

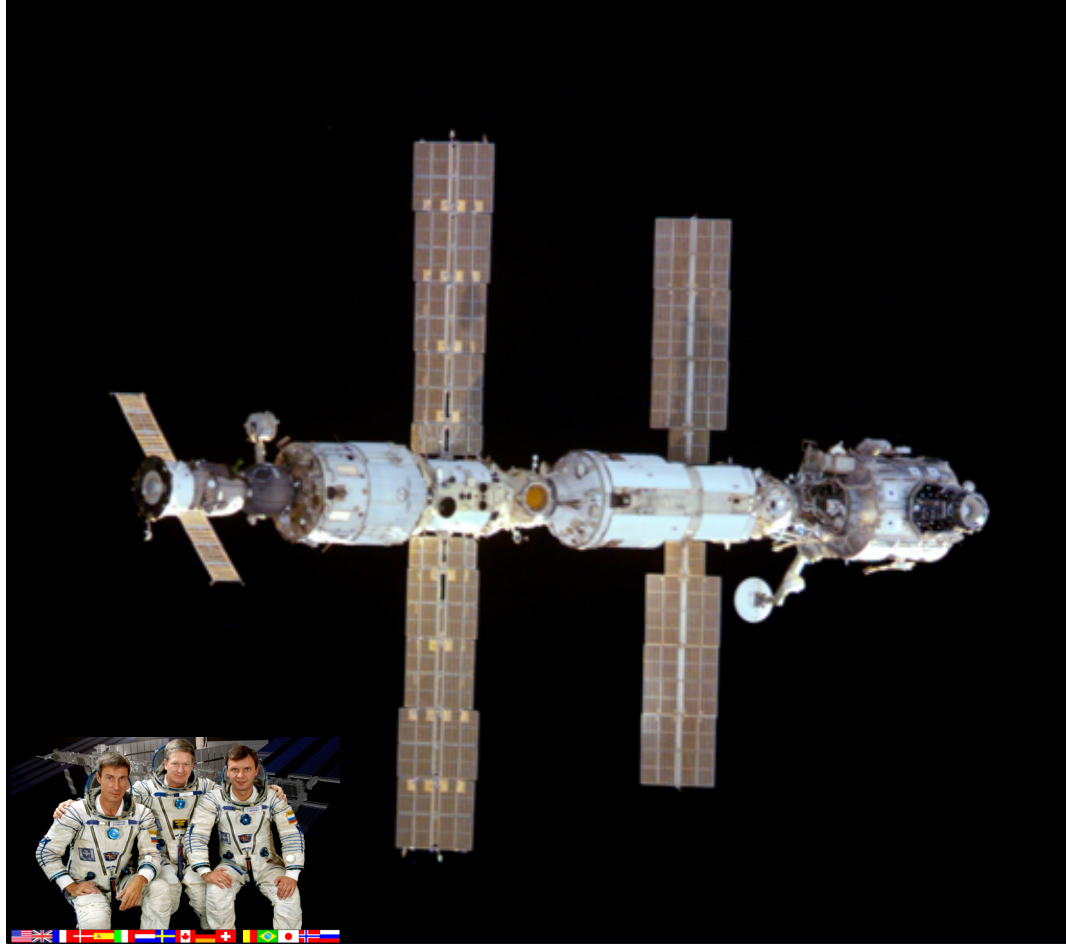


ISS NATIONAL LAB UPDATE TO THE CBPSS

Michael Roberts
Chief Scientist (acting)

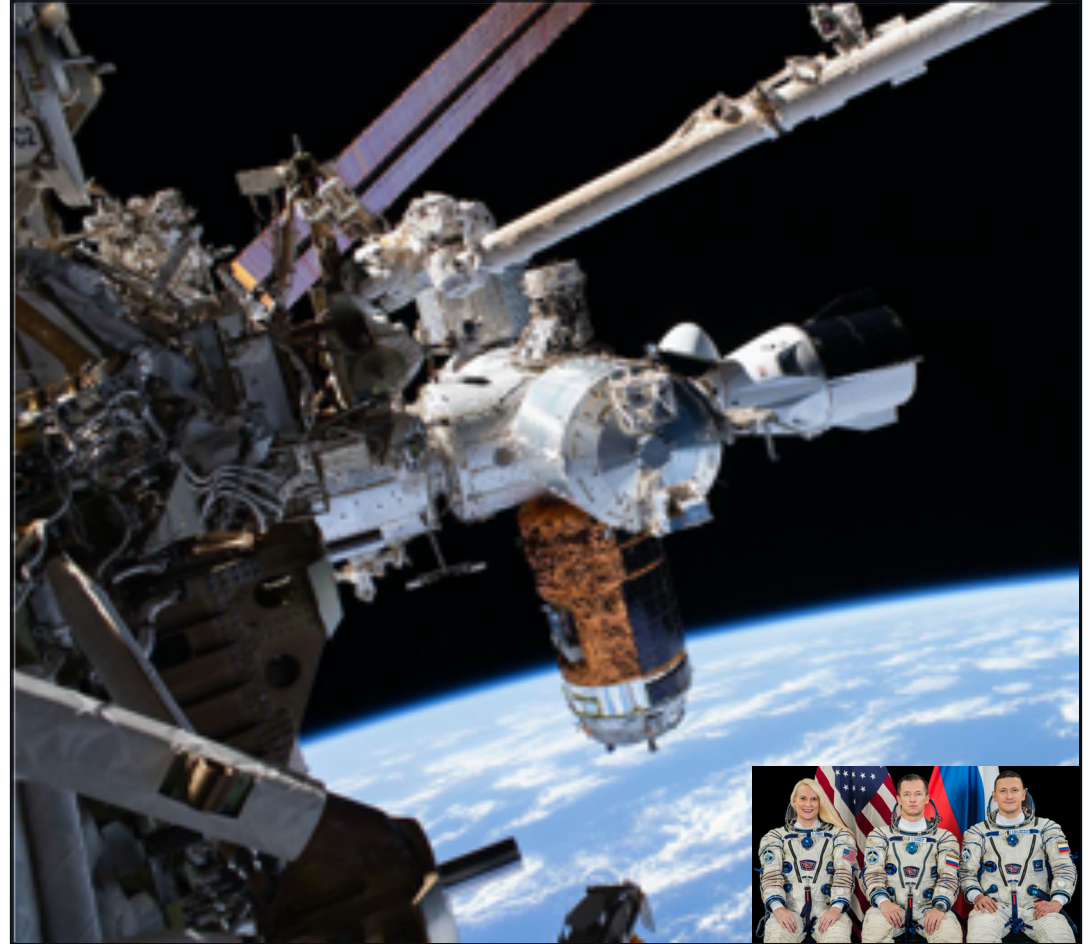
28 October 2020

HOW IT STARTED



ISS Expedition 1 crew (inset left), launched 2 Nov 2000 to the ISS, seen here during the approach of STS-97.

