Safety Characteristics In System Application Software For Human Rated Exploration

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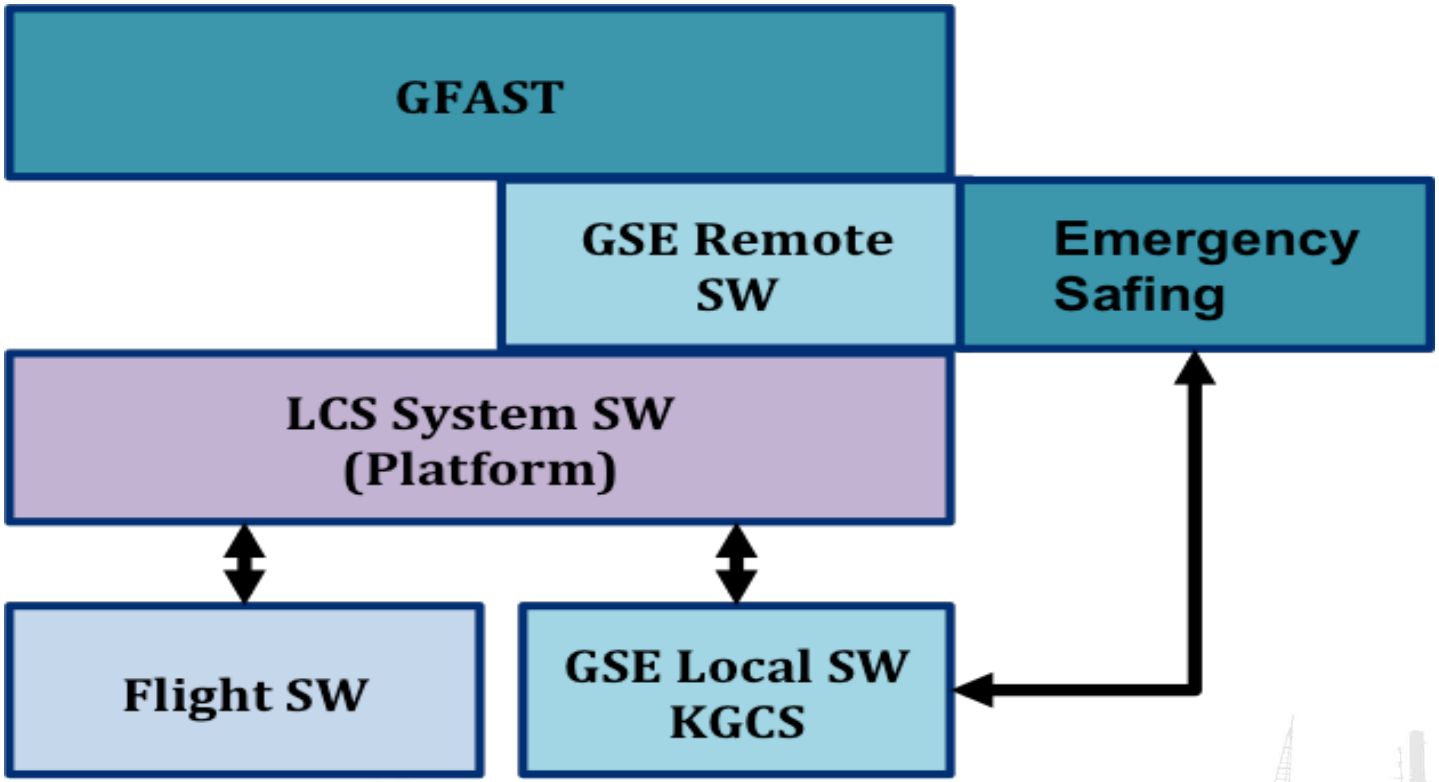
Exploration Systems Enterprise Structure

- Develop Human Rated capabilities for exploration class missions into our solar system
- Exploration System Directorate in NASA HQ
- Three separate Programs cross integrated
- JSC – Orion
- MSFC – Space Launch
- System (SLS)
- KSC – Ground System Development and Operations (GSDO)
  - Command and Control is a project under GSDO

