NESDIS Long Term Sustainability & Commercial Services

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National Environmental Satellite, Data, and Information Service

GSAW Working Group B

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Evolving NESDIS Ground Enterprise to Support a Climate Ready Nation

NESDIS Enterprise Architecture Evolution

1:4 BOLSTER AUTHORITATIVE DATA & INFORMATION STEWARDSHIP

1.5: ENHANCE COMPREHENSIVE OBSERVATIONS & MONITORING SYSTEMS

NEXT-GENERATION ENTERPRISE GROUND SERVICES

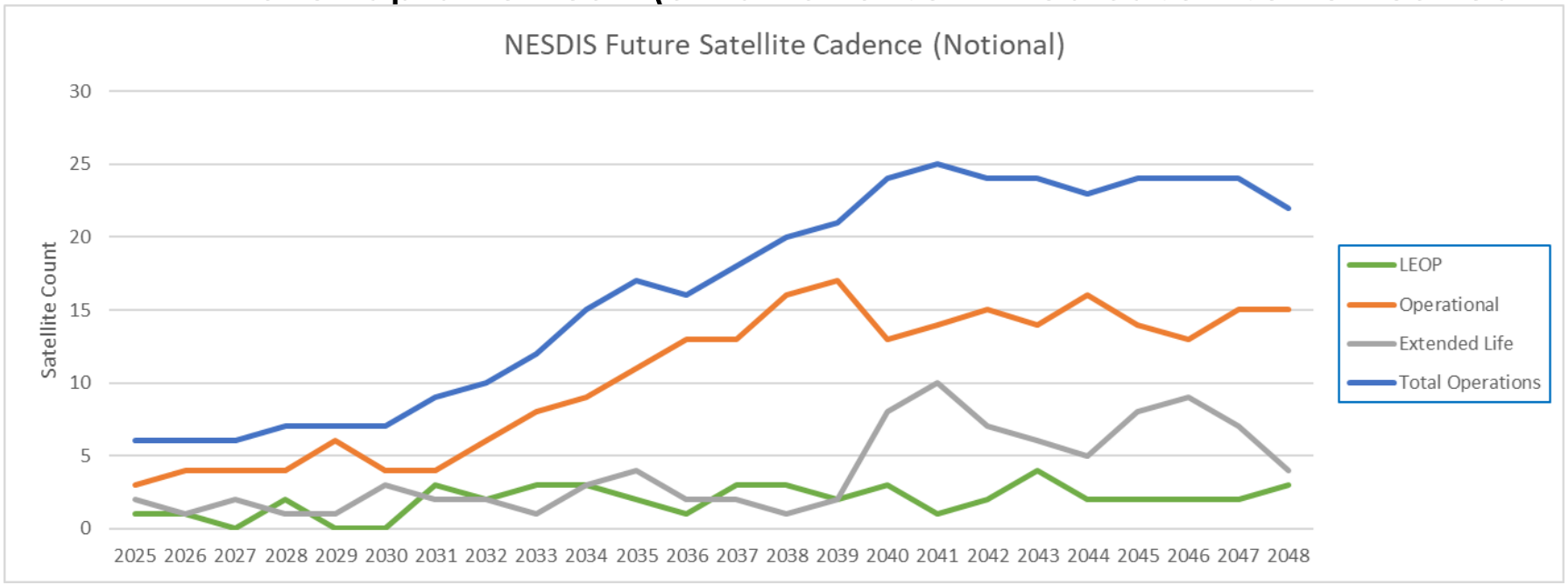
- IMPROVED DATA STEWARDSHIP
- OPTIMIZED PLATFORM-AGNOSTIC DATA & INFO
- IMPROVED ENTERPRISE-LEVEL DATA MANAGEMENT
- IMPROVED LOCAL/IN-SITU DISTRIBUTED OBSERVATIONS
- INNOVATIVE SPACE-BASED OBSERVATIONS
- EXPANDED COMMERCIAL PARTNERSHIPS & NEW TECH
- ***IMPROVED COMMON SOURCE DATA INTEGRATION & COMMON GROUND SERVICES***

Evolving Technology Capability

- Traditional NOAA's ground systems have been based on custom built solutions tailored to meet exacting performance requirements with very high reliability
  - Expensive and time consuming to build and maintain
  - Lack agility to respond to changing mission needs
- Technology Innovation (both flight & ground) has outpaced NOAA's needs
  - What was difficult a generation ago is routine today
  - Many aspects of Satellite & Data Operations can now be delivered through tailoring of off-the-shelf commercial services
- Enables NOAA to buy capabilities that satisfies need rather than build capabilities to meet requirement