HOW IT'S GOING

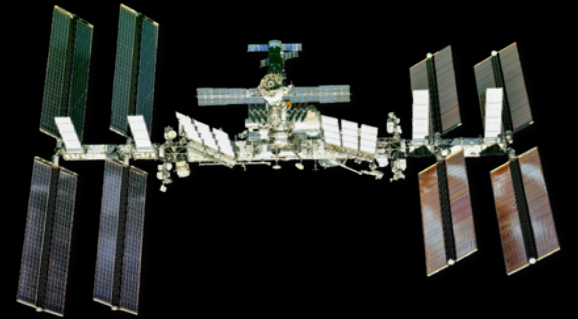


Increment 64 crew (inset right), launched 14 Oct 2020 to the ISS, seen here during the docking of SpaceX Crew Dragon Demo-2.

ISS NATIONAL LAB: HOW IT STARTED

Created by Congress in 2005 on the United States Orbital Segment (USOS) of the International Space Station.

Since 2011, the ISS National Lab has been managed through a partnership, established via a Cooperative Agreement, between NASA and CASIS, a not-for-profit nongovernmental organization.



ISS National Laboratory

CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE

ISS NATIONAL LAB: HOW IT'S GOING

\$323M

158

**ACADEMIC, NONPROFIT, &
OGA PROJECTS**
Emory, MIT, MJFF, ORNL, etc.

171

INDUSTRY PROJECTS
*AstraZeneca, Delta,
Goodyear, Merck, etc.*

**COMMERCIAL
PARTNERSHIPS**

*Airbus, Axiom, Sierra
Nevada Corp, etc.*

38

**COMMERCIAL
IMPLEMENTATION PARTNERS**
*Alpha Space, BioServe, MIS,
Nanoracks, Space Tango,
Teledyne, etc.*

**INDUSTRY FUNDING
PARTNERS**

*Apple, Boeing,
Target, etc.*

200

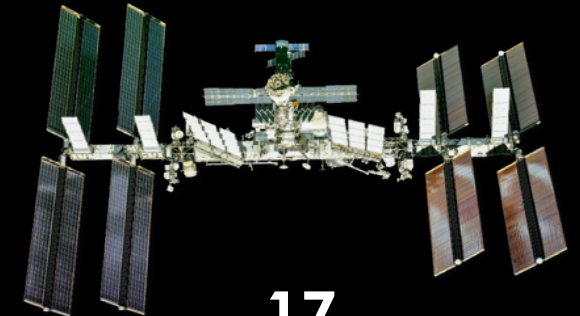
**MEMBER
INVESTOR
NETWORK**

**GOVT AGENCY
FUNDING PARTNERS**
*DoD, MLSC, NASA,
NSF, NIH, etc.*

449
PAYLOADS

\$135M
**NASA
FUNDING**

\$188M
**EXTERNAL
FUNDING**



17
**COMMERCIAL
LAB FACILITIES**

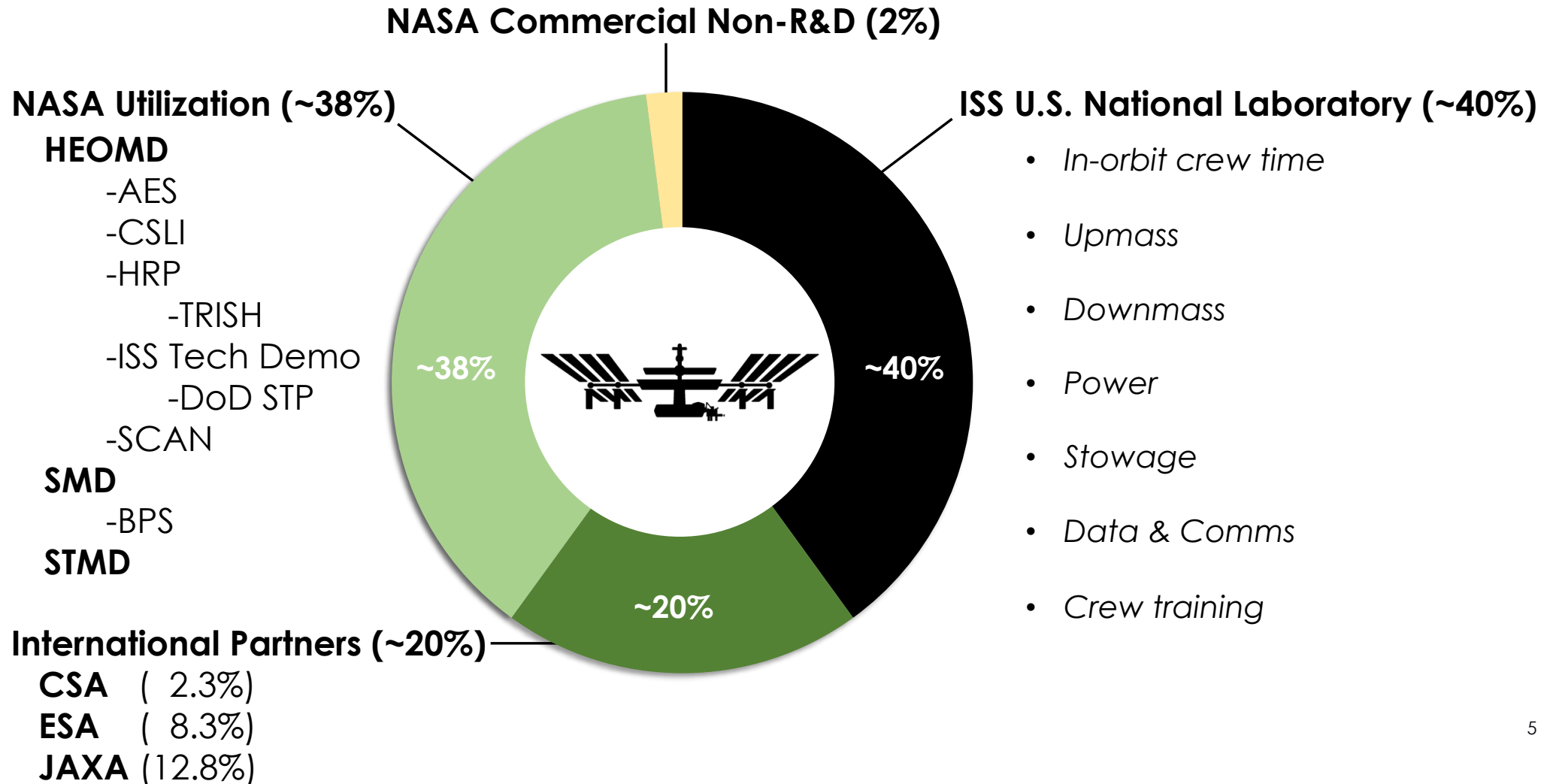
AS OF Q4FY20



ISS National Laboratory

CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE

INTERNATIONAL SPACE STATION RESOURCE ALLOCATION BY SPONSOR



THEN: ISS NATIONAL LAB PORTFOLIO ORGANIZED BY ACADEMIC MODEL

STEM Education

Life
Sciences
R&D



Physical
Sciences
R&D

Technology
Development



Facilities

Remote Sensing

NOW: ISS NATIONAL LAB PORTFOLIO ORGANIZED BY BUSINESS MODEL

COMMERCIAL
UTILIZATION



TECHNOLOGY
DEMONSTRATION



FUNDAMENTAL
SCIENCE



STEM
ENGAGEMENT



IN-SPACE
PRODUCTION
APPLICATIONS



ISS NATIONAL LAB LINES OF BUSINESS

COMMERCIAL UTILIZATION: Projects developed by Commercial Service Providers for the purpose of promoting, enabling, and facilitating their respective commercial demand-generation efforts.

FUNDAMENTAL SCIENCE: Hypothesis-driven research leading, sponsored by other government agencies, to new scientific discovery or advancing current knowledge through access to microgravity and the operating environment of the ISS.

IN-SPACE PRODUCTION APPLICATIONS: Applied R&D programs seeking to demonstrate space-based manufacturing, production activities and services that enable new business growth and capital investment, represent scalable and sustainable market opportunities, and produce reoccurring value with the potential to generate demand for, and revenue from, access to space.

STEM ENGAGEMENT AND EDUCATIONAL OUTREACH: Programs, projects, and public-private partnerships that leverage the ISS and space-based research to promote next generate science standards and advance U.S. leadership in space-based R&D by workforce development.

TECHNOLOGY DEMONSTRATION: Projects in applied R&D, technology demonstration, and Technology Readiness Level maturation to improve products and/or processes that will produce positive economic impact.

COMMERCIAL UTILIZATION

Projects developed by
Commercial Service Providers
for the purpose of promoting,
enabling, and facilitating their
respective commercial demand-
generation efforts.

