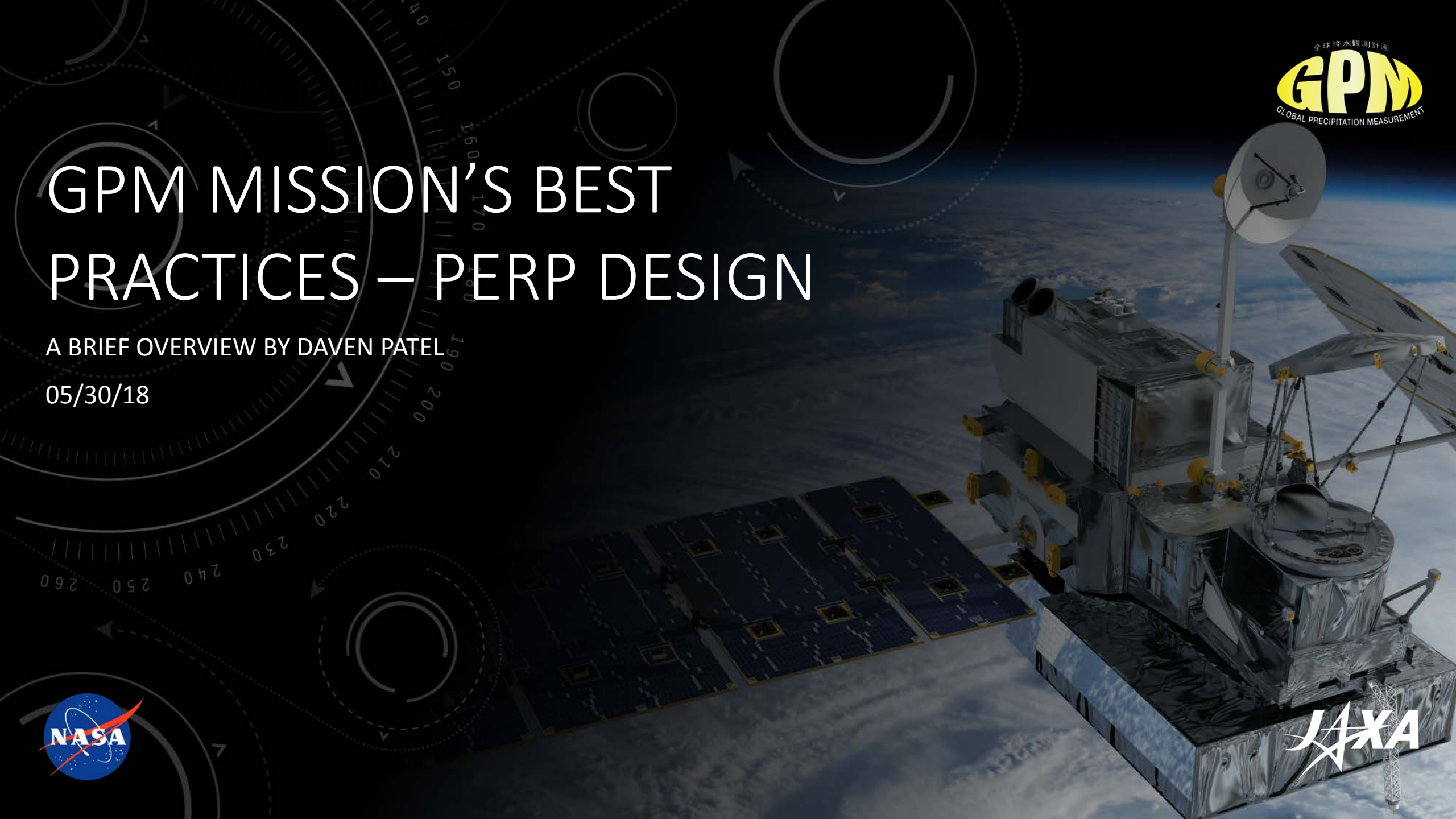
GPM MISSION'S BEST PRACTICES – PERP DESIGN

