NASA Space Life and Physical Sciences: Open Science for Space Research

Presentation to:

The National Academies of Science - Committee on Biological and Physical Sciences in Space

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

Open Science Summary

- Open Science is a paradigm shift away from the traditional approach of enabling science for one specific Principal Investigator (PI) at a time.

- Open Science allows us to enhance science returns by developing high-content science community reference experiments (flight data for advanced modeling, analysis, and discovery) which will later support large numbers of investigators to conduct ISS derived research– NASA funds NRA to encourage translation of ISS derived research to multiply discovery and enable exploration and commercialization

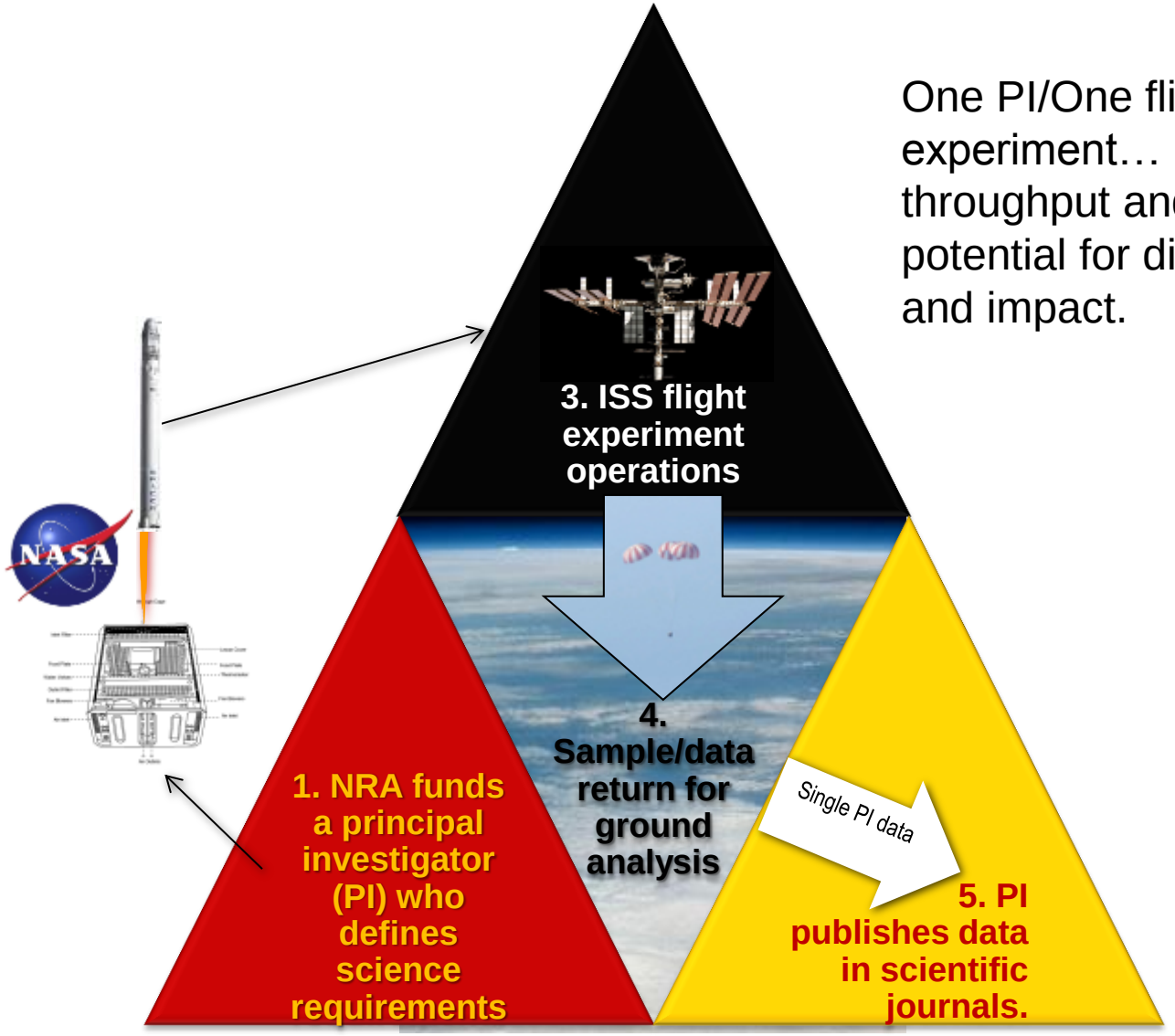
- Our vision is to implement Open Science initiatives across the whole program.

Initial Pathfinders:

- GeneLab (Space Biology)
- MaterialsLab (Physical Sciences)
- Physical Science Informatics (PSI)

