SLPSRA Program Overview and Directions

Human Exploration & Operations Mission Directorate
Division Director, Space Life and Physical Sciences:

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National Academy of Sciences
7 February 2017

Research for Human Exploration

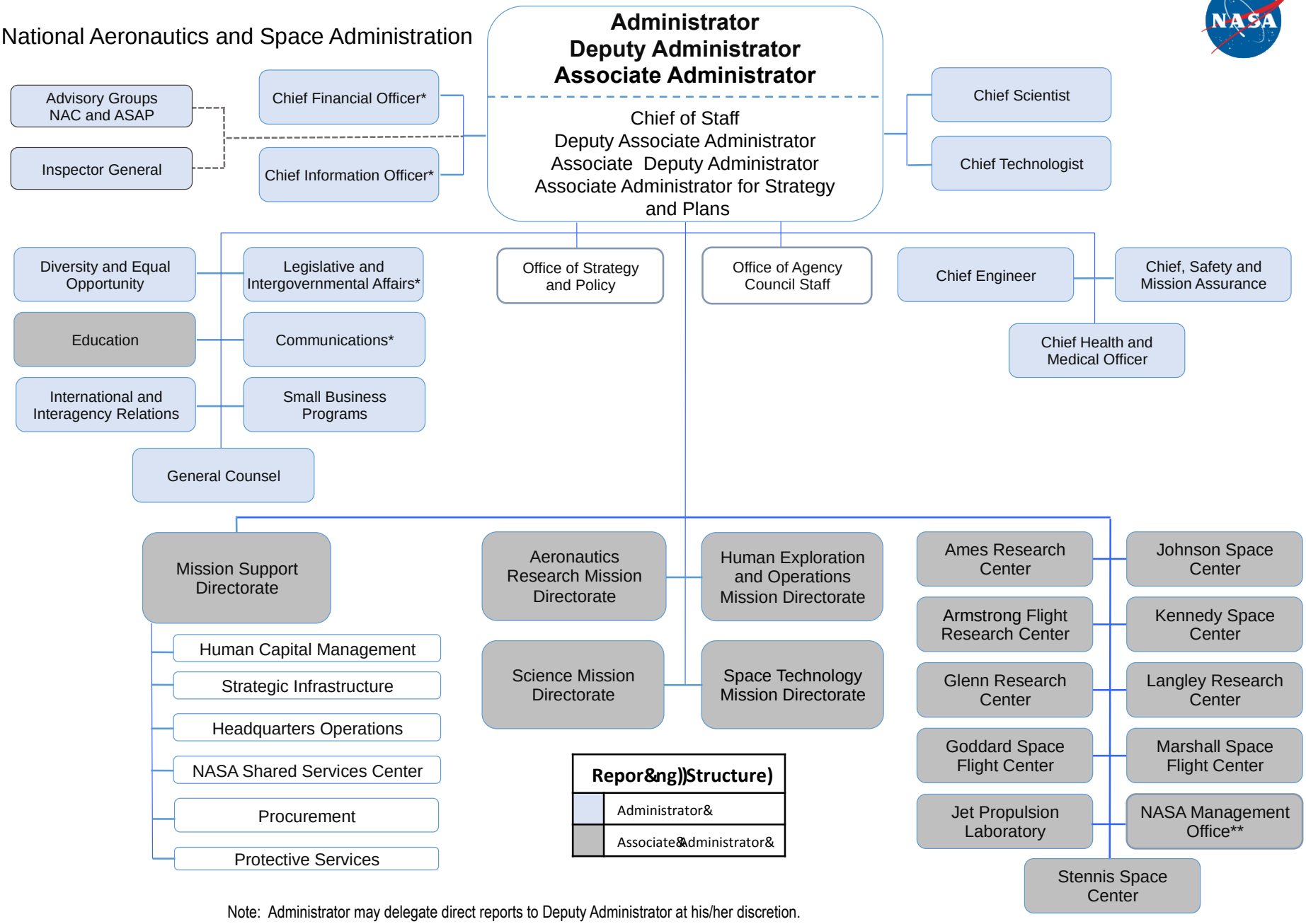
Outline

- SLPSRA organizational overview

- SLPSRA and the decadal
  - Past
  - Present
  - Future directions

- Midterm task discussion

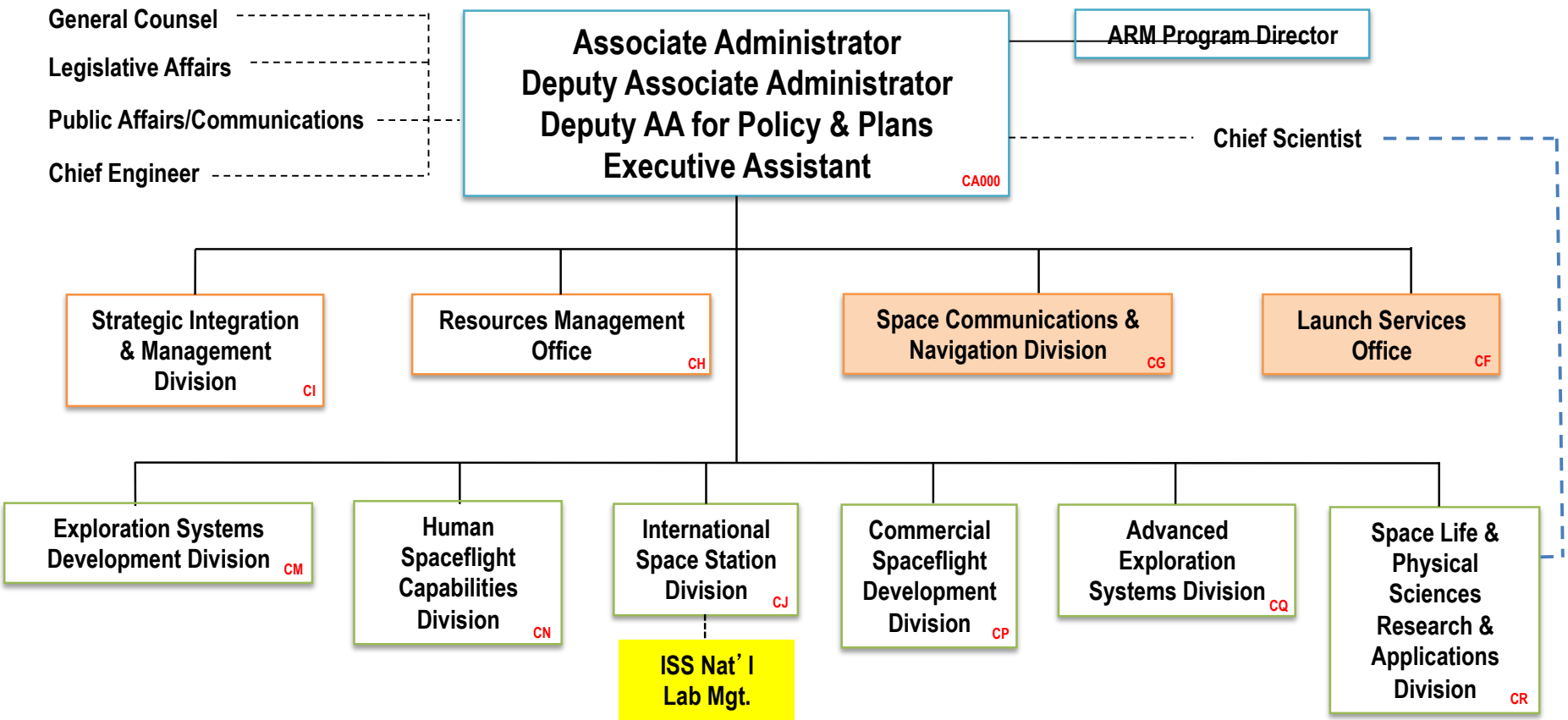
National Aeronautics and Space Administration



