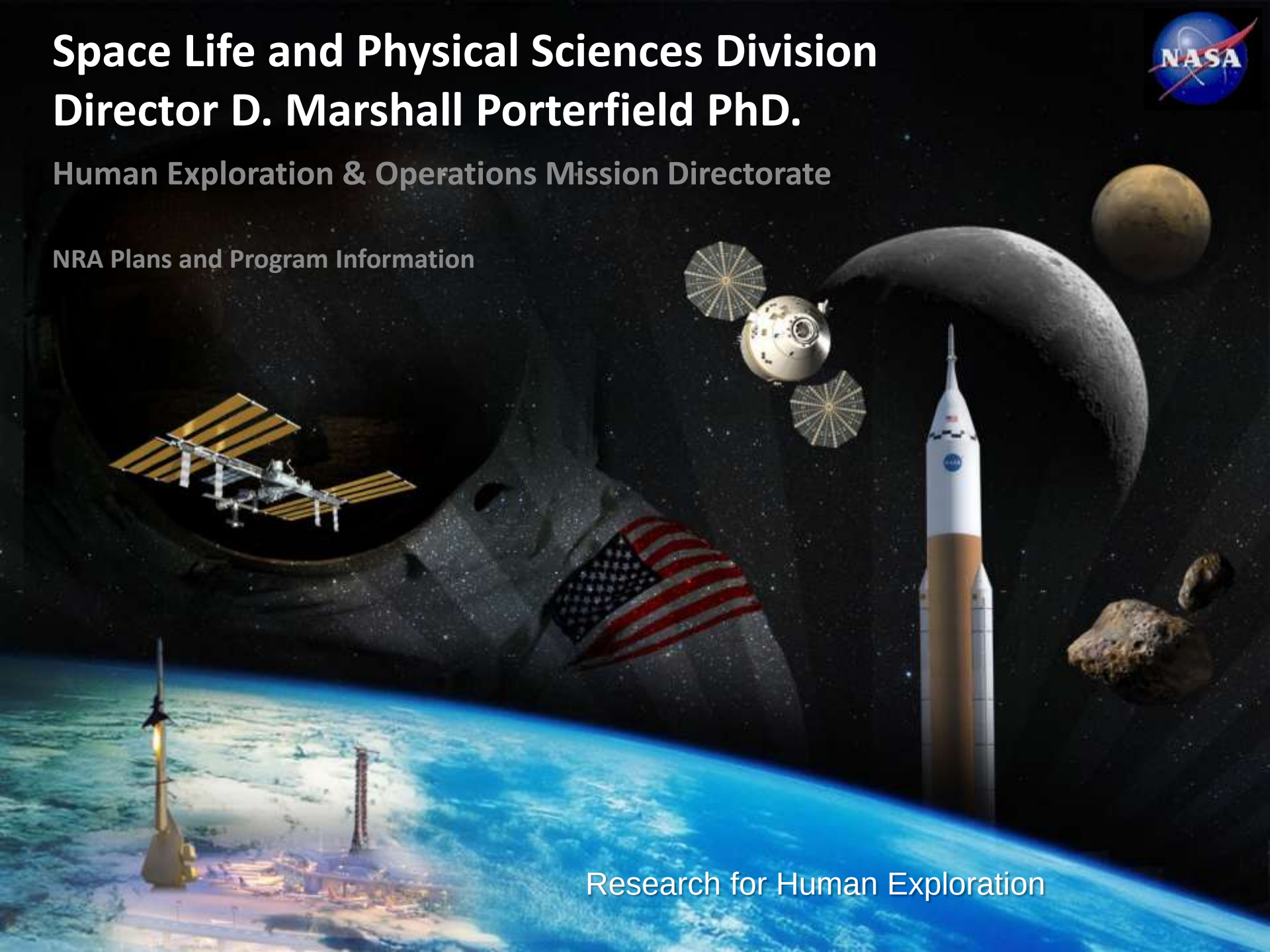
Space Life and Physical Sciences Division
Director D. Marshall Porterfield PhD.

