Research Planning Process

NASA ISS Research Academy and Pre-application Meeting

August 5, 2010

Rodney Lofton
Space Station Program
Research Planning Office

Goal & Objectives

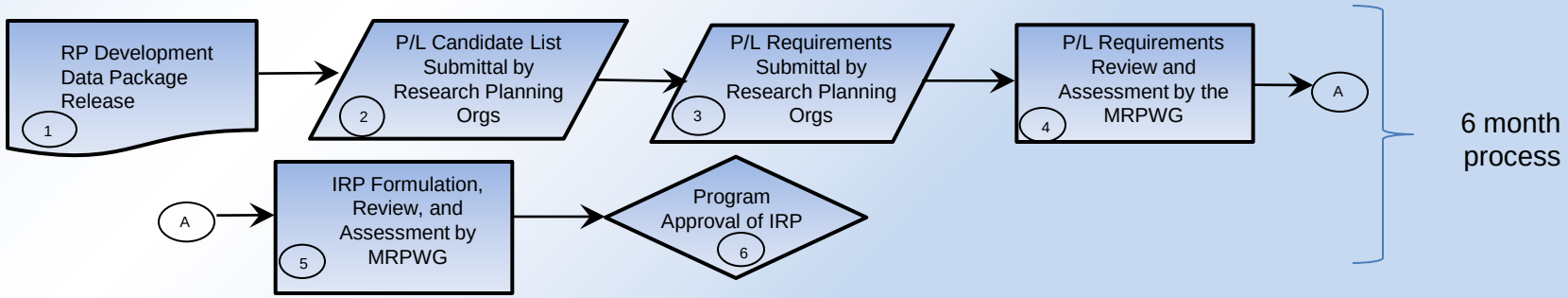
- *This presentation describes the process used to collect, review, integrate, and assess research requirements desired to be a part of research and payload activities conducted on the ISS.*

- *The presentation provides a description of:*
  - where the requirements originate,
  - to whom they are submitted,
  - how they are integrated into a requirements plan, and
  - how that integrated plan is formulated and approved

- *It is hoped that from completing the review of this presentation, one will get an understanding of the planning process that formulates payload requirements into an integrated plan used for specifying research activities to take place on the ISS.*

Process Description

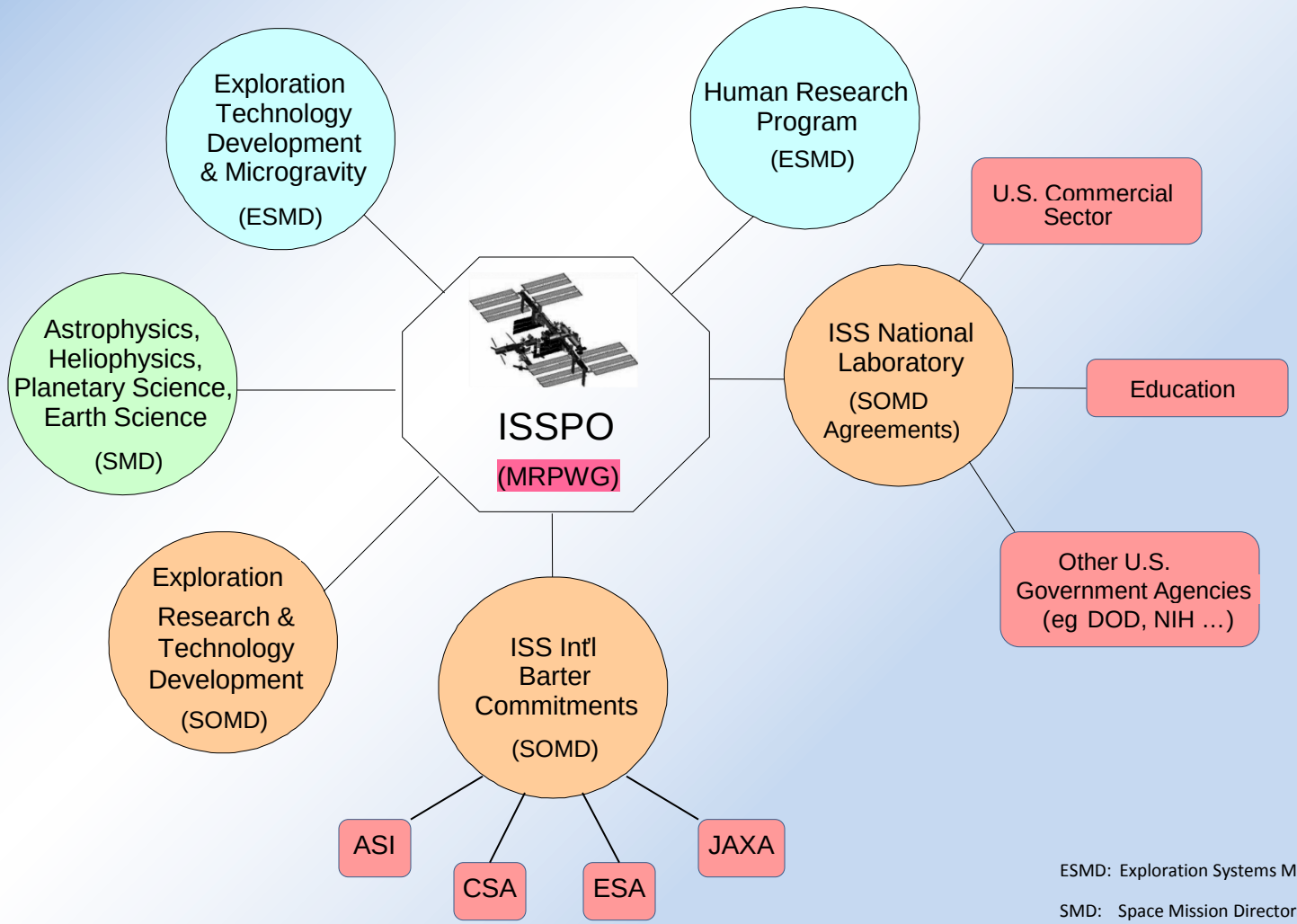
- *The Research Planning Process is a series of steps used to develop an ISS Increment Research Plan (IRP) which defines the payload requirements requested to be implemented during an ISS increment.*
- *The Research Planning Office is the Space Station Payloads Office organization tasked to develop the IRP and uses the Multilateral Research Planning Working Group (MRPWG) as the technical forum to develop the IRP.*
- *The IRP consists of a list of research investigations, resource allocation specifications, payload manifests for the ISS cargo transportation vehicle flights, and needed on-orbit resource requirements for each payload/investigation.*
- *The flow of development of the IRP is as follows:*



- *The IRP is used as the basis for development of the Space Station Program Document, IDRD Annex 5: Payload Tactical Plan (PTP). The PTP document is under development control by the Payloads Mission Integration Office and is not described in this presentation.*

