National Aeronautics and Space Administration

Space Life and Physical Sciences Status

D. Marshall Porterfield
Director, Space Life and Physical Sciences
Human Exploration & Operations Mission Directorate

October 7, 2014

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)**

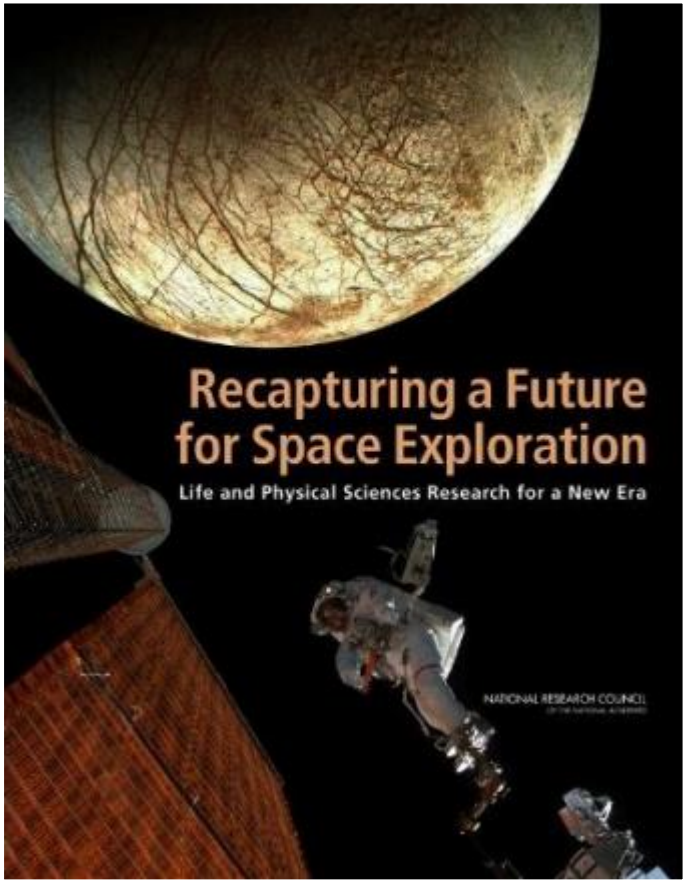
Response to the Decadal Survey: Perspectives and Approaches for Going Forward

- Chartered by Congress the National Academy of Science Commissioned a National Research Council decadal survey of NASA Life and Physical Sciences

- The Resulting report serves the SLPS Division in HEO as a guideline for developing applied and fundamental research that serves to promote the NASA human exploration mission

- Decadal recommendations serve the ultimate direction in prioritization of ISS research efforts coming from the SLPS Division at HQ

- NASA/SLPS is directly responsible back to the NAS/NRC and congress in how the recommendations are addressed.



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Chief Scientist
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Fran Chiaramonte
Stephen Davison
Bruce Hather
Mark Lee **(SL)**
*Angel Otero
David Tomko
Nicole Rayl **(D)**
Dennis Bahena **(C)**
Amir Zeituni **(C)**
Victor Schneider **(I@CHMO)**

Eracenia Kennedy **(Sec)**

[S] - SES
SL – Senior Level
* - Supervisor
** - Team Lead
C – Contractor
D – Detailee
N – NEX
I – IPA
U - Intern
Sec - Secretary

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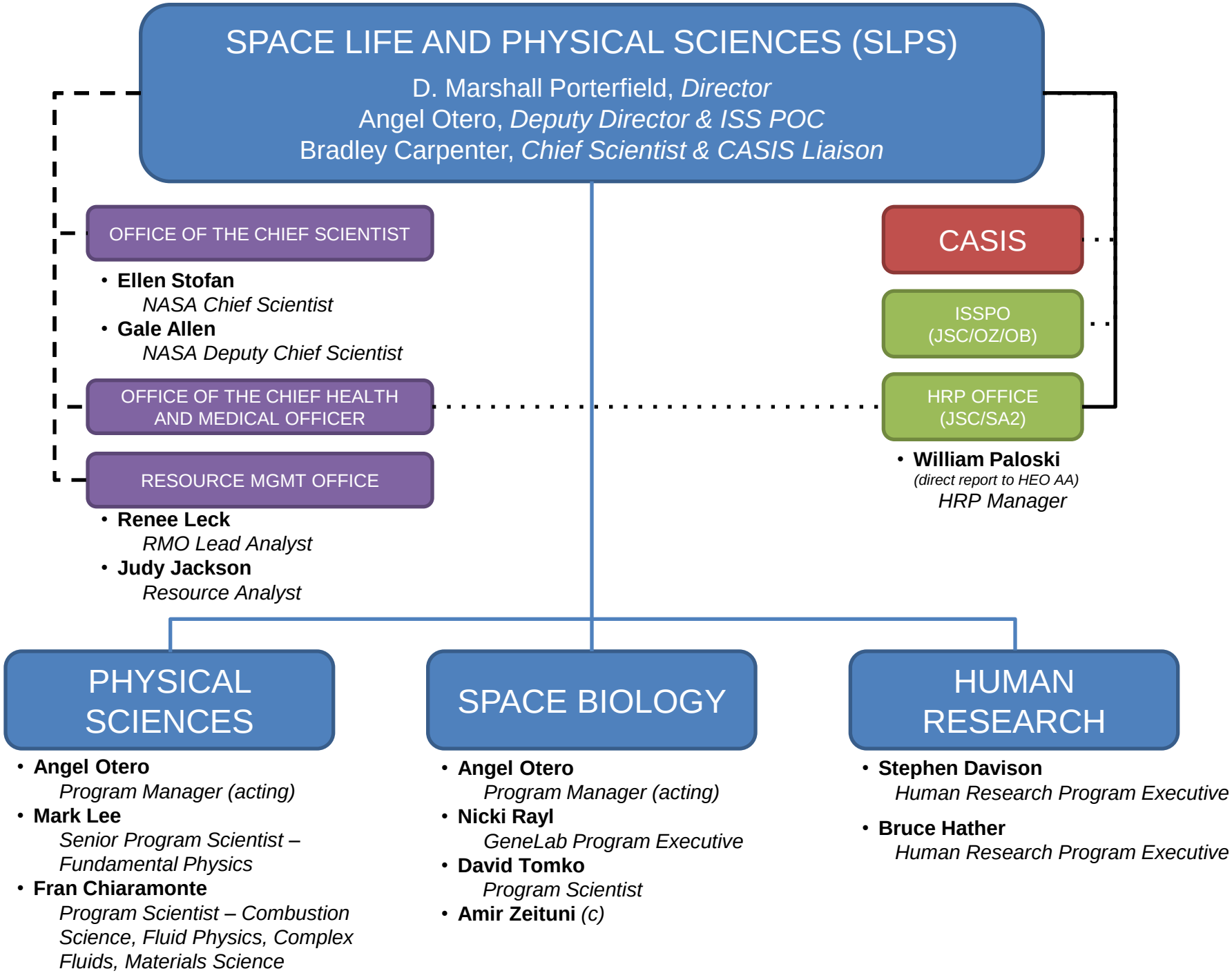
SPACE LIFE AND PHYSICAL SCIENCES (SLPS)
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Angel Otero, Deputy Director & ISS POC
Bradley Carpenter, Chief Scientist & CASIS Liaison
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GeneLab Program Executive
• David Tomko
Program Scientist
• Amir Zeituni (c)
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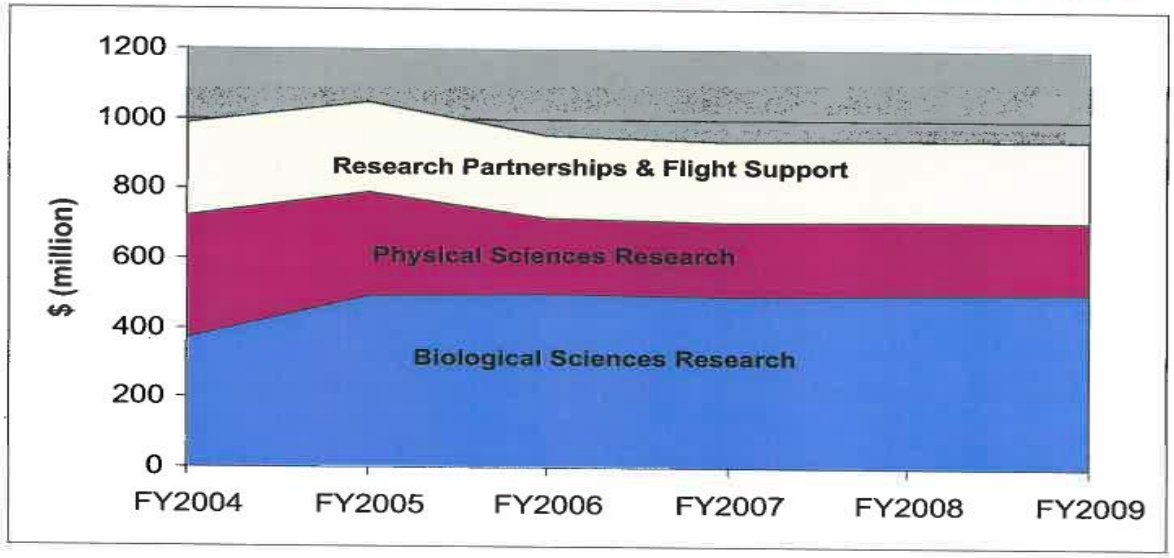
• Stephen Davison
Human Research Program Executive
• Bruce Hather
Human Research Program Executive