Human Exploration & Operations Mission Directorate

NRA Plans and Program Information



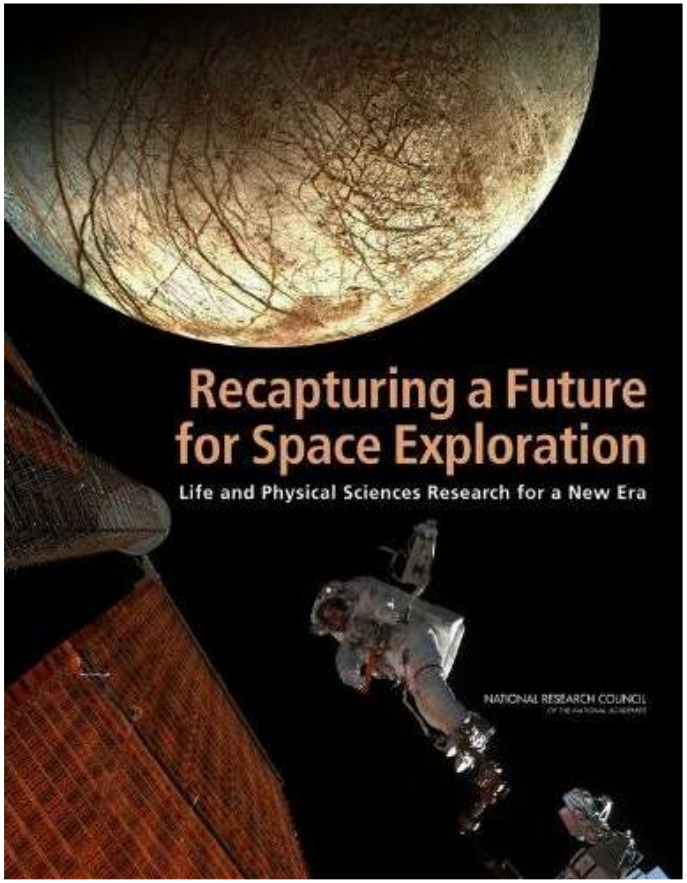
Research for Human Exploration

Space Life and Physical Sciences

- **NASA's Space Life and Physical Sciences Research and Applications Division (SLPS) has been formulated to execute high quality, high value research and application activities in the areas of:**
  - Space Biology
  - Physical Sciences
  - Human Research
- **These programs conduct fundamental and applied research to advance basic knowledge and to support human exploration in the environment of space.**
- **Division serves as the agency liaison with the ISS National Laboratory management organization (CASIS)**

Response to the decadal survey: Perspectives and approaches for going forward.

- Results from evaluation of decadal recommendations adapted into NRAs.
- PPBE14 realigned for annual NRAs.
- NRAs in Fundamental Space Biology will adopt a “wide net” approach.
- Coordination with HRP to assure overlap in animal models research.
- Reorganizing ISLSWG and JWG for international partner collaboration.
- NAC subcommittee on Life and Physical Sciences Research is being developed
- Workshop on gender differences in spaceflight
- Decadal Survey evaluation committee will reconvene annually to evaluate progress.



Space Biology NRAs and research initiatives

Research Areas:

- Uses the space environment to enhance understanding of the response of living organisms and biological processes to spaceflight conditions.
- Works toward an understanding of the requirements of terrestrial life in non-Earth environments
  - Cell biology
  - Plant Sciences
  - Microbiology
  - Animal Sciences
  - Rodent research
  - other model systems

Implementing Centers:

NASA's Physical Sciences Research Program is carried out at Kennedy Space Center (KSC), and Ames Research Center (ARC).

Physical Sciences NRAs and research initiatives

Research Areas:

- Fluid Physics: two-phase flow, phase change, boiling, condensation and capillary and interfacial phenomena
- Materials Science: solidification in metal and alloys, crystal growth, electronic materials, glasses and ceramics
- Combustion Science: spacecraft fire safety, solids, liquids and gasses, supercritical reacting fluids, and soot formation
- Complex Fluids: colloidal systems, liquid crystals, polymer flows, foams and granular flows
- Fundamental Physics: critical point phenomena, atom interferometry and atomic clocks in space.

Implementing Centers:

