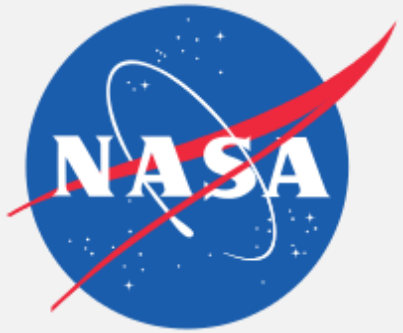


SPACEPORT
NORWAY

Public—Private Partnerships:

NASA as Your Business Partner

Gary Martin

Director, Partnerships

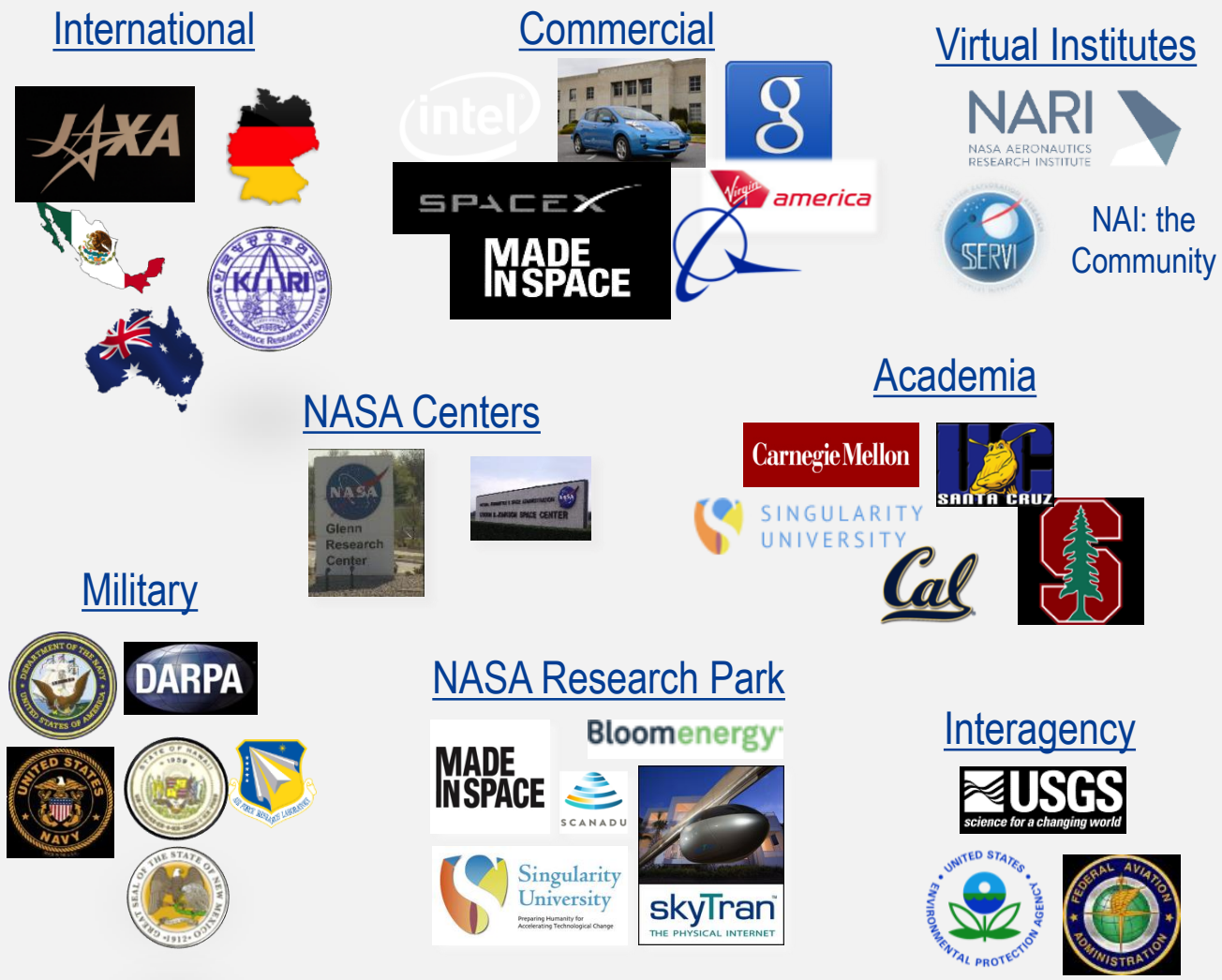
Partnerships at Ames

Partnering with external organizations to access capabilities under collaborative agreements

Entering into reimbursable agreements for partner access to NASA capabilities

Expanding overall landscape of space activity (maximizing public and private sector growth)

Spurring innovation



Government's Role in Commercializing Space

"What role should the government play in the commercialization of space?"

National Advisory Council for Aeronautics

Established in 1915 by Congress

Developed key technologies to enabled air travel to become effective, economical and safe

Studied the problems of flight to identify and resolve risks that kept air travel from being safe and commercially viable

Government worked closely with industry to fund studies that retired technological risks and enabled private enterprise to successfully create a new industry

Changes at NASA

Program Characteristic	Early Space Age Approach	Commercial-Oriented Approach
Owner	NASA	Industry
Contract Fee-Type	Cost Plus	Fixed Price
Contract Management	Prime Contractor	Public-Private Partnership
Customer(s)	NASA	Government and Non-government
Funding for Capability Demonstration	NASA procures capability	NASA provides investment via milestone payments
NASA's Role in Capability Development	NASA defines "what" and "how"	NASA defines "what" Industry defines "how"
Requirements Definition	NASA defines detailed requirements	NASA defines top-level capabilities needed
Cost Structure	NASA incurs total cost	NASA and Industry share cost

U.S. National Policy on Commercial Space

"Develop a robust and **competitive U.S. commercial space sector**"

"**Energize competitive domestic industries** to participate in global markets"

NASA is to achieve this by:

- Purchasing and using commercial space capabilities and services to the maximum practical extent