Budget Historical Perspective

BPRE

Biological & Physical Research Enterprise

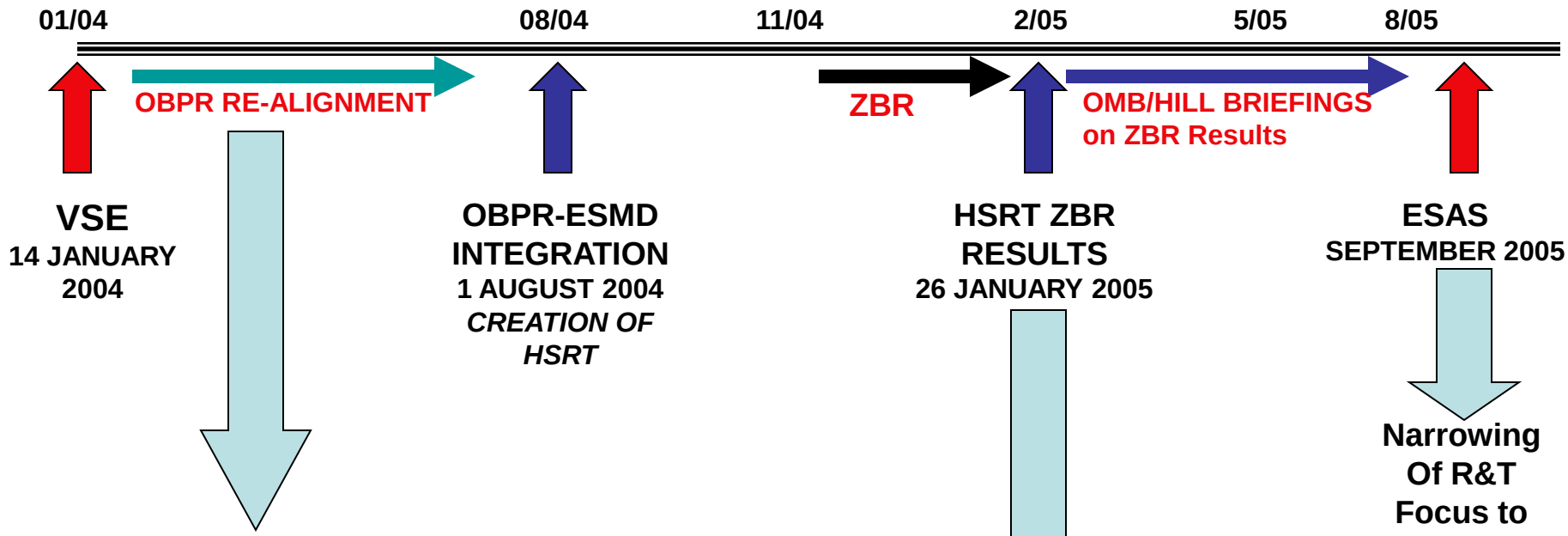
Current Environment
President's FY05 Budget for BPRE



($ in millions)	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	Total
FY 2005 PBS	**985**	**1049**	**950**	**938**	**941**	**944**	**5807**
Biological Sciences Research	368	492	499	496	500	502	2857
Physical Sciences Research	357	300	220	210	210	210	1507
Research Partnerships & Flight Support	260	257	232	232	231	232	1444

OBPR AA briefing, House Authorization Committee Staff, March 2004

Exploration Era Re-Alignment Timeline



Reduction in non-Exploration research elements in OBPR portfolio. Elimination of fundamental:
Fluid Physics
Combustion
Materials Science
Macromolecular Biotechnology (PCG)
Physics (LTMPF)
Reduction in ISS research utilization (MUSS)
June 25, 2004 Op Plan Change

Reduction in Animal and Cell Biotechnology research elements. Further Reduction in:
Fluid Physics
Combustion
Materials Science
Atomic Physics (Atomic Clock)
Reduction in ISS research utilization (MUSS)
May 10, 2005 Op Plan Change

OBPR: Office of Biological and Physical research; HSRT: Human Systems Research and Technology

Space Life and Physical Sciences circa 2008

ISS Re-alignment and Narrowing of R&T Focus

2002 OBPR ISS Portfolio

Total OBPR	966
Ground Research Investigations	809
Flight Research Investigations	157
Ground/Flight Ratio	5:1

ISS R&T primary focus:
- *Biomedical*
- *Basic Physical Sciences*
- *Fundamental Biological Sciences*

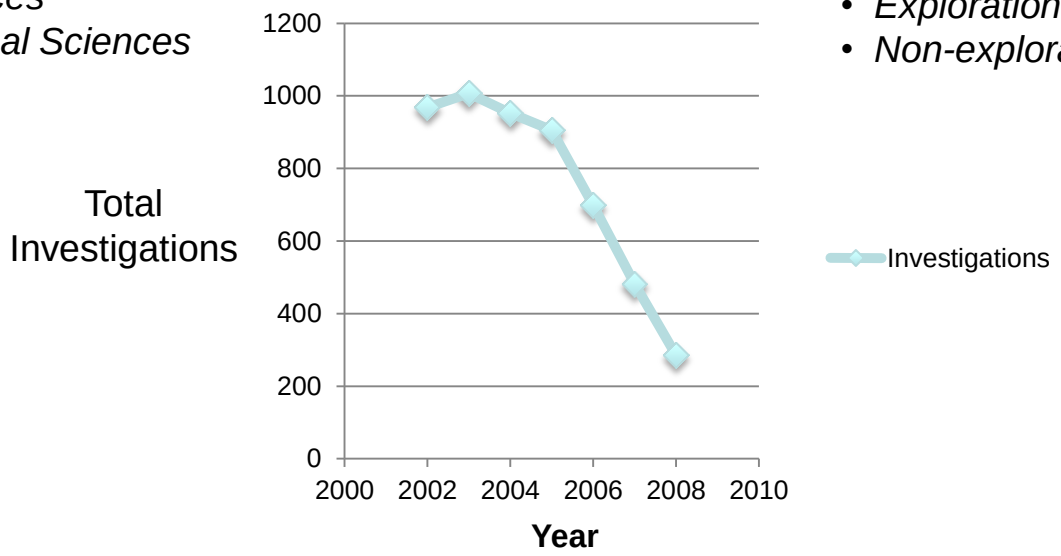
Re-alignment

2003-2006

2008 ISS Portfolio

Total	285
Ground Research Investigations	201
Flight Research Investigations	84
Ground/Flight Ratio	2.5:1