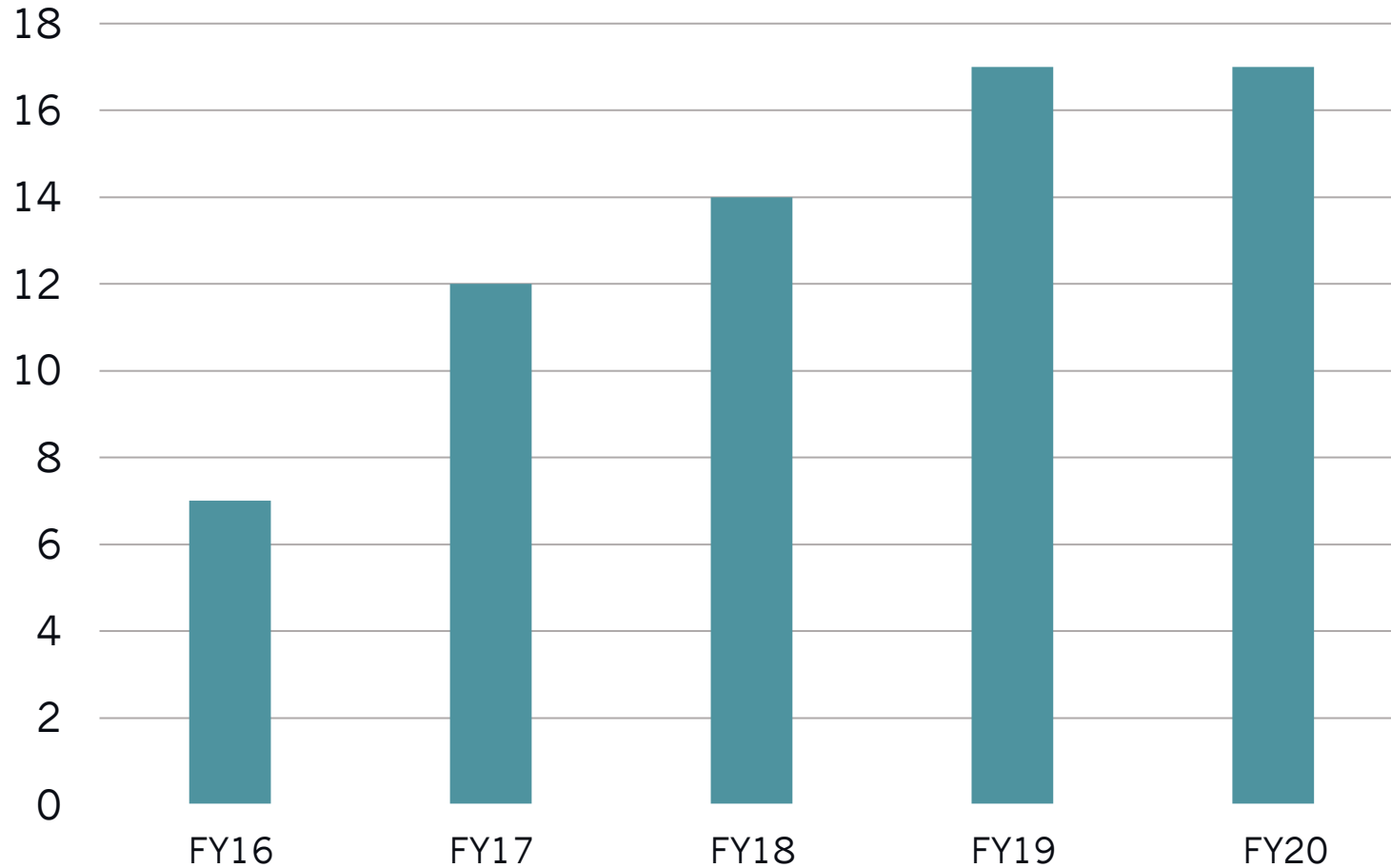




TECHNOLOGY DEMONSTRATION

Projects in applied R&D, technology demonstration, and TRL maturation to improve products and/or processes that will produce positive economic impact.

