OSGS Annual End of Year Report 2021

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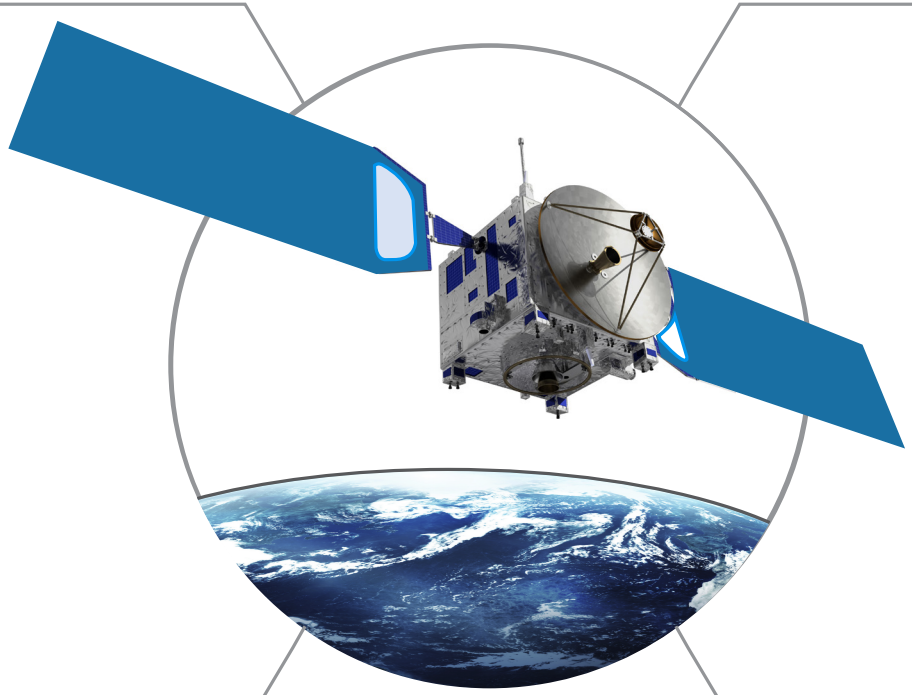
The Office of Satellite Ground Services (OSGS) is a key element of NOAA’s value chain to deliver products and services from its vast Earth and Space observing platforms and systems. The OSGS plans and executes common ground services for NOAA’s satellite, data and information capabilities. It develops and sustains services to acquire, process and manage environmental data from NOAA’s satellite missions, facilitate access to non-NOAA domestic and international satellites and commercially-acquired data, and provide the infrastructure to archive and steward data to benefit the broader Earth Observing enterprise. The OSGS also partners with the Office of Systems Architecture and Advanced Planning (OSAAP) to evolve the NESDIS Ground Enterprise comprising satellite, data and science operations.

New Mission Areas

Product Portfolio Management (PPM):
Lead product portfolio management and the transition to operations of science applications across the organization

NESDIS Common Cloud Framework (NCCF):
Build out, sustain, and optimize the NCCF and migrate capability to common services



NESDIS Ground Enterprise (NGE):
Support the definition and evolution of the future NESDIS ground enterprise

On-premises Systems:
Develop, sustain, and optimize enterprise on-premises systems

PPM

Product Portfolio Management (PPM) within OSGS is the oversight of development and implementation of science algorithm projects in order to maintain product quality and performance while leveraging continuous science improvement. **PPM** ensures effective integration of data from applicable data sources and retirement of old sources as well as provide management of the algorithm portfolios from formulation though retirement. Ideally, the PPM would have authority to optimize product performance within budget by judicious utilization of available data sources. A few things to note to gain a better understanding of **PPM:**

- Algorithm work is shifting from core development to primarily integration and tailoring efforts.
- Only a small percentage of algorithm work is creating brand new algorithms; most work is dedicated to updating enterprise algorithms.
- Once an enterprise algorithm is in place, incorporating a new data source is significantly less costly than before.
- Many products are distributed within one algorithm output file; our ability to manage development and distribution at a finer level would require future work.
- Cloud product generation framework enables a more efficient, modular approach, as many algorithms share computational elements.
- Moving to a data agnostic approach will require some cultural changes with our user community.