ISS R&T primary focus :
- *Exploration Biomedical*
- *Exploration Technology Testing*
- *Non-exploration Research*



Data from taskbooks: http://taskbook.nasaprs.com/Publication/welcome.cfm

Historical Conclusions

- The Agency's decision in 2004 to focus it's resources into the Exploration Vision directed resources ($$) away from the traditional Microgravity Program efforts
- The organization responsible for directing, managing and more importantly, advocating for life and physical science research was ultimately disbanded
- Ground and flight grants were terminated in an abrupt manner in 2004 leaving many researchers and students in a dire situation
- Life and physical science research was placed in an organization focused mostly on engineering development activities, not research
- Funding for space biology and physical science became dependent on annual Congressional earmarks, making long term planning extremely difficult
- Until 2011 there was no high level organization responsible for directing, managing and advocating for life and physical science research
- In 2011, with the merger of ESMD and SOMD, the Space Life and Physical Science Research and Applications Division was created to direct, manage and advocate for life and physical science research across the Agency

PPBE 15 BPS Budget

CURRENT IN-GUIDE PMR BUDGET						
Center	Fiscal Years					
	FY14	FY15	FY16	FY17	FY18	FY19
Ames Research Center	$12.668	$13.158	$13.976	$14.105	$14.105	$14.105
Glenn Research Center	$20.666	$17.641	$18.373	$16.734	$16.767	$16.767
Jet Propulsion Laboratory	$2.117	$3.566	$4.615	$4.337	$3.376	$3.376
Kennedy Space Center	$3.576	$3.389	$3.646	$5.238	$5.147	$5.147
Marshall Space Flight Center	$7.390	$7.048	$7.193	$7.236	$6.786	$6.786
NASA Headquarters	$10.874	$12.519	$12.114	$12.020	$13.489	$13.489
(CASIS)	$15.000	$15.000	$15.000	$15.000	$15.000	$15.000
Total In-Guide	**$72.291**	**$72.321**	**$74.917**	**$74.670**	**$74.670**	**$74.670**

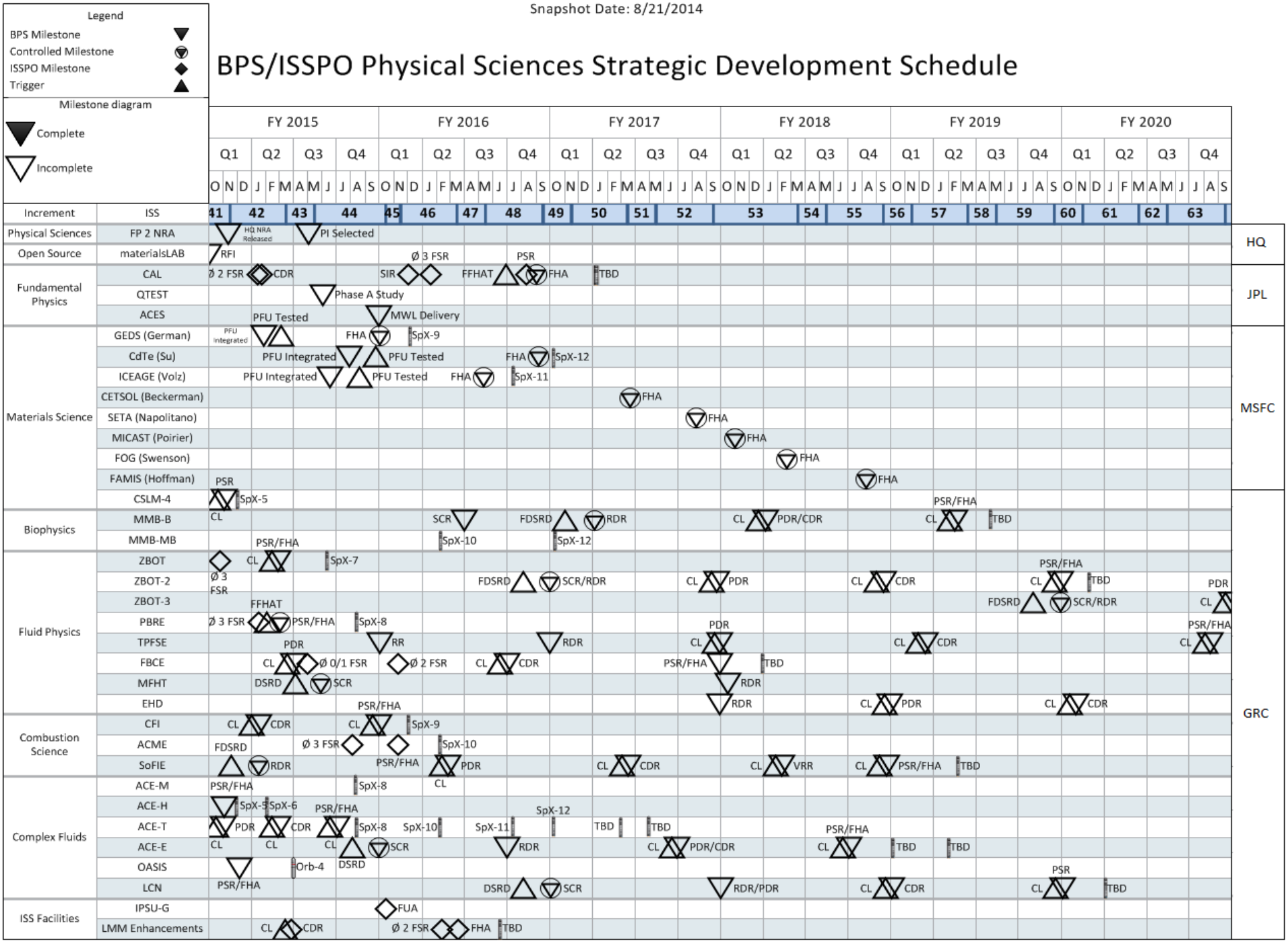
*All center overguide requests are being funded within the BPS in-guide budget.

PPBE 15 HRP Budget

($M)	FY14 IOP	CY (2015)	BY (2016)	BY + 1 (2017)	BY + 2 (2018)	BY + 3 (2019)	BY + 4 (2020)	Total
Human Research Program	$146.7	$158.5	$161.0	$161.8	$161.7	$161.7	$163.3	$1,114.8
Ames Research Center	$10.2	$9.6	$9.4	$9.6	$10.1	$10.1	$10.6	$69.7
Glenn Research Center	$5.2	$6.9	$7.2	$6.0	$6.0	$6.0	$6.1	$43.3
Johnson Space Center	$105.8	$114.9	$117.1	$123.8	$140.8	$140.7	$141.8	$884.8
Kennedy Space Center	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$1.3
Langley Research Center	$3.0	$3.0	$3.0	$3.1	$3.1	$3.2	$3.2	$21.6
NASA Headquarters	$0.9	$1.1	$1.5	$1.5	$1.5	$1.6	$1.4	$9.4
NSBRI	$21.6	$22.9	$22.6	$17.6	$0.0	$0.0	$0.0	$84.7