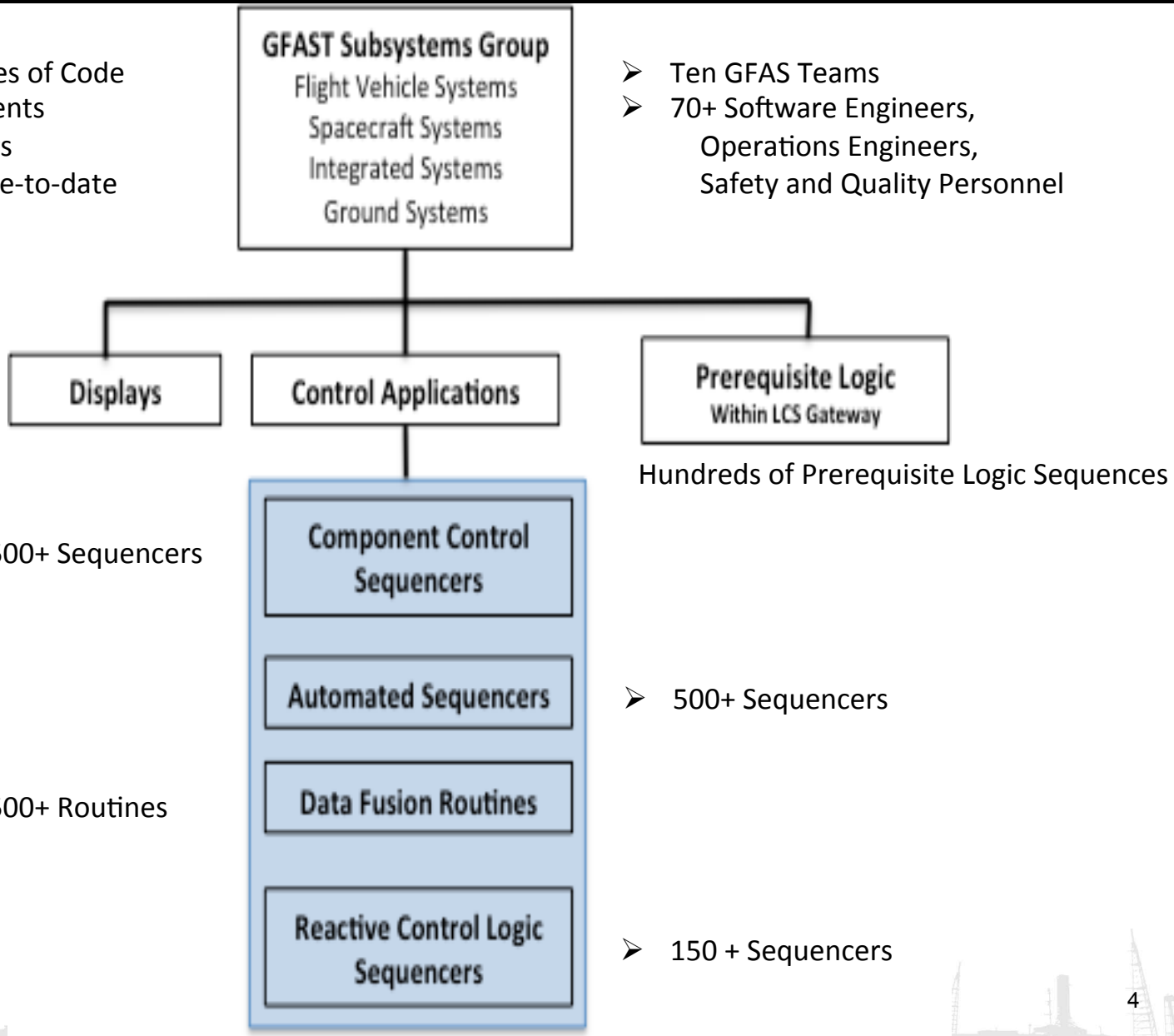
Ground and Flight Application Software (GFAS)

- GFAS applications integrate the flight software packages of the Orion, the flight software of the SLS, and the ground control systems through the LCS
- Developing the integrated firing room console applications and displays for pre and post launch activities to support flight and ground processing and integrated ground subsystem processing as required for Orion, Core Stage, Booster and ICPS



GFAS Structure

- Over 1.5 Million Lines of Code
- 80,000+ measurements
- About 370,000 hours
- About 30% Complete-to-date



- Ten GFAS Teams
- 70+ Software Engineers, Operations Engineers, Safety and Quality Personnel