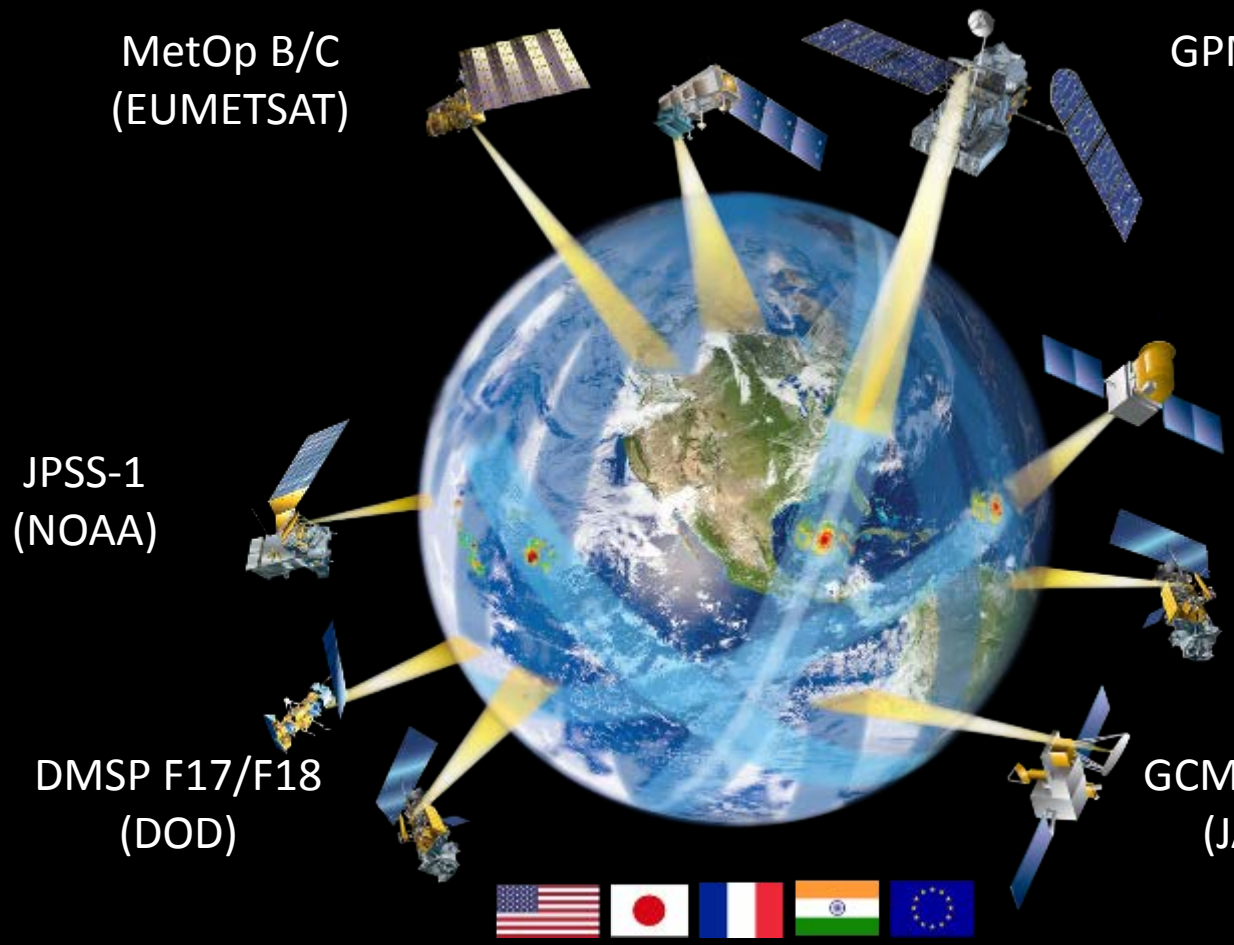
A BRIEF OVERVIEW BY DAVEN PATEL

05/30/18



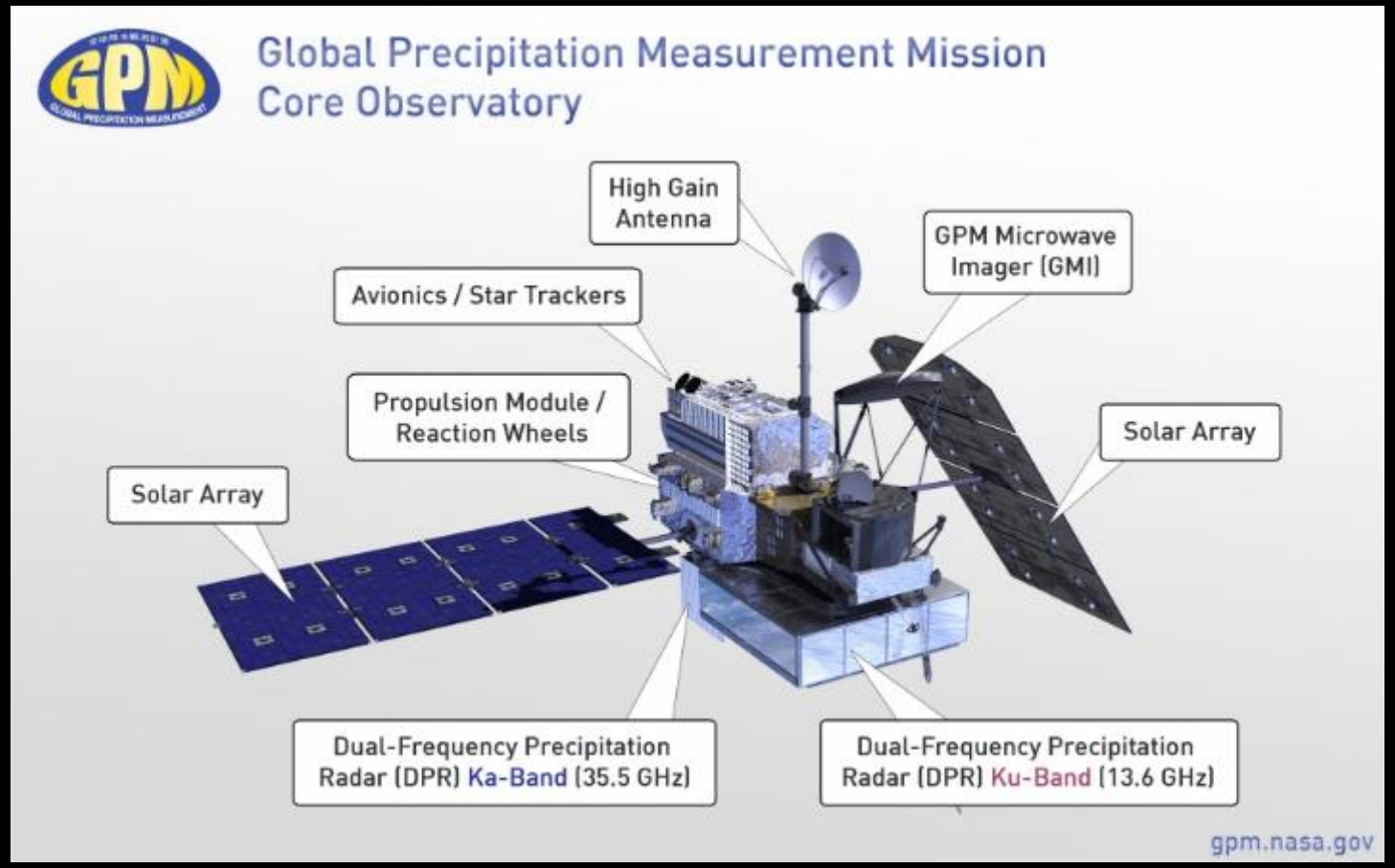
GPM – GLOBAL PRECIPITATION MEASUREMENT

CONSTELLATION OVERVIEW



GPM – GLOBAL PRECIPITATION MEASUREMENT

SPACECRAFT OVERVIEW



GPM – GLOBAL PRECIPITATION MEASUREMENT

MISSION OVERVIEW

- Advancing precipitation measurement capability from space
- Improving knowledge of precipitation systems, water cycle variability, and fresh water availability
- Improving climate modeling and prediction
- Improving weather predication and 4-D climate reanalysis
- Improving hydrometeorological modeling and prediction