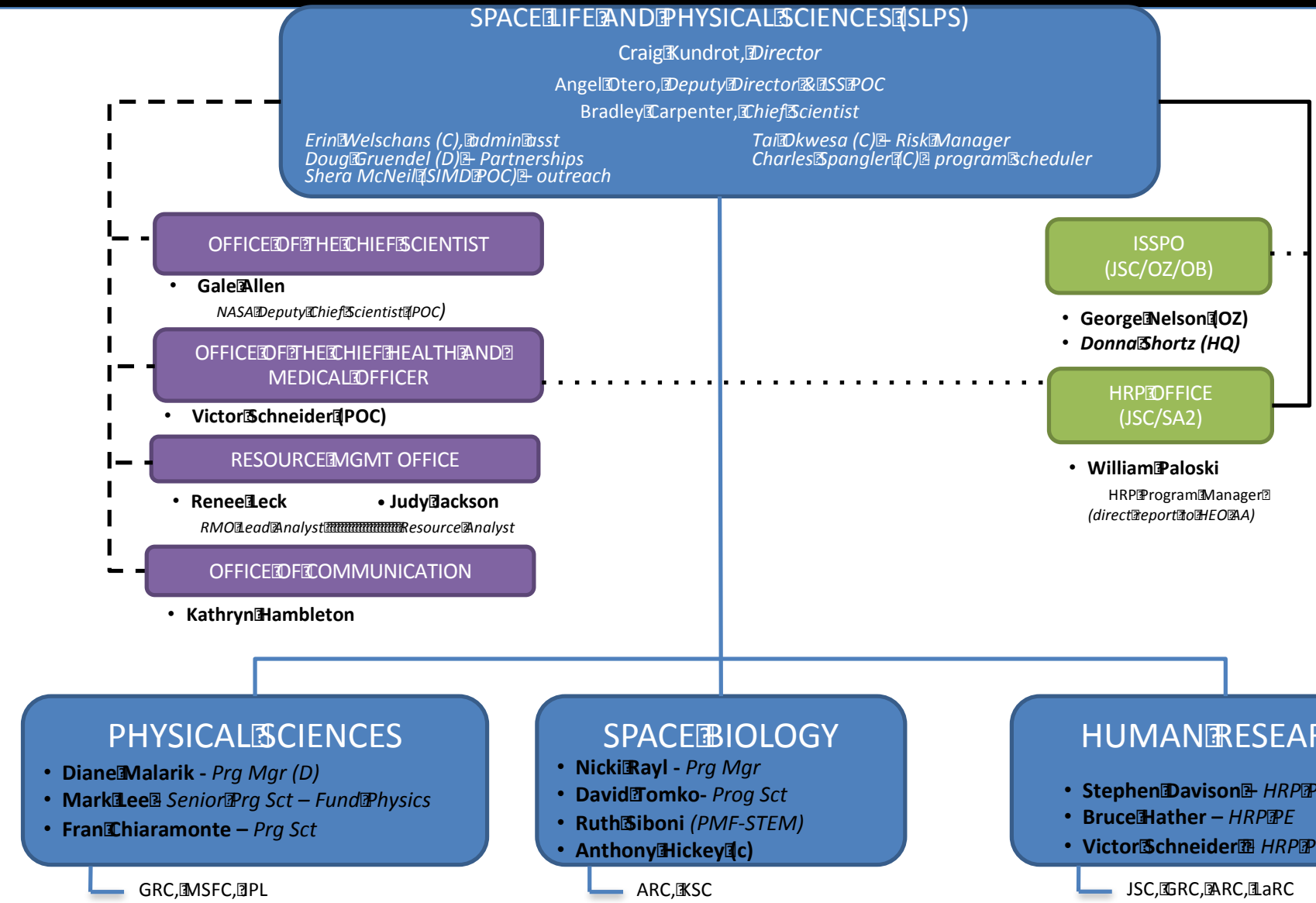
Note: Administrator may delegate direct reports to Deputy Administrator at his/her discretion.
* Center functional office directors report to Agency functional AA or Chief. Deputy and below report to Center leadership.
** NMO oversees the Jet Propulsion Laboratory and other Federally Funded Research and Development Center work

November(2015(

Human Exploration and Operations Mission Directorate Organizational Structure



SLPSRA Organizational Chart



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A SLPSRA Chronology

1993 Office of Space Science and Applications is reorganized, and the Life Sciences Division and Microgravity Science and Applications Division are incorporated into the Office of Life and Microgravity Sciences and Applications

1998 ISS assembly begins

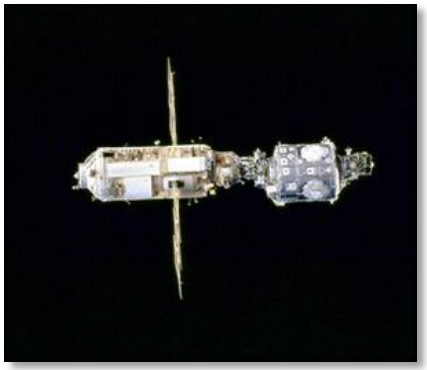
2000 Office of Life and Microgravity Sciences and Applications becomes an Enterprise: Office of Biological and Physical Research

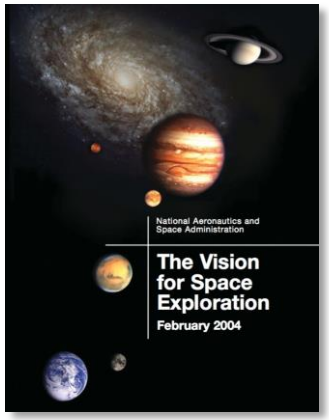
2001 ISS Management and Cost Evaluation Task Force recommends that in order to maximize research within proposed budgets, research priorities be established and implemented

2002 Research Maximization and Prioritization (ReMaP) Exercise

2003 Columbia accident on STS-107 reentry causes reconsideration of human spaceflight plans

2004 Vision for Space Exploration lays out an ambitious plan to return to the moon, paid for in part by terminating the Shuttle and ISS programs; NASA reorganizes and the Office of Biological and Physical Research is absorbed into the Exploration Systems Mission Directorate as the Advanced Capabilities Division.