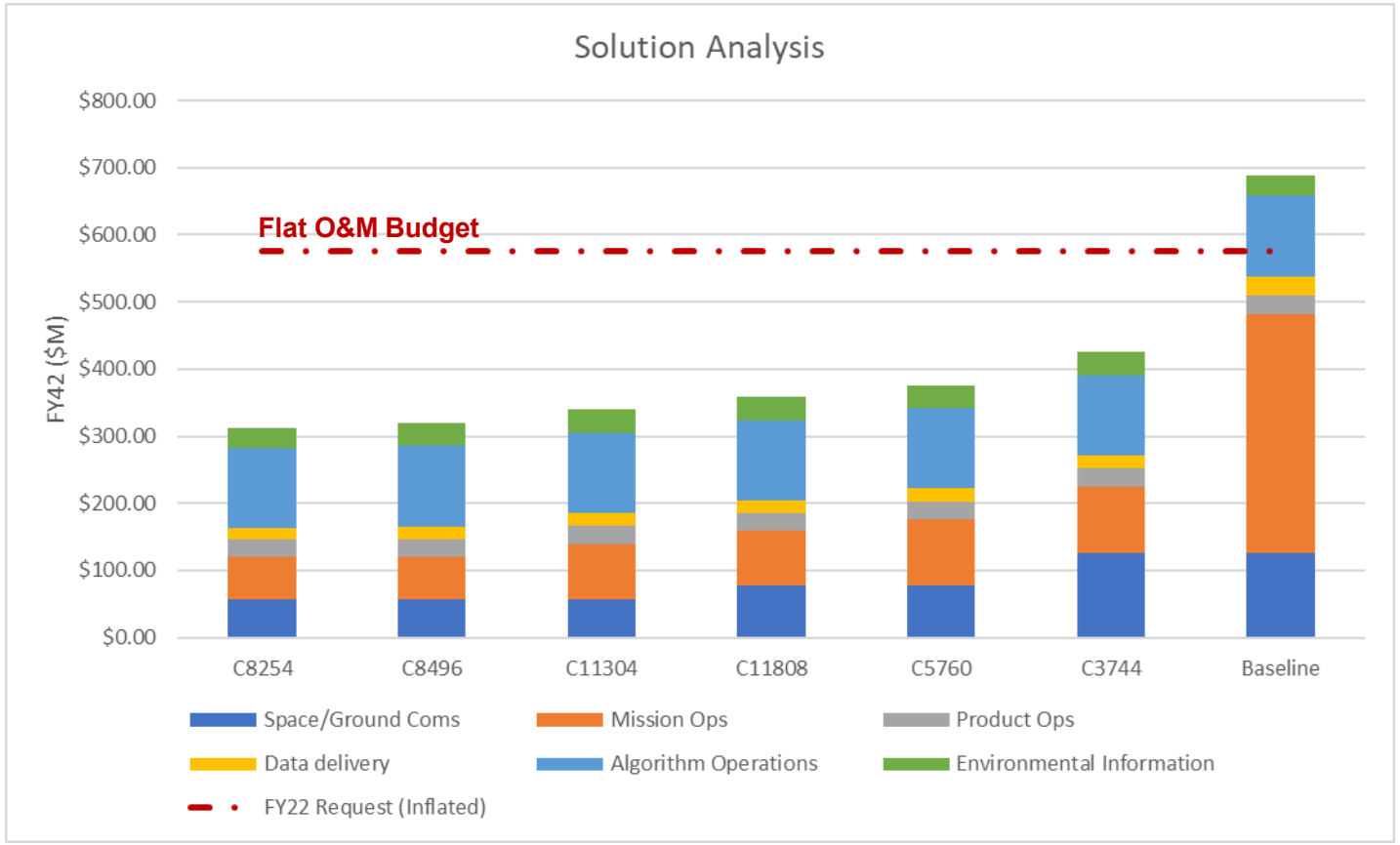
Evolving Observing Needs

- Escalation in supported missions driven by:
  - Disaggregation (multiple satellites to carry the observation suite)
  - More rapid refresh (small shorter-lived satellite refreshed more often)



  - >3x increase in operational satellites
  - >2x of pre/post operational satellites

Sustainability Impact



Mission Cadence in 2035-2050 era will drive costs to exceed current spending levels

- O&M increases from 17% to 21% of Budget

Most alternatives considered can reduce O&M costs to below current spending

- O&M ranges from 9% - 13% of budget
- Significant cost avoidance over Baseline

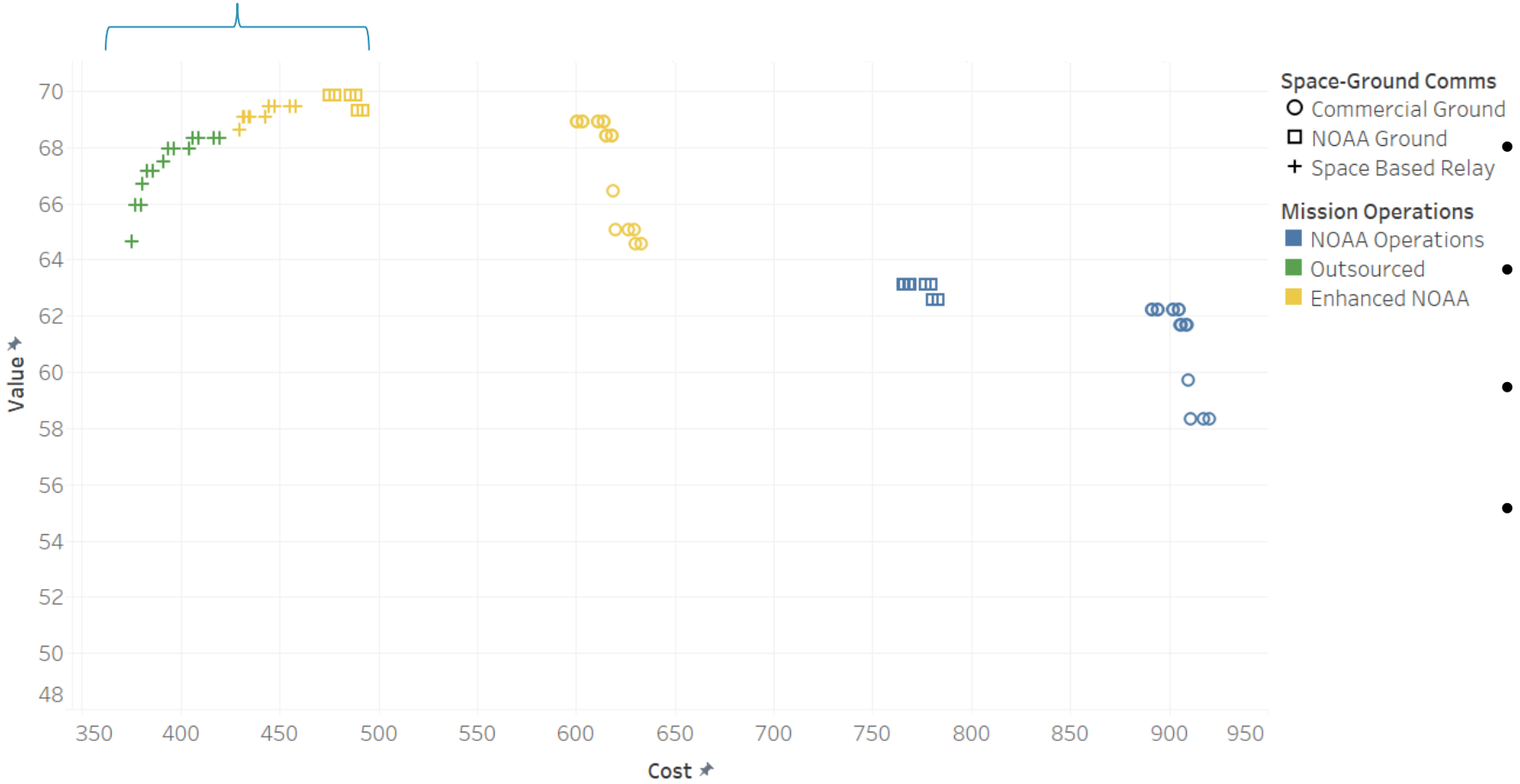
Non-budgetary cost estimates in FY42 $'s and are for comparison purposes only

Dimensions of Change

- Evolution of the NESDIS Ground Enterprise is not only about the use of technology, but also about how that technology is used to provision NESDIS business services

Dimension	Asset Location	Asset Ownership	Operational Control	Capability Provisioning Model	Acquisition Model	Operational Mode
Current Approach	NOAA Facility	NOAA Owned	NOAA Operated	Mission-Centric	Systems	Data Driven (Push)
Radical Alternative	Non-NOAA Facility	3rd Party	Outsourced Operations	Enterprise	Services	User Driven (Pull)
Enterprise Architecture Impact	Transfer of Capital Investment Responsibility	Transfer of Sustainment Responsibility	Transfer of Operations Responsibility	Transfer of Development Responsibility	Reallocation of Budget (PAC to ORF)	Realignment of Operational Priorities

