INTERNATIONAL SPACE STATION PAYLOAD INTEGRATION

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ISS Payload Philosophy

Our goal is to fly and operate a payload as soon as it is ready

To operate the ISS like a laboratory to enable the flexibility for investigators to adapt their research plan based on new and unexpected findings

Examples:

- Increased air to ground communication channels allows the crew to talk directly to the scientists during operations to review research objectives, discuss observations and findings and collaborate on new ideas
- Improved data rates and on board diagnostic equipment allows researchers to get their results without waiting for the hardware and samples to be returned shortening the research cycle

To continue to make the integration and operation of payloads on ISS as simple and ground like as possible

Examples:

- Implemented a software environment to allow the use of common lab software on-orbit
- Certified 110v AC power source with commercial power connectors
- Continue expand our remote laptop operation system that allows you to operate your payload anywhere the internet is available
- Deploying a payload test set that allows our customer to conduct their end to end testing and verification at their facility
- Delay Tolerant Network = send and ignore

Payload Planning Overview

Strategic Research planning and resource projection is conducted annually by looking forward 3 years to determine if the ISS transportation and on orbit resources are adequate to meet the customer research requirements

Findings from this review provide the program with recommendations on hardware and resource improvements

Recommendations the program is implementing:

- Additional conditioned cargo return required by 2014
- Second glove box to increase utilization capability
- Additional external sites will be required post 2016
- Additional external data capacity required to support external sites

Increment specific Research Planning begins 18 months prior to the mission

The first Research Plan is baselined12 months prior to the mission and refined up to the start of the increment where it transitions to the real time planning and execute phase

Depending on its complexity a Payload can be entered into the plan any where along the process

Payload Design and Verification

ISS has well defined interfaces allowing payloads to be designed with minimal risk and ground testing

ISS provides flight support equipment and interfacing hardware to reduce payload developers design time and hardware cost

The ISS laboratory environment allows greater payload design flexibility

Examples:

- NASA's over-site of a payloads design is focused on ensuring crew and vehicle safety not the developers design approach
- Payloads can be designed with less system redundancy, lower parts certification than systems hardware, i.e. Class "D"

The program has stratified hardware verification, testing and crew training to reduce planning and manifesting templates

Examples:

- Hardware that is ready to fly can be added to our research plan and flown in months, weeks and even days depending on the complexity of the devise
- Crew training can be performed on orbit just in time for operations

Payload Key Milestones

Payload design requirements and interface data definition begins in the early stages of the payload development and are base lined at the payloads' Critical Design Review

Payload application software loads that need to be tested with the on board compliment for that mission is delivered 7 months prior to the mission

Payload training products need to be complete by 1 month prior to start of crew ground training. On-orbit training can be delivered, up linked and performed any time prior to planned operations.

Pressurized Payload Key Milestones

Payload cargo can be manifested as early as 12 months prior to the mission

Space is reserved for payloads that are defined later in the planning process

- Manifests are revised within reason until vehicle packing occurs

Delivery of cargo to the packing site is driven by vehicle type and when and where the payload cargo needs to be stowed

- HTV Launch minus 6.5 months for early stow, Launch minus 60 days to 14 days for late stow
- Space X Launch minus 2 months for early stow, Launch minus 21 to 2 days for late stow