So why is PPM important within OSGS? As we sustain a user-impact driven suite of products and services through innovation and iterative development on a NESDIS common cloud infrastructure, we need a portfolio approach to managing products and infrastructure efficiently and effectively to support our operational users such as NOAA's customers. The benefit of a common infrastructure is to foster agility, flexibility, and scalability to accommodate any data source. This is accomplished with enterprise governance and priority management with these key roles in the forefront:

1. Interface and coordinate with all stakeholders
2. Execute all funds across all NESDIS offices
3. Align schedules and priorities
4. Identify and mitigate risks and issues
5. Maintain focus on overarching requirements

As of the end of 2021, this is what **PPM** has accomplished and their impacts:

- **L2+ products implemented into operations for Himawari-8, and at 95% for GOES-16/17 and NOAA Data Exploration (NDE) Deliveries**
  The Himawari-8 L2+ products were the first products implemented into operations within the NCCF. This paved the way for the transition of the legacy OSPO L2+ products, GOES-16/17 NDE products and the JPSS NDE products into the NCCF.

NCCF

The National Environmental Satellite, Data, and Information Service (NESDIS) operationalized the first phase of its new enterprise cloud environment: **The NESDIS Common Cloud Framework (NCCF).**

So why do we need NCCF? Simply put, technology evolves how we understand the world. As we ensure data is reliable, meaningful, and accessible to NOAA's customers, we need the technology to accommodate this mission and serve the public. Thus, migrating capabilities to the cloud has definite advantages.

The **NCCF** is a collection of cloud services that provide end-to-end ground service functionality and will replace elements of the on-premises enterprise in a phased approach:

- The initial phase deployed a Consolidated Ingest Service that provides a single entry point for a scalable, data agnostic, data ingest cloud service for foreign and commercial data files
- The second phase added migration of enterprise product generation algorithms and metadata cataloging to the NCCF to generate data products, beginning with Himawari-8 L2+, in a scalable cloud environment
- Additional phases will transform the traditional on-premises NESDIS Ground Enterprise System (NGES) capabilities to cloud agnostic hosted services
  - Current on-premises services handle 16.5 TB/day and the NCCF phase 1 handles 94 GB/day

This transformation to the NCCF enables ingest, product generation, storage, dissemination, and archive services to be changed into a common, non-stove piped, cloud framework.

NCCF accomplishments and positive impacts as of the end of 2021:

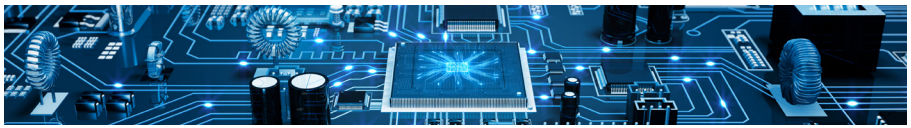
- **Operationally producing Himawari-8 products in the NCCF; Established an interface to the NCCF to securely ingest data from European Meteorological Satellite's (EUMETSAT) Meteosat-Third Generation (MTG) satellites; Operationalized EUMETSAT's MetOp Sea Surface Temperature products in the NCCF; Sentinel-1A/1B data ingested in NCCF from the European Space Agency (ESA); Developed NDE migration roadmap and initiated NDE algorithm products migration to the NCCF.**
  OSGS has expanded cloud enabled products from new and existing data sources, and migrated product generation, tailoring and distribution from on-premises systems to the NCCF to support NESDIS strategic objectives of enabling common services in the cloud, optimized IT modernization investments and improved efficiencies of service deliverables and ingest of data from all sources.

- **Conducted Steganography (Steg) Analysis of Alternatives (AoA) to identify appropriate tools for use in NCCF Consolidated Ingest security checks**
  Investigated steganography-based security risks for the NCCF Ingest service and identified the best tool available in the market place to enable the NCCF to prevent ingest of compromised files, and ultimately protect the NOAA/NESDIS network and customer base from external and internal security threats to ensure resilient, reliable, trustworthy, timely, complete and accurate quality of provided NOAA information.

- **Steg Study**
  This allowed OSGS to validate the tool choices made to architect the secure ingest service of NCCF to allow maximum flexibility while remaining secure, while ingesting NOAA and non-NOAA data sources.

