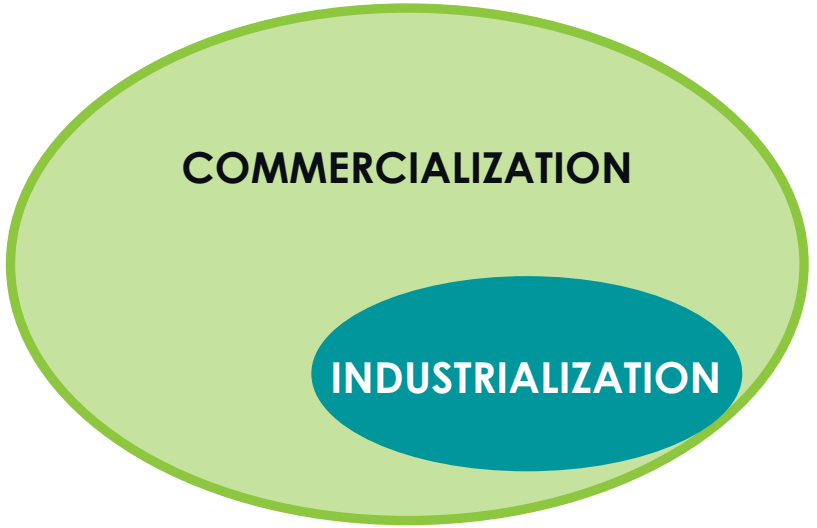
Examples:

- Advanced communications
- Engineering & Prototyping Services
- Equipment
- Flight Operations Services
- Industrial Biomedicine
- Manufacturing Advanced Materials
- Navigation
- Novelty
- Remote Sensing (earth & space-facing)
- Resource Extraction
- Satellite
- Space Equipment
- Telecommunication Service
- Tourism & Entertainment
- Transportation (ground & space)

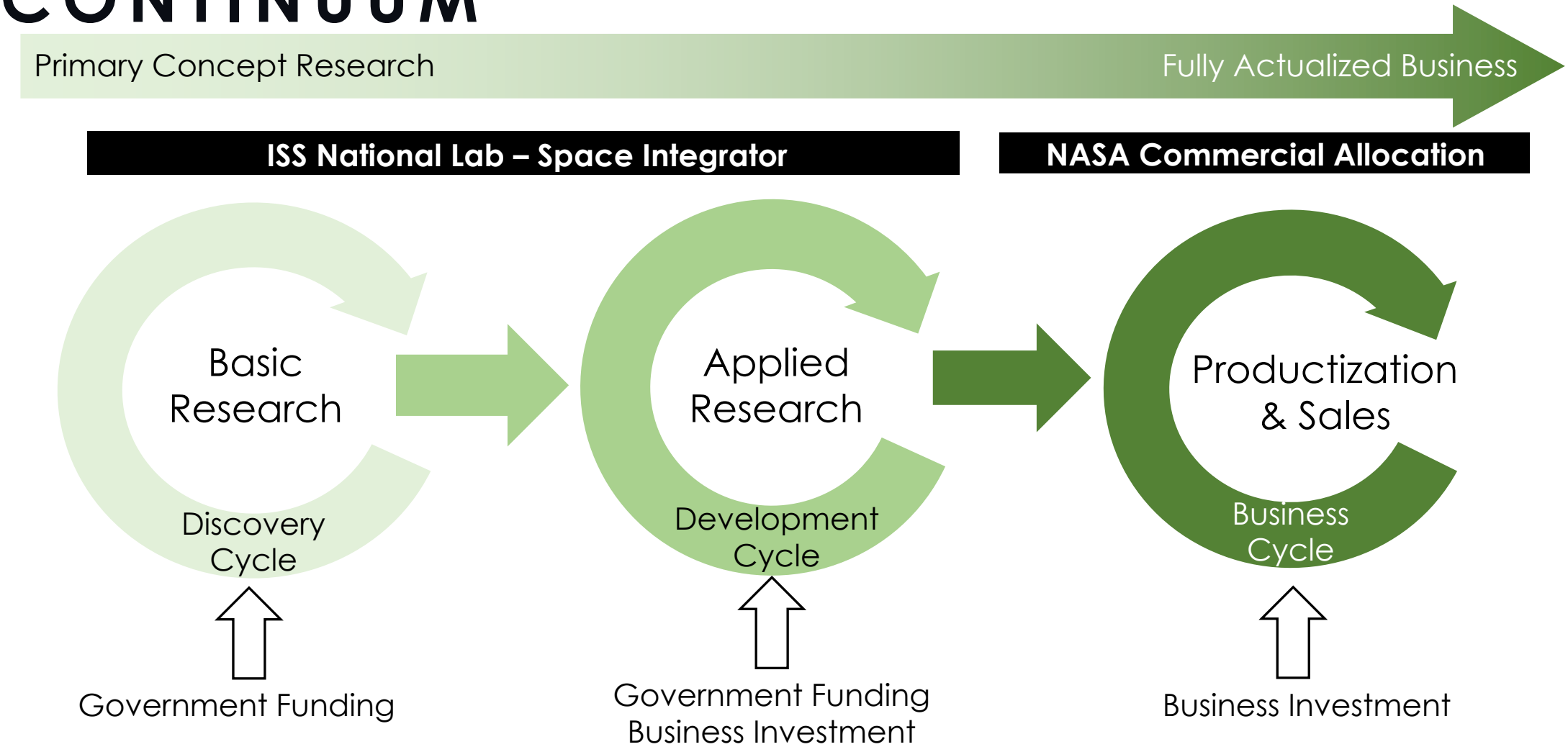
The ISS National Lab builds the LEO business case.