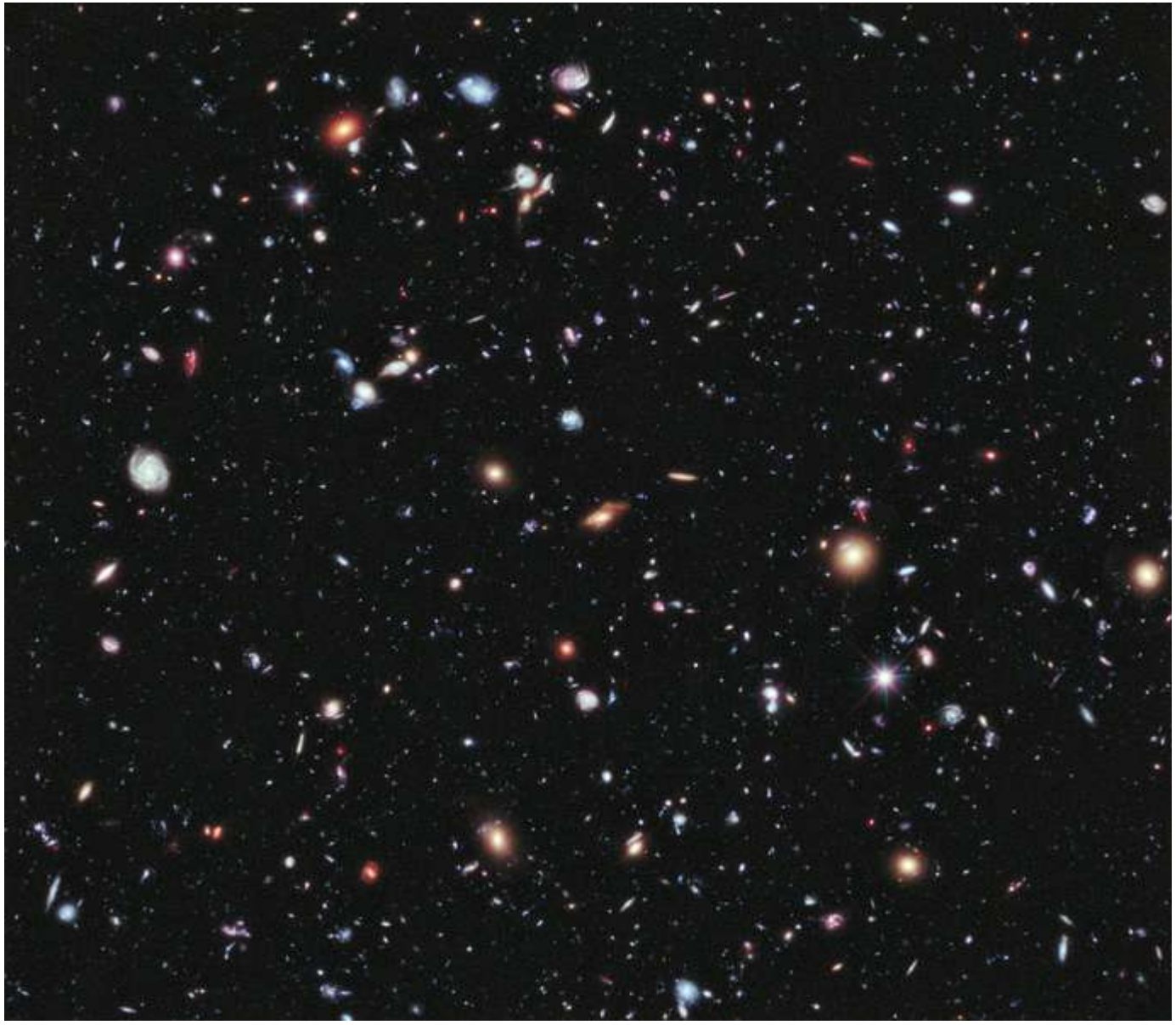
NASA's Physical Sciences Research Program is carried out at the Glenn Research Center (GRC), Jet Propulsion Laboratory (JPL) and Marshall Space Flight Center (MSFC).

Next NRA: Research Opportunities in Complex Fluids and Macromolecular Biophysics to be released Dec. 10, 2012

Human Research Program

- **HRP applied research is well documented and reviewed on a continuous basis by external evaluators. See: http://humanresearchroadmap.nasa.gov/**
- **Examples of Human Research Linkages to Physical Sciences and Biology FSB research in the areas of molecular & cellular, organism and developmental biology would provide basic foundational knowledge for HRP applied research aimed at risk mitigation.**
  - Examples
    - mechanisms of immune function
    - fracture and wound healing
    - microbial virulence
    - neural vestibular function
- **Implementing Center JSC**