Snapshot Date: 8/21/2014

BPS/ISSPO Physical Sciences Strategic Development Schedule



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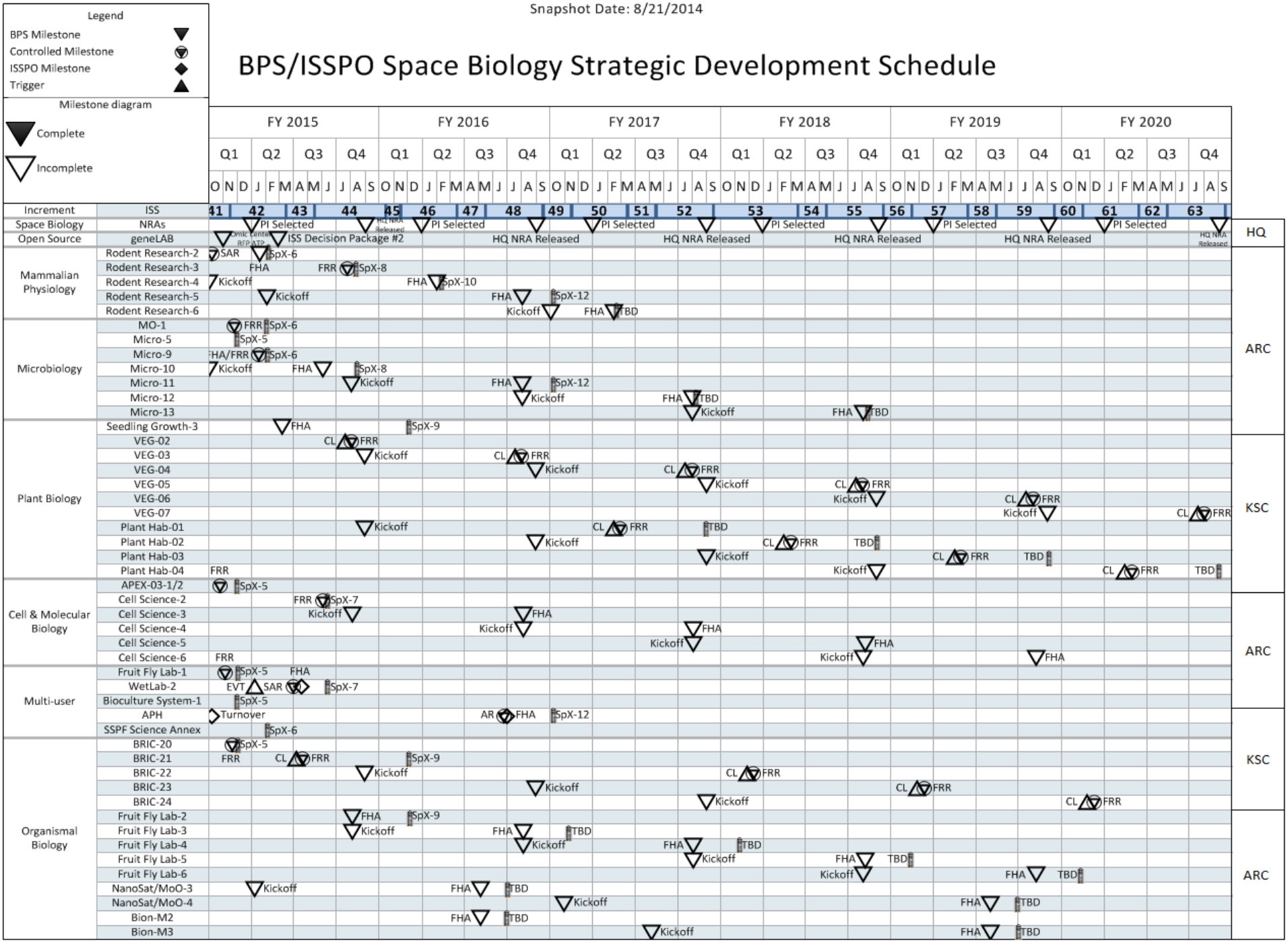
Snapshot Date: 8/21/2014

BPS/ISSPO Space Biology Strategic Development Schedule



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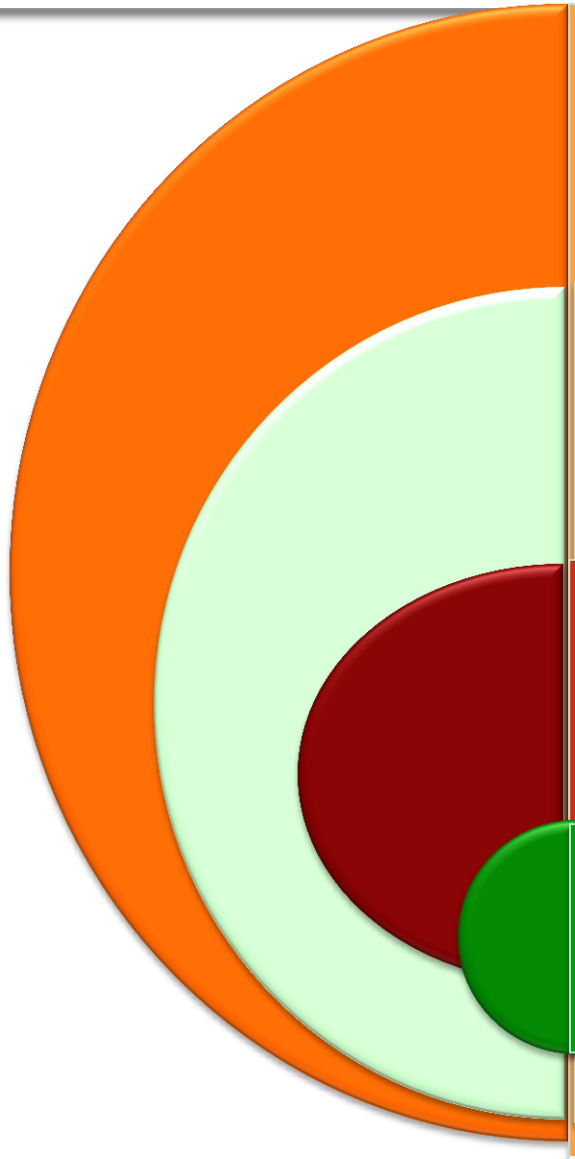
Biological & Physical Sciences Response to Decadal Survey



Base Response to Decadal Survey
= $150 M/yr

- Mouse Centrifuge
- Life Beyond LEO
- Research for Bioregenerative Life Support
- 2nd payload/yr for cell science
- Mouse Centrifuge payloads, Granular materials program
- 100% of budget for Science Capability Development
- Fully fund SISSEC (Int.) Optical Clock project

Open Source Initial Capability
≅ $120 M/yr

- ISS campaigns (incl. GeneLAB & Microbial Observatory) in place
- Twice annual NRAs
- Informatics Databases in place for PS and SB
- 50% of full budget for Science Capability Development
- Fully fund "Open Source" LAB Facilities for PS and SB.
- Fully fund QTEST (International); Phase A study SISSEC.
- Initiate Biophysics cross-discipline experiments

PPBE15 Program (Post MOA)
≅ $73 M/yr

- 2nd payload/yr for rodents a possibility, pilot OS projects started
- Annual NRAs
- Partial funding for Science Capability Development
- GeneLAB, Microbial Observatory concepts initiated
- Cold Atom Lab implementation started
- Re-engaging community through working groups to kick start Open Source Science campaigns
- Much better posture to maintain hwde commitments to ISS

PPBE14 Program
≅ $73 M/yr

- Intermitent Annual NRAs
- Limited ISS payloads for rodents, plants, cells, and flies
- 2 Nano and 2 Bion missions
- No GeneLAB, Microbial Observatory, Open Source Science
- Limited to no ability to maintain hardware delivery schedules

Issues/ Concerns moving forward

- Funding for research continues to be a constraint, still nowhere near an adequate response to the Decadal Survey recommendations
- Developing a ground research capability is still an area of concern. A spaceflight program needs a sound ground research base to be successful
- Need ISS to continue to deliver the MOA agreement content
- ISS to address some of the additional requests made by the centers and SLPSRA to be able to maximize our research opportunities
- Research facilities on ISS are limited, need additional facilities to be able to deliver our research. Additional Glovebox, Rodent Research Centrifuge are some examples
- CASIS is a new endeavor, learning how to deal with this new paradigm