- Actively exploring the use of inventive, nontraditional arrangements for acquiring commercial space goods and services
- Refraining from conducting U.S. Government space activities that preclude, discourage, or compete with U.S. commercial space activities
- Pursuing potential opportunities for transferring routine, operational space functions to the commercial space sector where beneficial and cost-effective.

FAA Office of Commercial Space Transportation

Founded 1984, to:

- **Regulate** the commercial space transportation industry, **only to the extent necessary**
- **Encourage**, **facilitate**, and **promote commercial space** launches by the private sector
- **Recommend appropriate changes** in Federal statutes, treaties, regulations, policies, plans, and procedures:
- Facilitate the strengthening and **expansion of the U.S. space transportation infrastructure**

Why Commercial?

Commercial companies must be competitive and governments have other priorities (safety, jobs, etc.).

Example: comparison of SpaceX to NASA Development Costs

- NASA initial estimates using its normal cost estimating software for Falcon 9 were 10 times more expensive than SpaceX actuals
- Even when NASA made adjustments its estimates were still 4 times more

Conflicting goals

- US Congress focused on jobs in their districts

NASA Programs to Stimulate Commercial Space

Commercial Orbital Transportation Services (COTs) 2006

- NASA investment $800M produced 2 new launchers 2 new ISS cargo carriers

Commercial Crew Development (CCDev) 2009 – 2011

- Stimulate development of privately operated crew vehicles

Commercial Crew Integrated Capability (CCiCap) 2012 – 2014

- Advance multiple integrated crew transportation systems
- Develop a Commercial Transportation System capability to LEO

Commercial Resupply Services

- 12 missions for SpaceX and 8 missions for Orbital Sciences ($3.5B)

Collaborations for Commercial Space Capabilities – SAAs

- Advance private sector development of emerging products and services commercially available to government and non-government customers