- Implementation of these pathfinders is bound by our budget

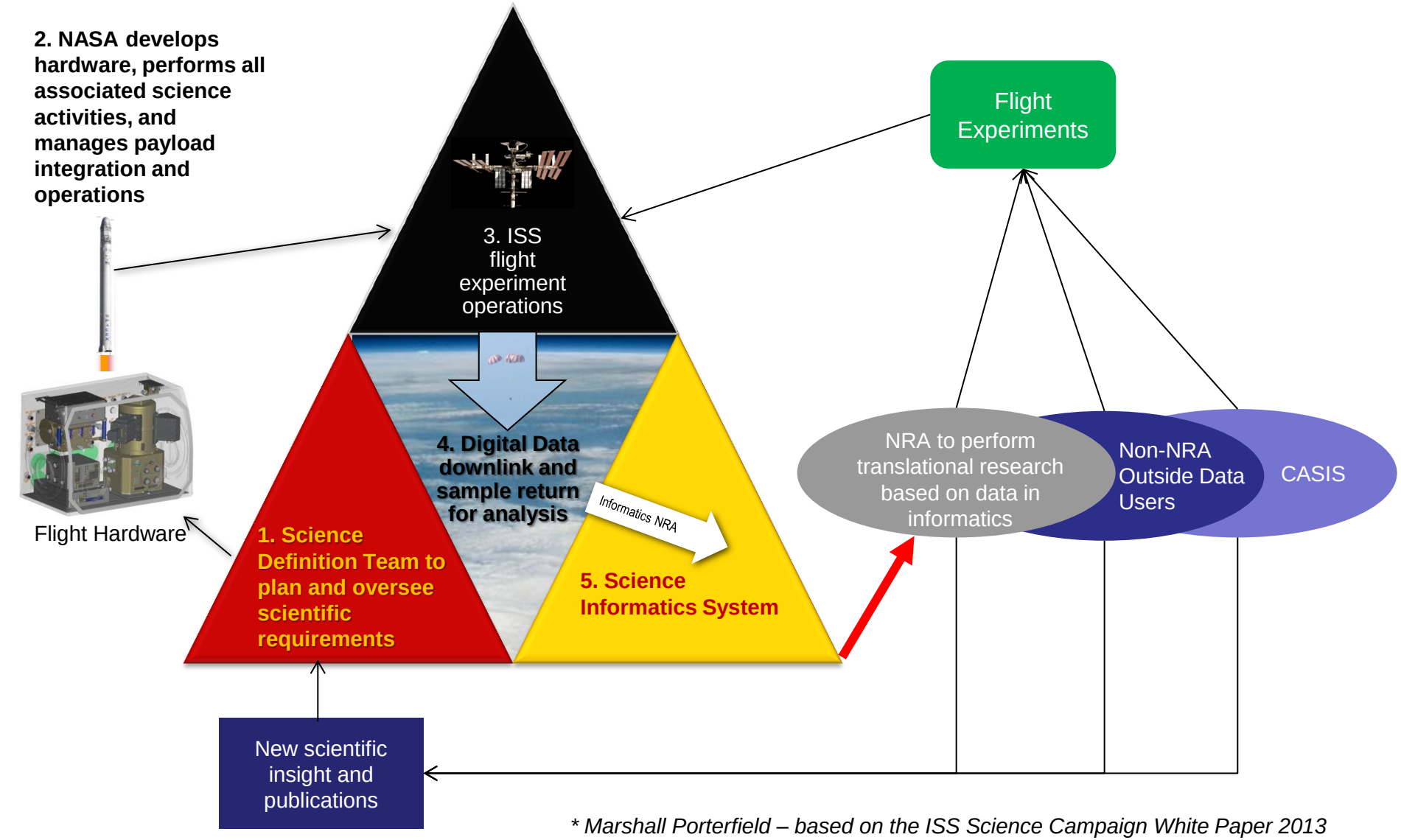
Traditional Approach to SLPS BPS



2. NASA works for the PI who performs all associated science activities. NASA develops and manages payload integration

One PI/One flight experiment… low throughput and limits potential for discovery and impact.

Open Science Campaign Platform*



** Marshall Porterfield – based on the ISS Science Campaign White Paper 2013*

Open Science is paradigm-shifting for NASA

Open Science shifts selection, implementation and dissemination of space sciences research and data

	Traditional Approach	Open Science Approach	Impact
Definition	NRA process to select 1 PI = 1 focused experiment	Open Science experiments defined based on science community inputs and Decadal Survey (systems approach). Science Definition Teams formed (not a single PI) to define reference experiments.	**Increases data generated from every mission PLUS the systems approach yields data with relevance to the broader community**
Implementation	PI leads experiment with integration and operations support	Science Definition Team standardizes procedures and operations to conduct extensive high-content sample analysis of broad interest.	**Generates data of interest to traditional and non traditional spaceflight research communities: CASIS, commercial, scientific, international**
Dissemination	PI chooses where to publish. Data is released publicly when PI publishes	All data is released publicly in searchable **informatics system/database,** a linkable system with collaboration and analysis tools built in. NRA funds many investigations to translate ISS data into knowledge	**Creates a integrated database for spaceflight data to increase collaboration and amplify impact of research to greatly increase science return from ISS and other flights**

Value of Open Science for NASA Missions and Earth-based Applications

- **Traditional Space Science Community:** NASA researchers and Pis will use GeneLab, MaterialsLab, and PSI to study and understand the fundamental scientific principles in space address the high priority recommendations of the NRC Decadal Survey
- **NASA Human Research Program:** geneLAB is a potential host for One Year Twins Study Data – Pilot Study for Human Omics Data. HRP researchers will use geneLAB to help close gaps in knowledge related to the risks to human health in space, and help develop more effective countermeasures to ameliorate the detrimental effects of spaceflight on human health and performance.
- **CASIS Commercial Utilization of Space:** Open Science tools provide an opportunity for data mining to identify commercial targets for drug development, personalized medicine, materials engineering, and translational sciences.
- **Non-Traditional Space Research Communities**: Open Science data and informatics will benefit commercial interests wherever those Earth-based research can be influenced at the molecular scale by gravity. Broader technical spinoffs include the advancement of the multi-channel omics approach of GeneLab. Open Science will demonstrate analytics and data processing possibilities that have broader value and benefit beyond the analysis of spaceflight data alone.
- **The General Public:** anyone with internet access and interest can access geneLAB data and freely explore Space Biology and ISS research results for themselves.