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

Open Science is paradigm-shifting for NASA

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

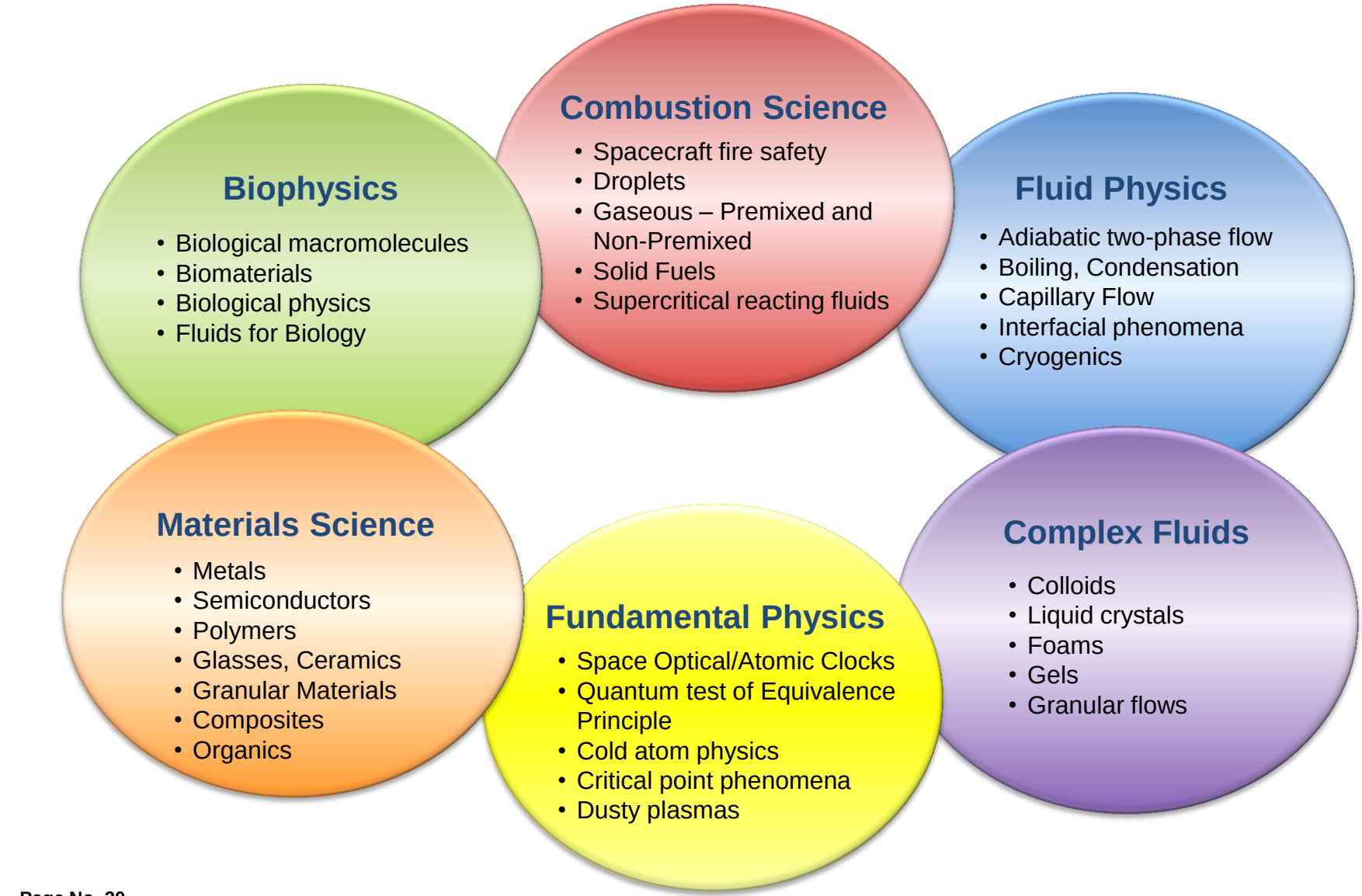
	Traditional Approach	Open Science Approach	Impact
Definition	NRA process to select 1 PI = 1 focused experiment	Open Science experiments defined based on science community inputs and Decadal Survey (systems approach). Science Definition Teams formed (not a single PI) to define reference experiments.	**Increases 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.

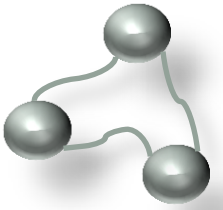
Biological & Physical Sciences (BPS) Status

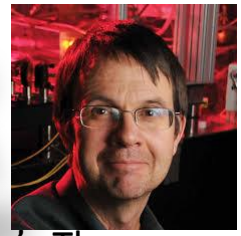
SLPS Gravity-Dependent Physical Sciences Research



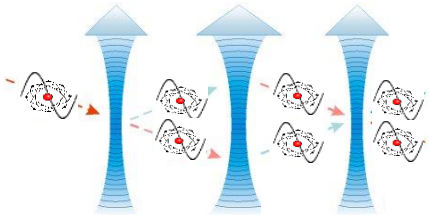
CAL1 5 Flight Investigations and Minor Facility Modifications Needed by Nobel-Laureate PIs

- Zero-G Studies of Few and Many Body Physics (PI E. Cornell)
  - How complexity of the universe evolves from subatomic scale
  - Incorporation of Potassium 39 and a fast tuning magnetic field into CAL instrument



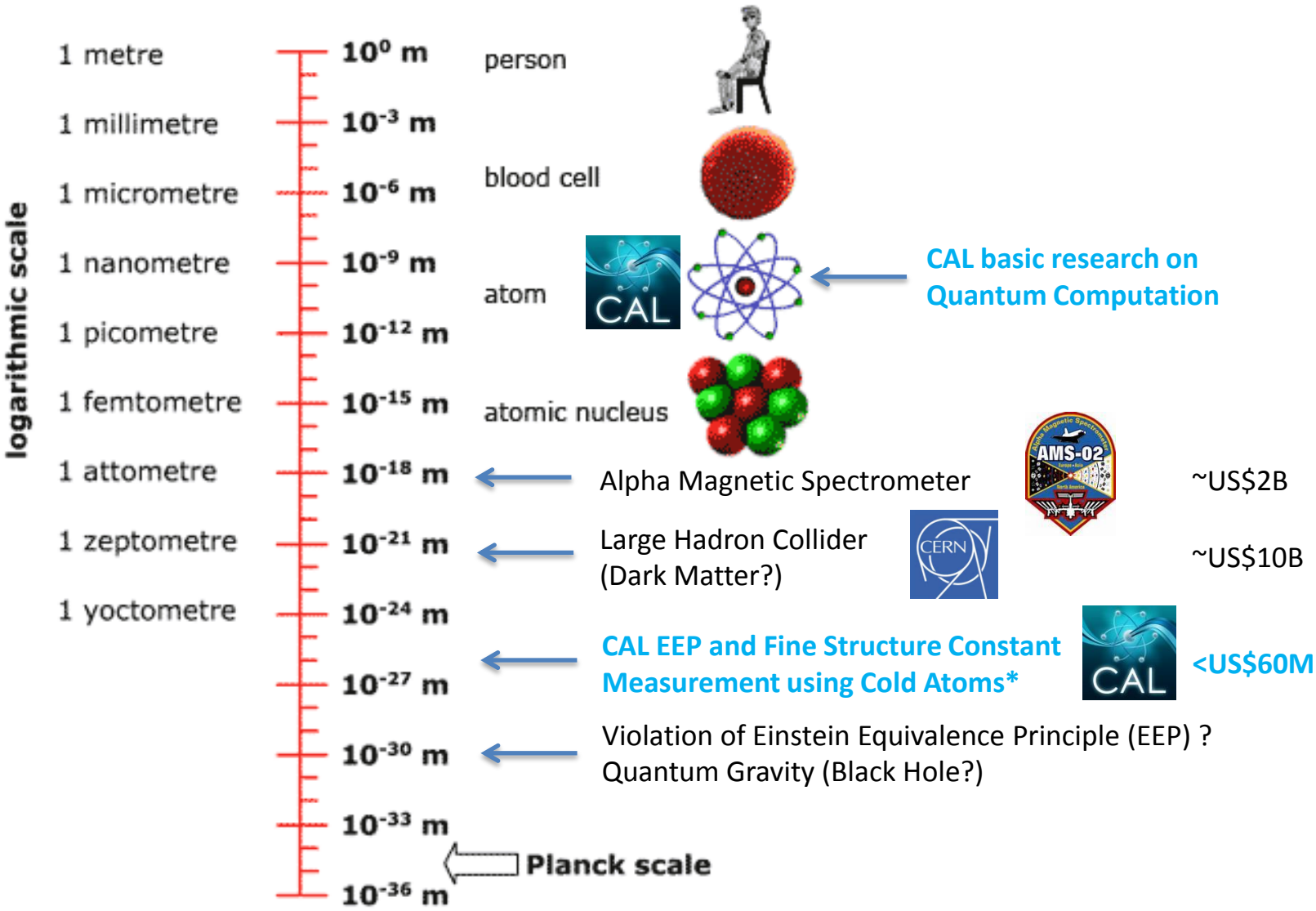


- Atom interferometry will pave the way for definitive space-based tests of Einstein's Theory of General Relativity (PI N. Bigelow, Co-PI W. Ketterle, Co-I W. Phillips)
  - Holy grail of theoretical physics probing deep into Planck-scale physics
  - Incorporation of Bragg scattering beam for two species atom interferometry