Persistent space R&D conditions needed

- Advanced Communications
- Engineering & Prototyping Services
- Industrial Biomedicine
- Manufacturing Advanced Materials
- Remote Sensing (Earth & space-facing)



R&D: THE INDUSTRIALIZATION CONTINUUM



ISS National Lab success = vibrant LEO economy

STRATEGY: MORE APPLIED RESEARCH PROJECTS

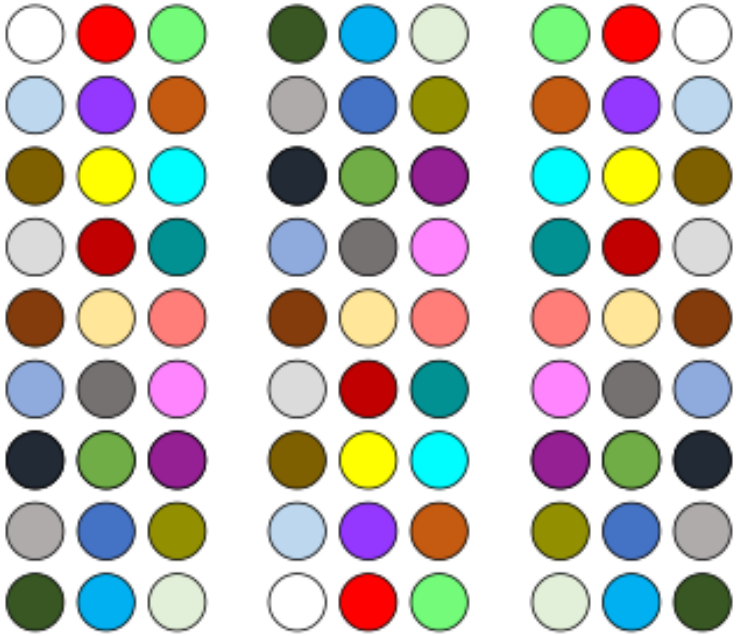
- Research mostly academic in nature
- Experimental designs geared toward discovery
- Results sometimes produce more basic research questions
- Discovery cycle driven by scientific pressure

- Chaperone basic research to applied research
- **Select greater proportion of projects that have line of sight to commercial endpoint**
- Make investor introductions
- Development cycle driven by business pressure

ISS NATIONAL LAB STRATEGY: R&D PROGRAM APPROACH

One year of project-based ISS National Lab missions

Mission A | Mission B | Mission C



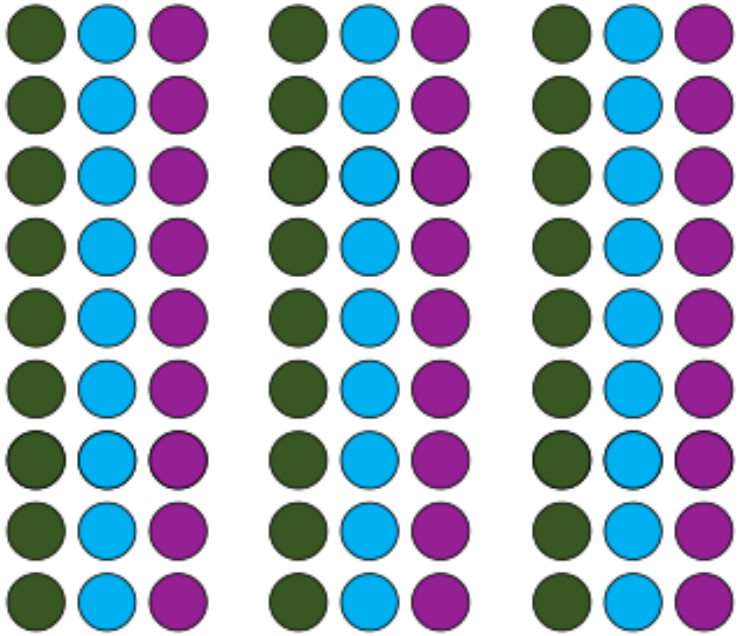
Multiple project disciplines per mission = **3 projects/discipline/year**