Flight Opportunities Program 2010 – Suborbital

- Commercial Reusable Suborbital Research Program (CRuSR) – supports commercial suborbital spaceflight by providing a steady, guaranteed market for research payloads
- Facilitated Access to Space Technology (FAST) – funding microgravity research

Alternatives to Government Funding

Google Lunar X-Prize (GLXP) 2007 - 2016

- Eighteen teams currently in competition for $30M in prizes
- Land a robot on the Moon then travel more than 500m and transmits high definition images and video to Earth

NASA Innovative Lunar Demonstration Data

- Indefinite delivery/indefinite quantity (IDIQ) contracts totaling up to $30.1M

Crowdfunding

- Kickstarter: Lunar Space Elevator (Liftport Group), CubeSat Ambipolar Thruster (CAT) (UMich), Arkyd Telescope $1.5M (Planetary Resources) etc.
- Spire

The Role of Private Industry

NewSpace Investments (NSG 50)

$200M-$2B

- SpaceX
- Virgin Galactic*
- Blue Origin*
- Vulcan Aerospace*
- O3B
- OneWeb
- Planet Labs
- Cloudera

Crunchbase Data 2015

$20M-$200M

- Skybox
- Spaceflight Industries
- MapBox
- Spire
- Moon Express
- SpaceIL
- Kymeta

(*) SVSC estimates

$2M-$20M

- Dauria Aerospace
- Planetary Resources
- OmniEarth
- Satelogic
- Astroscale
- Nanoracks
- XCOR
- Rocket Lab
- Firefly Reaction Engines
- Accion Systems
- Orbital Insight
- ClearStory Data
- SpaceKnow

Source: Sean Casey (SVSC)

From 2005-2015 $12B in private investment
Source: Silicon Valley Space Center

How does NASA partner?

Non-Reimbursable
Space Act Agreements

Agreement benefits both parties, with each funding their own participation.

Proposed activity must be relative to a NASA mission or program requirement.

The level of the other party's contribution is relatively equitable to NASA's contribution

Reimbursable
Space Act Agreements

Requires transfer of funds or other financial obligations from the other party to NASA.

No goods or services are provided to NASA.

NASA provides unique facilities, equipment, or expertise.

Technology Areas of Common Interest

NASA Missions

Planned human-machine interaction in natural and time delayed environment

Space & planetary navigation

Spacecraft autonomy

Cyber-security for "one-off" systems

Space environment

Limited ability to address/recover faults

Common Technologies

Autonomy
Advanced planning & scheduling algorithms, etc.

Human-Autonomy Teaming
Robotic supervision including human/robotic interactions, etc.

Networked Operations
Remote vehicle management, etc.

Prognostics and Diagnostics
Including state management, etc.

Sensor Technologies
Data processing / fusion methodologies, etc.

Verification & Validation
Methodologies & application experiences, etc.

Self-Driving Cars and UAVs

Partners' Requirements

Diverse human-machine interaction in a structured environment

GPS & map-based navigation

Distributed and cloud-based autonomy

Cyber-security for consumer product

SBIR/STTR

The mission of the SBIR program is to support scientific excellence and technological innovation through the investment of Federal research funds in critical American priorities to build a strong national economy.

NASA's SBIR and STTR programs have awarded over $3.3B to research-intensive American small businesses to date.

Phase I: Concept

- Award Guideline: $125K
- Duration: 6 months (SBIR)
  12 months (STTR)

Phase II: Full Research, R&D to Prototype

- Award Guideline: $750K
- Duration: 24 months
  - Phase II-E → 1:1 Matching up to $375K (2016 Solicitation onwards)

Phase III: Commercialization/Infusion

- Non-SBIR/STTR funds
  - Contract from NASA program, other agency, prime contractor