COMMERCIAL FACILITIES ON STATION



Alpha Space

Bioserve Space Technologies

Craig Technologies

Made In Space

Nanoracks, LLC

SEOPS, LLC

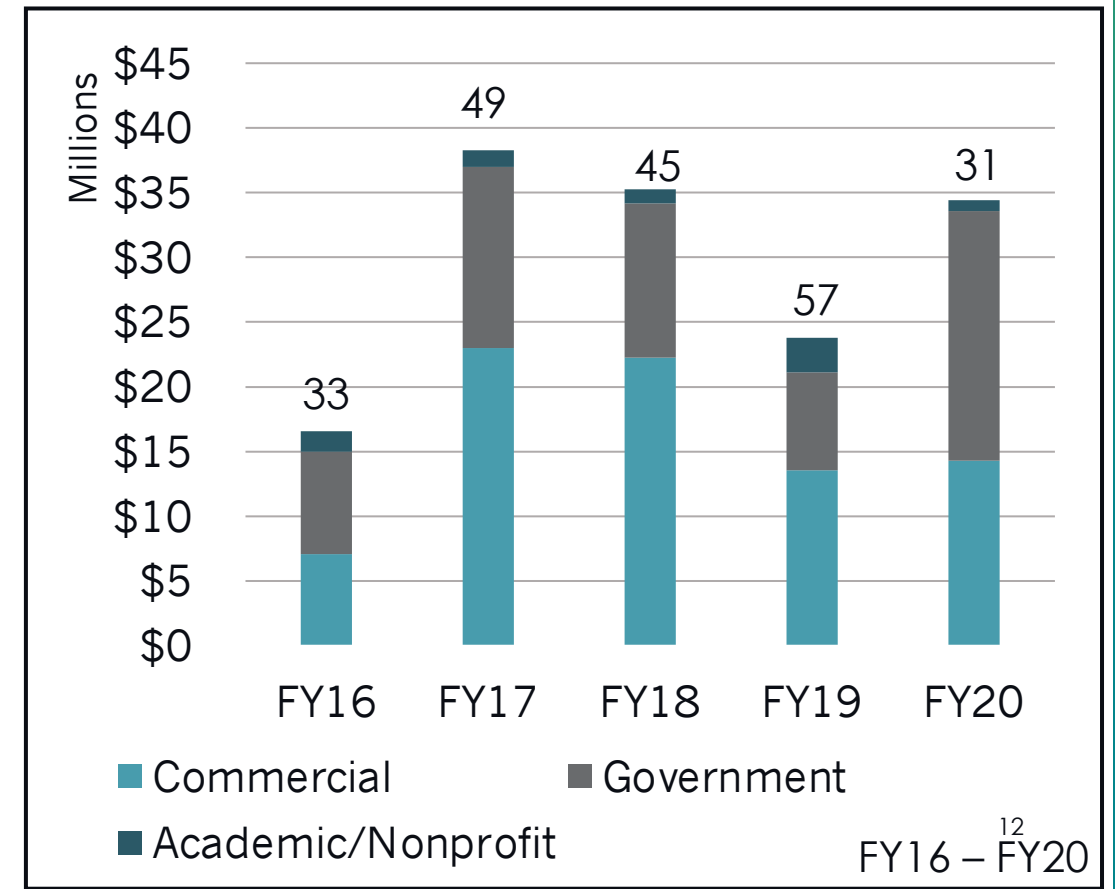
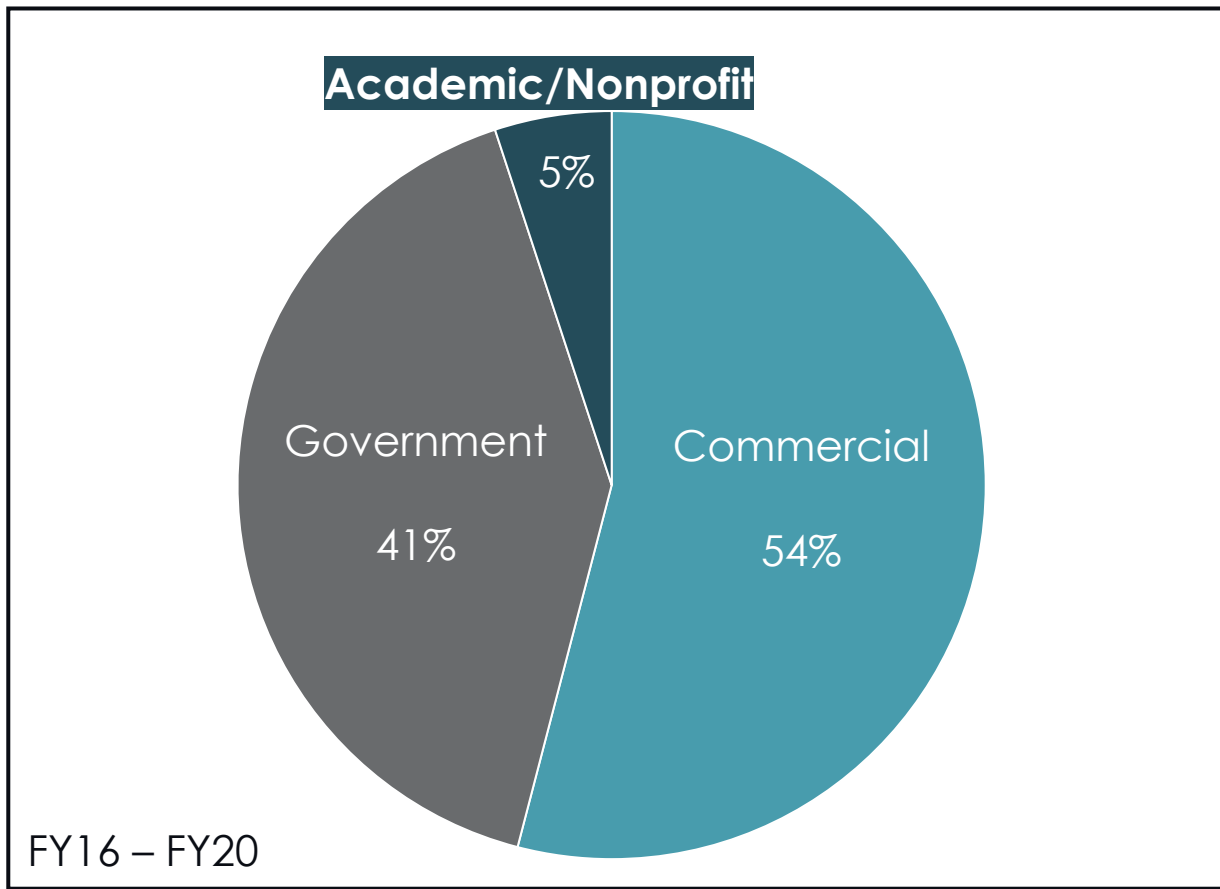
Space Tango, Inc.