- **Conducted Data Dissemination as a Service (DDaaS) Study to identify cloud-based architectural approaches, technological solutions and industry partnering options to establish a knowledge base to develop a Dissemination Service in the NCCF**
  Established a knowledge base comprising architectural approaches, technological solutions and industry partnering options to drive the implementation of a scalable and extensible Dissemination as a Service (DaaS) in the NCCF that leverages emerging technology to support timely dissemination of a wide range of data to a broad customer/user base.

- **The dissemination study offered an analysis on the DDaaS concept**
  The study analyzed cloud-based architectural approaches, technological solutions, and industry partnering options that support DDaaS to a wide community of interest in the growing volume of environmental data processed through the NESDIS Ground Enterprise (NGE). The advantage was that it provided forward leaning strategies to validate near term solutions being implemented, and outlined a pipeline for further research or prototyping to prove new concepts for use in NESDIS.



- **Piloting new enterprise capabilities in the cloud**
  Completion of Cloud Pilot Phase II project demonstrated science/algorithm development and cloud-based dissemination from the cloud is practical and feasible. Piloting archive and stewardship workflows to meet NCEI needs.

- **Demonstration and implementation of agile and DevOps processes that reduce the transition to operations time for science data products**

- **In 2021 NOAA operationalized the secure ingest and product generation functionalities within the NCCF to support ingest and processing of non-NOAA and commercial radio occultation (RO) data**

On-Prem Systems

The **Comprehensive Large Array-data Stewardship System (CLASS**) supports all NOAA missions and goals, and supports NOAA's crosscutting priority to provide an integrated data environment and data management system for NOAA.

CLASS is NOAA's premiere on-line facility for the distribution of data products and derived data from NOAA's satellite systems, including NOAA's polar-orbiting and geostationary environmental satellite systems and their follow-on programs.

CLASS continues to provide outstanding customer, strategic, business, and financial performance through continuous operation and sustainment of a key, capable, NOAA Enterprise system. CLASS provides capabilities in three primary functional areas based on the Reference Model for an Open Archival Information System (OAIS-RM): **Ingest, Archival Storage, and Access.**

- **Ingest and Archive**
  The CLASS archive is made up of 859 unique data products organized into 147 collections and is approximately 17.8 PB in size. In 2021, CLASS ingested and archived over 170 million files comprising 4.7 PB of data. **Fifteen new products** were added to the archive.

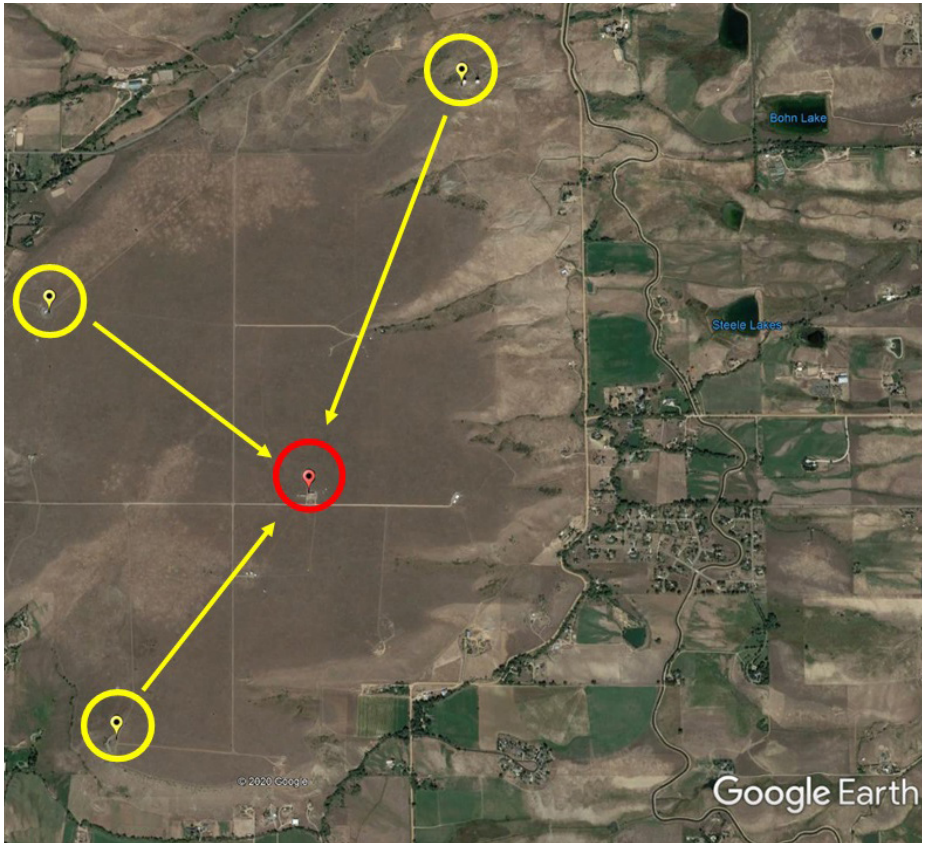
- **Access**
  Nearly 3,000 registered unique CLASS users consumed over 7.9 PB of data from the CLASS archive in 2021. Over 50% of the CLASS users were from the private sector, 18% from the international community, 16% from education and 6.7% NOAA.