VS.

Colored dots represent individual project disciplines

One year of PROGRAM-based ISS National Lab missions

Mission A | Mission B | Mission C



Program disciplines per mission = **27 projects/discipline/year**

ISS NATIONAL LAB ACTIVE PROGRAMS

Industrial Biomedicine Program – Initiated August 2019

This program focuses on microgravity R&D with line of sight toward products and services for clinical application.

- Evergreen RFP, quarterly reviews
- Active Program Partner development effort

Advanced Materials Program – Initiated August 2019

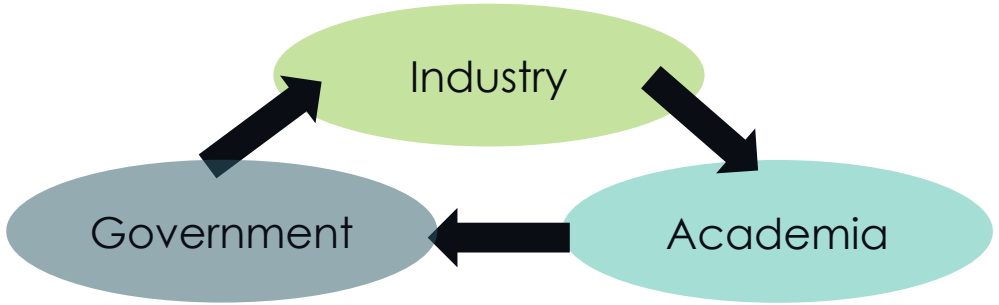
This program will use all the different aspects of the space-based environment to test material formation and proof-of-concept development, as well as enable next-generation production methods.

- Evergreen RFP, quarterly reviews
- Active Program Partner development effort

From the inception of every project, the aim will be to create products & services for an industrial marketplace on Earth.

ISS SELECTION AND ALLOCATION

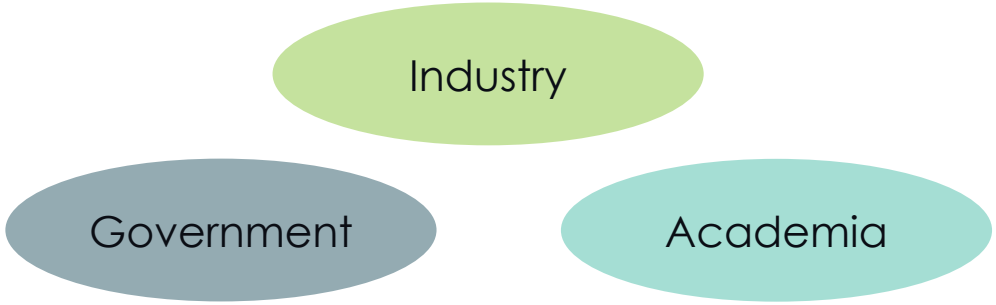
PROGRAM-BASED



- Program partner contributing significantly (e.g., ground-based facilities, funding)
- Organized around centers of excellence (e.g., regenerative medicine)
- Dedicated ISS National Lab allocation (20% initial) & has skin in the game
- Projects selected & organized around program-specific goals
- ISS National Lab proposal & evaluation process
- Project governance by steering committee (members of alliance & ISS National Lab)
- More applied in nature
- Projects sourced through alliance members

AND

PROJECT-BASED



- Projects organized around individualized goals
- ISS National Lab proposal & evaluation process
- Unsolicited & solicited proposals
- More basic in nature
- Project governance by ISS National Lab
- Projects sourced through ISS National Lab Business Development and/or commercial implementation partners
- Shared ISS National Lab allocation

ISS
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THANK YOU!

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Discover the unique advantages of conducting research in microgravity onboard the ISS National Laboratory.

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