STaARS

Techshot, Inc.

Teledyne Brown Engineering, Inc.

COMMERCIAL USE/TECH DEMO DRIVEN BY EXTERNAL NON-NASA FUNDS



*Numbers above bars represent projects selected during FY.

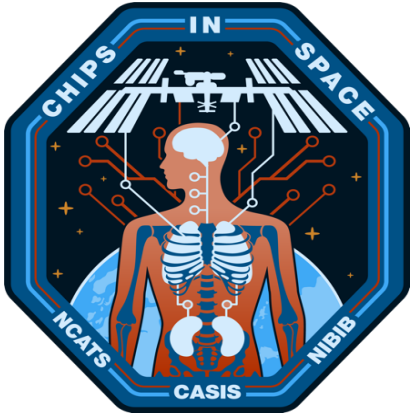


FUNDAMENTAL SCIENCE

Hypothesis-driven research,
sponsored by other
government agencies, leading
to new scientific discovery or
advancing current knowledge
through access to microgravity
and the operating
environment of the ISS.

FUNDAMENTAL SCIENCE: OGA* SPONSORED PROGRAMS

STEM CELLS, TISSUE ENGINEERING, & REGENERATIVE MEDICINE



NIH/NCATS – NIBIB

Chips in Space 2.0

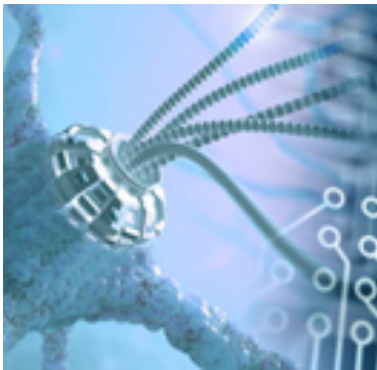
RFA-TR-18-001

\$11M

Chips in Space 1.0

RFA-TR-16-019

\$12M



NSF/CASIS Tissue Engineering and Mechanobiology

NSF 21-520

\$1.6M

NSF 20-500

\$2.0M

NSF 19-509

\$2.2M

NSF 18-514

\$0.6M

ADVANCED MATERIALS & IN-SPACE PRODUCTION



NSF/CASIS Fluid Dynamics & Transport Phenomena

NSF 21-xxx

TBD

NSF 20-501

\$3.0M

NSF 19-525

\$4.0M

NSF 18-521

\$2.0M

NSF 16-518

\$1.5M



NSF/CASIS Combustion

NSF 17-517

\$1.8M

NSF/CASIS PROGRAM HISTORY



NSF Engineering Directorate (ENG)

Chemical, Bioengineering, Environmental and Transport Systems (CBET) Division

Civil, Mechanical and Manufacturing Innovation (CMMI) Division

5 annual Transport Phenomena Solicitations

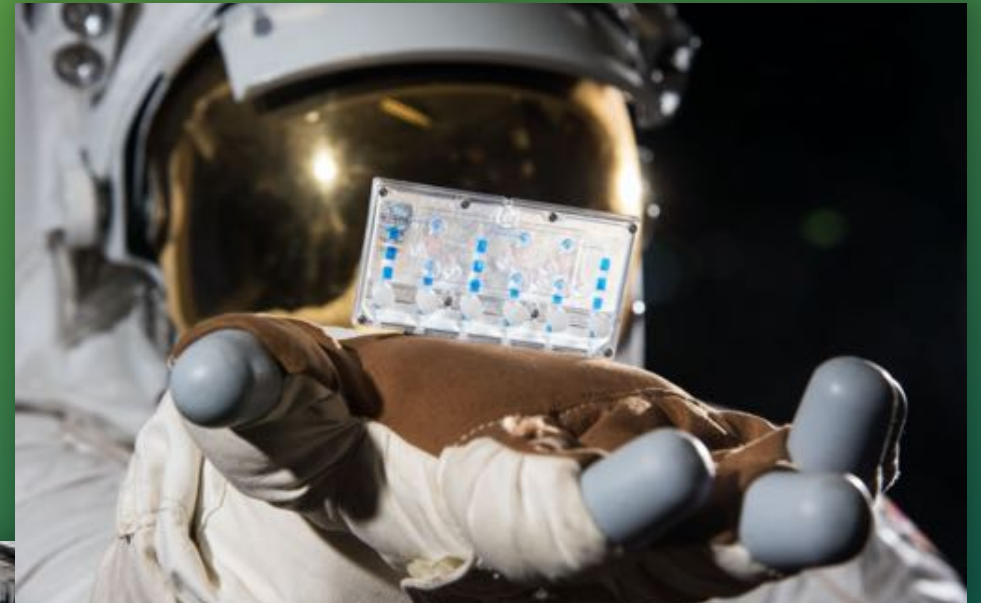
3 annual Tissue Engineering and Mechanobiology Solicitations

| Year | Transport Phenomena Awards | Tissue Engineering Awards | Total NSF Awards |
|------|----------------------------|---------------------------|------------------|
| 2016 | 5 | | 5 |
| 2017 | 3 | | 3 |
| 2018 | 1 | 2 | 3 |
| 2019 | 3 | 6 | 9 |
| 2020 | 5 | 4 | 9 |