SBIR/STTR International

NASA Centers and Installations

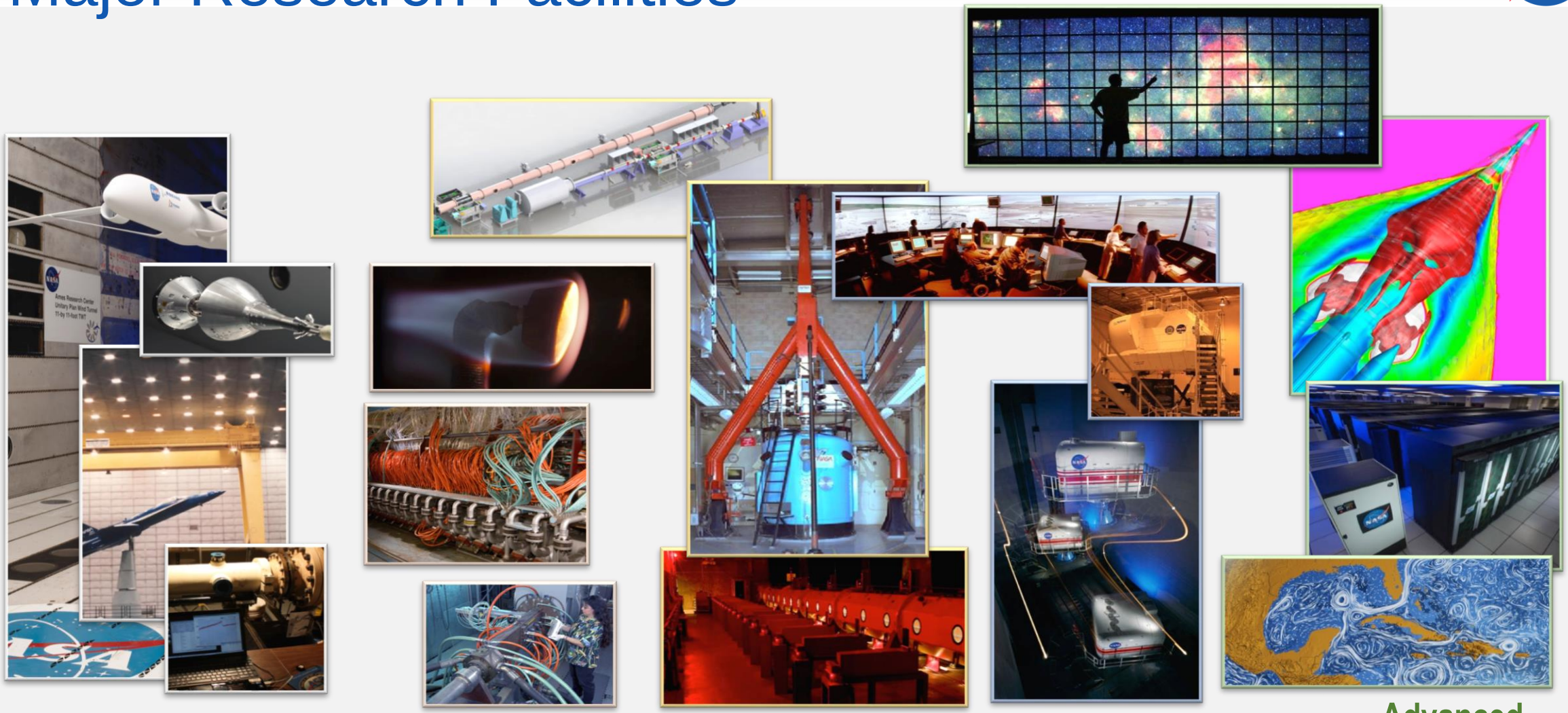
Occupants:
~1,130 civil servants
~2,100 contractors; 1,650 tenants
~1,344 summer students in 2015

FY2016 Budget: ~$915M (including reimbursable/EUL)