- Microgravity dynamics of bubble-geometry Bose-Einstein condensates (PI Nathan Lundblad)
- Fundamental Interactions for Atom Interferometry with Ultracold Quantum Gases in a Microgravity Environment (PI Jason Williams)
- Development of Atom Interferometry Experiments for the International Space Station's Cold Atom Laboratory (PI Cass Sackett)

CAL's Place in Probing Space-time Structures



*"Constraining the Energy-Momentum Dispersion Relation with Planck-Scale Sensitivity Using Cold Atoms", Giovanni Amelino-Camelia, Claus Lammerzahl, Flavio Mercati,and Guglielmo M. Tino, PHYSICAL REVIEW LETTERS, 103, 21 OCTOBER 2009

materialsLAB
A New Generation of Materials Science Experiments onboard ISS

<u>Purpose</u>: Engineers & scientists identify most promising engineering-driven ISS materials science experiments

<u>Goal</u>: Seek needed higher-performing materials by understanding materials behavior in microgravity

<u>Open Research and Informatics</u>: Inspire new areas of research, enhance discovery and multiply innovation

Engineering-Driven Science

Partners:
Industry
Academic institutions
DOD
Other Government agencies
International partners
NASA
CASIS

materiaLab Workshop: Registered Attendees' Organizations

Commercial Entities
Alcoa
ASM International
Astrium North America
BNIM
Boston Electrometallurgical Inc
Brimrose
Caterpillar
Consultant
CST
DQX Company Metallurgist & PMI, LLC
DS SolidWorks
Ford Motor Company
GEOCENT
Made in Space
Materials Development, Inc.
Power Systems Manufacturing
RightDirection Technology Solutions
Sierra Nevada Corporation
Southern Research Assoc
SpaceX
Techshot, Inc.
Teledyne Brown Engineering
ZIN Technologies, Inc.

Academic Institutions
Alfred University
Alfred University/Kazuo Inamori School of Engineering
Auburn University
Austin Peay State University
Carnegie Mellon University
Clarion University
Cleveland State University
Dartmouth College
Georgia Institute of Technology
Harvard Medical School -- Brigham and Women's Hospital --
MIT
Iowa State University
IRDFProject Harvard / Columbia
Louisiana State University
Northwestern University, Evanston
Oregon State University
Pennsylvania State University
Purdue University
South Dakota School of Mines & Tech.
South Dakota State University
Stony Brook University
Texas A&M University
The Catholic University of America
The George Washington University
The University of South Dakota
Tufts College Inc
University of Alabama
University of Alabama at Birmingham
University Of Alabama, Huntsville
University of California, Davis
University of Central Florida
University of Colorado
University of Colorado, Boulder
University of Delaware
University of Houston
University of Houston, Center for Advanced Materials,
University of Illinois at Urbana-Champaign
University of Iowa, Iowa City
University of Kentucky
University of Maryland, Baltimore County
University of Massachusetts
University of Massachusetts Lowell
University Of Massachusetts, Amherst
University of Michigan
University of Minnesota
University of Puerto Rico at Río Piedras
University of Texas at Austin
University of the District of Columbia
University of Washington
Wayne State University
University of New Mexico/AFRL

Military
Army Research Laboratory (ARL) / Materials & Manufacturing Science Division
U.S. Army Research Laboratory
US Army
US Army TARDEC

Other Government Agencies
Federal Housing Authority
NIST
Office of Science and Technology Policy, Executive Office of the President

Foreign Entities
European Space Agency
CNES
NUI
Tanzania Commission Science & Tech

NASA and Affiliated Entities
CASIS
NASA/ARC
NASA/GRC
NASA/GSFC
NASA/HQ
NASA ISS Program Science Office
NASA/JPL
NASA/JSC
NASA/JSC/White Sands Test Facility
NASA/KSC
NASA/LaRC
NASA LaRC/National Institute of Aerospace
NASA/MSFC
NRESS

Goals of Materials Genome Initiative for Global Competitiveness and how MaterialsLab contributes

Goal:
To accelerate the pace of discovery, development, and deployment of advanced materials in US manufactured goods.

*Components:
1. Enhanced fundamental understanding of materials
2. New measurement methods for characterizing materials (new data and standards)
3. Improved data and enhanced (open) databases
4. New computational tools for materials science
5. Software development

Result:
US manufacturers take advantage of advanced materials to make their products more competitive because the process of discovery, development, design, and deployment of these materials is faster, less expensive, and more predictable

* **MaterialsLab** will contribute to items 1, 2 and 3.

Space Biology Highlights

2013 NRA Selections Announced

- 96 proposals received, 26 proposals selected for flight definition
- Total potential value of $11.7M

Rodent Research has three missions in planning

- RR-1 planned for launch on SpX-4 this month – first rodents on a Dragon flight
- RR is the largest single user of crew time on ISS – between 100 and 200 hours per increment pair

Veggie Restarts Life Support Technology

- Veggie clearly demonstrated feasibility and interest in growing food on orbit
- HRP now involved to assess safety and palatability

2013 Space Biology NRA Timeline

- NRA Issued: November 15, 2013
- Step-1 Proposals Due: December 19, 2013
- Step-2 Proposals Due: March 20, 2014
- Peer Review: April-May 2014
- Technical Review: May-July, 2014
- Selection For Definition Review: August 11, 2014 (Note: Proposals are recommended today for a 6-18 month Definition Study in which the centers and proposers study experiment maturity, implementation feasibility/risks and costs. Budgets in the proposals are notional and may change during definition. Definition studies may result in a recommendation to not propose the experiment for flight, or to modify details of its implementation plan or budget. All budgets will be within the limits defined in the NRA. After definition is complete the centers will bring appropriate proposals forward to the Selecting Official to be considered for "Selection for Flight".)

Space Biology Research Areas

From Section B in the solicitation:

- **B.1 - Mechanisms of Mammalian Adaptation to Long-term Spaceflight and Re-adaptation On Return to Earth:** proposals are requested to study the effects of long-term spaceflight exposure on female mice.
- **B.2 - Mammalian Cell, Tissue and Organ Generation and Degeneration in Space:** studies are requested that use cell cultures from human or other mammalian model organisms to study changes in fundamental cellular processes under microgravity conditions.
- **B.3 - Multigenerational and Developmental Biology of Invertebrates:** studies are requested that use small invertebrate model organisms to study processes of reproduction, development, aging and multigenerational adaptation to life in space.
- **B.4 - Plant and microbial growth and physiological responses to the multiple stimuli encountered in space flight environments:** proposals will characterize how plant, invertebrate, and microbial growth and physiological responses are affected by a microgravity/space environment.
- **B.5 - Experiments demonstrating the roles of microbial-plant systems in long-term life support systems:** flight experiment proposals are requested that explore the basic biological changes in spaceflight that will affect the potential for the use of plant, invertebrate and microbial systems in long term Bioregenerative Life Support Systems.
- **B.6 - Long-term, multigenerational studies of microbial population dynamics:** experiments are requested for multigenerational studies of physiological, genetic, metabolomic, and reproductive characteristics of microbial, invertebrate, and plant populations onboard the ISS.
- **B.7 - Special topic - ISS Rodent Tissue Sharing Opportunity:** two prime experiments selected from the recent NRA **NNH12ZTT001N** will be conducted with mice on the ISS (Space X6). All tissues from both experimental and control animals (other than blood, spleen & control mice brains) will be available for experiments proposed by investigators whose studies address at least one of the relevant high priority recommendations of the Decadal Survey.
- **B.8 - Special Topic - Space Biology Investigations Using Nanoracks Cubelab ISS Flight Hardware:** NASA encourages the submission of proposals for Space Biology research emphases described in sections B.2, B.3, B.4 B.5 or B.6 that utilize the Nanoracks Cubelab facility, currently aboard ISS.