NIH NCATS & NIBIB TISSUE CHIPS IN SPACE

- Blood brain barrier
- Immune function
- Kidney function
- Lung host defense
- Musculoskeletal disease
- Cardiac drug response
- Cardiac dysfunction
- Gut microbiome
- Innervated muscle



IN-SPACE PRODUCTION APPLICATIONS



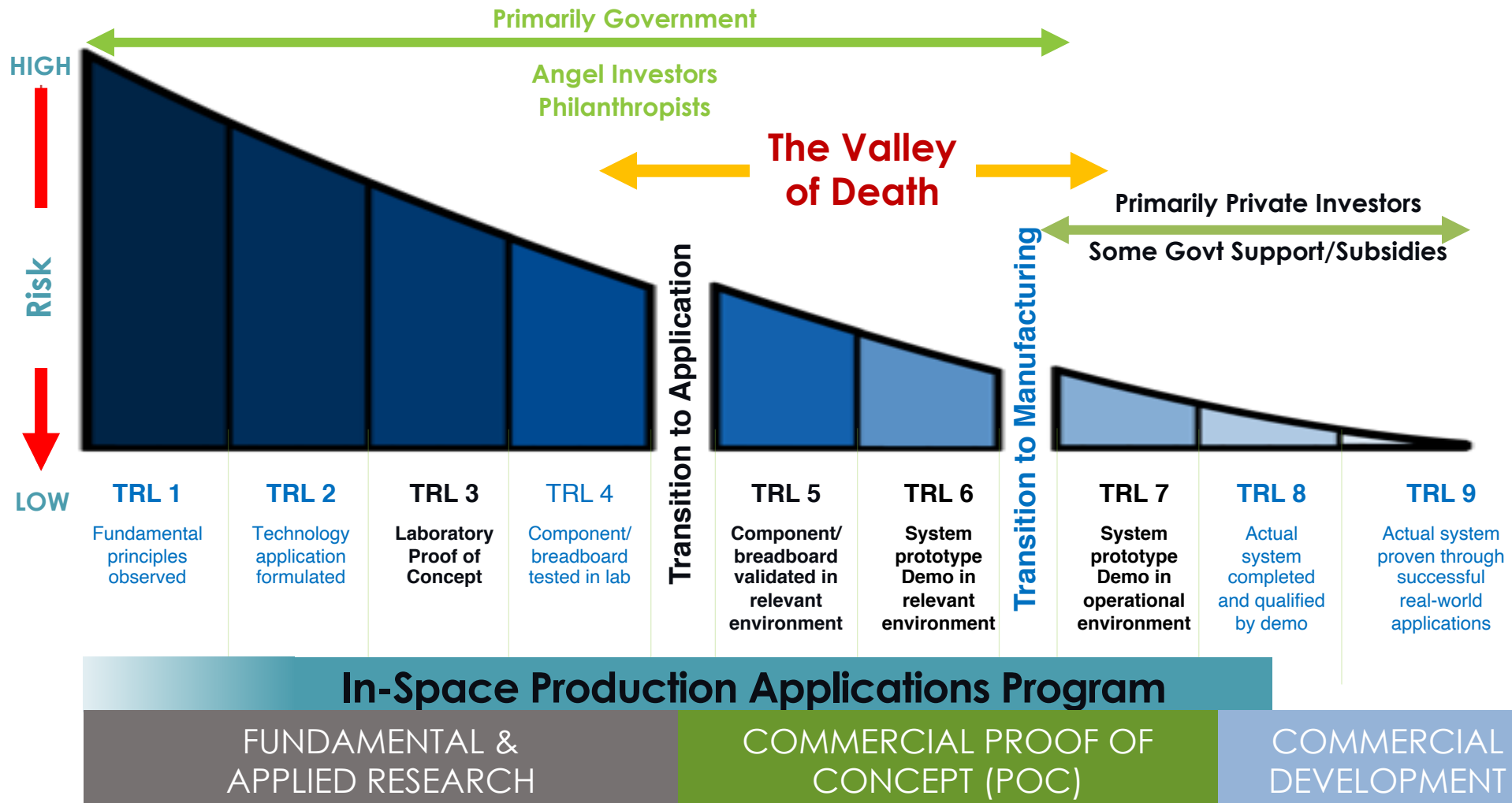
A photograph of a satellite or space station component in orbit above Earth's horizon. The component is a complex structure with various panels, antennas, and mechanical parts, illuminated by sunlight. The Earth's horizon is visible at the bottom, showing a thin layer of atmosphere and the dark surface of the planet.

IN-SPACE PRODUCTION APPLICATIONS

In-space production applications refers to LEO-based R&D seeking to demonstrate space-based manufacturing and production activities that enable new business growth and capital investment, represent scalable and sustainable market opportunities, and produce reoccurring value with the potential to generate demand for and revenue from access to space.

IN-SPACE PRODUCTION APPLICATIONS

EXTENDING PROJECT SCOPE TO ADVANCE TRL



Pre-decisional and notional.