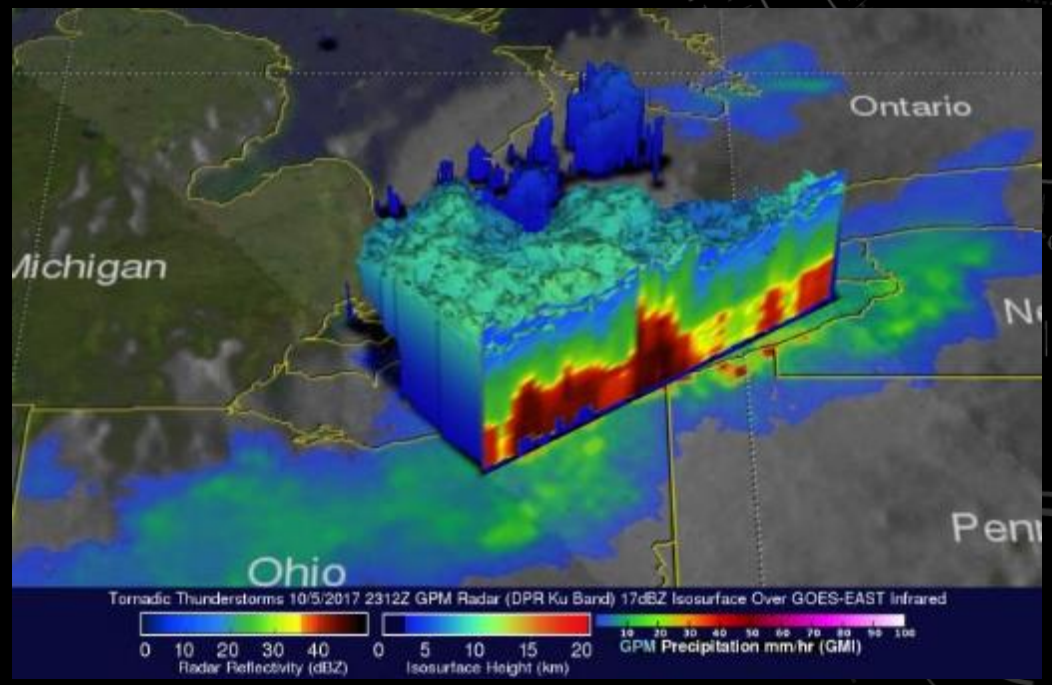
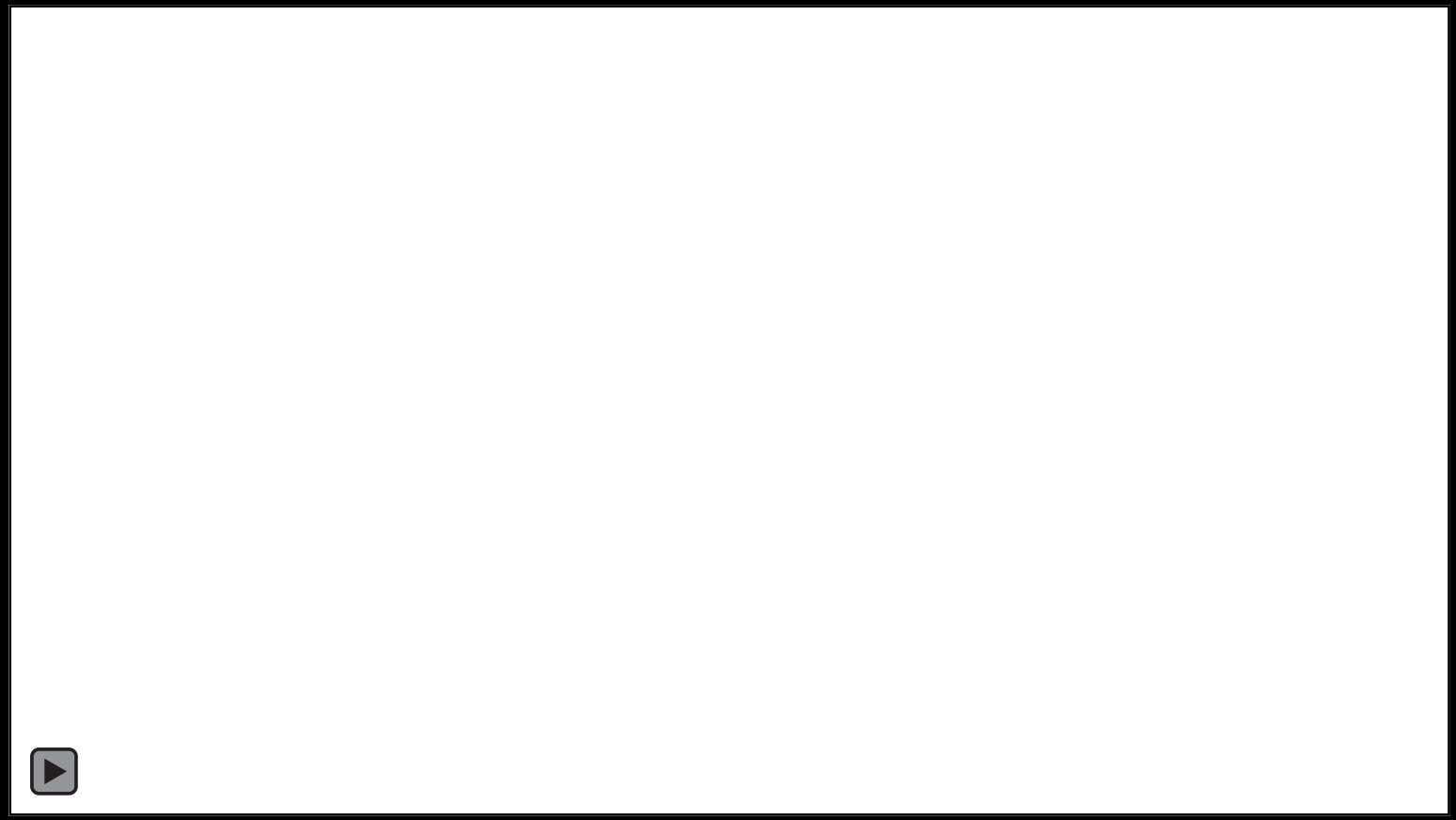