Utility Comparison



- Each Symbol represents a complete solution
  - All 6 Functions
- Data & Science Operations
  - ~$50m/yr of AoA variability
- Space-Ground Coms
  - ~$200m/yr of AoA variability
- Mission Operations
  - ~$335m/yr of AoA variability
- Optimal Utility is found between:
  - Enhanced NOAA Ops using NOAA Ground Stations, and
  - Outsourced Mission Ops using Space Based Relay

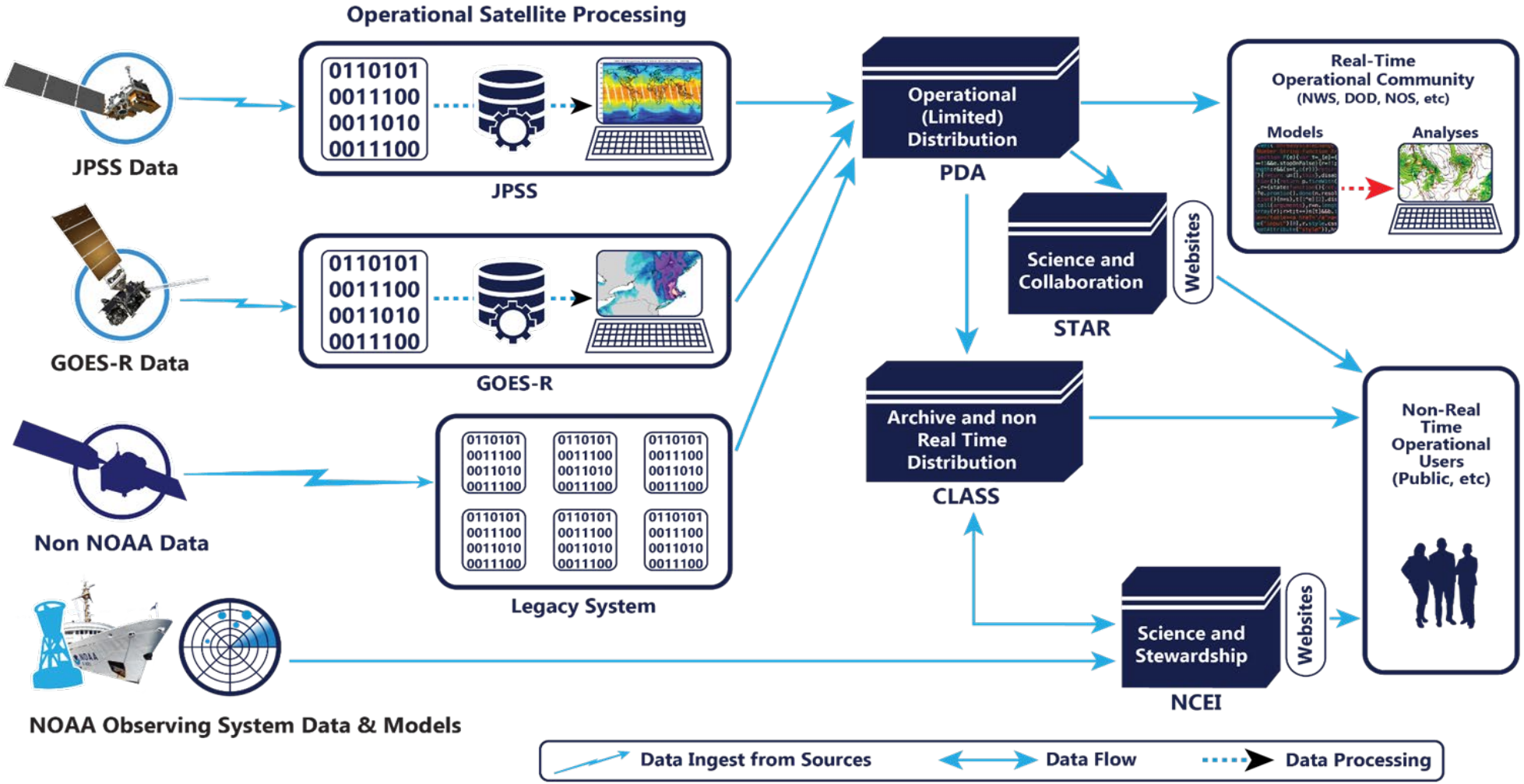
Non-budgetary cost estimates in FY42 $'s are for comparison purposes only

Enterprise Study Conclusions

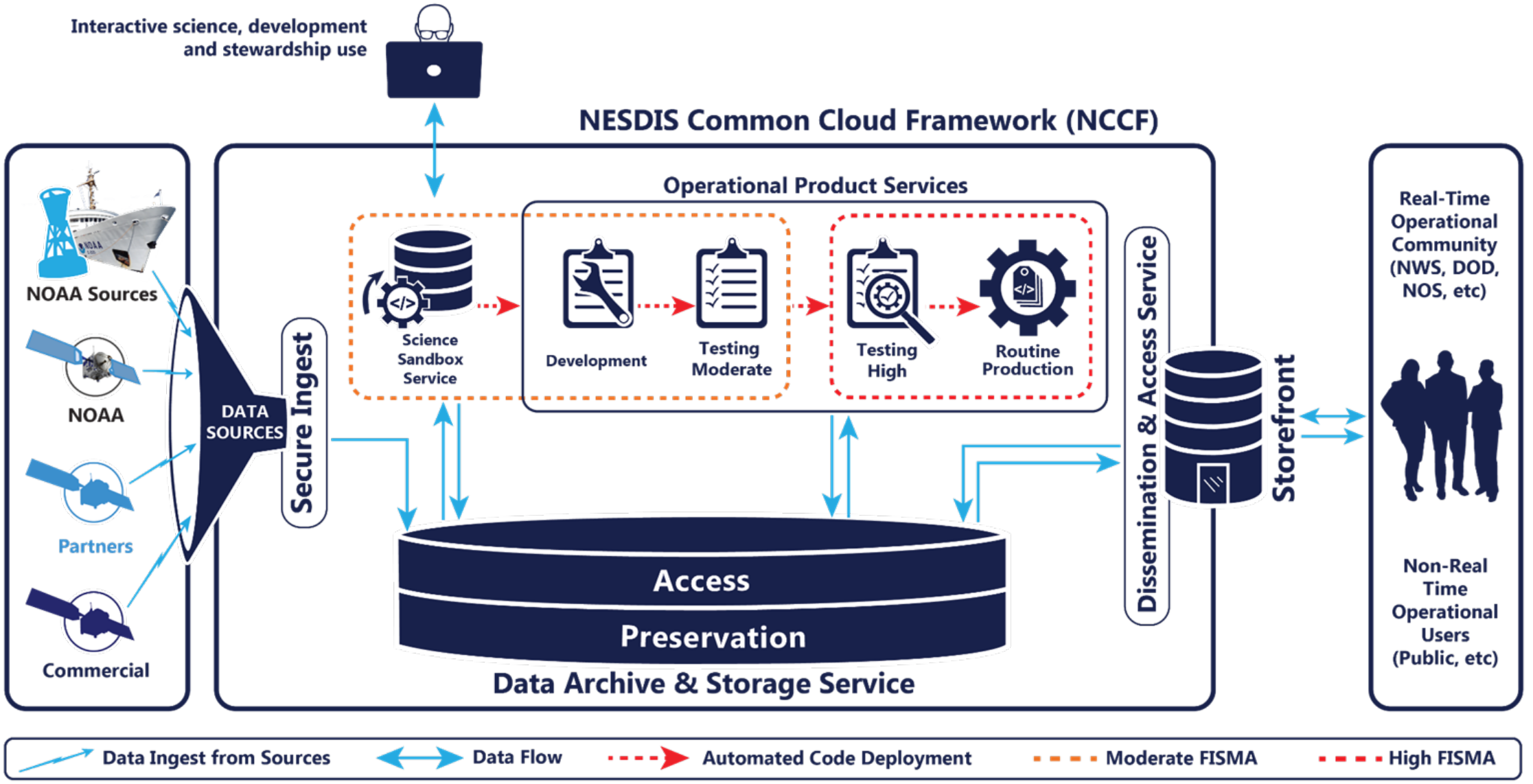
- Current NESDIS operational services are not future proofed
  - Operational costs are projected to become a larger fraction of the NESDIS budget
  - NESDIS will need to change its business practices going forward in order to achieve affordable adaptability and resilience