**STEM
ENGAGEMENT
AND
EDUCATIONAL
OUTREACH**

THE ISS INSPIRES MILLIONS OF STUDENTS



Credit: First the Seed Foundation



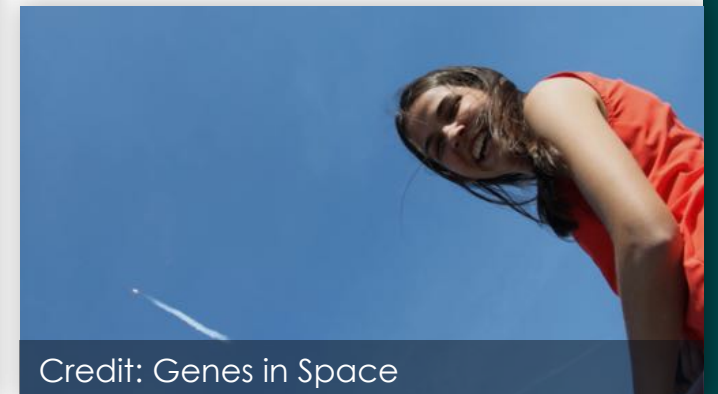
Credit: SSEP



Credit: Magnitude.io

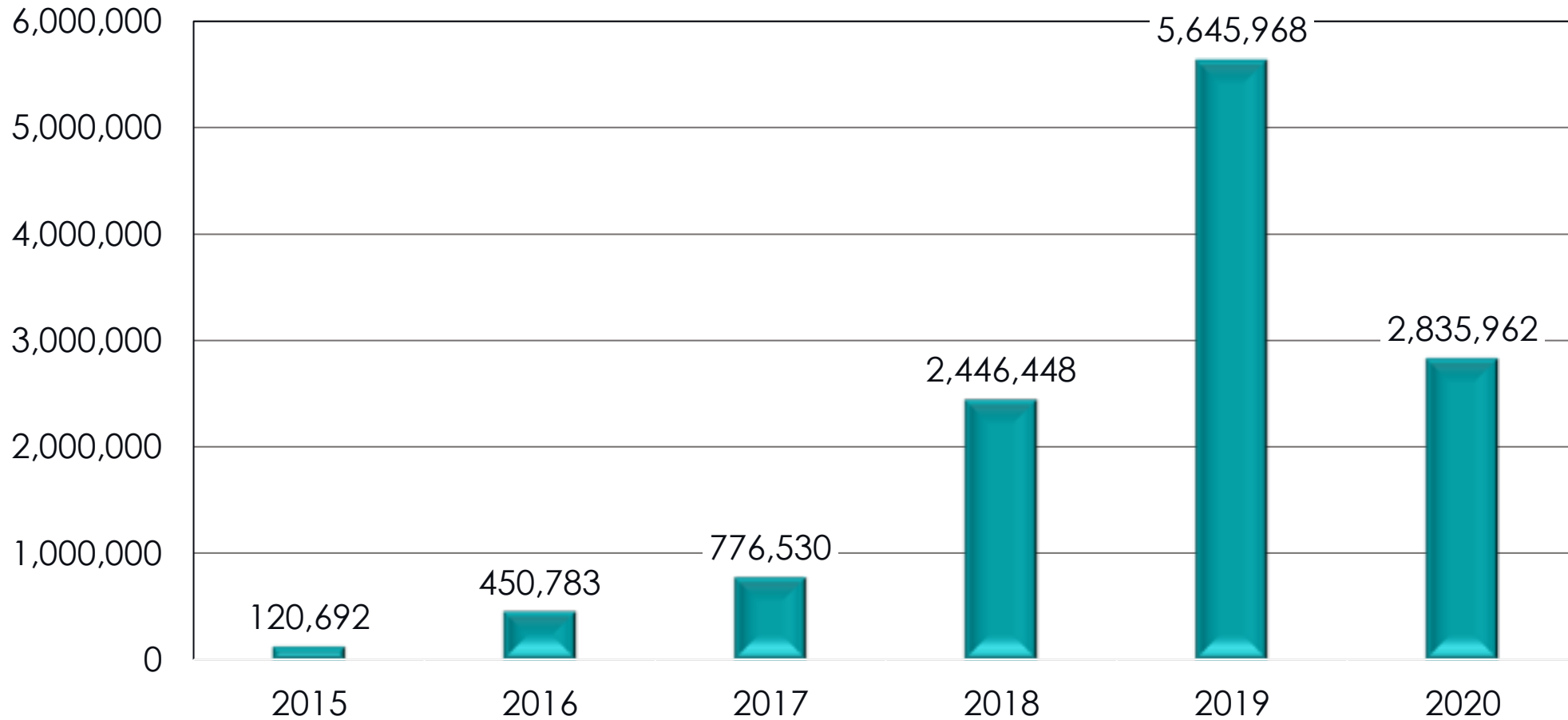


Credit: Higher Orbits



Credit: Genes in Space

REMARKABLE GROWTH IN EDUCATION REACH



20 Years of Student Experiments USING THE INTERNATIONAL SPACE STATION



**FOR A COPY OF
THE REPORT, VISIT
SpaceStationExplorers.org**

ISS NATIONAL LAB USER ADVISORY COMMITTEE

The ISS National Lab User Advisory Committee (UAC) shall monitor, assess, and make recommendations regarding effective utilization of the International Space Station (ISS) U.S. National Laboratory as a platform for research and technology development.