Image credit: NASA/JAXA, Hal Pierce

GPM – GLOBAL PRECIPITATION MEASUREMENT

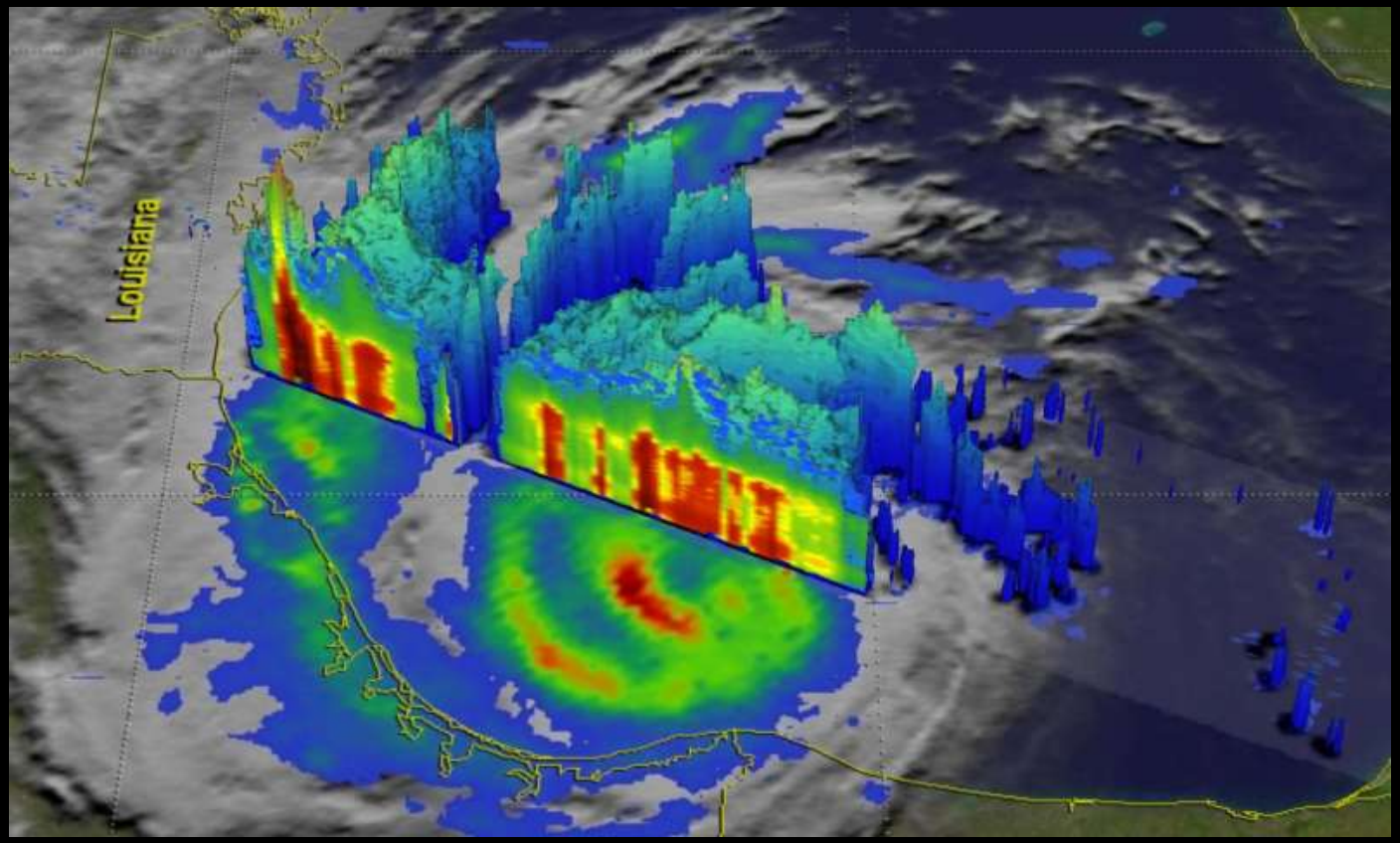
INTEGRATED MULTI-SATELLITE RETRIEVALS FOR GPM (IMERG) SCIENCE PRODUCT



https://go.usa.gov/xNESIR

GPM – GLOBAL PRECIPITATION MEASUREMENT

PRECIPITATION PROCESSING SYSTEM (PPS) SCIENCE PRODUCT



Hurricane Harvey on Aug. 25, at 1150 UTC. Rain rate greater than 82 mm/hr.