- Emerging technologies and business practices offers a path forward
  - Cloud-based solutions reduces hardware footprint through reduced redundancy
  - New technologies improve asset utilization through multi-mission use
  - Buying commercial services reduces up front investment and ongoing sustainment costs while providing operational scalability

NESDIS Ground Enterprise: Mission-Centric Legacy

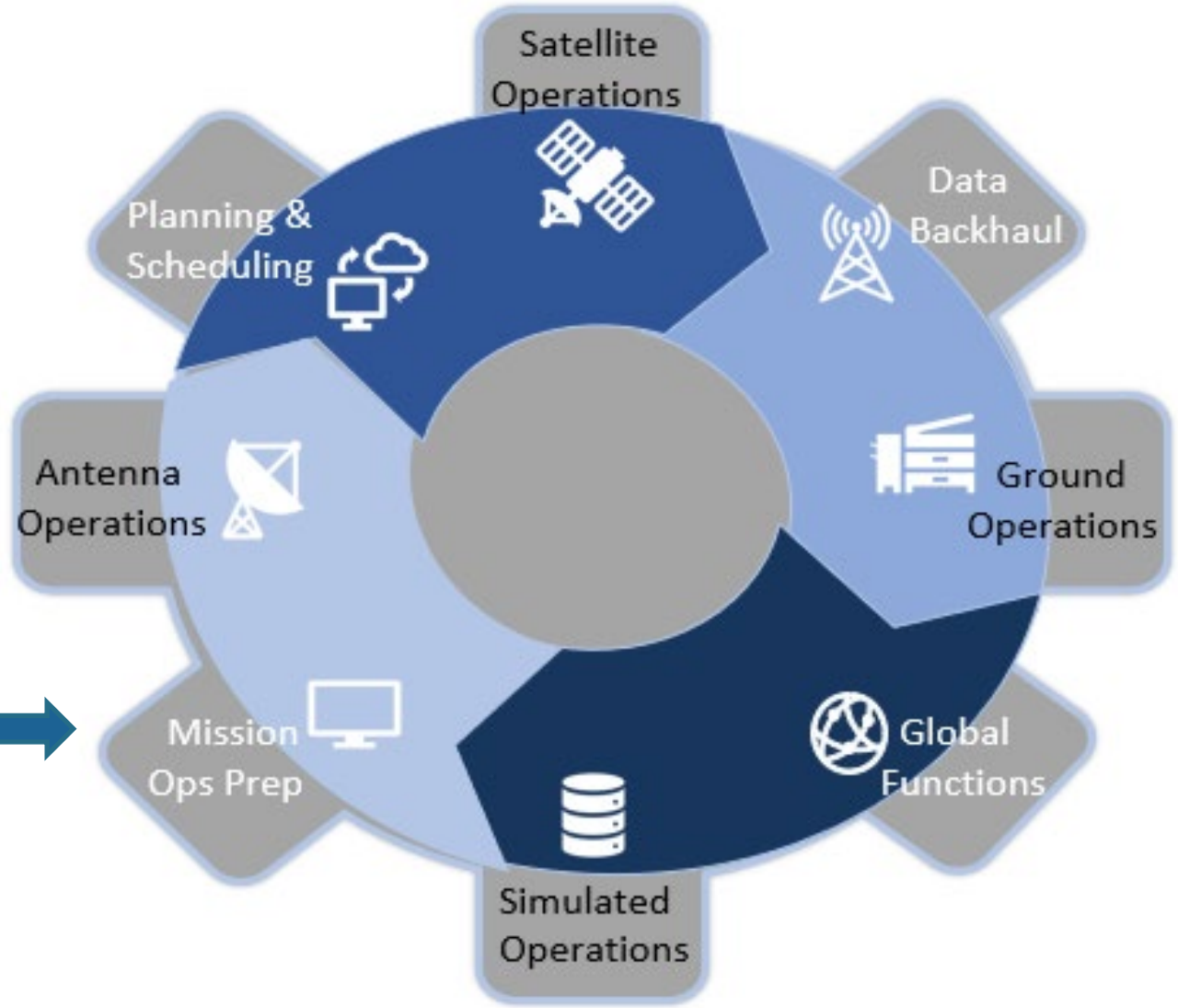


NESDIS Ground Future Enterprise in the Cloud

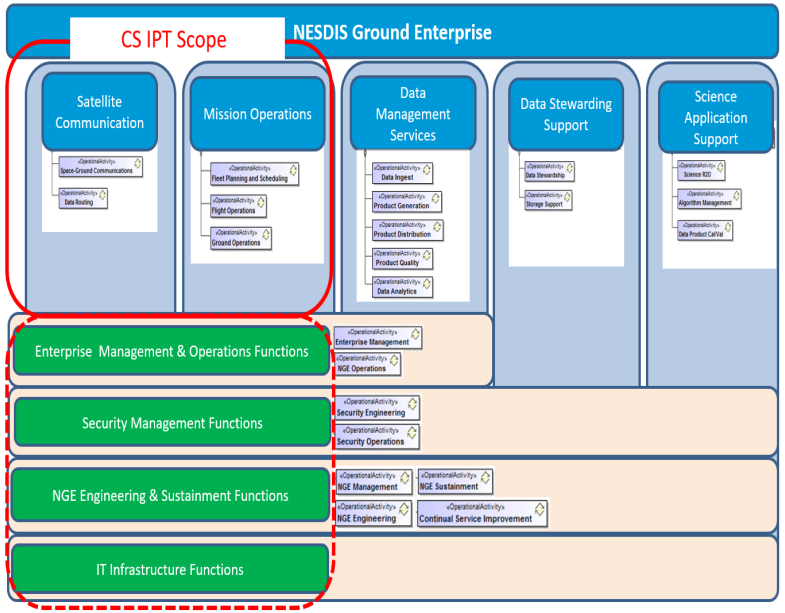


Commercial Services Evolution

- The Commercial Services IPT is an **OCS led initiative** formed to:
  - Investigate the commercial sector's ability to support **OCS' establishment of a NESDIS cloud-based common services enterprise ground system**
  - Evaluate suitability for adoption of **enterprise aligned** commercial capabilities into OCS provided common services
  - Identify a common set of approaches to incorporate **core NESDIS Satellite Communications and Mission Operations (SCM/MOP) capabilities** into the NESDIS Common Cloud Framework (NCCF)



Commercial Service Focus



NESDIS core business functions

SCM/MOP - Functional Capabilities

Function	Capability Title
SCM: Data Backhaul	Data Accounting
	Data Routing