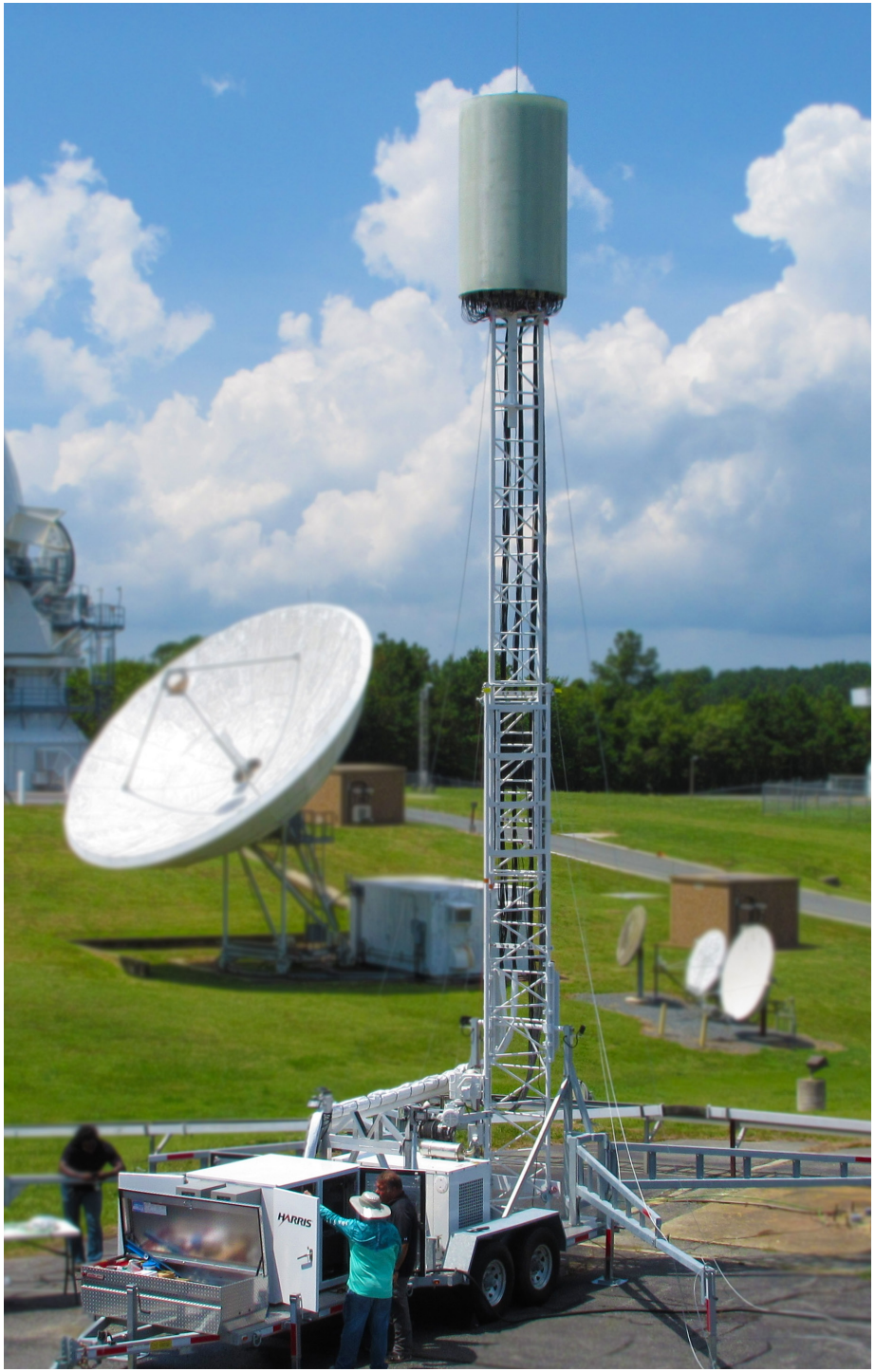
- **CLASS became a fully operational hybrid system with both Cloud and on-premises components. The team completed the migration of a backup copy of CLASS holdings to the commercial Cloud, which reduced the on-premises infrastructure by forty percent as the redundant failover node in Boulder, CO was closed down. The copy of the CLASS holdings in the cloud also enabled the successful execution of a Continuity of Operations (COOP) test event with a failover of CLASS Operations in the Cloud. Additionally, the expanded use of virtualization resulted in higher availability, reduced long term sustainment and maintenance costs, improved server provisioning and deployment and better productivity. The migration to a No-SQL database led to improved efficiency and cost savings. The team planned and completed a cadence of releases to maintain and enhance all systems and achieved full compliance with Defense Information Systems Agency (DISA) Security Technical Implementation Guides (STIG) for the CLASS operating systems.**