Space Biology Statistics by Subject Area

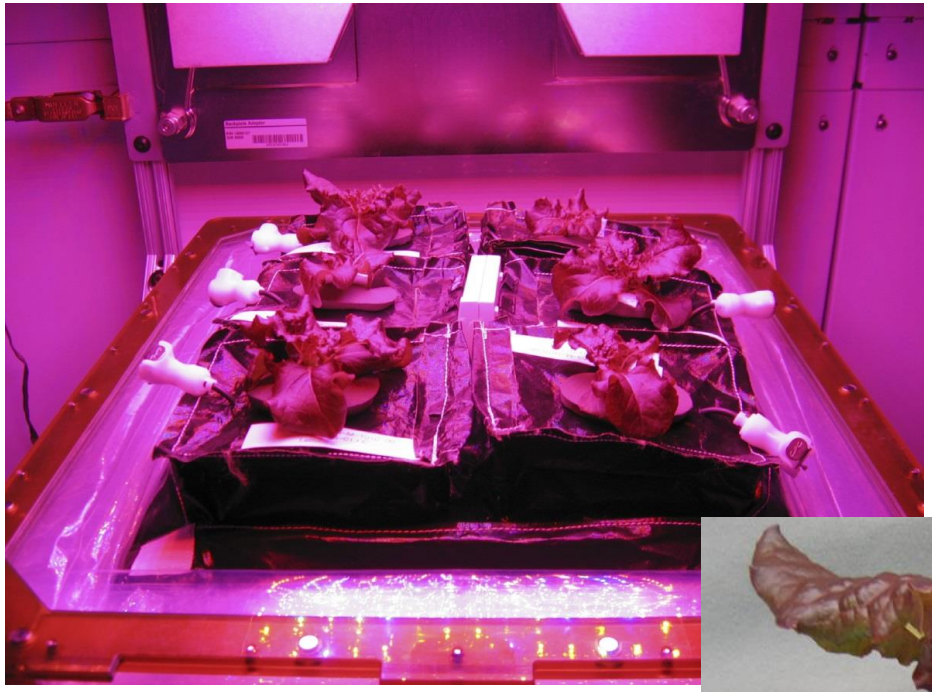
	NUMBER RECEIVED	NUMBER 70 &>	TOTAL IN PANEL	% PASSED IN PANEL
SpaceFlight Proposals	92	49		
PANEL				
Musculoskeletal		6	15	40
Microbiology		12	18	67
Immunology		8	13	52
Plant Biology		10	21	48
Neuroscience		4	6	67
Developmental Biology		8	17	40
Mail Reviews		1	2	50
TOTAL		49	92	53

Space Biology Selection STATISTICS

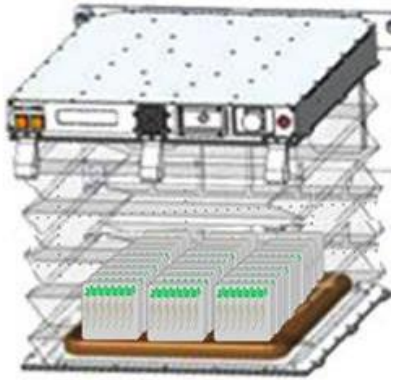
TYPE OF PROPOSAL	NEW TO SB	FORMER	INTRAMURAL	EXTRAMURAL
TOTAL # OF PROPOSALS = 92	69 (75%)	23 (25%)	16 (17%)	76 (82%)
TOTAL # PASSED PEER REVIEW = 49	32 (65%)	17 (35%)	11 (22%)	38 (68%)
TOTAL SELECTED FOR DEFINITION = 26	16 (62%)	10 (38%)	5 (19%)	21 (81%)

Rodent Research

Veggie merges plant science and life support technology



Commander Steve Swanson takes a moment to pose with the red romaine lettuce he just harvested, 6/10/14



Strategic Plan

High Fidelity Draft shared with ISLSWG geneLAB representatives in June 2014

Now signed and approved now awaiting public release

The Expressome as the "Telescope for Life Sciences"

High Content Screening: A Platform for High Density/High Throughput Life Science Utilization of ISS

- Transcriptome
  - mRNA transcription
- Proteome
  - Protein expression
    - Intron/exon editing
  - Protein activity control
    - Signaling
    - Phosphorolation
    - Nitroslylation
- Metabolome
  - Substrates, intermediates, and products for enzyme pathways
- Epigenome
  - Changes in DNA and histone chemistry

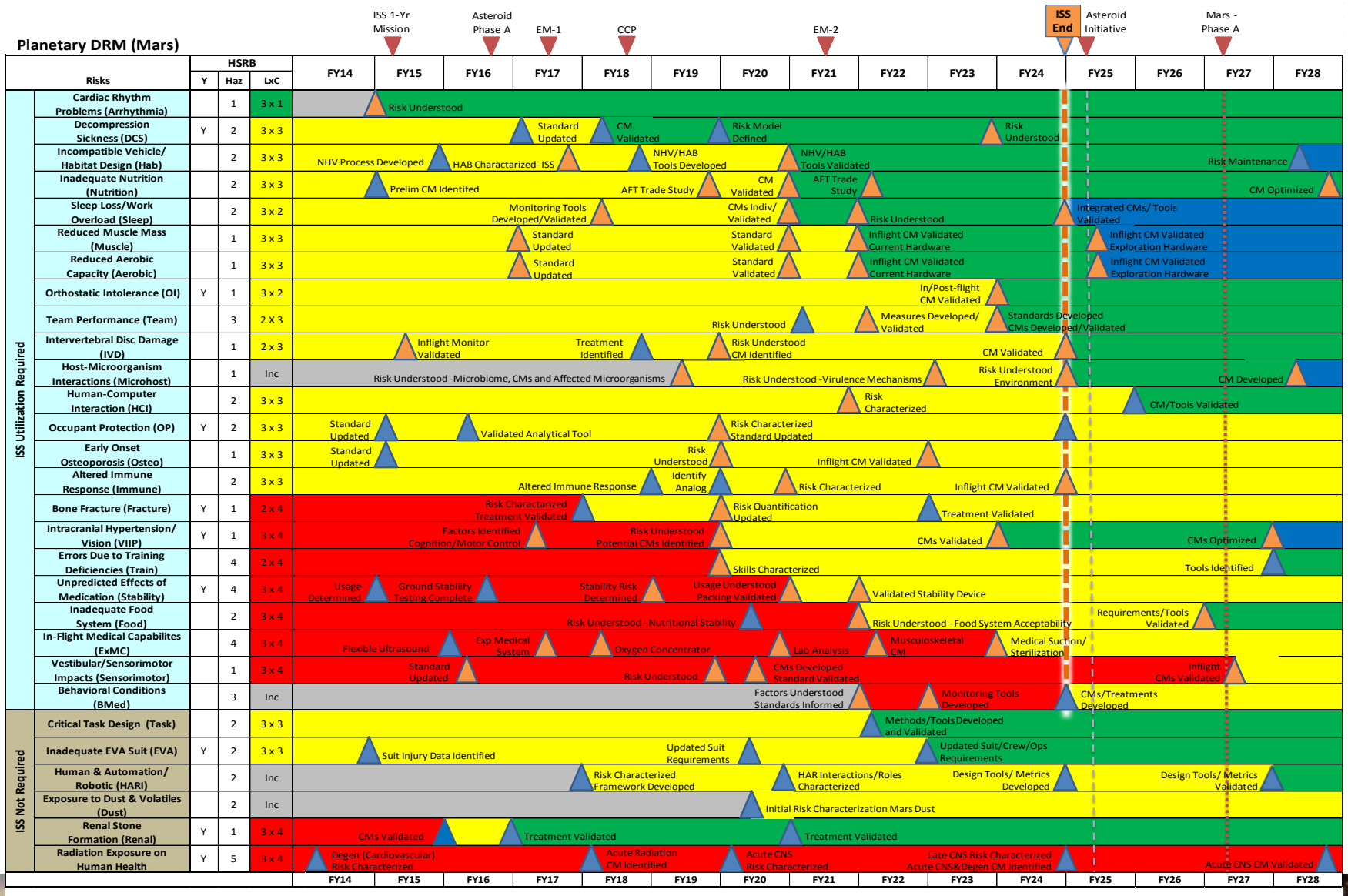
Transcriptome
Proteome
Metabolome
+ Epigenome
= Expressome