A SLPSRA Chronology

2005 NASA Authorization directs NASA to maintain basic research capability, and to support non-exploration research

2008 NASA Appropriation directs NASA to work with the National Research Council to develop recommendations for research in the life and physical sciences

2010 NASA Authorization directs NASA to establish a non-profit entity to manage non-NASA use of the ISS National Laboratory

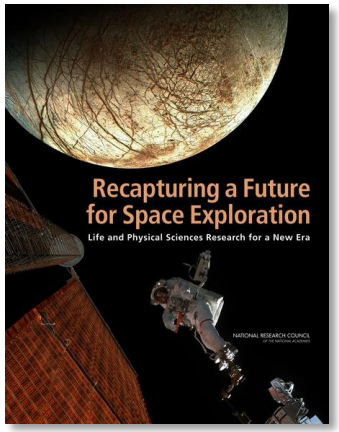
2011 Last Space Shuttle flight

2011 ISS Assembly complete

2011 The Advanced Capabilities Division becomes the Space Life and Physical Sciences Research and Applications Division in the newly formed Human Exploration and Operations Mission Directorate

2011 Recapturing a Future for Space Exploration: Life and Physical Sciences Research for a New Era is published

2012 First permanent director selected for SLPSRA



Explanatory Statement, Consolidated Appropriations Act, 2008

Achieving the goals of the Exploration Initiative

will require a greater understanding of life and physical sciences phenomena in

microgravity as well as

in the partial gravity environments of the Moon and Mars.

Therefore, the Administrator is directed to enter into an arrangement with the National Research Council to conduct a “decadal survey” of

life and physical sciences research

in microgravity and partial gravity

to establish priorities for research for the 2010-2020 decade.

Further, within amounts provided, NASA is directed to increase the amount for non-exploration microgravity life and physical sciences research by $13,500,000.

These funds are for non- multi-user support and services activities.

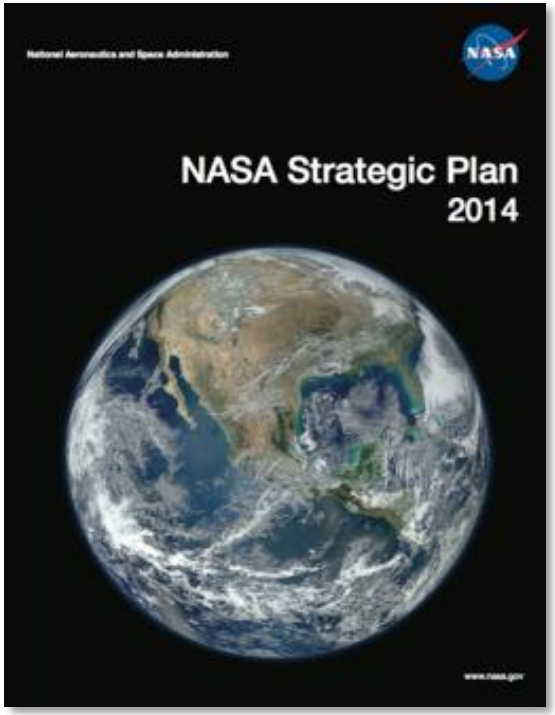
Current NASA Strategic Plan

- Our Vision

  We reach for new heights and reveal the unknown for the benefit of humankind.

- Our Mission

  Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth.



Current NASA Strategic Plan

Strategic Goal 1

Expand the frontiers of knowledge, capability, and opportunity in space

By empowering the NASA community to...

Objective 1.1: Expand human presence into the solar system and to the surface of Mars to advance exploration, science, innovation, benefits to humanity, and international collaboration.

Objective 1.2: Conduct research on the International Space Station (ISS) to enable future space exploration, facilitate a commercial space economy, and advance the fundamental biological and physical sciences for the benefit of humanity.

Objective 1.3: Facilitate and utilize U.S. commercial capabilities to deliver cargo and crew to space.

Objective 1.4: Understand the Sun and its interactions with Earth and the solar system, including space weather.