The short term impact is the reduction of the sustainment costs for the CLASS system over the next several years. A reduced technical refresh burden on the government and contract staff will be realized beginning in FY 21/22. In addition, the technical, administrative, and financial lessons learned will be of significant benefit to NOAA offices as the organization adapts its business model to cloud-based computing systems to supersede traditional on-premises systems going forward.

The **RFIMS** (Radio Frequency Interference Monitoring System) objective is to design, test and deploy a system at 17 NOAA ground stations that can detect RF interferences in real-time, classify the nature of RF interference in real-time, identify the source(s) of interference, and notify NOAA operators of interference.

- **Successfully accepted 1st and 2nd Systems (RFIMS)** *(pictured to right)* Verification of RFIMS Key Performance Parameters establishing a NOAA capability for spectrum sharing interference monitoring, along with the establishment of the first operational RFIMS at a Wallops Command and Data Acquisition Station (WCDAS). OSGS has also established an operational test capability with operational satellite receivers at **Table Mountain Test Range.** *(pictured below)*



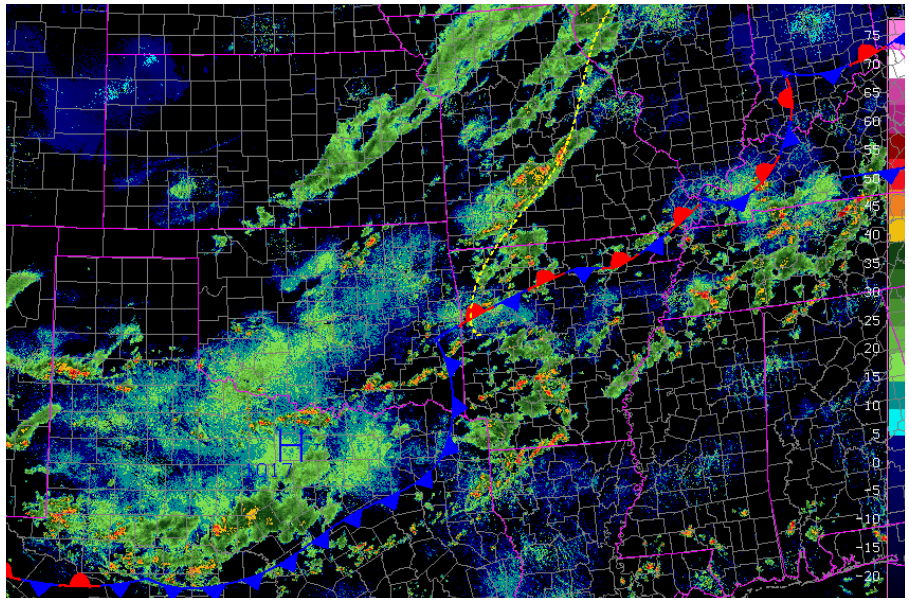


NGE

- **Used CRADA with Microsoft to perform successful capture of POES-18 data**

In June 2021, the NESDIS Assistant Administrator (AA) signed a Cooperative Research and Development Agreement (CRADA) with Microsoft Azure Orbital to demonstrate the viability of commercial cloud capabilities in the operations of on-orbit assets, specifically NOAA-18. Initial telemetry downlink testing and Mission Operations monitoring were completed in 2021 from the MS Azure ground station in Quincy, WA. CRADA efforts will culminate with Azure Orbital executing risk averse commanding to NOAA-18 in 2022.

Through the collaboration between Azure Orbital and NESDIS established under the CRADA, NESDIS has been able to evaluate the commercial sector's ability to support satellite commanding and mission operations. The information gathered under the CRADA informed NESDIS in its AoA for future legacy POES operations and will continue to provide key insights into NESDIS' evaluation of commercial sector capabilities for TT&C and Mission Operations.