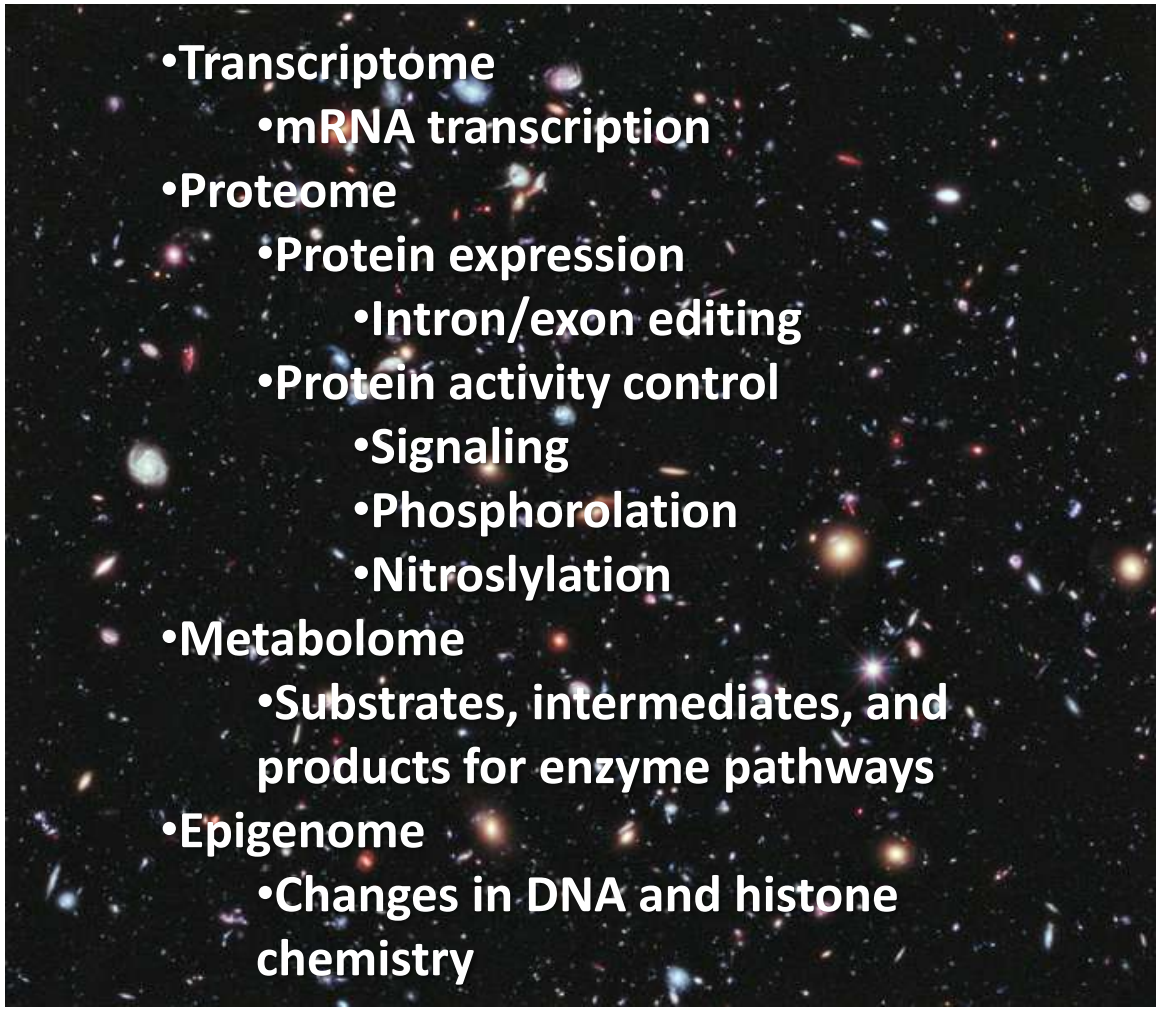
A Telescope Platform to Unite Life Sciences?



Hubble Extreme Deep Field

The Expressome as the "Telescope for Life Sciences"