Objective 1.5: Ascertain the content, origin, and evolution of the solar system and the potential for life elsewhere.

Objective 1.6: Discover how the universe works, explore how it began and evolved, and search for life on planets around other stars.

Objective 1.7: Transform NASA missions and advance the Nation's capabilities by maturing crosscutting and innovative space technologies.

Strategic Goal 2

Advance understanding of Earth and develop technologies to improve the quality of life on our home planet

By engaging our workforce and partners to...

Objective 2.1: Enable a revolutionary transformation for safe and sustainable U.S. and global aviation by advancing aeronautics research.

Objective 2.2: Advance knowledge of Earth as a system to meet the challenges of environmental change, and to improve life on our planet.

Objective 2.3: Optimize Agency technology investments, foster open innovation, and facilitate technology infusion, ensuring the greatest national benefit.

Objective 2.4: Advance the Nation's STEM education and workforce pipeline by working collaboratively with other agencies to engage students, teachers, and faculty in NASA's missions and unique assets.

Strategic Goal 3

Serve the American public and accomplish our Mission by effectively managing our people, technical capabilities, and infrastructure

By working together to...

Objective 3.1: Attract and advance a highly skilled, competent, and diverse workforce, cultivate an innovative work environment, and provide the facilities, tools, and services needed to conduct NASA's missions.

Objective 3.2: Ensure the availability and continued advancement of strategic, technical, and programmatic capabilities to sustain NASA's Mission.

Objective 3.3: Provide secure, effective, and affordable information technologies and services that enable NASA's Mission.

Objective 3.4: Ensure effective management of NASA programs and operations to complete the mission safely and successfully.

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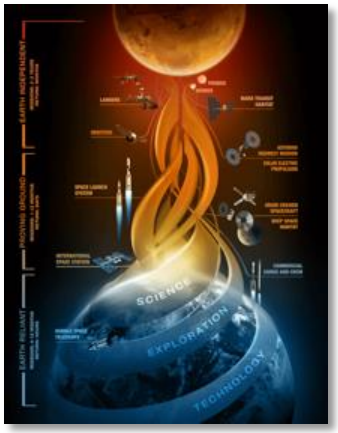
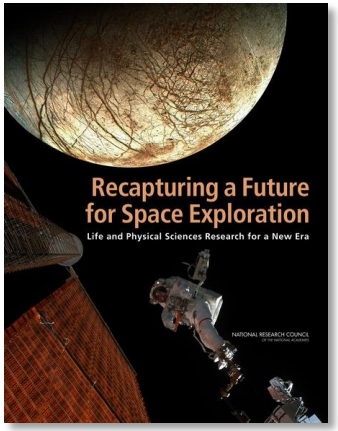
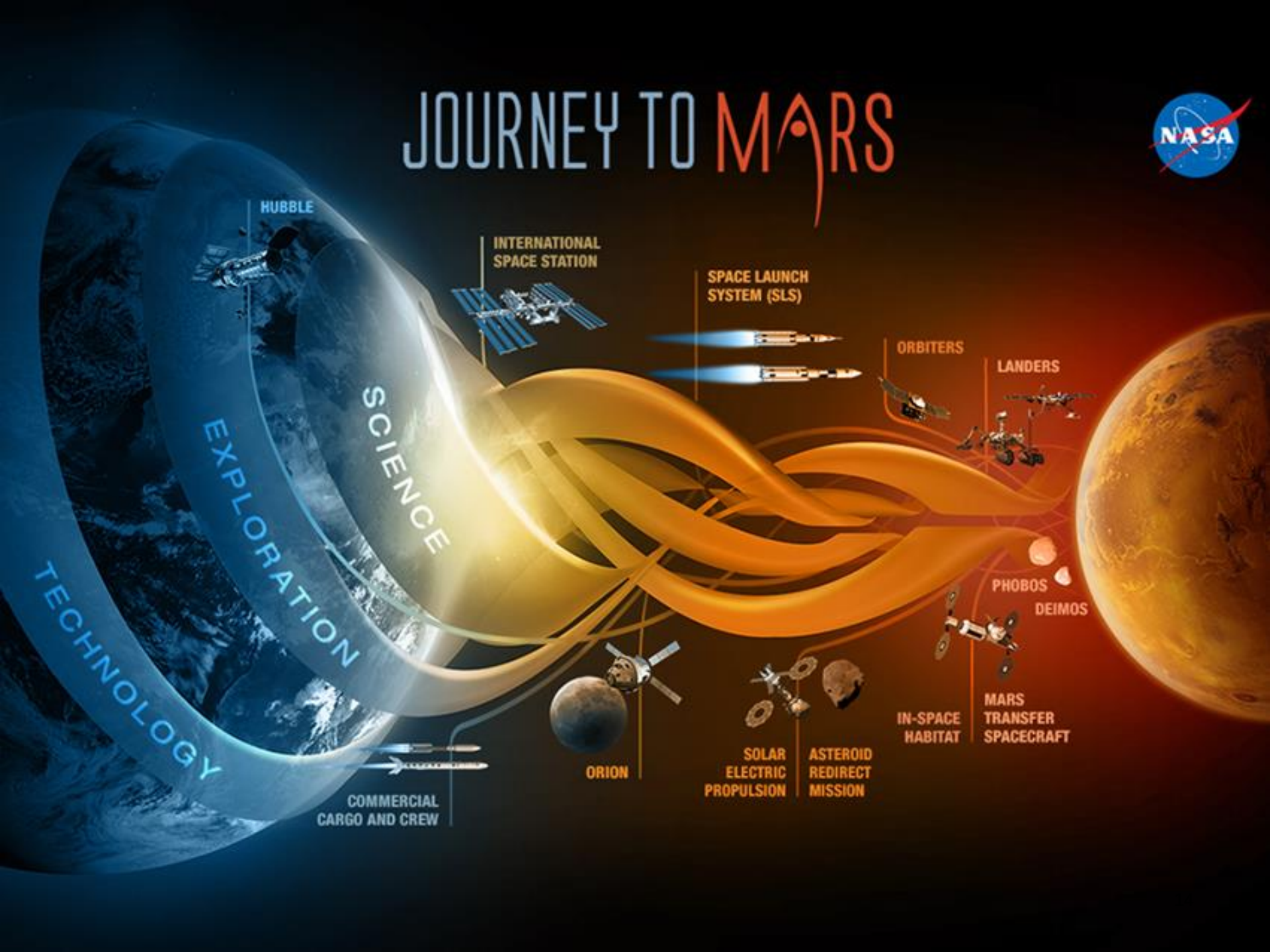
SLPSRA