SCM: Antenna Operations	Satellite Acquisition
	Data Acquisition
	Data Transmit
	Satellite Ranging & Tracking
MOP: Simulated Operations	Contingency Planning
	Concurrent Operations
	Routine Operations
MOP: Planning & Scheduling	Fleet Planning & Scheduling
MOP: Satellite Operations	Observatory Management
	Telemetry Operations
	Command Management
MOP: Ground Operations	Ground Equipment Monitoring
	Ground Equipment Management
MOP: Mission Operations Preparation	Training
	Procedure Development
Global Function	Flexible Role Based Access

Commercial Services Approach

- CS IPT conducts extensive market research through a variety of methodologies in order to:

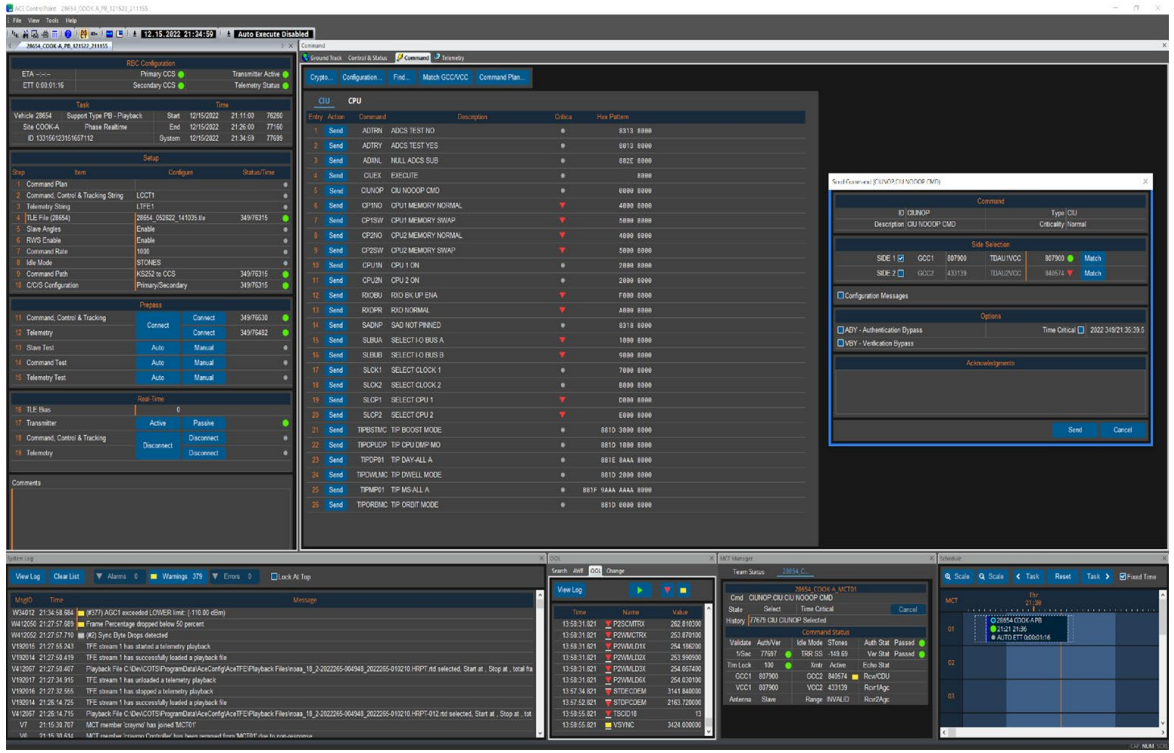
Map current commercial trade space against required core capabilities	Conduct Analyses of Alternatives for select core capabilities
Assess viability for incorporation of commercial core capabilities into the NCCF	Establish a recommended roadmap for transition of legacy core capabilities into the NCCF, if commercial or SaaS offerings do not meet requirements
Assess viability of commercial software as a service (SaaS) offerings to replace legacy and potential future, on-premise, NESDIS-owned MOP/SCM software	Evaluate internal opportunities for architectural convergence