- **Updated 15-Year Antenna Study to factor in risk assessment, policy considerations, upcoming missions, and partnership missions (Fifteen Year Follow-on [FYFO] final report disseminated)**

In January, 2021, OSGS initiated a task with Aerospace to conduct an updated FYFO Antenna Study to evaluate worldwide NESDIS antenna assets, provide recommendations for transition to a common services-based Ground Enterprise architecture and validate antenna utilization and excess capacity.

In 2021, the FYFO study directly supported recent execution of the United States Space Force (USSF) Partnership by completing an engineering analysis of NESDIS excess antenna capacity for usage by the USSF to augment its capacity-constrained Satellite Control Network (SCN). The study also provided baseline inputs and modeling to the NOAA Ground Enterprise Study (NGES) and outlined recommendations for transition to a NESDIS Enterprise Antenna architecture.

The detailed analysis of NESDIS' antenna assets performed under the FYFO will inform its ability to support new and existing missions, enter into new partnerships and continue its efforts towards establishing an efficient, effective ground enterprise.

- **Enterprise Transition of Legacy Geostationary (GEO) Antenna Assets**

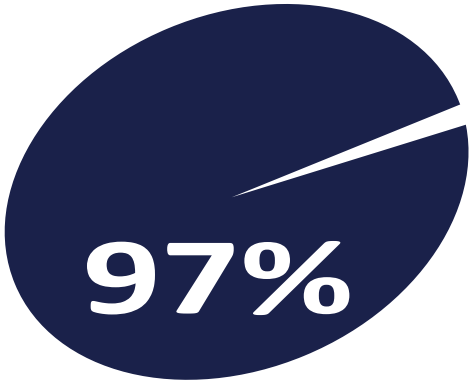
Throughout 2021, OSGS continued its efforts to transition the HR1 and HR2 antennas at WCDAS to Enterprise assets, expanding their capabilities to support the GOES-NOP, GOES-R, DSCOVR and SWFO missions. In support of this transition, OSGS has led the execution of multiple procurements, including upgrades to the Feeds, Antenna Control Systems (ACS), Up/Down Converters, Frequency Distribution Systems and Solid State Power Amplifiers (SSPAs).

OSGS by the numbers

40% Increase in onboarding new **staff**

Implemented a **SharePoint tool** to execute **35 FY 2022 Performance Plans** Systematically in compliance with record accessible and retention requirements

Obligated **97%** of operating funds provided in **FY 2021**



$73M Implemented '**Data-source Agnostic Common Services (DACS)**' Budget Planning and Funds Control to execute a **FY 2022 PBR of $73M**

12 Billets and $17.2M

HR successfully transferred **sustainment staff** and supporting **contracts** to **OSPO**