Human Research Program

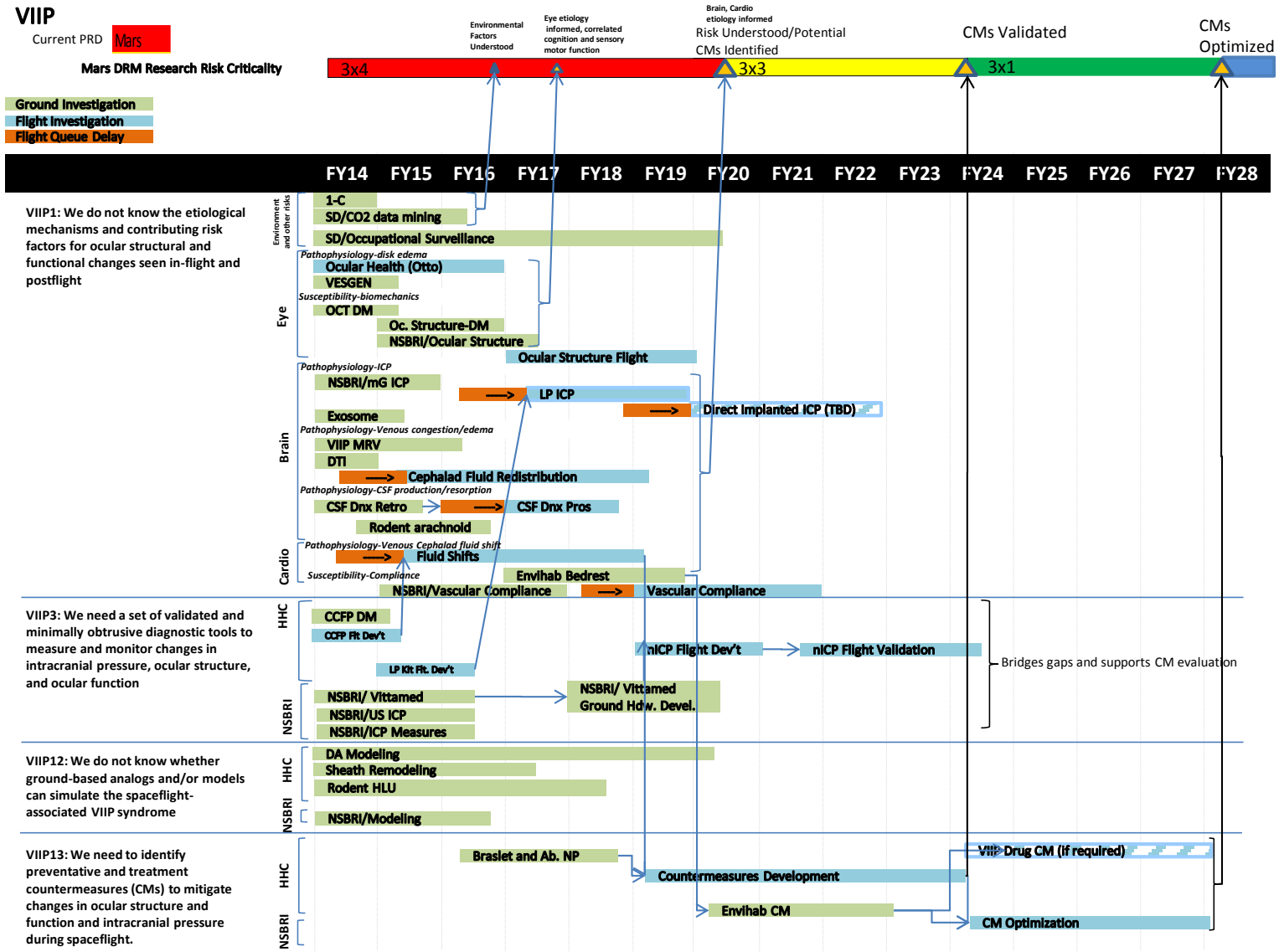
- HRP Risk Reduction Model
- One-Year Mission
- Twins Study & Genomics

Human Research Program

Integrated Path to Risk Reduction, Revision B PCN-1 (2014)



Human Health Countermeasures
Path to Risk Reduction - VIIP



MHRPE 1-Year Mission (1YM) Update

Multilateral biomedical investigations on US and Russian crewmembers

2012:
- Agency-level bilateral agreement
- Candidate investigation lists exchanged

2013:
- Bi-monthly meetings at IBMP
- Developed milestones, overarching principles for hardware, data, subject sharing
- Field Test experiment (US, Russian co-PI's) initiated, transitioned to operations
- Fluid Shifts experiment (US, Russian co-PI's) initiated; implementation issues
- Identified complementary ESA, JAXA investigations (thus "multilateral")
- Initiated multi-step crewmember informed consent process

2014:
- Completed informed consent for for both crewmembers
- Sponsored Joint PI meetings to establish collaborations and data exchange needs
- Fluid Shifts experiment formally added to Russian science program (see box below)
- Crew time oversubscribed (both US and Russian)
  - Majority of investigations "below the line"
  - Nearly-full implementation expected with further timeline refinement

Fluid Shifts Experiment
- Endorsed by Roskosmos
- Approved by KNTS (Roscosmos-RAS committee: V. Solovyev, chair; A. Markov dep.)
- Energiya to assess feasibility, provide recommendation

Note: used one-off ad hoc process – slow-going on developing truly joint process for fully-integrated US-Russian investigations

NASA Twins Study Progress Update

Differential Effects on Homozygous Twin Astronauts Associated with Differences in Exposure to Spaceflight Factors

Jul 2013:	Solicitation released
Sep 2013:	40 proposals received
Jan 2014:	Peer review panels met - Sleep, Metabolism, Microbiome - Omics, Epigenetics, Chromosomes - Cardiovascular
Mar 2014:	10 proposals selected
Apr 2014:	First IWG Meeting held
May 2014:	Received IRB approval (contingent*)
July 2014	Received HRMRB approval (contingent*)
Current:	Detailed planning integrating all investigators into one combined study
Oct 2014:	Planned collection of first samples

***HRP is working with OCHMO, CHS, NASA legal, CB, and the IRB to develop a policy that will protect all human spaceflight research subjects volunteering for genetic studies:**

- Aspects of risk unique to astronauts
- Provision of genetic counseling
- Permitted degrees of sharing genomic data
- Medically actionable findings and relation to medical records
- Research subject approval of public presentations and publications
- Disposition of samples remaining after the conclusion of an investigation
- Retention of data after the conclusion of an investigation
- Extension of Privacy Act protections after the subject is deceased

Conclusions

- SLPS is poised to move forward into this new exciting era of growth for our research program

- We look forward to continue to work with the ISSPO to implement the MOA and continue to look for ways to maximize our available resources

- SLPS is moving forward with the Open Science research management approach (GeneLAB, materialsLAB)

- We continue to work at HQ and DC to look for ways to identify ways to grow our program