Campus: ~1,900 acres (400 acres security perimeter); 5M building ft^2

Airfield: ~9,000 and ~8,000 ft runways

Major Research Facilities



Wind Tunnels

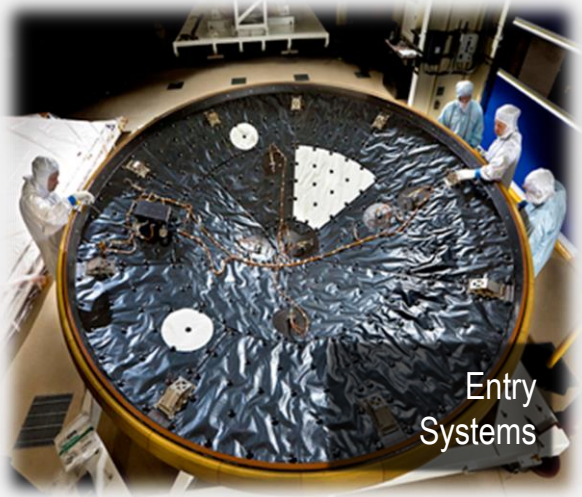
ARC Jet Complex

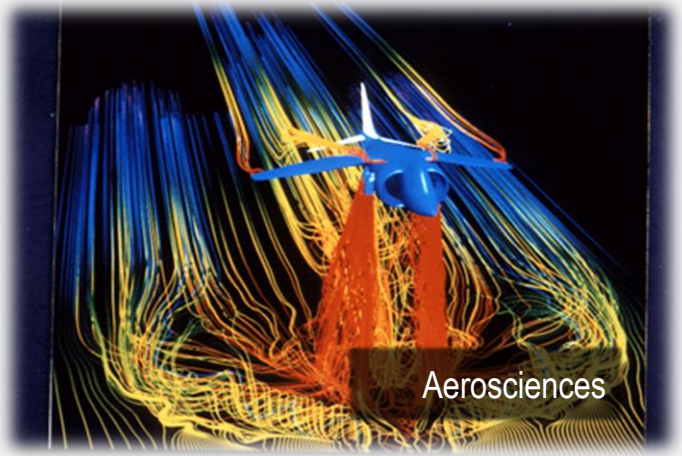
Range Complex

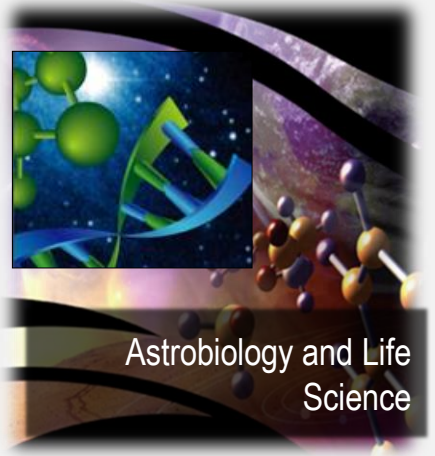
Simulators