- **Vision**
  - We lead the space life and physical sciences research community to enable space exploration and benefit life on Earth

- **Mission**
  - **Enable exploration** to expand the frontiers of knowledge, capability, and opportunity in space
  - **Pioneer scientific discovery** in and beyond Low Earth Orbit to drive advances in science, technology, and space exploration to enhance knowledge, education, innovation, and economic vitality






JOURNEY TO MARS
NASA
HUBBLE
INTERNATIONAL SPACE STATION
SPACE LAUNCH SYSTEM (SLS)
ORBITERS
LANDERS
SCIENCE
EXPLORATION
TECHNOLOGY
PHOBOS
DEIMOS
IN-SPACE HABITAT
MARS TRANSFER SPACECRAFT
ORION
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
COMMERCIAL CARGO AND CREW

Implementation: Partnerships

- Enrich content
  - Needed to Enable Exploration (Pull)
    - E.g., Advanced Exploration Systems, Space Technology Mission Directorate
  - Needed to Pioneer Scientific Discovery (Adopters)
    - E.g., CASIS, NIH, NIST, NSF, other government agencies; international partners; industry
- Facilitate execution
  - Access new platforms
  - Leverage SLPSRA resources

Partnering with the NIH

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DEPARTMENT OF HEALTH & HUMAN SERVICES
National Institutes of Health

SUBJECT: Letter of Intent between the National Aeronautics and Space Administration and the National Institutes of Health

Dava J. Newman, Ph.D.
Deputy Administrator
National Aeronautics and Space Administration

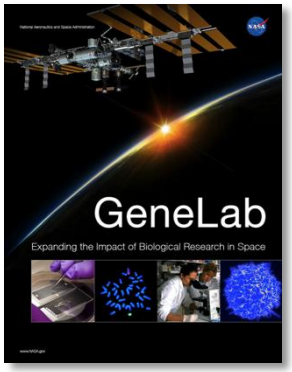
12 JAN 17
Date

Francis S. Collins, M.D., Ph.D.
Director
National Institutes of Health

JAN 13 2017
Date

Implementation: Open Science

- Tailor formulation of investigations
  - Traditional PI-led
  - Team-led
    - Co-Principal Investigator Teams
    - Science Definition Teams
- Disseminate results through databases
  - Timely data deposition
    - With space flight metadata
    - With unique analysis tools
  - Platforms
    - GeneLab
    - Physical Science Informatics
    - Life Sciences Data Archive
    - Lifetime Surveillance of Astronaut Health