External Payload Key Milestones

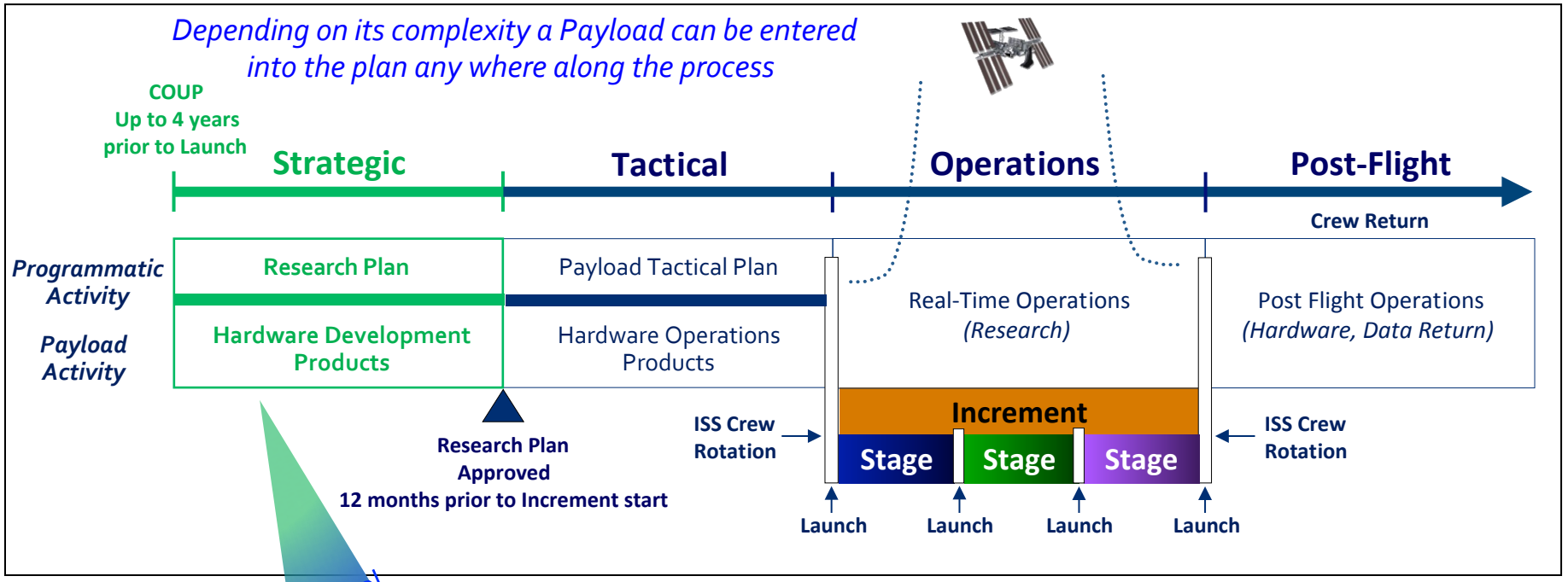
Vehicle type and manufacturing lead time for vehicle flight support equipment determines manifest assignments to launch vehicles:

- HTV Launch minus 24 months
- Space X Launch minus 18 months

Delivery date to the launch site to begin vehicle integration is determined by the carrier:

- HTV Launch minus 6 months
- Space X Launch minus 1 month

Strategic Planning Phase



WHO: Points of Contact

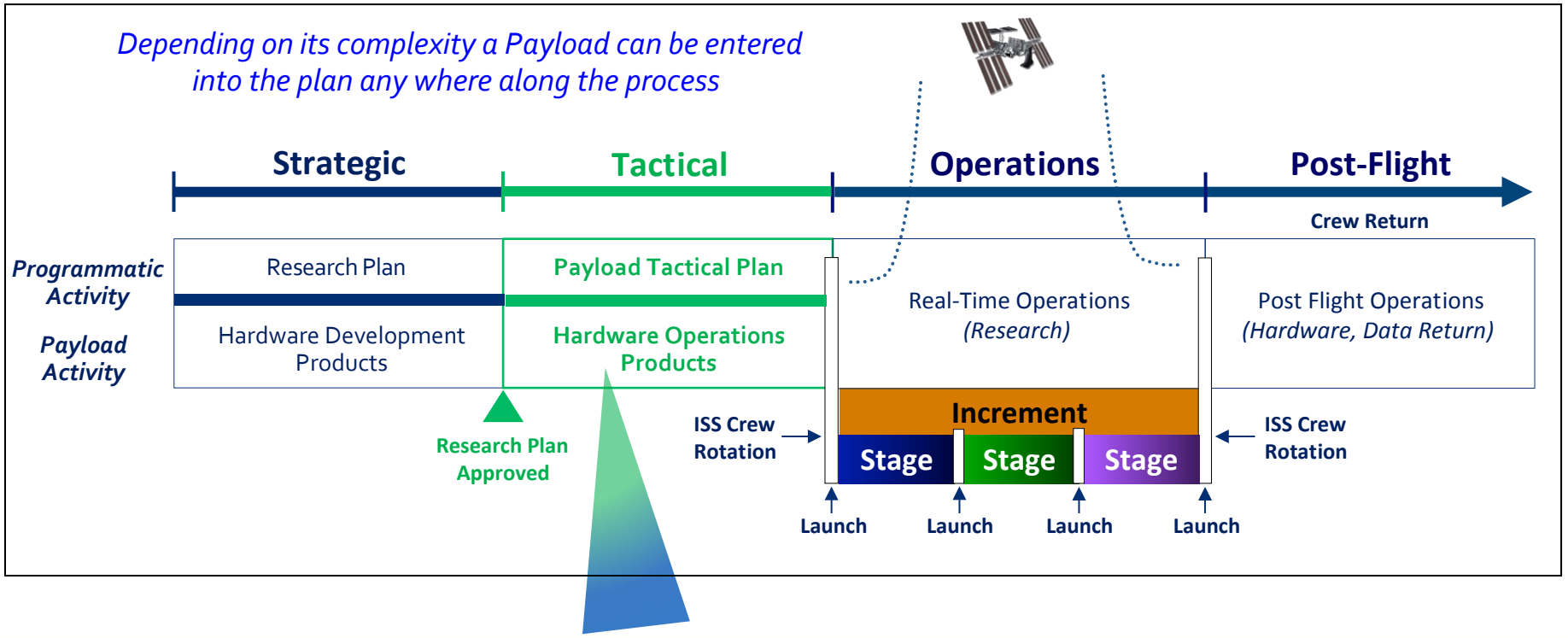
WHAT: Requirements Definition

WHEN: Operations Plan

WHERE: Launch and On-Orbit Requirements

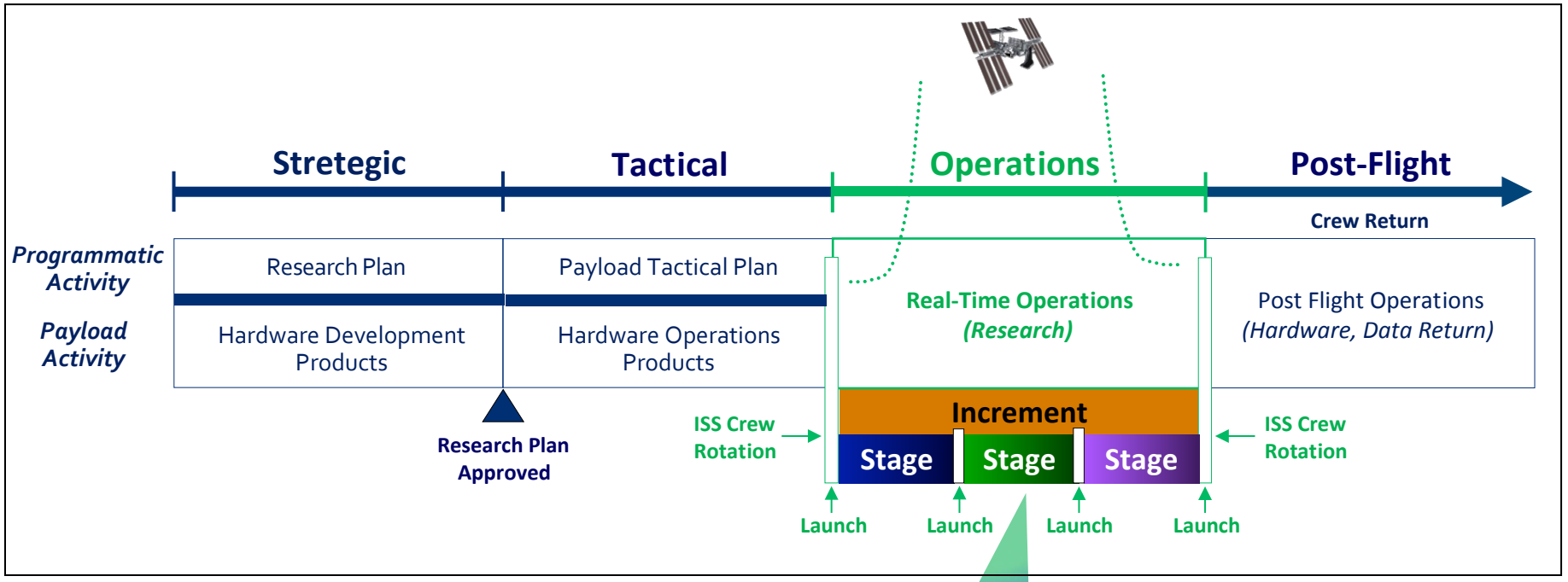
WHY: Investigation Objectives

Tactical Planning Phase



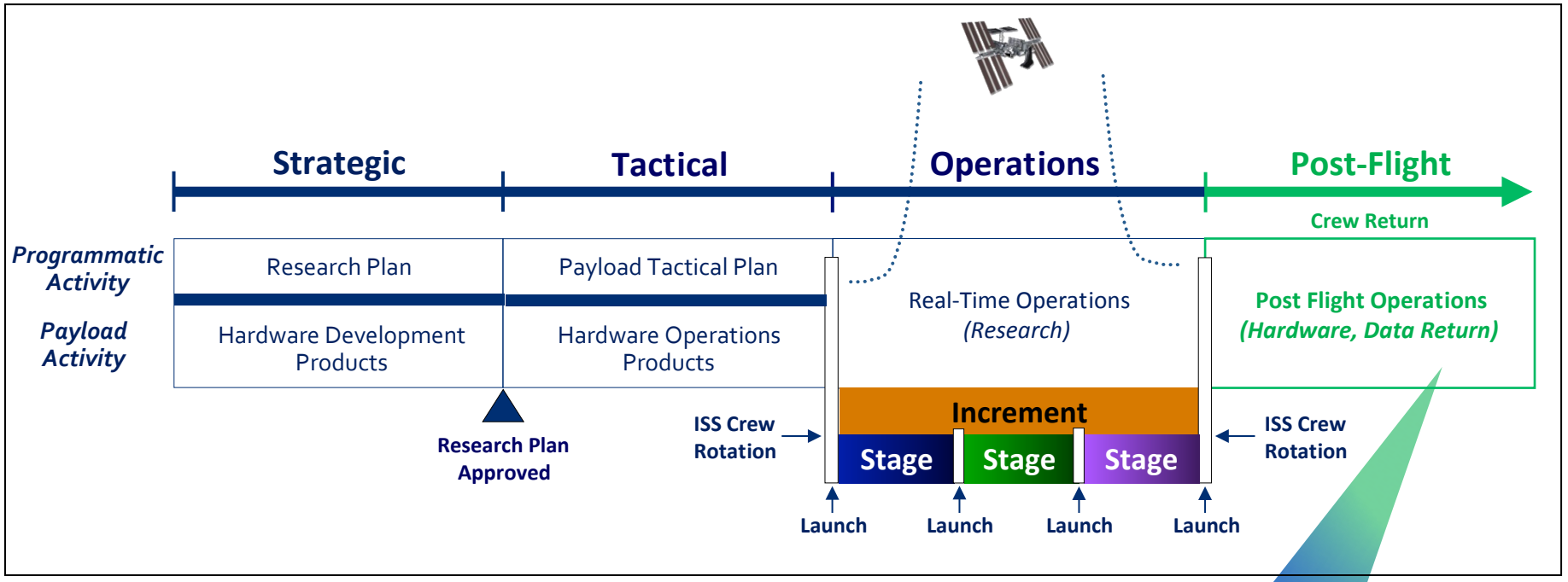
- Changes to Baselined Research Plan
- Training Products and Procedures
- Safety Review Packages
- Hardware Verification Data
- Software Verification Data

Operations Phase



- Investigator Participation Real-Time (e.g., Console Operations)
- Crew Conferences
- Anomaly Resolution
- Data Collection and Sample Return

Post-Flight Phase



- Research Summary Updates
- 30-Day Reports
- Formal Publications