CS IPT - Common Service Accomplishments

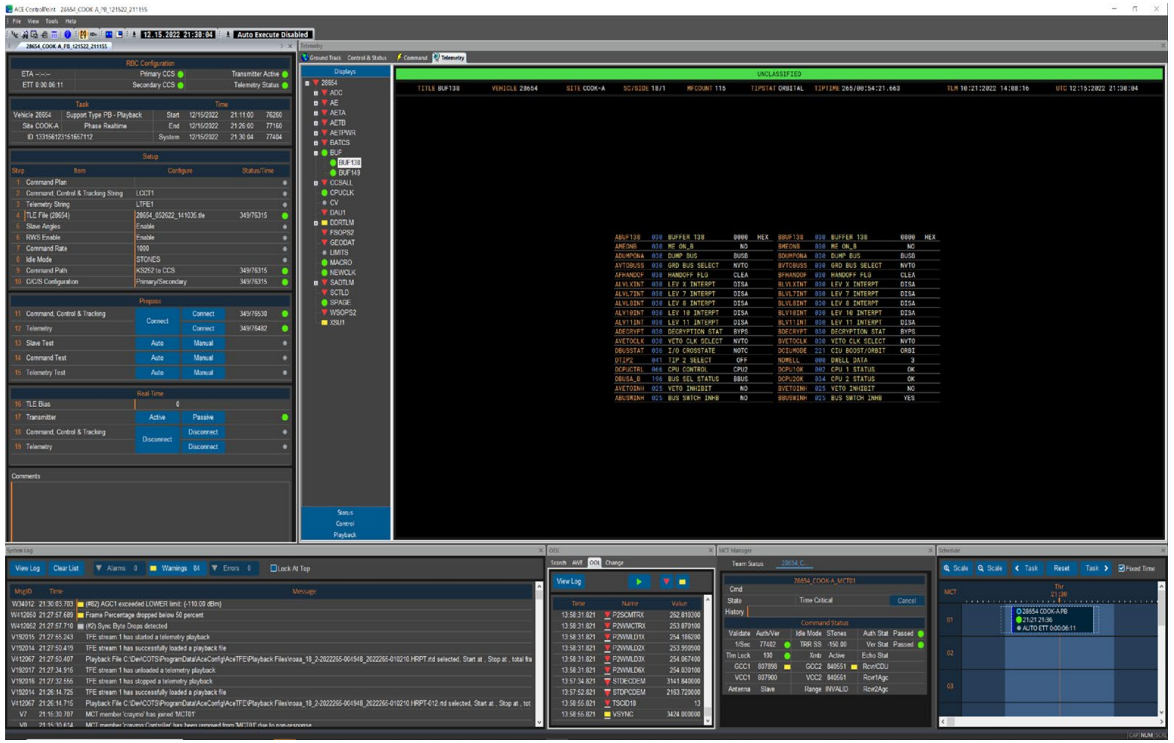
- **SCM/MOP: POES Extended Life Acquisition:** Contract initiated on September 15, 2022
  - POES LE RFI and MS Azure CRADA provided stepping stones
  - NESDIS next level assessment for commercial Saas and GSaaS capabilities
- **SCM: Space Based Data Relay (SBDR) RFI:** Completed November 30, 2022
  - Market Research for SBDR architectural considerations
  - In alignment with NESDIS Ground Enterprise Study (NGES)
  - CS IPT is coordinating with NASA CSP and SDA
- **SCM/MOP: Digital Ground Broad Agency Announcement (BAA):** Issued on December 5, 2022
  - Market Research for commercial Software Defined Radio (SDR) capabilities
  - Trade space for expansion of NCCF
- **SCM: Phased Array CRADA:** Initiated on January 3, 2023
  - Perform limited in situ field testing of industry phased array capabilities
  - Expand understanding of business case and technical performance for core LEO services

Tailored Market Research in service of NESDIS Tactical and Strategic Objectives

POES Extended Life – Commercial Operations



Cloud-based commanding



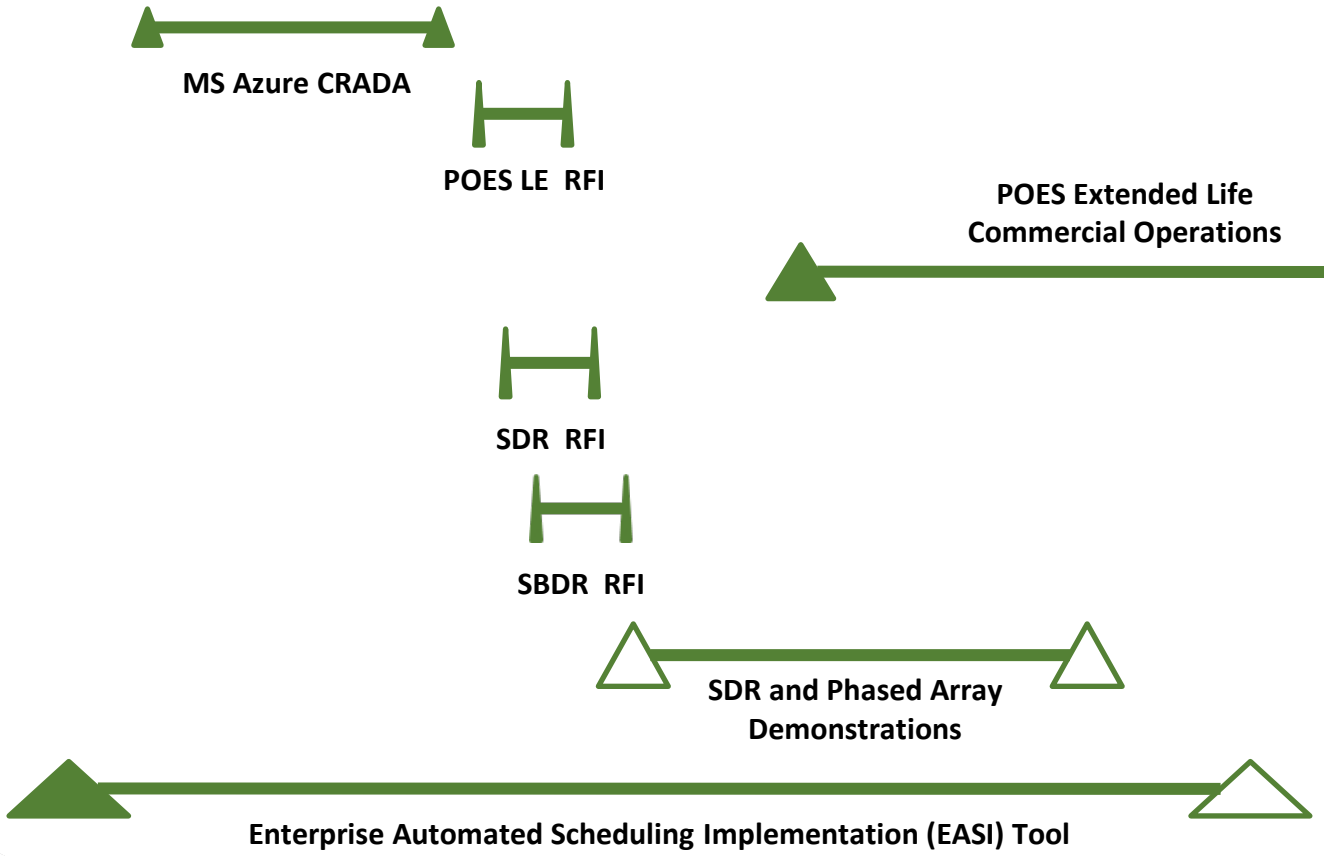
Cloud-based telemetry

- Current POES Extended Life through commercial services is a historic first for NESDIS
  - CS IPT activities provided clear-cut roadmap for this initiative
  - Validation of commercial GSaaS, SaaS capabilities
  - Provides next step in roadmap to NCCF based SCM and MOP common service implementation