Image Credit: NASA/JAXA, Hal Pierce

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GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

COMMAND AND DATA HANDLING OVERVIEW

- RAD750
  - 36 MB SRAM
  - 8 MB SRAM for SpaceWire
  - 4 MB EEPROM
  - SpaceWire router
  - MIL-STD-1553

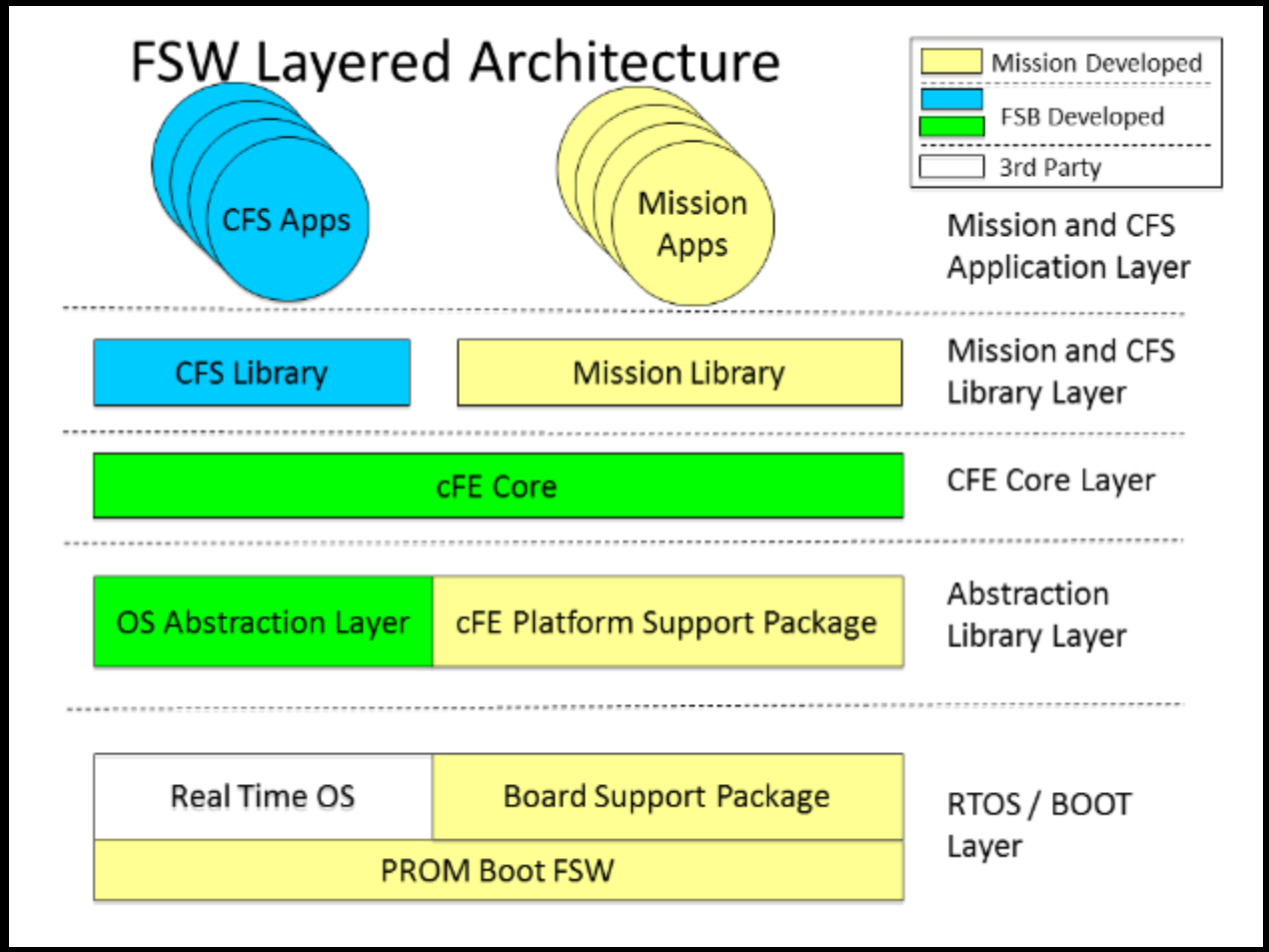
GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

COMMAND AND DATA HANDLING OVERVIEW

- EEPROM File System (EEFS)
  - Core Flight Executive (cFE) Startup Scripts
  - Uncompressed cFE Object Files
  - Default FSW Binary Table Files
  - Compressed Application Object Files
  - Libraries for all GPM FSW applications
- Local SRAM
  - All applications and tables

GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

COMMAND AND DATA HANDLING OVERVIEW



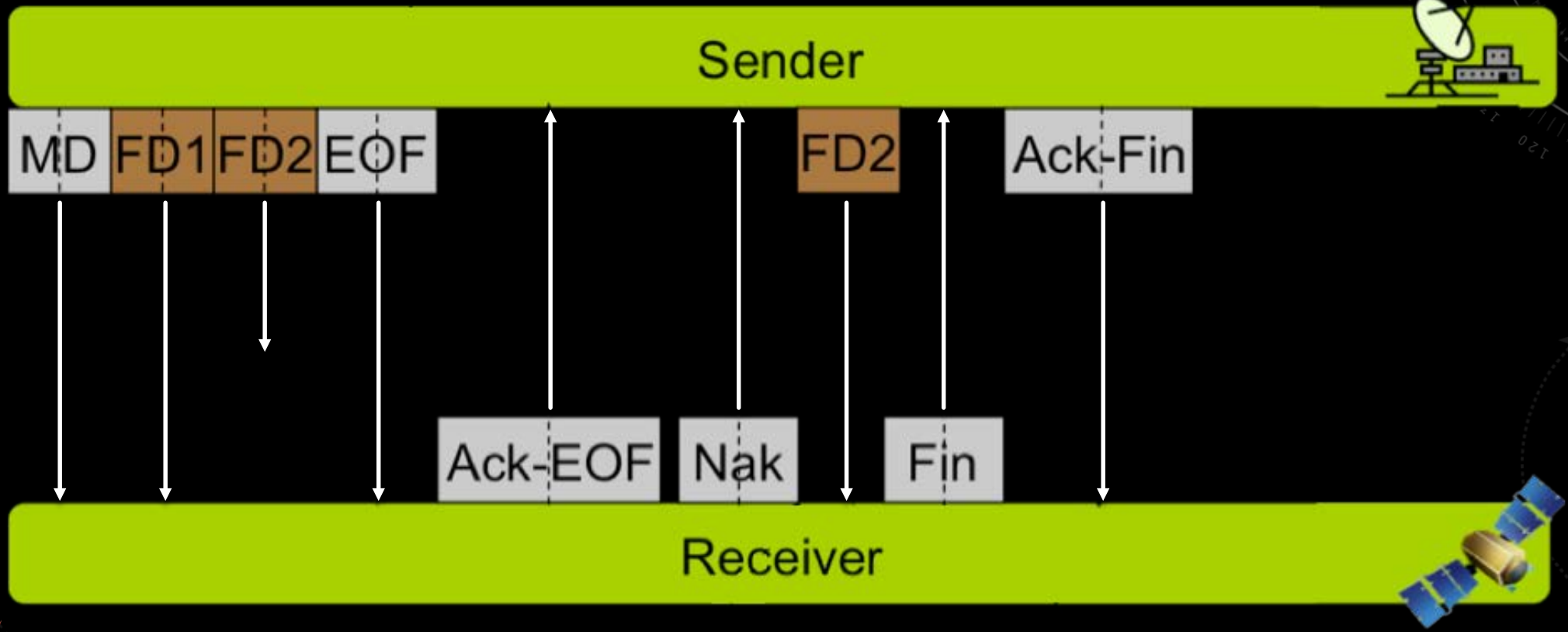
GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

SBC INITIALIZATION TYPES

Reset Type	Reset Subtype	Cause
Power On	Power cycle	Power having been removed and restored
	Command	cFE processing a reset command
	HW debug	Debug mode connection
	Bank switch	Reset reverted to a cFE power on due to a bank switch
	Undefined	Unknown reset type
Processor	HW watchdog	Watchdog timer expiring
	Exception	Processor exception
	Command	cFE processing a reset command

GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

CCSDS FILE DELIVERY PROTOCOL



GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

DIFFERENCE BETWEEN TRADITIONAL METHOD AND PERP

1 > Many

GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

FILE COMMANDING (FC) APPLICATION

The key to the PERP.

GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

FILE COMMANDING (FC) APPLICATION

- Interfaces with the cFE environment
- Processes ground-uplinked binary files
  - Reads command packets
  - Routes commands to the appropriate receiver application
- Processes five commands per second at max, one command per sixty seconds at min
- Allows for long commands otherwise not accepted by the ground system
- Unlimited queue with optional specified delay parameters

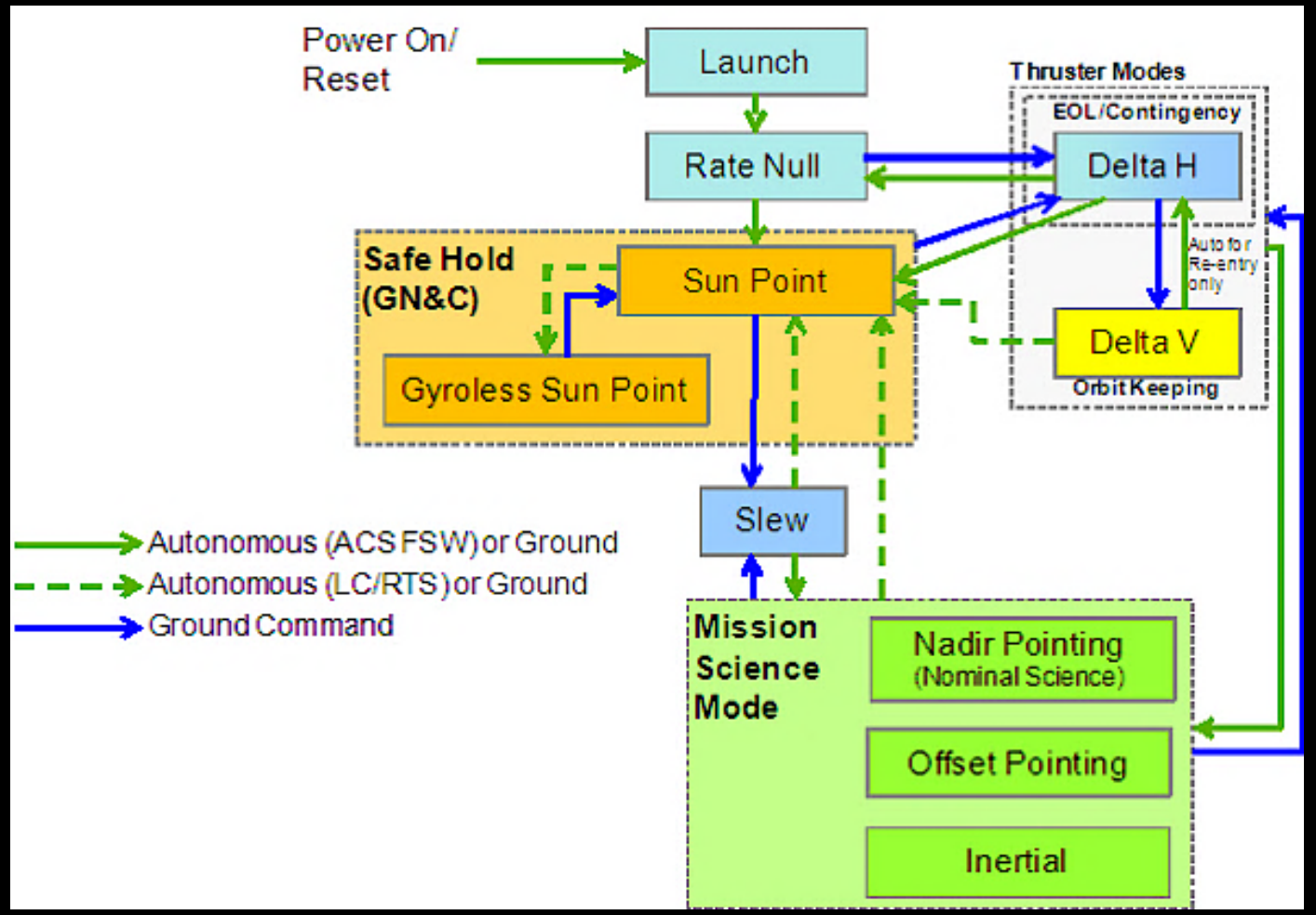
GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

RECOVERY PROCESS – LOAD BUILDING

1. Identify required loads and order in which to repopulate RAM.
2. Build procedure that performs the RAM reloading based on Step 1.
3. Run procedure from Step 2 on GPM Simulator.
4. Capture the commands sent to simulator and compile them.
5. Create FC file from the compiled commands.
6. Compress FC file.

GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

RECOVERY PROCESS – LOAD UPLINK



GPM – POR EXPEDITED RECOVERY PROCESS DESIGN

RECOVERY PROCESS – WBS HOURLY COMPARISON

Activity	Traditional Estimate	PERP Estimate
Initial anomaly assessment	2	2
Scheduling of supports	8	2
Planning of RAM reload	3	1
CAM to reload RAM	3	1
Execution of RAM reload	40	2
FOT support required	720	72
Post-anomaly support	4	4
Total	**780**	**84**

GPM MISSION'S BEST PRACTICES
PERP DESIGN