- 1200 + Displays

Hundreds of Prerequisite Logic Sequences

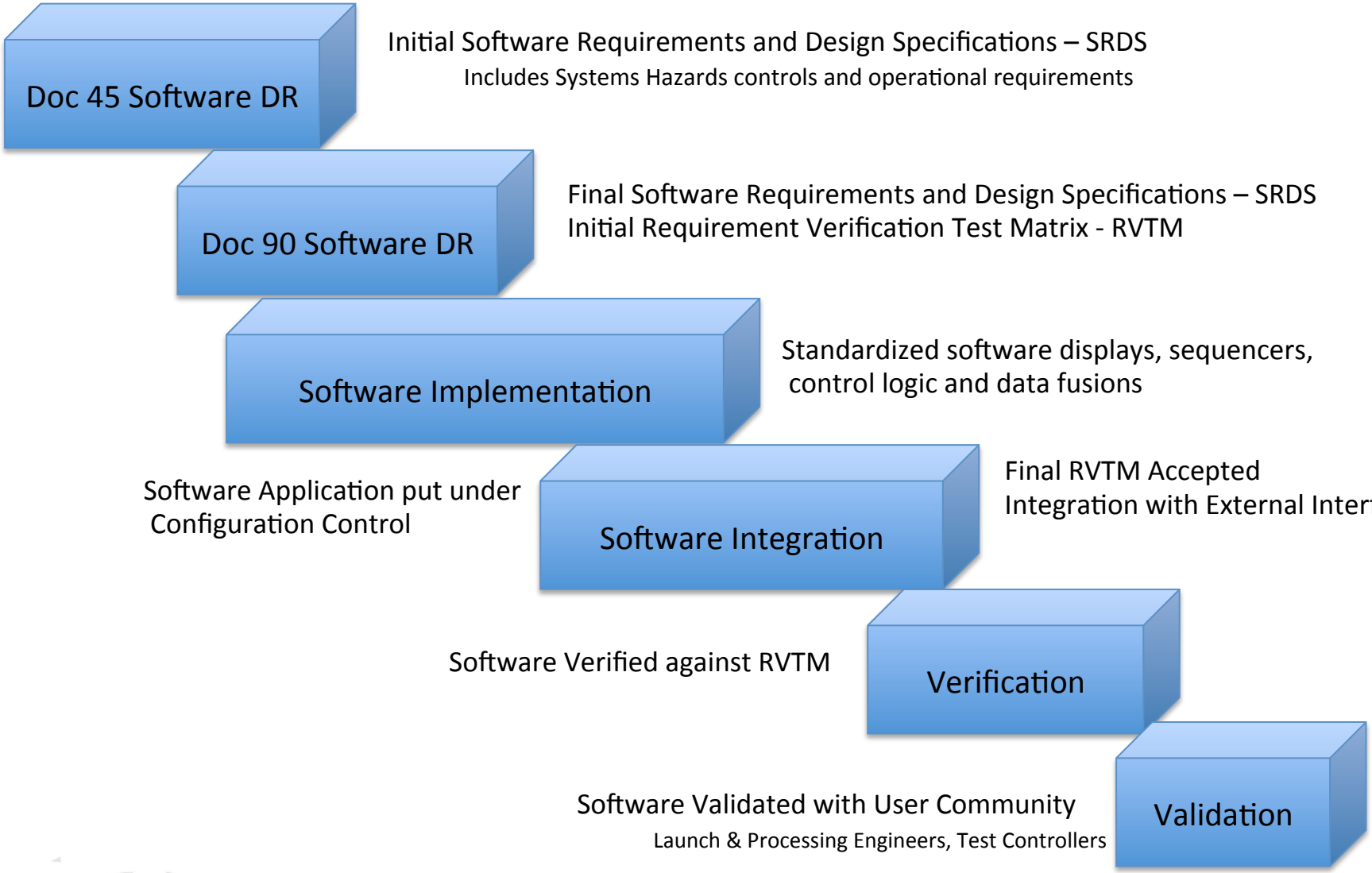
- 500+ Sequencers

- 500+ Sequencers

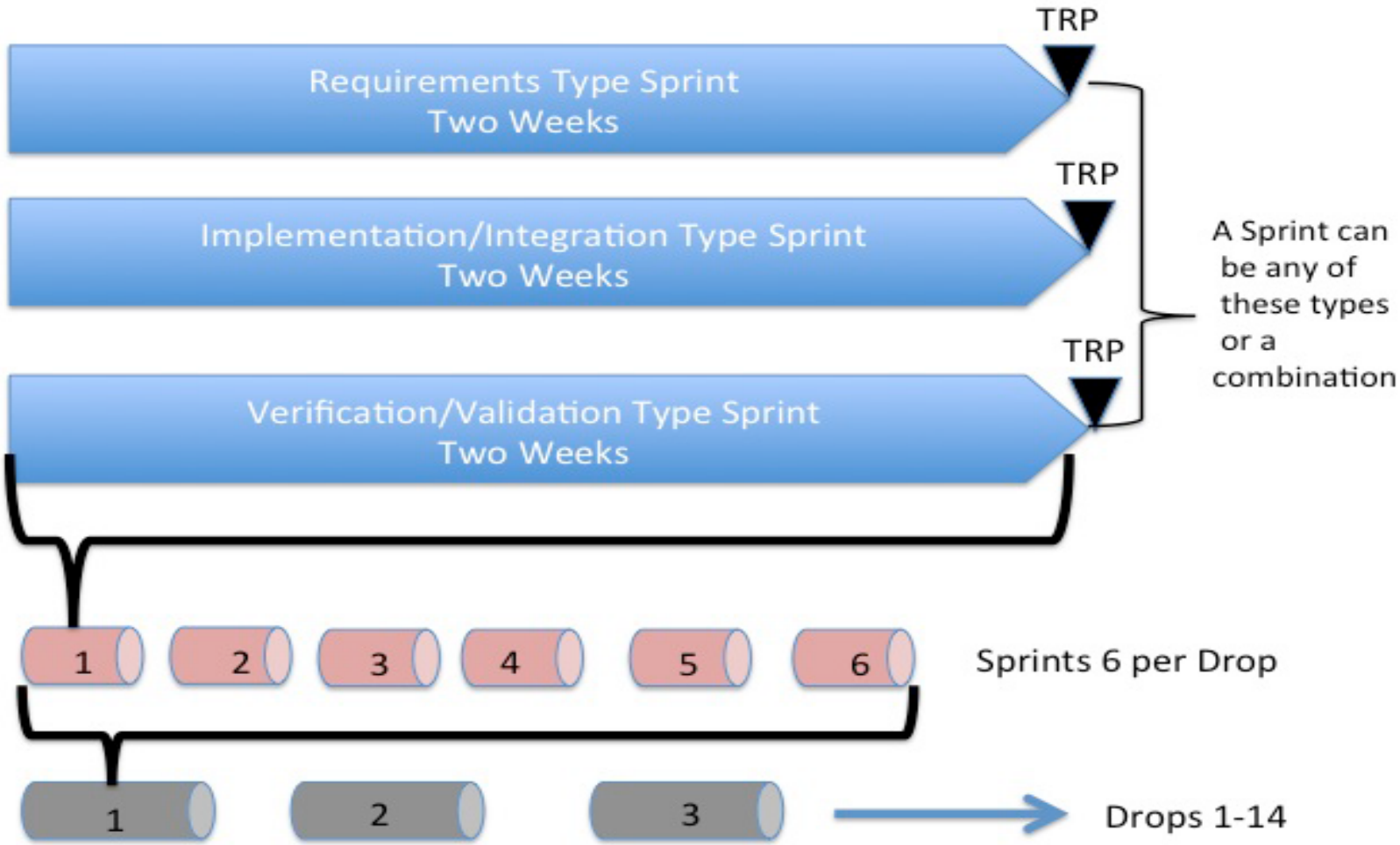
- 500+ Routines

- 150 + Sequencers

GFAST Software Design Lifecycle

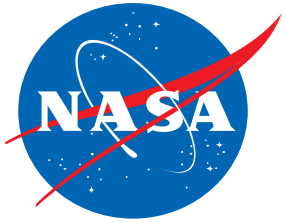


GFAS Agile Development Process

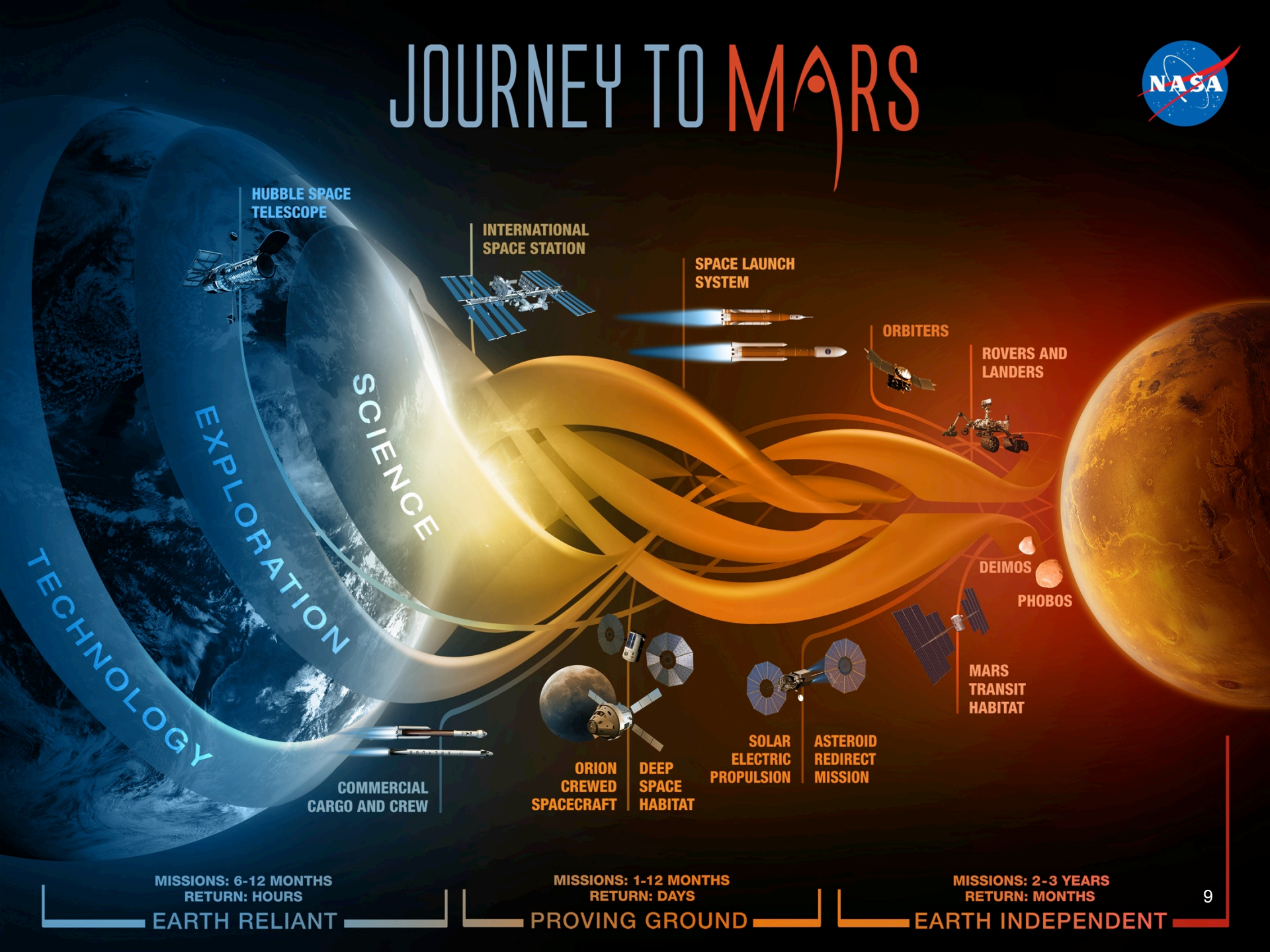


- Five Overarching Software Safety Characteristics

- Comply with NASA NPR 7150.2B Class A Classification for Human Spaceflight Systems
- GFAS system safety engineers embedded into the GFAS Teams to ensure proper implementation of hazard controls and operational safety requirements are included in the software code
- Software safety engineers concurrence on software displays, sequencers, control logic and data fusions are standardized
- Quality engineering supports the engineering reviews and verification/ validation preparations to ensures each step of the SRDS is reflected in the RVTM and in the corresponding Verification and validation processes
- Software configuration control from initial implementation through final TCID Build with clear tractability



Questions?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DEIMOS
PHOBOS
MARS TRANSIT HABITAT
COMMERCIAL CARGO AND CREW
ORION CREWED SPACECRAFT
DEEP SPACE HABITAT
SOLAR ELECTRIC PROPULSION
ASTEROID REDIRECT MISSION
MISSIONS: 6-12 MONTHS
RETURN: HOURS
EARTH RELIANT
MISSIONS: 1-12 MONTHS
RETURN: DAYS
PROVING GROUND
MISSIONS: 2-3 YEARS
RETURN: MONTHS
EARTH INDEPENDENT