Evolutionary Space-Ground Communication Services

2021	2022	2023	2024	2025	2026	2027

FYFO-NGES Alignment → Pilots and Demonstrations → Leverage Enterprise On Ramps to Evolve Antenna Network to Support Multiple Missions



Key Accomplishments / Insights

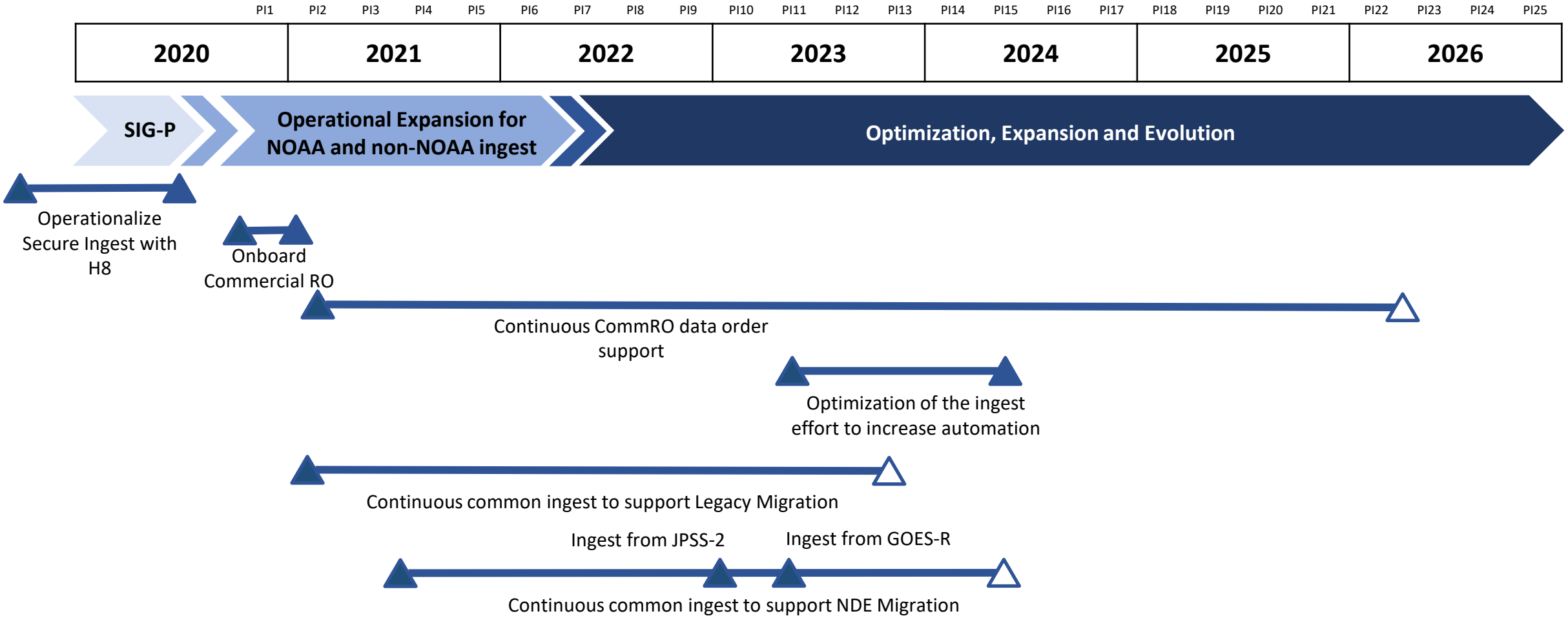
- Demonstrating next step commercial operations for POES mission (Saas/GsaaS)
- Developing Enterprise Automated Scheduling Implementation (EASI) scheduling and mission management tool on premises - investigating cloud migration
- Upcoming: Cloud-based Software Defined Radio (SDR) BAA and Phased Array CRADA in FY23
- Completed SBDR RFI vendor meetings and analysis
- Utilization of RFIs as foundational step in market research

Final Takeaways

- The CS IPT provides a forum to conduct low cost high return market research
- Commercial Services offer viable options for establishment of common service pathways
- Current commercially provided operational GSaaS services to NESDIS are a direct outcome of CS IPT efforts and fulfil a critical enterprise roadmap milestone for evaluation of extensibility to future satellite systems