98% of funds provided to CLASS awarded on contracts

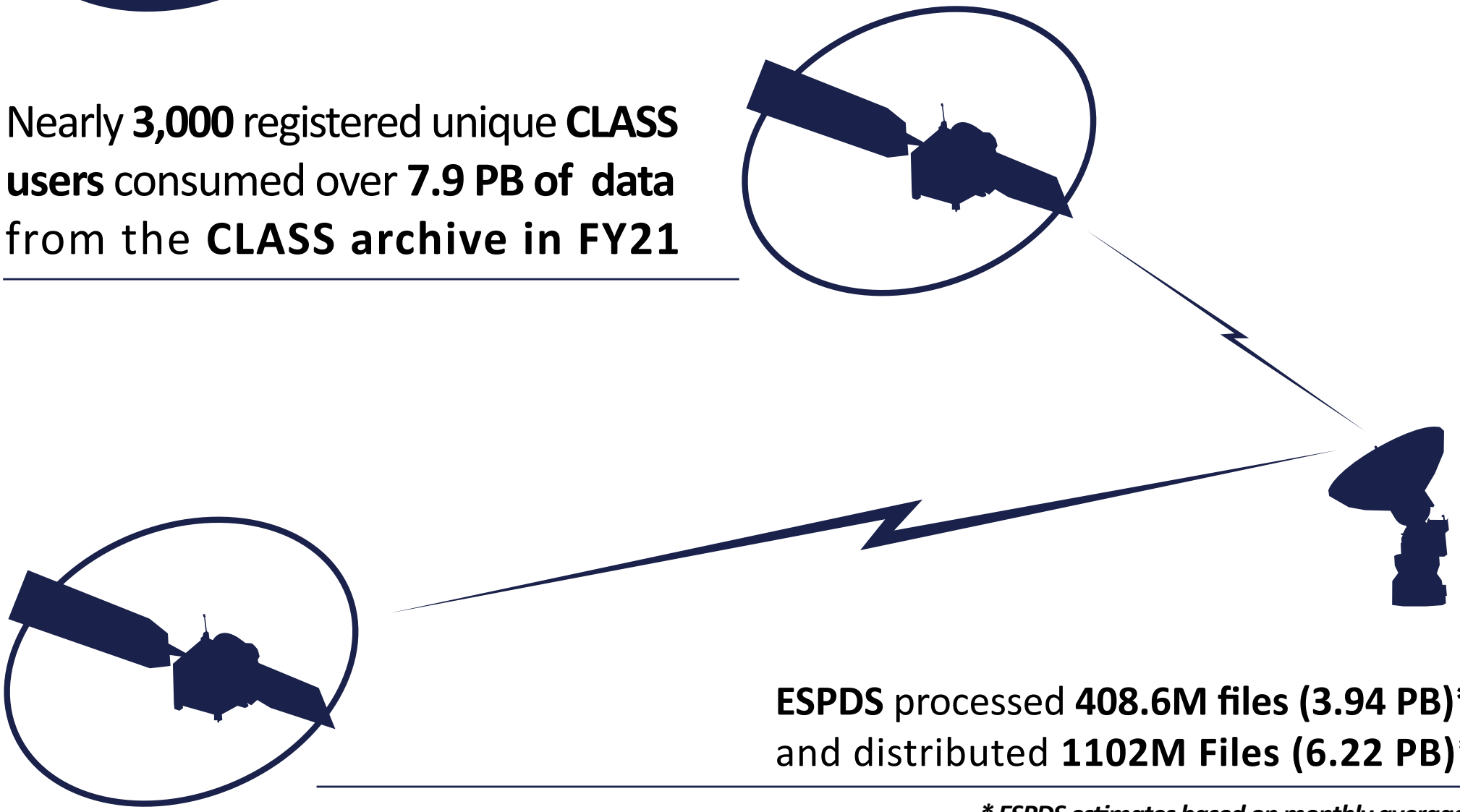
The Front Office Created an OSGS **Employee Advisory Council (EAC)**

> The EAC is a volunteer body of OSGS employees that has engaged to advise and support senior leadership regarding pertinent issues that affect the morale, working conditions, business culture, and success of employees in their jobs within the organization

Click **here** to learn more

OSGS data by the numbers

Nearly **3,000** registered unique **CLASS users** consumed over **7.9 PB of data** from the **CLASS archive in FY21**



ESPDS processed **408.6M files (3.94 PB)***
and distributed **1102M Files (6.22 PB)***

**** ESPDS estimates based on monthly averages***