ISS U.S. NATIONAL LABORATORY USER ADVISORY COMMITTEE

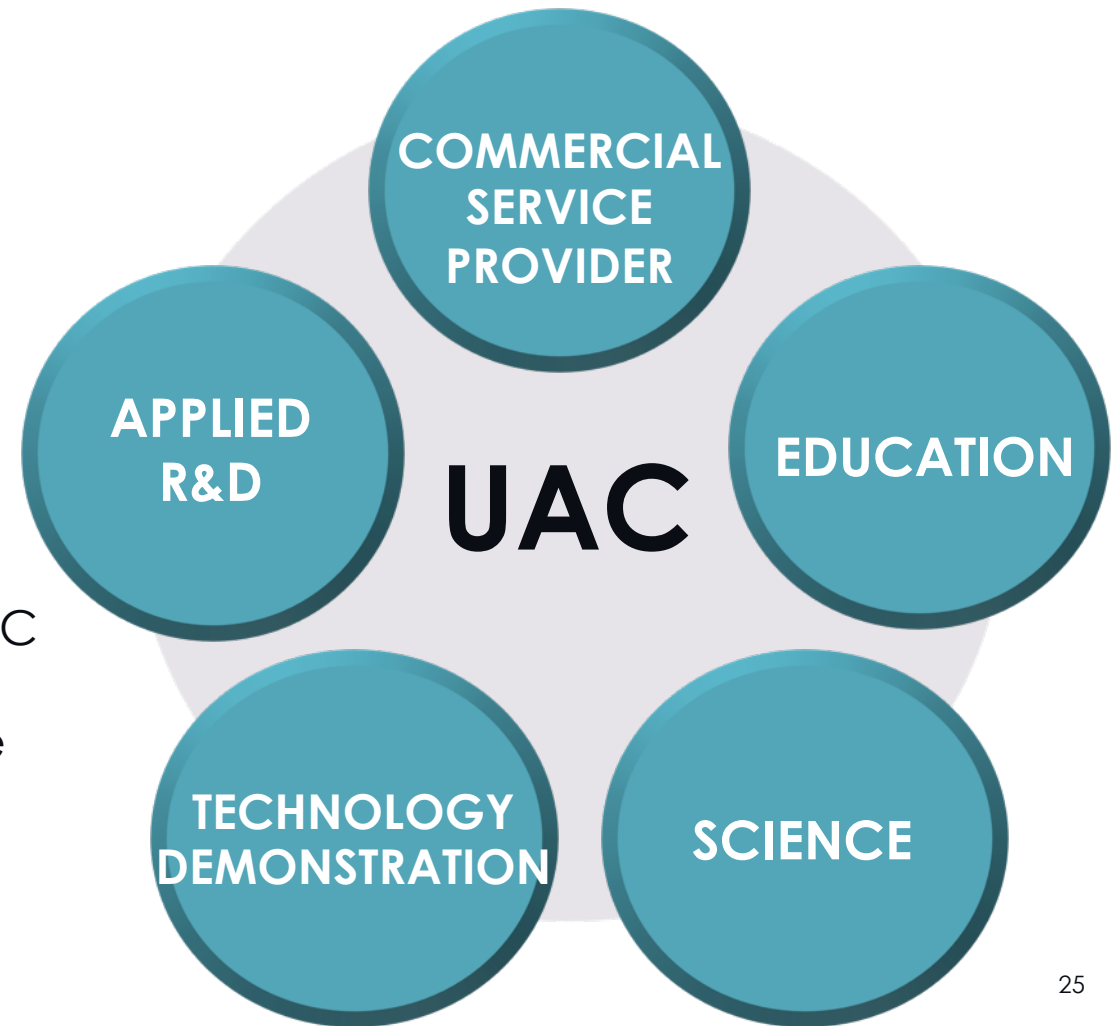
5 UAC Subcommittees

- Applied Research & Development
- Commercial Service Provider
- Education
- Science
- Technology Demonstration

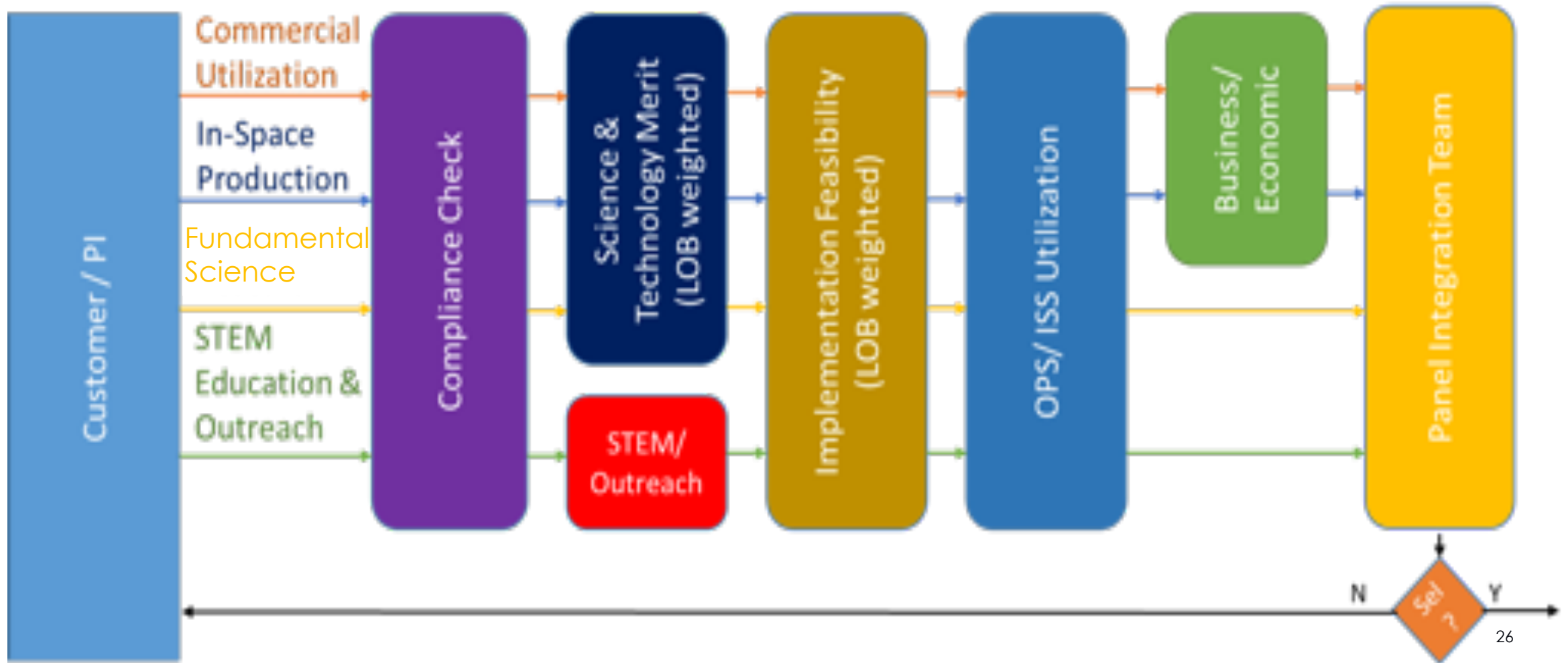
Subcommittee Membership

- 7 members per each subcommittee*
- Each Subcommittee Chair serves as UAC voting member
- 2-year term for UAC and subcommittee

* Commercial Service Provider subcommittee membership extended to all CSPs



ISS NATIONAL LAB: PROPOSAL REVIEW PROCESS REVISIONS



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