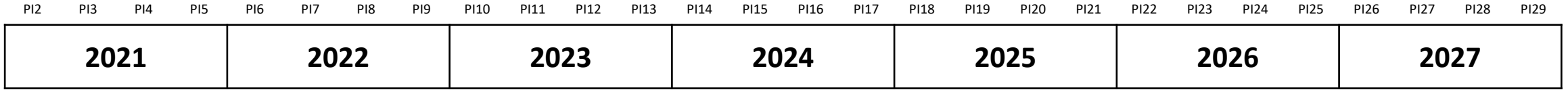
Backup

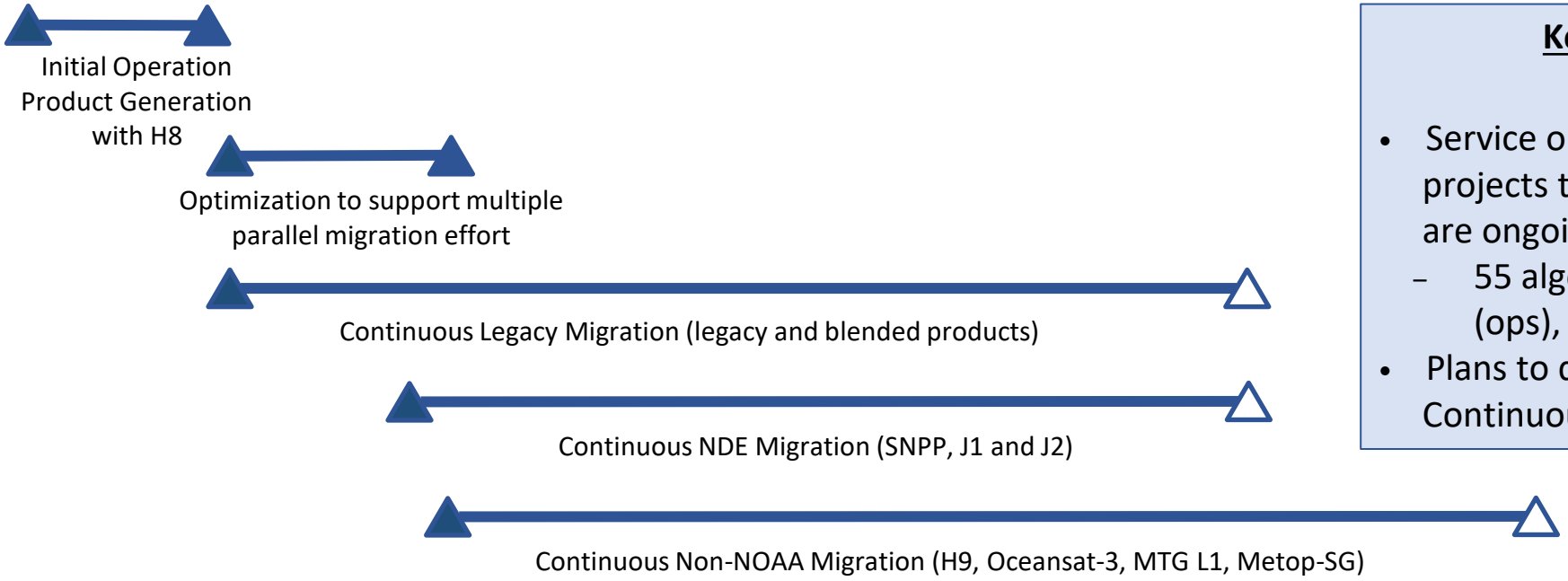
NCCF Secure Ingest Service



Service completed, secure ingest operationalized, further optimization and rapid onboarding

NCCF Compute (Product Generation) Service



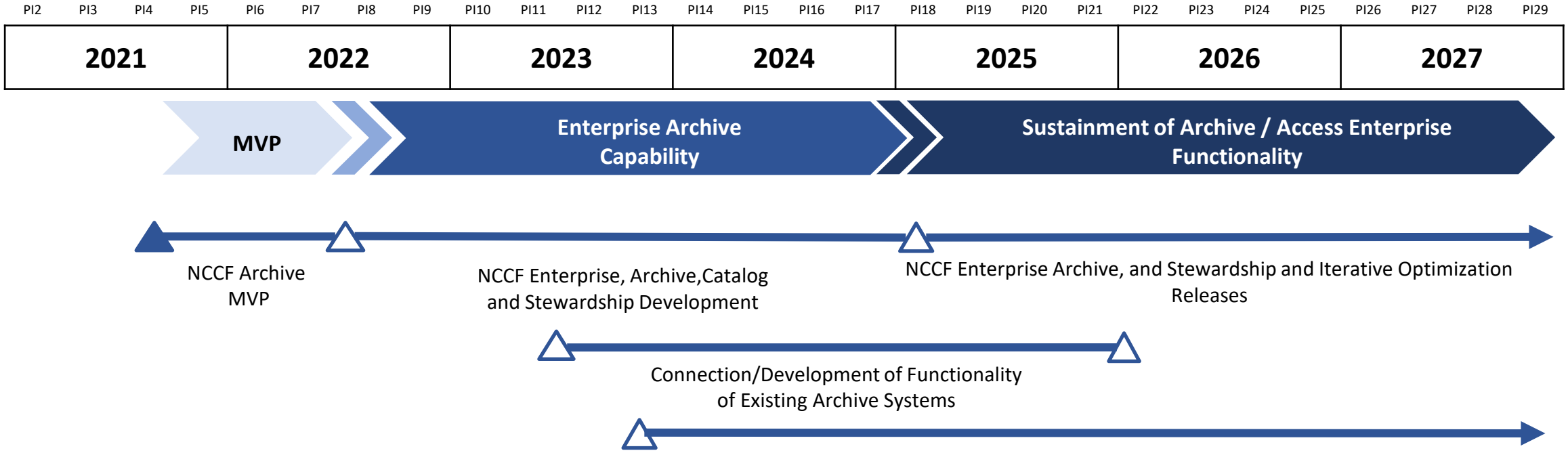


Key Accomplishments / Insights

- Service operational since May 2021. Migration projects to move on-prem algorithms to the Cloud are ongoing
  - 55 algorithms integrating into production (ops), generating 325 products
- Plans to deploy Continuous Improvement/ Continuous Delivery (CI/CD) pipeline in FY24

Robust and scalable operational compute service, ready to meet GEO and LEO workflows

NCCF Archive Service



Key Accomplishments / Insights

- NCAP - Piloted archive capability in NCCF within 12 months
- MVP running in the NCCF Development environment
- Continued development in 2023 to include dual catalog implementation NCEI OSIM and NASA CMR

Archive service will aggregate all NESDIS data in a common, accessible location, enabling innovation like Artificial Intelligence

NCCF Sandbox Service

PI2	PI3	PI4	PI5	PI6	PI7	PI8	PI9	PI10	PI11	PI12	PI13	PI14	PI15	PI16	PI17	PI18	PI19	PI20	PI21	PI22	PI23	PI24	PI25	PI26	PI27	PI28	PI29
2021				2022				2023				2024				2025				2026				2027			

Design → **Demonstrate** → **Utilize Sandbox Services as an initial capability** → **Sustainment Sandbox Capability**

Key Accomplishments / Insights

- Three science teatms identified from STAR and NCEI for the demonstration
- Demonstration will provide the usage patterns and help with cost modeling and governance for sandbox utilization

Planning, design, and MVP

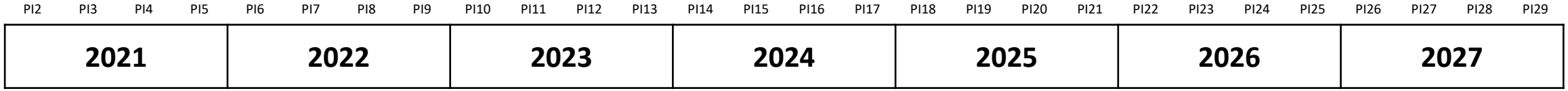
Sandbox Service Demonstration

NCCF Sandbox Service Utilization

Cost modeling and governance Design

The Sandbox Service will bring developers, scientists and users to the data versus downloading and transmitting all information

NCCF Dissemination and User Access Service



IOC for Access → **Distribution IOC with Fire Storefront** → **Enterprise Dissemination and PDA Migration** → **Sustainment of Access and Dissemination Capability**

Flat Rate Egress Contract in place

NCCF limited dissemination to NODD (formerly BDP)

Key Accomplishments / Insights

- Flat rate cloud egress contract in place as of July 1, 2022
- NCCF leveraging ESPC PDA distribution services initially
- Dissemination Minimum Viable Product (MVP) planned for Oct 2023 for Distribution with Fire Weather Storefront
- Demonstration project to set up a public S3 March 2023

Dissemination Pilot

NCCF Enterprise Public Access and, Dissemination development and PDA migration

Wildland Fire MVP

NCCF Enterprise Public Access, Dissemination and Iterative Optimization Releases

Flat rate egress contract awarded July 1, 2022