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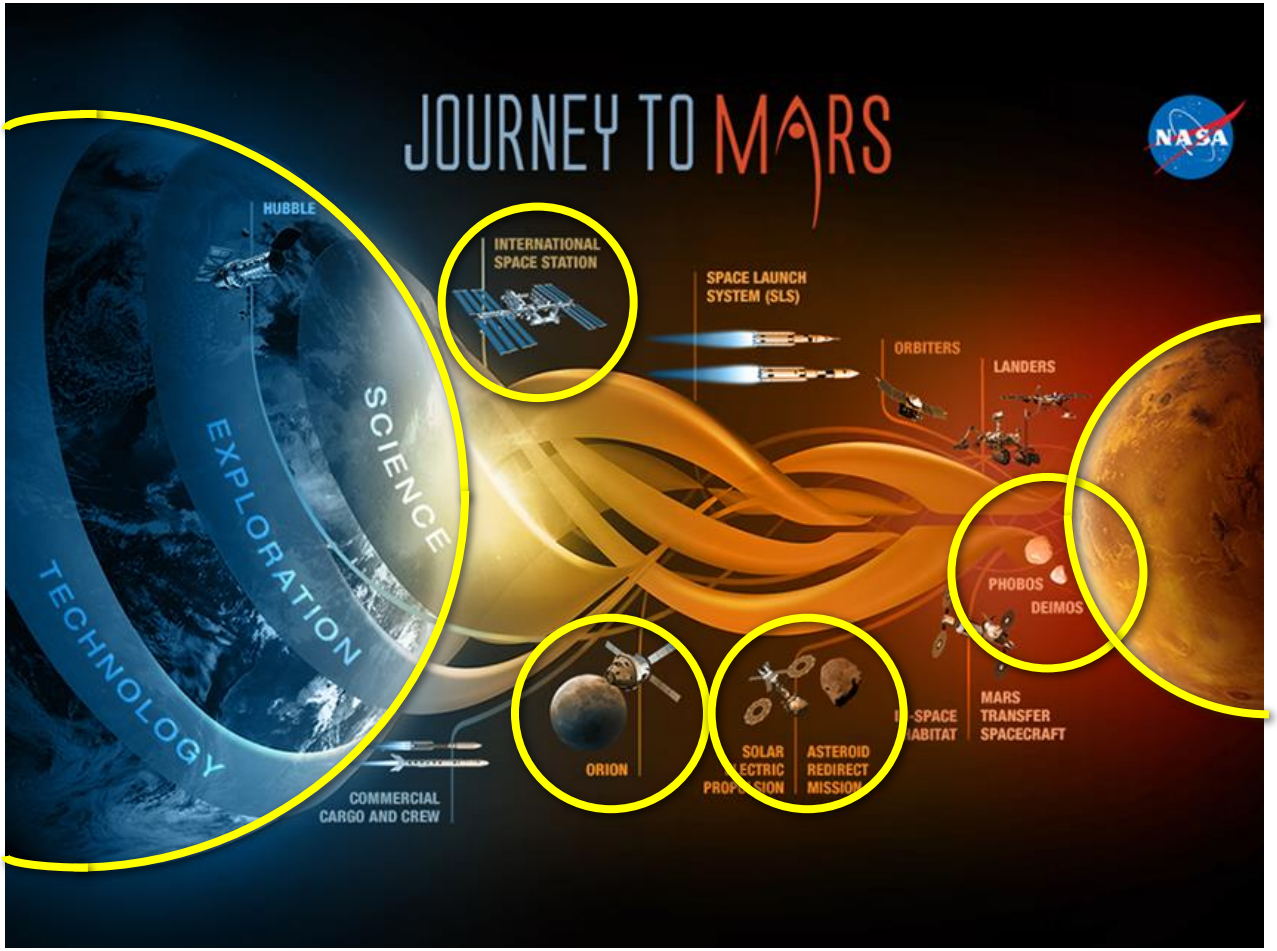

Enabling Exploration

Examples:

- Fluid Physics
- Combustion
- Human Research
- Microbiology
- Plant Science

SLPSRA in LEO and below

- Space Stations
  - International Space Station
  - International partner space station(s)
  - Commerical space station(s)
- Free Fliers
  - Other government agencies
  - Commercial
  - International partners
- Sub-orbital
  - Crewed flights
  - Sounding rockets
  - Balloons
  - Parabolic aircraft
- ~~Ground research~~