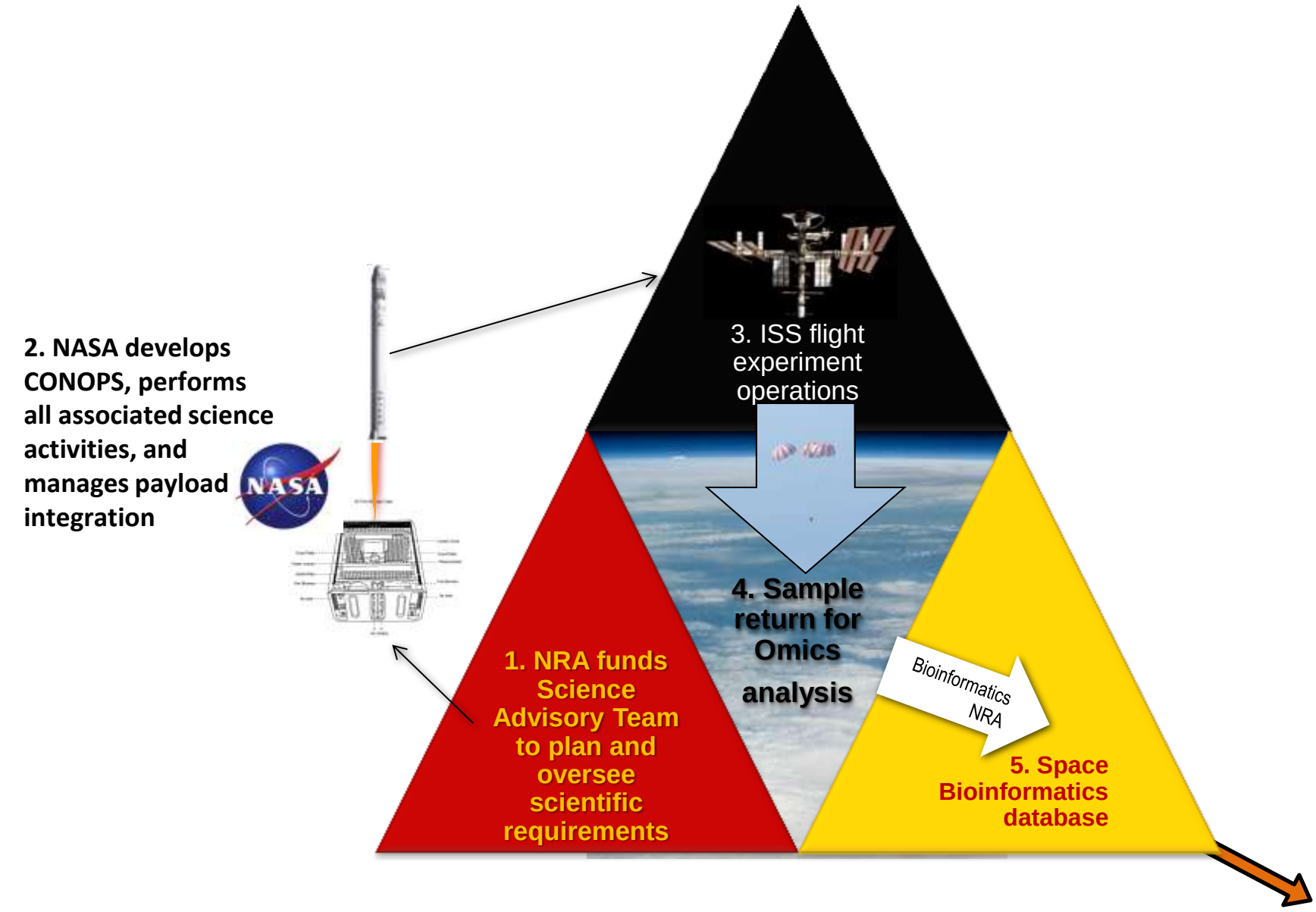
High Content Screening: as platform for high density/high throughput life science utilization of ISS



Transcriptome
Proteome
Metabolome
\+ Epigenome

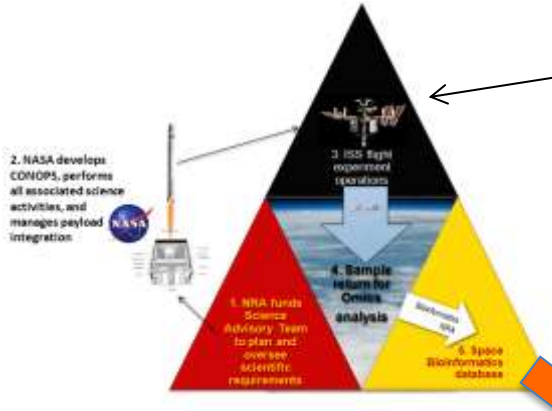
=Expressome

geneLAB Science Campaign



geneLAB supports multi-investigator utilization
Open Source Science for ISS Utilization

geneLAB
Expressomics
Bioinformatics



Individual PI Flight experiments

New scientific insight and publications

NRA to perform ground research based on data in informatics database

Non-NRA Outside Data users

CASIS

National Aeronautics and Space Administration

Questions?