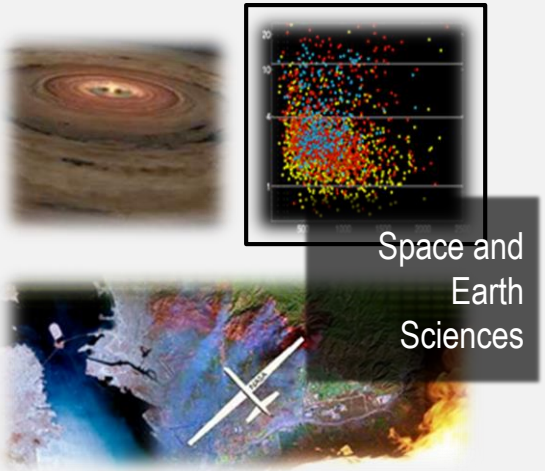
Advanced Supercomputing

Core Competencies at Ames Today







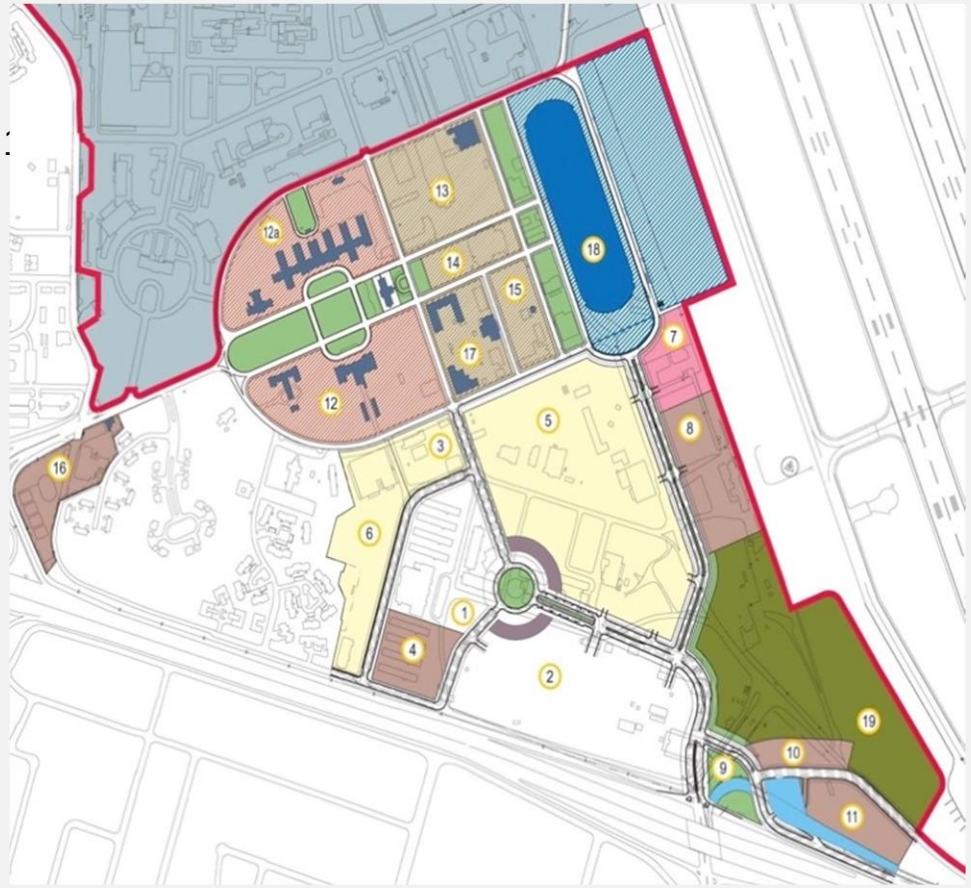


NASA Research Park

An established regional innovation cluster that facilitates commercialization by serving as a technology accelerator through vital and robust onsite collaborations.