Enabling Exploration

Pioneering Scientific Discovery

- Other government agencies
- Commercial
- International partners

Historical Context

- Chapter 1: Exploration (1961-1974)
  - Mercury
  - Gemini
  - Apollo
  - **Skylab**
  - Apollo-Soyuz Test Project
- Chapter 2: Low Earth Orbit (1981-2024(8))
  - **Space Shuttle**
  - **International Space Station**
- Chapter 3: Exploration Resumed (2018-?)
  - **International Space Station**
  - Commercial vehicles in LEO?
  - Commercial stations in LEO?
  - EM-1, EM-2, Cis-lunar
  - Phobos, Demo, Mars surface

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Midterm Task Discussion

The National Academies of Sciences, Engineering and Medicine shall convene an ad hoc committee to review the progress of NASA's Space Life and Physical Sciences Research and Application program in addressing the strategies, goals, and priorities outlined in the 2011 NRC decadal survey report, Recapturing a Future for Space Exploration, Life and Physical Sciences Research for a New Era.

1. The committee's assessment will describe:
   a. NASA's approach to and progress on realizing the strategies, goals, and priorities outlined in the 2011 decadal survey and other relevant Academies reports;
   b. Existing and emerging challenges to and opportunities for the implementation of decadal strategies, goals and priorities, including:
      - Plans for the International Space Station and the long-term future for research infrastructure in Low Earth Orbit (LEO)--including the provision of privately-owned and operated infrastructure;
      - Resource and program constraints,
      - The opportunities and challenges of a multi-sponsor (NASA, Center for the Advancement of Science in Space, other government agencies, commercial) science procurement approach using Reference Experiments and Open Databases; and
      - Developments in the research community and its engagement with NASA, CASIS, and other research sponsors.

Midterm Task Discussion

c. While considering current and forecasted resources, actions that could be taken to optimize the science value of the program in the context of enabling the expansion of human exploration into deep space. In this regard:
   - The committee will identify and rank from among the “highest priority recommendations” in the decadal survey a set of targeted research priorities which are critical for NASA to conduct in order to enable the expansion of human exploration into deep space.
   - To the greatest extent possible, the committee will also identify the platform environment where the priority research should take place in order to be successful--such as: Earth analogs, LEO (on ISS through 2024), LEO (on other platforms), beyond Earth orbit (such as, a cis-lunar habitat).
   - In identifying and ranking its targeted research priorities, the committee will consider the full set of “highest priority recommendations” in the decadal survey in conjunction with relevant exploration technology development priorities identified in the NRC report NASA Space Technology Roadmaps and Priorities: Restoring NASA's Technological Edge and Paving the Way for a New Era in Space. The committee will also consider NASA’s deep space exploration goals and priorities as presented by the agency.
   - Using the remaining “highest priority recommendations,” from the decadal survey, the committee will identify where possible those that are aligned with ongoing activities in other government agencies and, where feasible, the commercial/private sector.

2. The committee will provide guidance about implementation of the recommended portfolio for the remaining years of the current decadal survey, recognizing likely resource and program constraints.

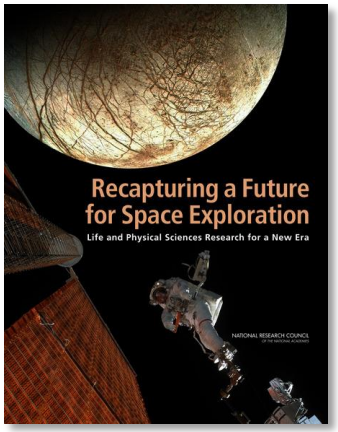
Conclusion

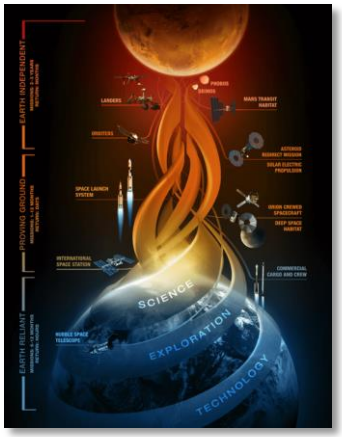
- SLPSRA has deployed its resources to address research and technology development identified in the Decadal Survey

- The current focus in SLPSRA is on a subset of the Decadal Survey
  - Enable exploration for customers
  - Pioneer scientific discovery for adopters

- Implementation of SLPSRA research and technology development emphasizes
  - Partnerships
  - Open Science in formulation and dissemination

- Future plans must be robust with respect to
  - changes in the post-ISS stepping stones towards Mars
  - the potential availability of a wide range of platforms





Thank You