Sources of Research Requirements

Sponsors of Research on ISS

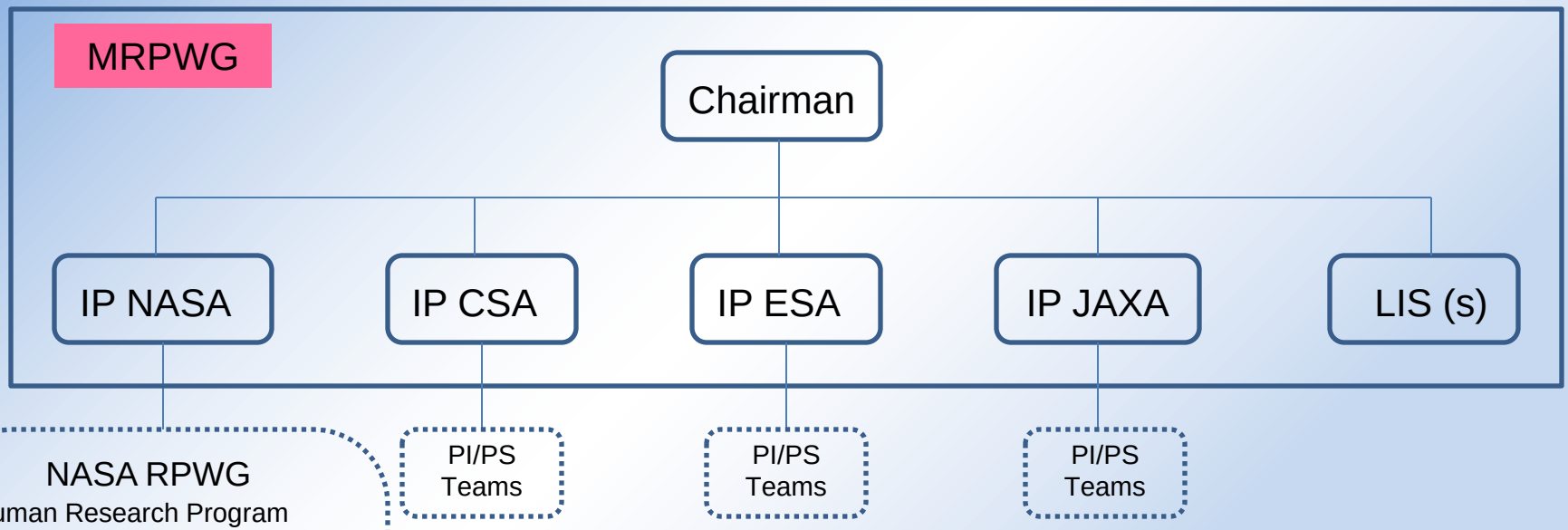


ESMD: Exploration Systems Mission Directorate

SMD: Space Mission Directorate

SOMD: Space Operations Mission Directorate

Multilateral Research Planning Working Group



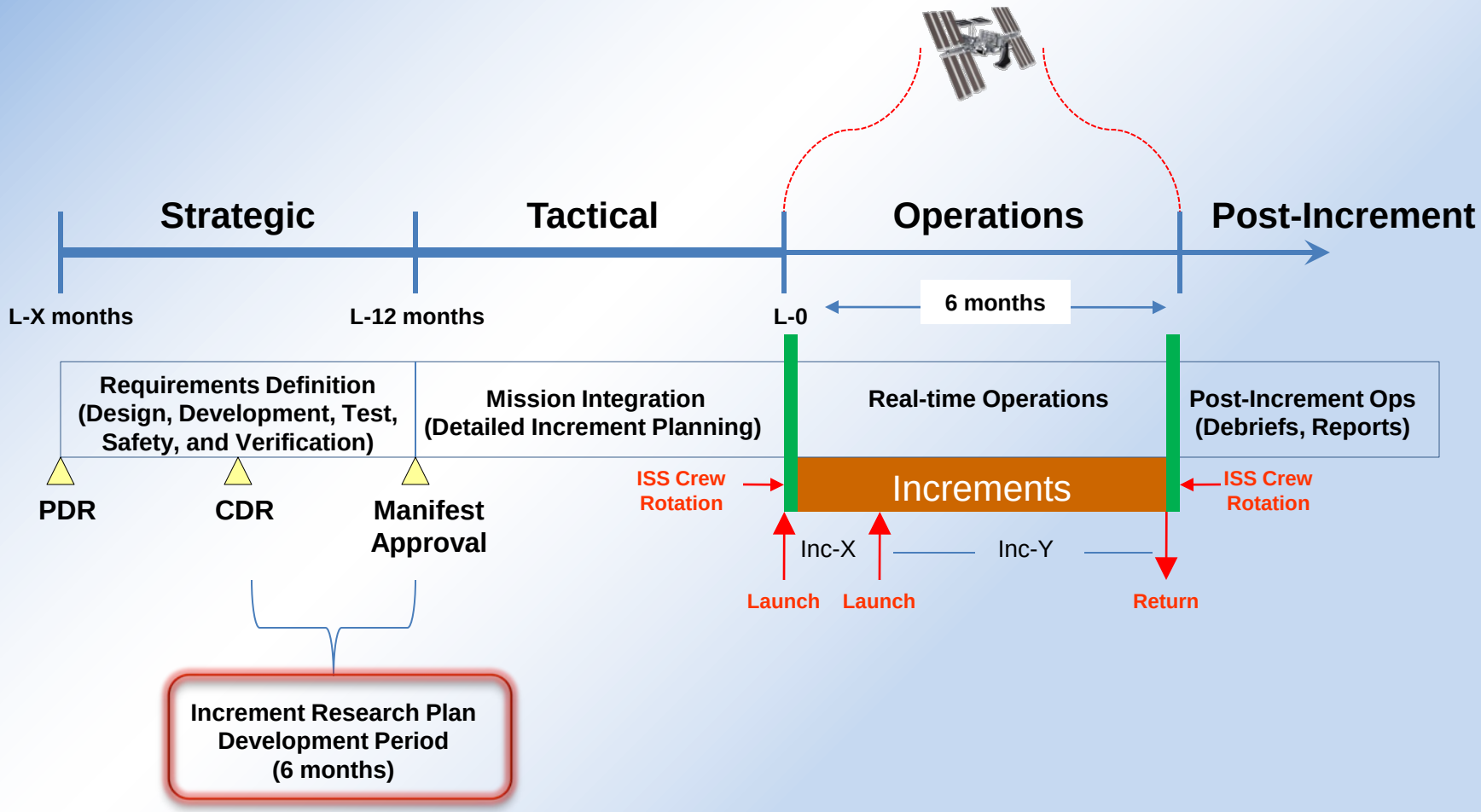
NASA RPWG
- Human Research Program
- ISS-KSC
- Ames Research Center PO
- MSFC – Life Sciences Habitation
- GRC – Life Science Habitation
- Space Operations
- National Lab Office
- ISS Program Science Office
- Payload Operations
- Payload Safety
- Astronaut Office
- Payload Mission Integration Team
- Payload Engineering Integration
- Space Shuttle Program Office

Roles & Responsibilities

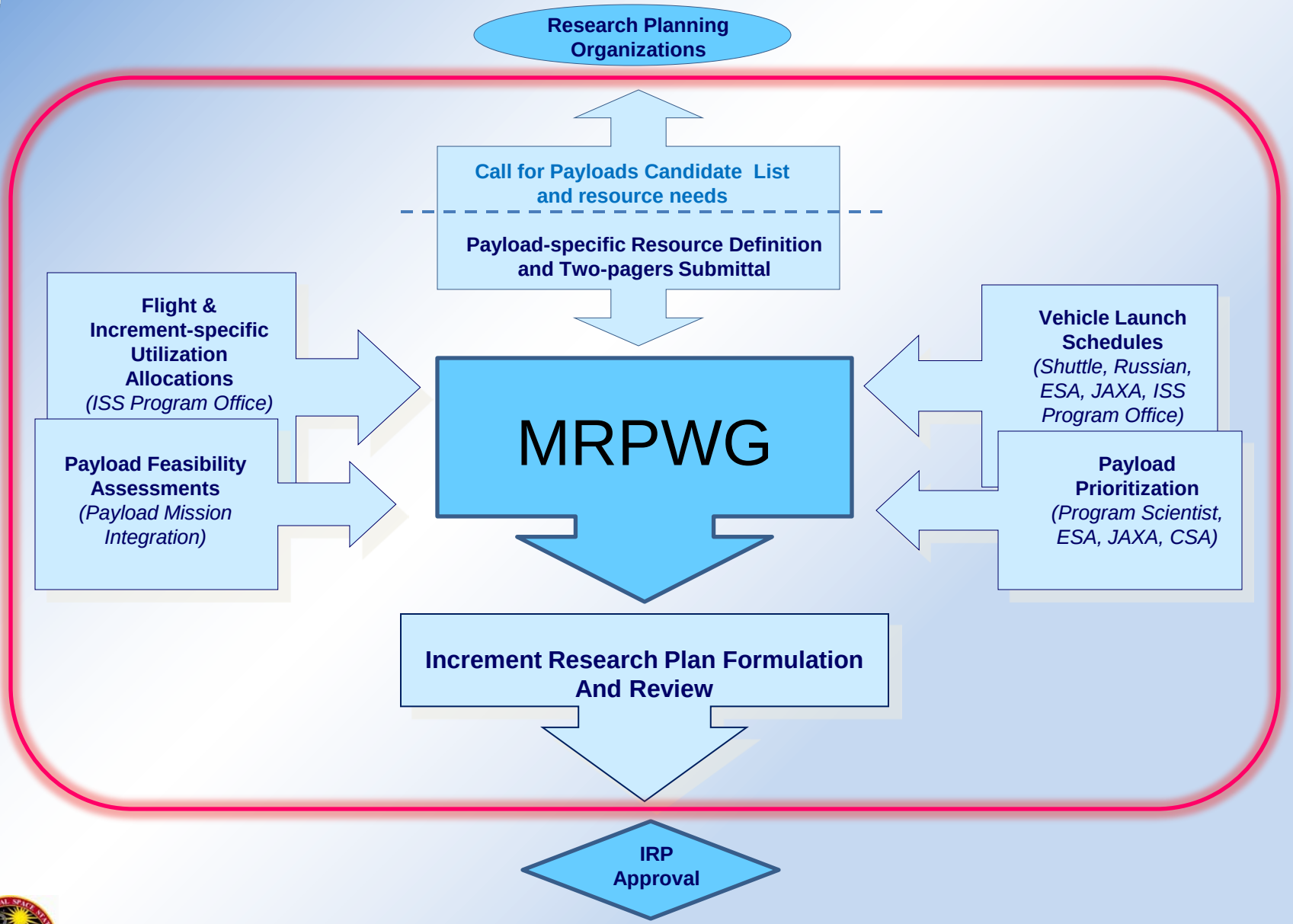
- *Tasked to ensure integrated and cohesive research requirements exists for increment operation*
- *Members are responsible for representing their respective research areas for multiple increments*
  - *Ensure long-term strategies for their research disciplines are implemented in the tactical and execution planning process*
  - *Ensure that hardware availability and use strategies are consistent with research plans*
- *Members are responsible for ensuring that the research priorities of their respective organization are represented*
- *Produces cross-discipline research plans for increment execution*

Where does the IRP fit in the Payload Integration Process?

Payload Integration Timeline



Increment Research Plan Development Process Overview

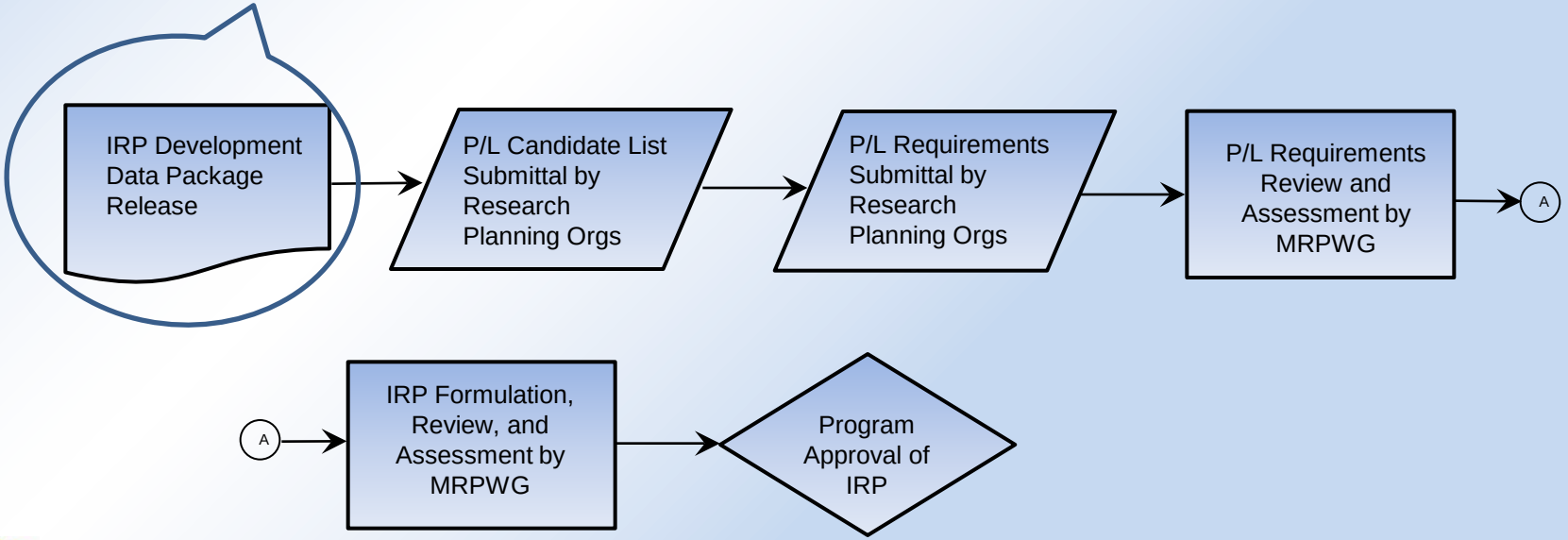


Increment Research Plan Development

Step 1

RP Development Data Package Release

- *At I-18 months, MRPWG Chairman issues a call for investigations and payloads desired to be flown and/or performed during the new increment being planned.*
- *RP Development Data Package goes out with the call and consists of:*
  - *A Research Plan Requirements Definition Planning Schedule*
  - *An Increment specific vehicle flight sequence schedule*
  - *Payload Candidate List Submittal Template (includes fight vehicle assignment request)*
  - *Payload 2-Pager Development Format (investigation description and basic ops)*
  - *Payload Tactical Plan data entry workbook address (computer based)*
  - *Experiment Summary request form*
  - *Target Milestone Chart for experiments requiring human subjects*



Increment Research Plan Development

Bodies In the Space Environment (BISE)

Canadian Space Agency | Agence spatiale canadienne

PROPOSAL NUMBERS
CSA: ILSRA-04-0198-0106

SCIENCE TEAM
Laurence R. Harris, Ph.D., R. T. Dyde, Ph.D.
M. R. Jenkin, Ph.D., H. L. Jenkin, Ph.D., J. E. Zacher
York University

2-pager example (Page 1)

RESEARCH OBJECTIVES
The specific objective of the present project is to conduct experiments during long-duration microgravity conditions to better understand how humans first adapt to microgravity and then re-adapt to normal gravity conditions upon return to earth. This experiment involves comparisons of pre-flight, flight, and post-flight perceptions and mental imagery, with special reference to spaceflight-related decreases in the vertical component of percepts.

OPERATIONS
Astronauts will conducted two OCHART Protocol sessions, once around flight day 10 and again around 2 weeks before return.
Floating aligned with the laptop display, the astronaut will view the laptop screen through the COGNI tunnel. On the laptop display, the astronaut will view a rotated character ('p' or 'd') superimposed over a highly polarized visual background. The background will be presented in different orientations. Via COGNI tunnel interface, the subject will indicate if the shape is recognized as a 'p' or a 'd'.

POINTS OF CONTACT
CSA Project Manager: Luc Lefebvre
Luc.Lefebre@space.gc.ca; (XXX) XXX-XXXX

Export Control Classification (NASA only): N/A

Laptop display testing

Hardware	*ESA on-board COGNI tunnel.* *Use of on-board laptop.* *Mechanical interface to adapt COGNI tunnel to laptop (ESA)*	
Facility/Interfaces	*Laptop*	
Late access	*No late access*	
Pre- flight session	*BDC Pre-flight*	*1 session/subject, 2.3 hrs* *L-90 40*
In-flight: # of sessions	*(1) Flight day 10 5* *(2) Return - 15 10* *Min. 60 days between sessions*	*~ 1h/subj/sess* *~ 1h/subj/sess*
Post-flight sessions	*(1) BDC Post-flight* *(2) BDC Post-flight*	*2 session/subject, 2.1 hrs +* *2.1 hrs ; R+60 15*
Early Retrieval	*No early retrieval*	
Target Subjects	*Execution (6 subjects, TBC) targeting 5 subjects for this*	
Total # of Subjects Required	*Short-term*	*N/A*
	Long-term	*6 subjects*
Ground reference	*No*	

Increment Research Plan Development

BISE – Increment 19/20 Scenario

Canadian Space Agency | Agence spatiale canadienne

Training:
-Hardware
Deploying the laptop and the Light Shield
Teardown
Stow
-BISE Software

Training may be combined with pre-flight BDC

Pre Flight BDC:
Establish a perceptual up model (3 protocols)
•OCHART protocol
•Luminous line protocol
•Shading protocol

Testing protocols in the second posture

Activity Table – Session 1

	Day	Activity	Duration	Comments
S1	FD10	Locate equipment	10 min	Subject 1
	FD10	Hardware Setup	25 min	Subject 1
	FD10	Laptop Config	05 min	Subject 1
	FD10	Subject preparation	10 min	Subject 1
	FD10	BISE-OCHART	25 min	Subject 1
	FD10	Teardown	10 min	Subject 1
	FD10	Data OPS file copy	05 min	Subject 1
	FD10	Downlink	05 min	Subject 1
	FD10	Stow	10 min	Subject 1
		TOTAL:	105	minutes
		TOTAL:	1.75	hrs

Activity Table – Session 2

	Day	Activity	Duration	Comments
S2	FD10	Locate equipment	10 min	Subject 1
	FD10	Hardware Setup	25 min	Subject 1
	FD10	Laptop Config	05 min	Subject 1
	FD10	Subject preparation	10 min	Subject 1
	FD10	BISE-OCHART	25 min	Subject 1
	FD10	Teardown	10 min	Subject 1
	FD10	Data OPS file copy	05 min	Subject 1
	FD10	Downlink	05 min	Subject 1
	FD10	Stow	10 min	Subject 1
		TOTAL:	105	minutes
		TOTAL:	1.75	hrs

Post Flight BDC:
•OCHART protocol
•Luminous line protocol
•Shading protocol

Testing protocols in the second posture

Note: If more than one subject per session, add 135 minutes for each additional subject.

2-pager example (Page 2)

Training	BDC	Inc 19 (crew TBD)	Inc 20 (crew TBD)	BDC

Russian segment:

US module: FD10 (5) Session 1 — R-15 (10) Session 2 | FD10 (5) Session 1 — R-15 (10) Session 2

Columbus:

Minimum 60 days between session

Increment 18 | Increment 19 | Increment 20

18S March09 | 19S May09 | Data Downlink | Data Downlink | ULF 3 Oct 09 | 19S Nov 09

Up: 16S
- ESA COGNI tunnel
- Interface between COGNI and laptop (ESA)

Up :
- Upload OCHART (software)

Down :
- NA

Mass up	*0.0 kg*
Mass down	*0.0 kg*

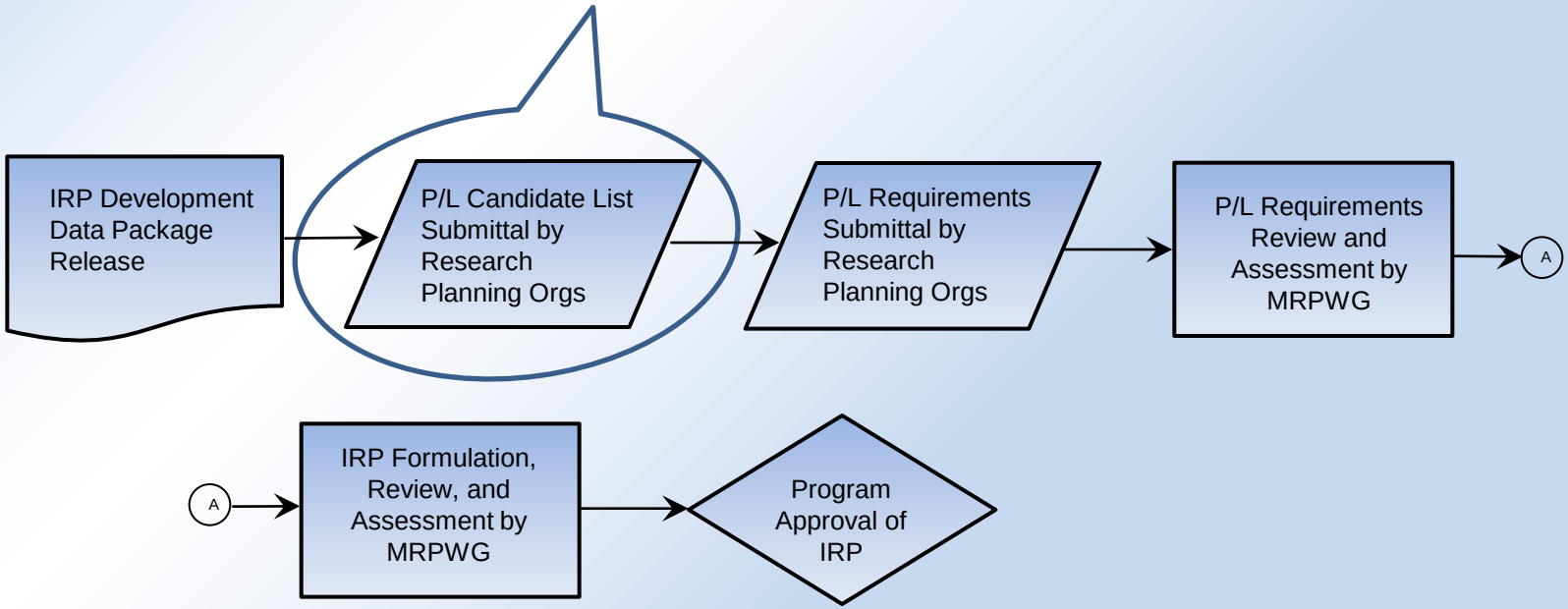
OZ4/Rod Lofton

Increment Research Plan Development

Step 2

P/L Candidate List Submittal by Research Planning Organizations

- *At approximately 17.5 months, research planning offices and/or payload developers submit their list of candidate payloads and payload resource requirements and activities desired to be performed during the increment being planned.*
- *Required resource specifications include the requested resupply vehicle flights (both ascent and descent) to be used, whether human subjects are needed for any investigations, and conditioned stowage/transport needs of investigation samples.*

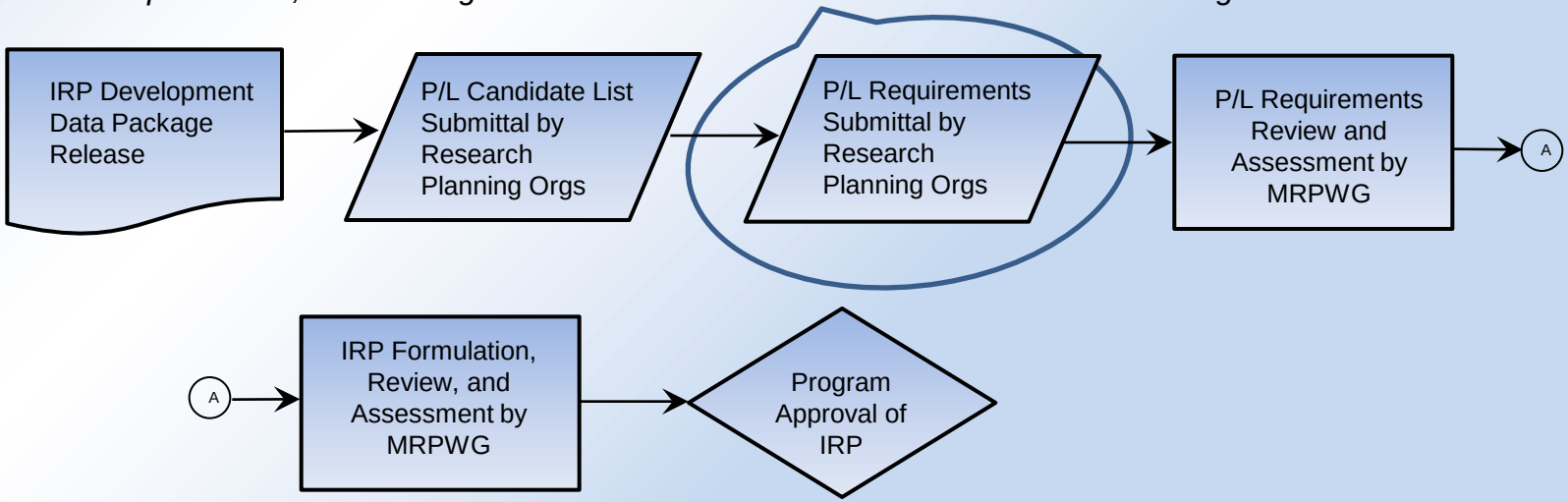


Increment Research Plan Development

Step 3

P/L Requirements Submittal by Research Planning Organizations

- *At approximately I-17 months, research planning offices and/or payload developers submit 2-Pager forms, PTP table development data, and narratives describing candidate research if new and updates to existing investigations descriptions if previously submitted for an earlier increment planning period.*
- *2-Pager forms describe in a summary fashion the investigation/payload major parameters and requirements*
  - *First page gives investigation name, sponsoring organization, research team members, investigation objectives and operations, list major payload hardware, and crew member usage requirements*
  - *Page 2 gives in graphical form the investigation operation scenario, depicting when payload hardware is desired to be transported to the ISS and results via samples, data cards, downlink data , etc. are brought to the ground from the station. Additionally, crew training, Baseline Data Collection requirements, and investigation session activities to be conducted on-board are given.*

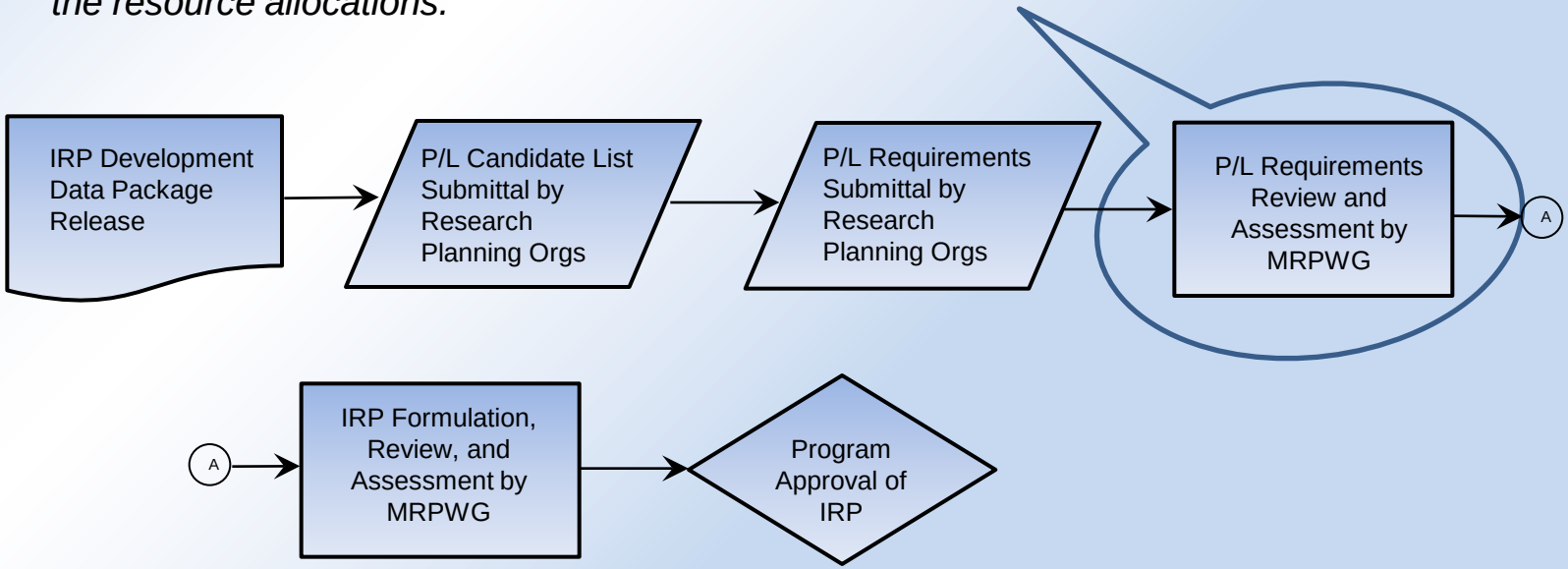


Increment Research Plan Development

Step 4

P/L Requirements Review and Assessment by MRPWG

- *At approximately I-17 months, review of submitted 2-Pager data and Payload Tactical Plan inputs begins. Review of the data occurs at special RPWG meetings some of which are MRPWG meetings with International Partners.*
- *The goal of these reviews is to get an in-depth understanding of each payload's requirements and constraints.*
- *Assessments involve comparison of the submitted payload requirements to the ISS Program specified resource allocations, principally up and down-mass, transport vehicle volume capability, and crew-time needs for on-orbit payload operations. Reviews focus on developing and evaluating changes to payload requirements that ensure the best IRP is formulated given the resource allocations.*

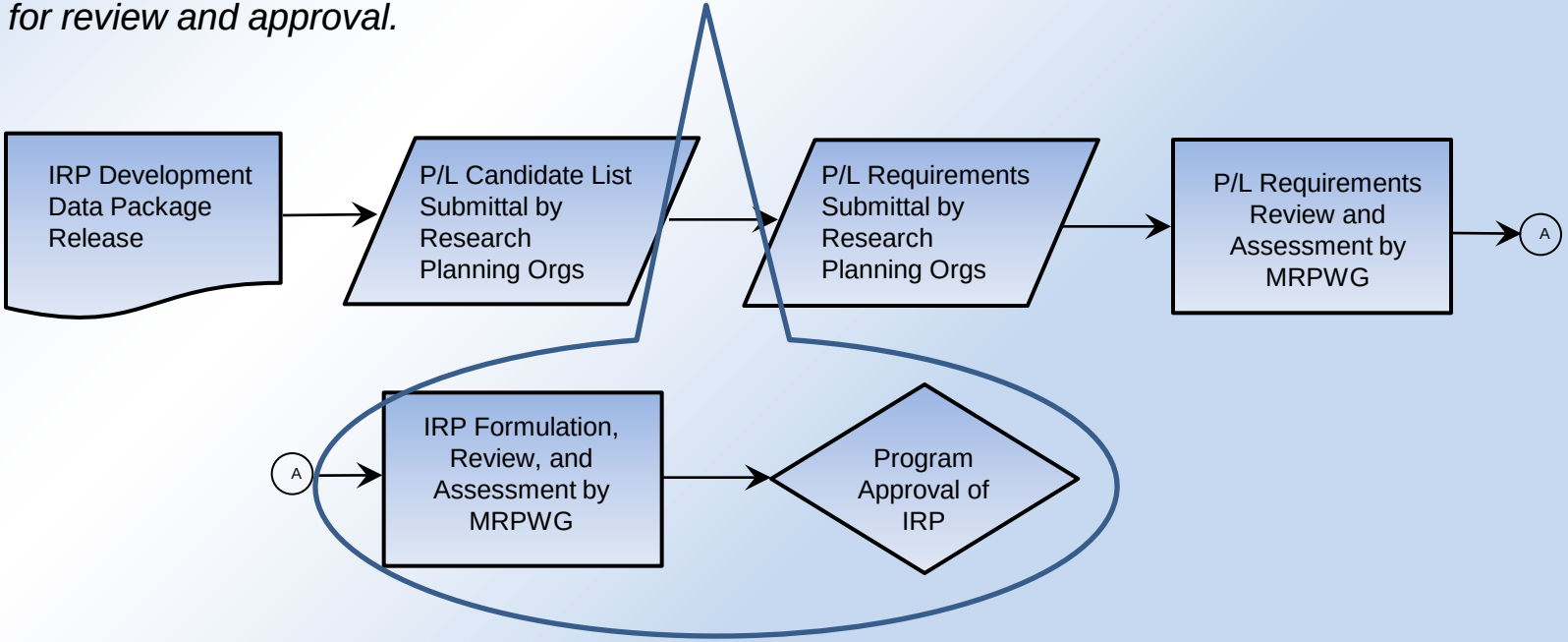


Increment Research Plan Development

Steps 5 6

Increment Research Plan Formulation and Approval

- *The MRPWG reviews the research plan which has been formulated into a presentation report put together by the Chairman of the MRPWG. This presentation includes listing and description of the proposed investigations and payloads, specification of the resource allocations, payload transportation requirements, manifest, and on-orbit crew time needs. Consensus is achieved on the recommendation to proceed forward to management reviews of the proposed IRP.*
- *Typically, at no later than I-12 months, the Chairman of the MRPWG presents the IRP to the Payloads Control Board (NASA internal) and to the Multilateral Payloads Control Board (MPCB) for review and approval.*



Increment Research Plan Elements

Research Investigation Lists

Investigation List

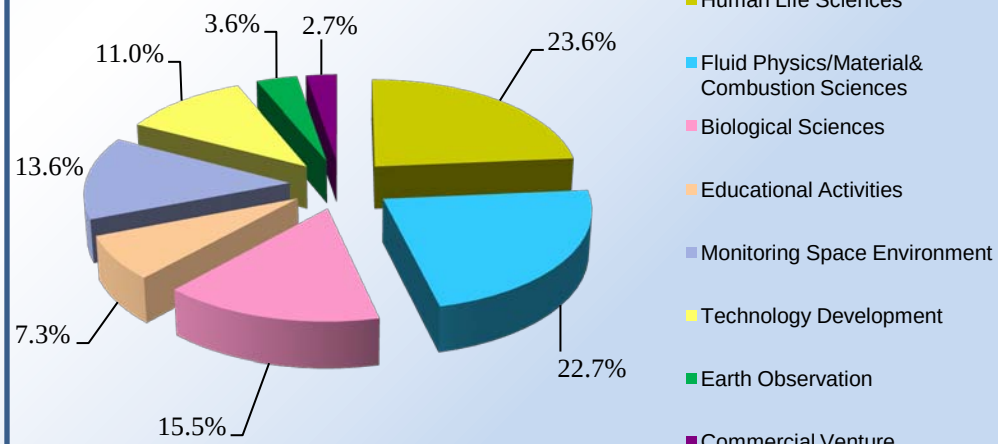
Investigation List

Investigation List

Investigation List

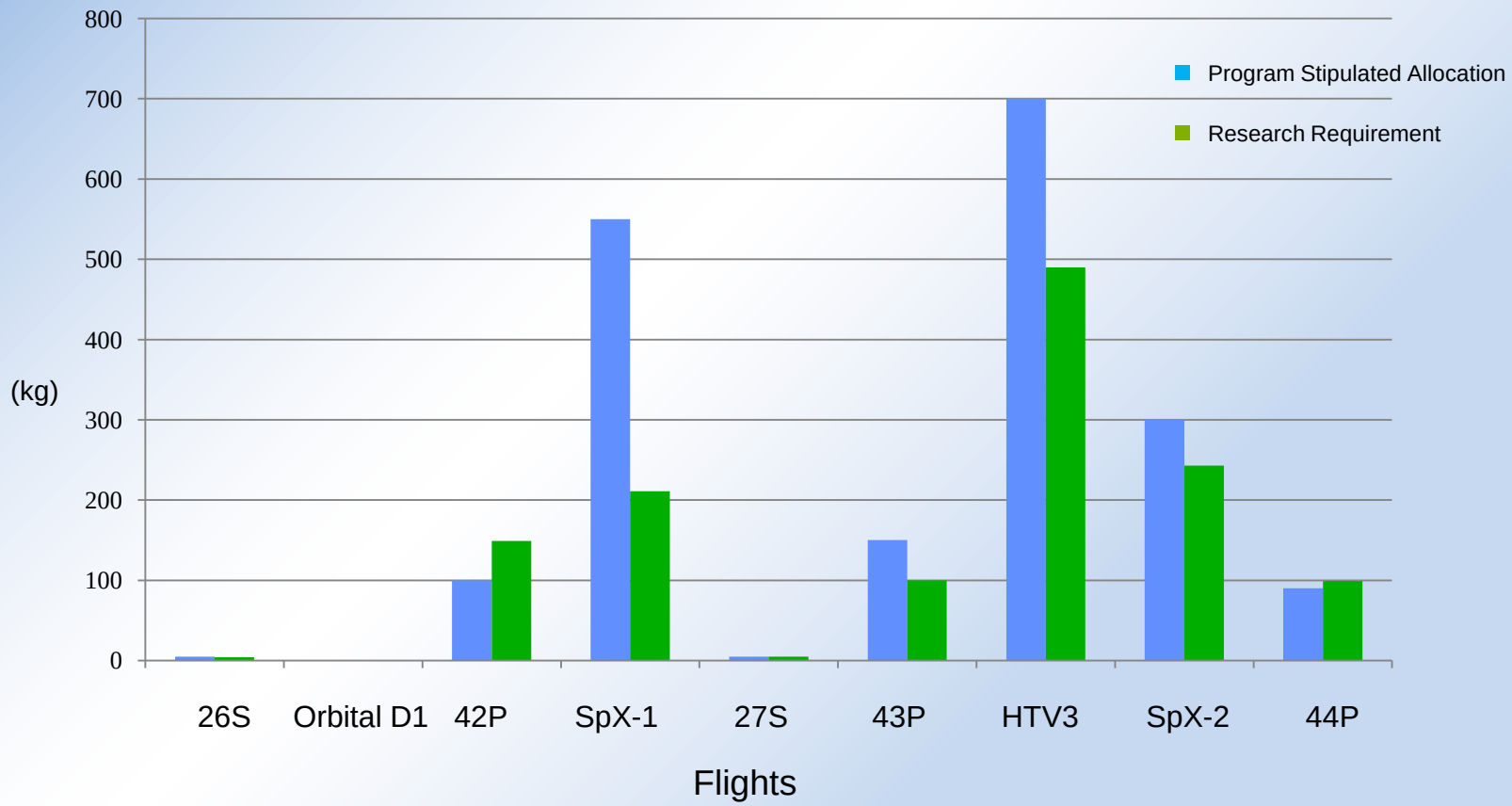
Investigation	Description	New	Prime Activity	Reserve Activity
Space Ops				
ALTEA Dosi	Will capture radiation particle flux data within the ISS	-	Yes	-
Disruptive Tolerant Network (DTN)	Investigated communication between intermittantly connected comm. nodes	-	Yes	-
SNFM	Analyzes and troubleshoot local area network data traffic of racks	-	Yes	-
Space Comm And Navigation	Will investigate reconfigurable Software Devined Radio technology	Yes	Yes	-
Human Research Program				
Bisphosphonates	Test whether antiresorptive agents help reduce bone loss	-	Yes	-
Functional Task Test (pre/postflight)	Will identify critical mission tasks impacted by exposure to microgravity	-	Yes	-
Integrated Cardiovascular	Determines the magnitude of left and right ventricular atrophy	-	Yes	Yes
Integrated Immune	Monitor immune function of crew (both long duration and short duration)	-	Yes	Yes
Nutrition	Designed to gain better understanding of nutrition-related changes	-	Yes	Yes
Reaction SelfTest	Evaluates extent to which PVT performance is sensitive to fatigue	-	Yes	-
Repository	Collection of biological samples for archiving for future research	-	Yes	-
Sleep Long	Monitory sleep cycles of long duration crew	-	Yes	-
Pro K (Protection against bone loss)	Test hypothesis that decrease in protein to potassium ration will decrease bone loss	-	Yes	-
VO2 Max	Measure maximal oxygen uptake during and following space flight	-	Yes	-
IRATS	Integrated Resistance and Aerobic Training Study to evaluate efficacy	Yes	Yes	-
ISS - KSC				
None				
ARC Non-Exploration Projects				
Seed Growth 1	Studies the effects of gravity levels on the tropistip responses of plant seedlings	-	Yes	-
Micro4	Group Activation Packs containing various biosamples	Yes	Yes	-

Investigations Distribution



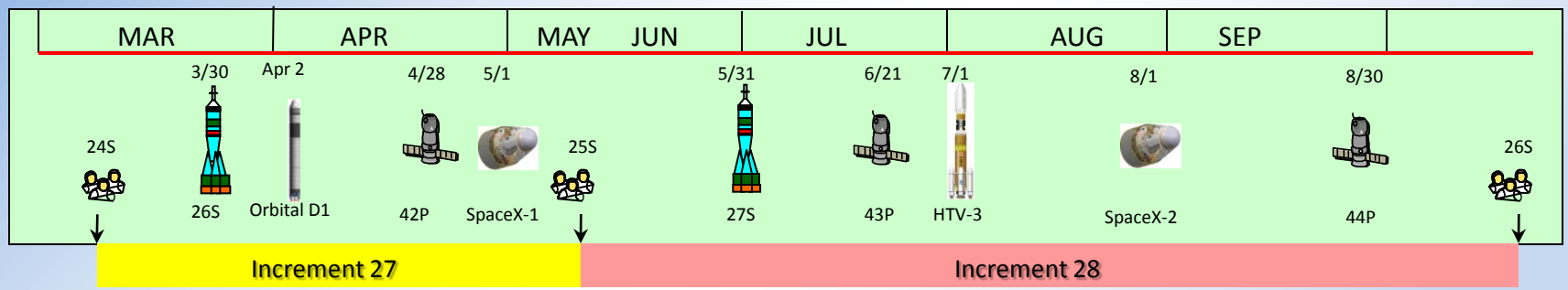
Increment Research Plan Elements

Up-mass Requirements versus Allocation Graph



Increment Research Plan Elements

Transportation Traffic Plan and Manifest - Launch



CSA

- *None*

ESA

- *CARD Items*
- *ESA EPO*
- *GRAVI-2 Items*
- *SOLO Items*
- *ESA Cold Stowage Boxes, ECCO Bags*

JAXA

- *Onboard Diagnostic Kit*
- *TEM for CRS-1*
- *Commercial for Inc 27 & 28*
- *JAXA EPO (Try Z-g)*

NASA

- *Cube Lab Resupply-8, 10, 11 & 12*
- *HRP Sample Collection Kits*
- *HRF Pantry Items*
- *Seed Growth-2*
- *Micro4*
- *NIH-1 & 2 GAPs*
- *NLP Cells-7*

CSA

- *Vascular Blood Collection Kit*

ESA

- *SOLO Blood & Urine Kits*
- *Vessel Imaging Ultrasound Kit*
- *FASTER Experiment Unit*
- *FASTER Facility Controller & EDR Drawer*
- *Portable PFS ORU*
- *ENERGY Hardware*
- *ESA Cold Stowage Boxes*

JAXA

- *JAXA EPO7*
- *Myco (inc 27-28)*
- *Onboard Diagnostic Kit*
- *Alloy Semiconductor Items*
- *Aquatic Habitat and Fixation Tubes*
- *Ice Crystal 2*
- *Nano Step*
- *Dynamic Surf*
- *Microbe-III*
- *Eval of Onboard Diagnostic Kit*
- *MCE Attached Payload*

NASA

- *Cube Lab Resupply-4*
- *Cube Lab Resupply-13*
- *Cube Lab Resupply-15*
- *Cube Lab Resupply-16*
- *HRP Sample Collection Kits*
- *HRF Pantry Items*
- *Integrated Immune Kits*
- *Re-entry Breakup Recorder*
- *MSL Batch 2a SCAs*
- *PFS Gas Cylinders*
- *VO2max Resupply Kit*
- *SpaceDRUMS Carousels, Debris Traps*
- *NIH-3 ADF*
- *USDA-1 ADVASC*
- *NLP Cells-8*
- *NLP Cells-9*
- *NLP Vaccine-18*
- *NLP Vaccine-19*
- *CSI-06 Ecosystem Habitat*
- *SCAN (CoNNeCT)*
- *Seed Growth-1*
- *GLACIER, Cold bags*

Increment Research Plan Elements

Crew time Needs - Research Activity Table

Allocation versus Requirements Summary

	Program Allocations (hrs)	**Planning Allocations** Prime (hrs)	**Planning Prime** (hrs)	**Planning Reserve** (hrs)
Total	875.0	875.0	868.6	346.7
NASA	-	691.3	*675.4*	*196.3*
JAXA	-	93.6	*94.3*	*69.1*
ESA	-	72.6	*78.9*	*41.3*
CSA	-	17.5	*20.0*	*40.0*

OZ4/Rod Lofton

Summary

- *The Research Planning Process involves the development of an Increment Research Plan which indentifies integrated research investigation and payload requirements desired to be implemented as part of ISS on-orbit increment activities. These requirements are specified by the various research planning organizations across NASA, other US Governmental agencies, ISS International Partners, and the private sector.*

- *The Increment Research Plan is developed over a 6 month period by the Multilateral Research Planning Working Group and is composed on investigation lists, ISS resource allocation specifications, payload manifests, and tables of on-orbit resource needs.*

- *Upon approval of the Increment Research Plan by the Multilateral Payloads Control Board, the IRP is used as the basis for development of the IDRD Annex 5: Payloads Tactical Plan document which is used to formally document all of the Utilization requirements (science, training, support equipment, etc.) for particular increments.*

Acronyms & Abbreviations

ARC	Ames Research Center
BDC	Baseline Data Collection
ESMD	Exploration Systems Mission Directorate
GRC	Glenn Research Center
HRP	Human Research Program
HTV	H-II Transfer Vehicle
IDRD	Increment Definition and Requirements Document
IP	International Partner
IRP	Increment Research Plan
ISSPO	ISS Program Office
JSC	Johnson Space Center
LIS	Lead Increment Scientist
LSH	Life Sciences Habitation
MPCB	Multilateral Payloads Control Board
MRPWG	Multilateral Research Planning Working Group
MSFC	Marshall Space Flight Center
NLO	National Lab Office
PI/PS	Principal Investigator/Project Scientist
P/L	Payload
PMIT	Payload Mission Integration Team
PTP	Payload Tactical Plan
RPWG	Research Planning Working Group
RP	Research Plan
SMD	Space Mission Directorate
SOMD	Space Operations Mission Directorate
SpaceX	Space Exploration Technologies Company
SpX	SpaceX