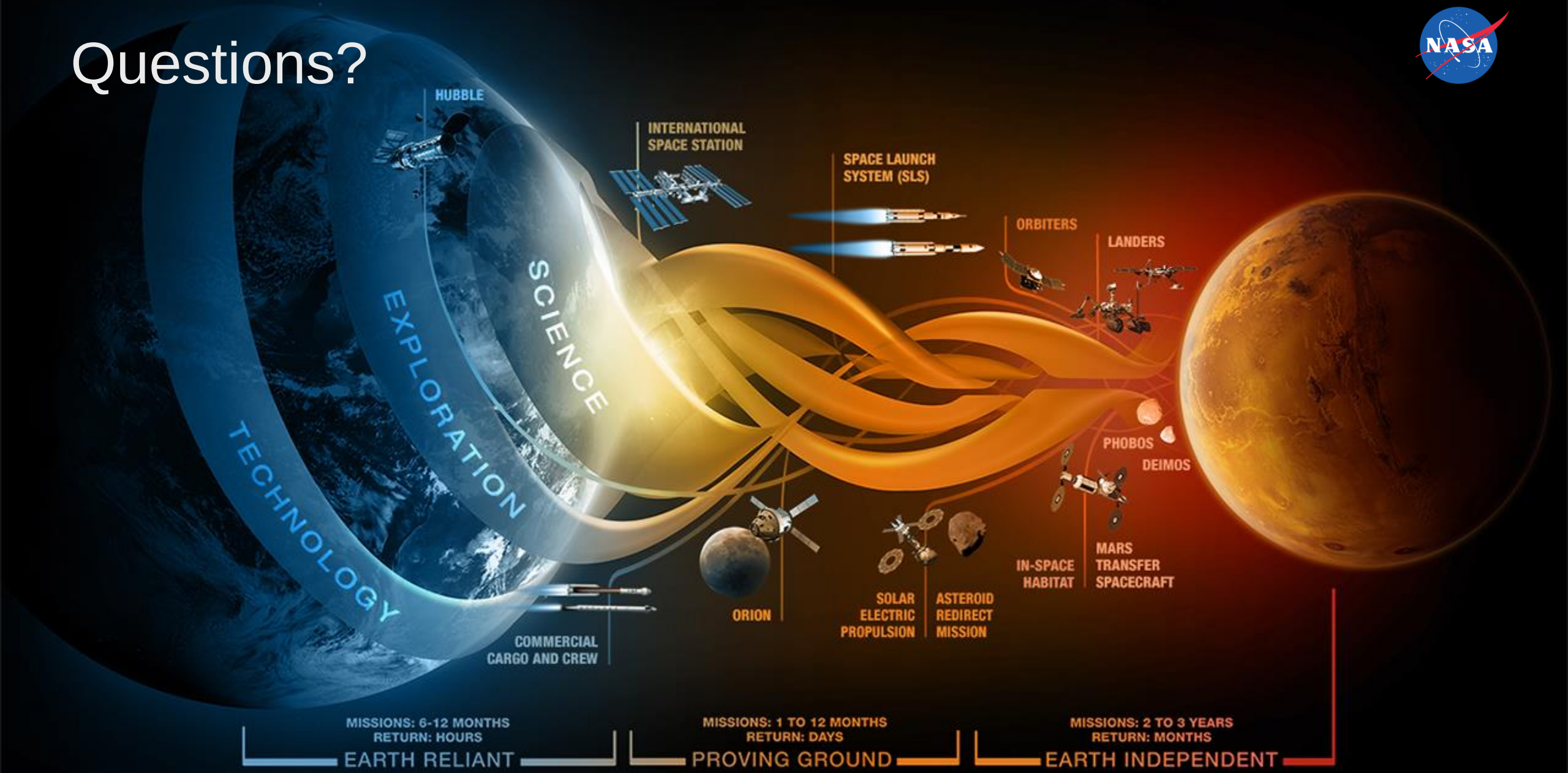
70+ Partners Today

- University Associates-Ground Lease
- PV “Google” (North East Section) Ground Lease
- M2MI Corporation-Bldg.19
- Carnegie Mellon University-Bldg. 23, 19
- Kentucky Science & Technology Corporation-Bldg.19
- Bloom Energy-Bldg. 543, 154 (Fuel Cell Research)
- UAV Collaborativer-Bldg.18
- Singularity Education Group-Bldg. 20
- BAER Institute-Bldg. 19
- Chandah Space Technologies-Bldg. 1
- IDM Technologies-Bldg. 19
- Logyx LLC-Bldg. 19
- Made in Space-Bldg. 153
- Neurovigil Inc.-Bldg. 19
- Rhombus Power-Bldg. 19
- Scanadu Inc.-Bldg. 20
- SkyTran-Bldg. 14
- Verdigris Technology-Bldg. 19
- ZeeAero-Bldg. 210
- LatIPnet-Bldg. 19
- Wyle Laboratories-Bldg. 19



NASA Centers and Installations

Questions?


HUBBLE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM (SLS)
ORBITERS
LANDERS
SCIENCE
EXPLORATION
TECHNOLOGY
PHOBOS
DEIMOS
ORION
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
IN-SPACE HABITAT
MARS TRANSFER SPACECRAFT
COMMERCIAL CARGO AND CREW
MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1 TO 12 MONTHS
RETURN: DAYS
PROVING GROUND
MISSIONS: 2 TO 3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT