One NASA Cost Engineering Database (ONCE) 2023 Update
NASA Cost & Schedule Symposium

2 – 4 May 2023

NASA HQ OCFO Strategic Investments Division

James K. Johnson, Eric Plumer, Julie McAfee (SAIC), Mike Blandford (SAIC)

Overview

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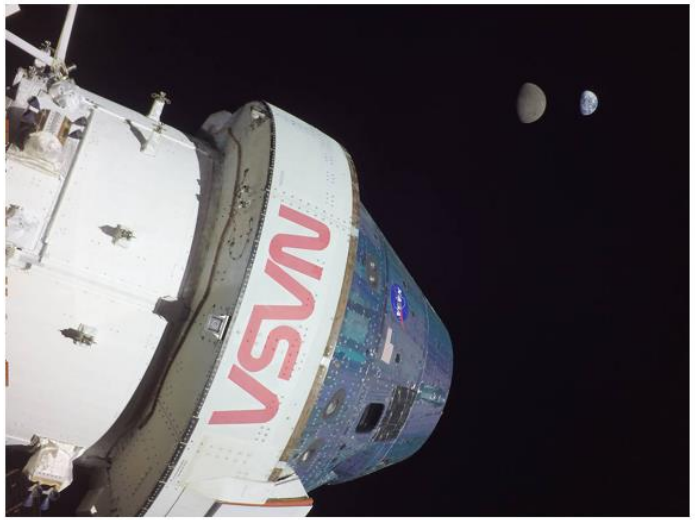
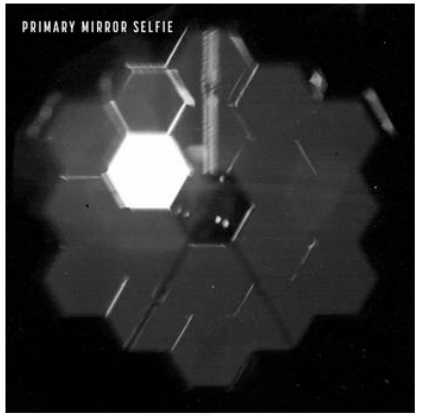


Orion



JWST Images

SWOT

Artemis 1

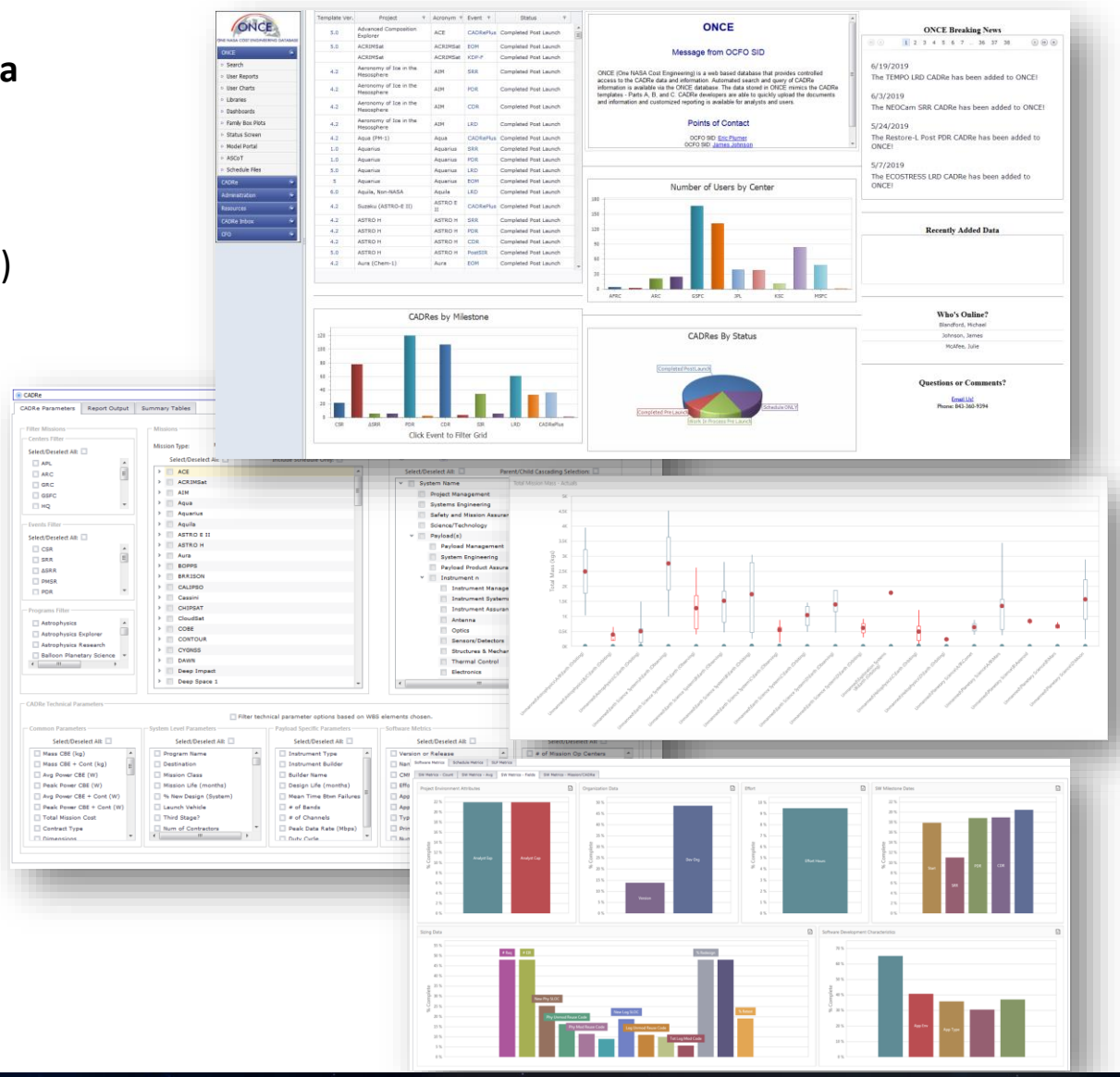
ONCE Virtual Live Demo:

7 June 2023, 1pm Eastern

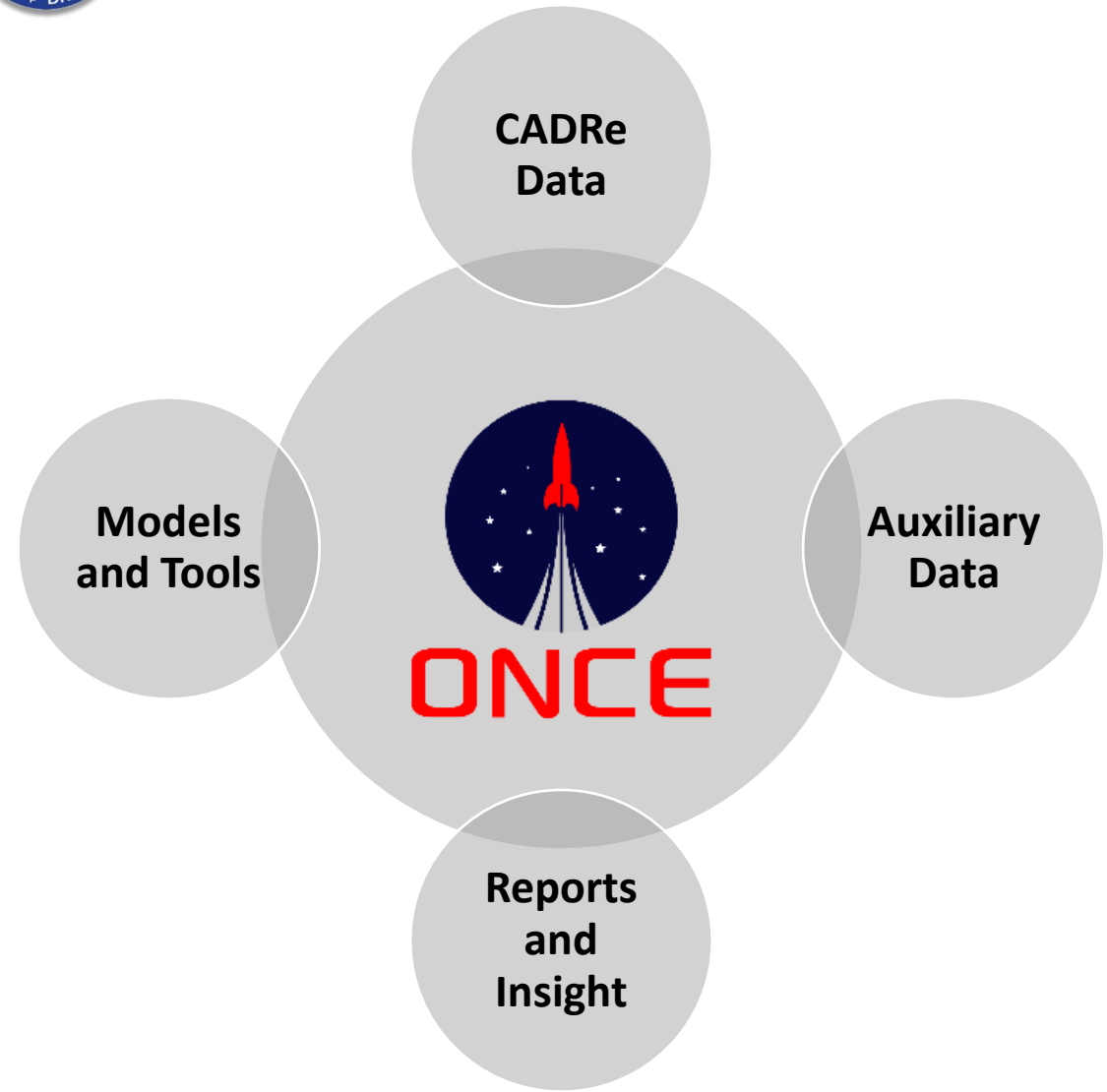
RSVP to hq-oncesupport@mail.nasa.gov for Invite

What is ONCE and CADRe?

- **The ONCE Database (aka https://oncedata.hq.nasa.gov, aka "ONCE") is a government website managed by HQ OCFO SID that provides access to technical, cost, schedule and other programmatic information about NASA Projects.**
- The **data primarily comes from CADRe** (Cost Analysis Data Requirements)
  - CADRe is the Agency's formal cost data collection initiative in NPR 7120.5F
  - CADRe is managed and funded by SID and performed during lifecycle reviews on Projects
  - **Part A** = Long narrative describing the mission, design, spacecraft, etc. (MS Word doc)
  - **Part B** = Technical Data (**MS Excel file**)
  - **Part C** = Cost, Schedule, Risk, Programmatic Data (**MS Excel file**)
- The website provides a user interface to search and retrieve data
  - Enables users to quickly build analogy datasets, develop estimating relationships, conduct assessments, examine historical trends, and many other important functions that support NASA projects and decision makers
- Request access to ONCE via IDMax/NAMS (https://nams.nasa.gov)
  - ONCE is behind the NASA firewall and intended for NASA CS and NASA Contractors
    - Exclusions include: NASA prime contractors, Academia/Universities, Foreign/International
  - For more information on ONCE and how to request access:
    - https://www.nasa.gov/offices/ocfo/functions/models_tools/CADRe_ONCE.html



ONCE Database at the Center



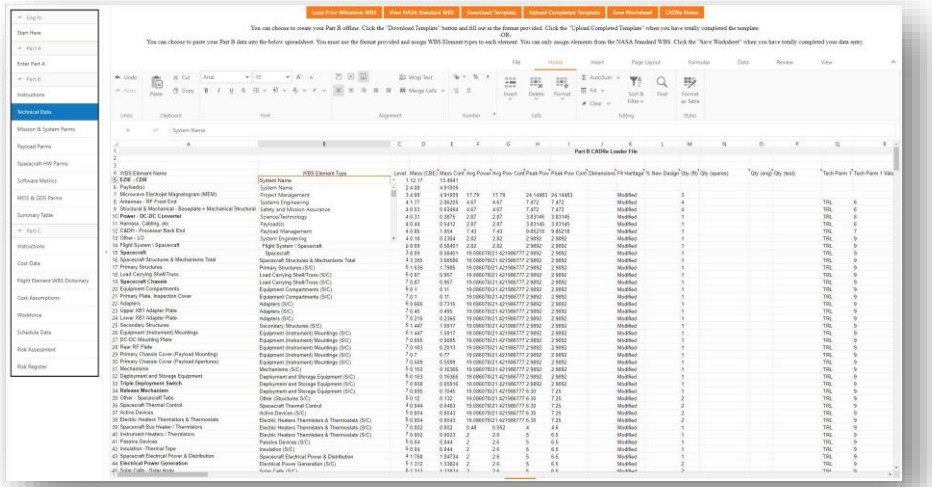
- The ONCE database is at the center of OCFO SID efforts to build and improve the NASA community.
- ONCE empowers analysts and improves estimating at NASA by providing access to:

  - **CADRe Data**
    - Active filtering for custom user reports
    - CADRe Library
  - **Auxiliary Data**
    - Normalized datasets
    - Multiple Electronic Libraries (Symposium, Schedule, KDP, etc.)
  - **Reports and Insight**
    - Dynamic graphical & tabular reports
    - Structured database reporting
    - **PowerBI export format**
  - **Models and Tools**
    - Model Portal sharing access across community
    - Online Models
    - **Container Hosting**

ONCE Major Improvements

✓ Online CADRe Entry in ONCE

- Piloting (EZIE) CADRe entry directly into ONCE for CADRe Developers
- Validation of data prior to database import
- Reuse of prior data and structure to improve consistency and save time
- CADRe documents can be created by ONCE



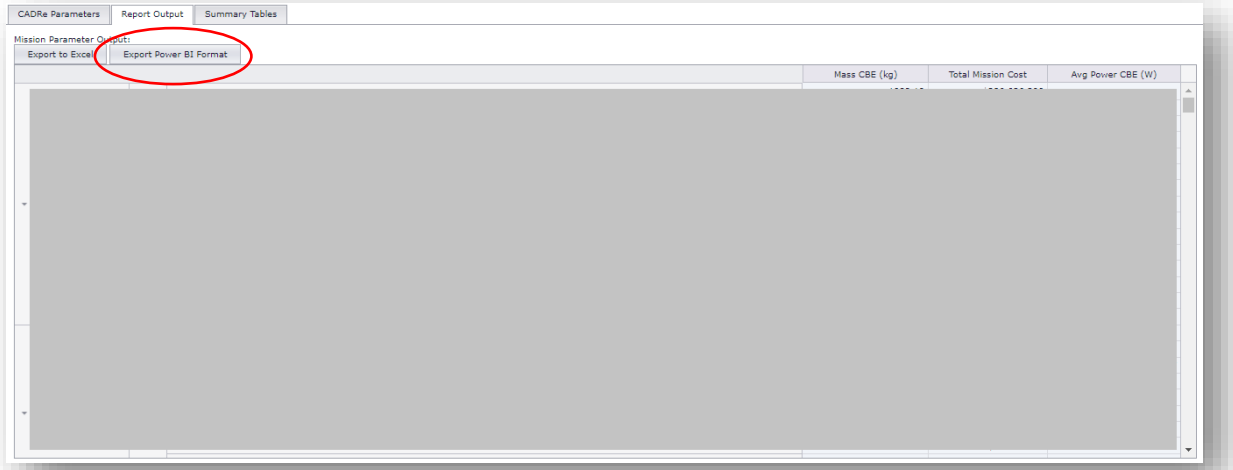
Online CADRe Entry in ONCE

✓ AWS Container Hosting

- Container hosting capability via AWS ECS
- Incorporated and operating the first container for models hosted in Other OS (Linux)
- Pilot #1: MSFC Planetary Program Office and Aerospace Corp, “aView” *[STAGING]*
- Pilot #2: JPL and SID, “ONSET: ASCOT & COMPACT” *[ACTIVE DEV]*
- Pilot #3: SID and APARC, “SMART” *[ACTIVE DEV]*

✓ PowerBI Export Format

- Export capability from ONCE User Reports menu item
- Includes both Technical and Cost data
- Includes CADRe, NICM, and NAFCOM datasets
- Format is “PowerBI-ready” for easy import and update



PowerBI Export Format

✓ Model Portal

- Incorporated new version NICM v10 (CS & Contractor)
- Added SEER by Galorath (Instructions & License only)
- Includes updates to ASCoT and COMPACT

✓ File Library

- Large expansion of KDP File Library (KDP Memo’s & Datasheets on 120+ Projects)
- Decision Memo Example Files: KDP0/1/2/A/B/C/D/E (aligned with 7120.5F)

ONCE Numbers & Information Summary

Model Downloads: 2380+
Top Models: Fuse, ACEIT/JACS, NICM, PCEC, MOCET, SMART

10 models & tools available for users to download

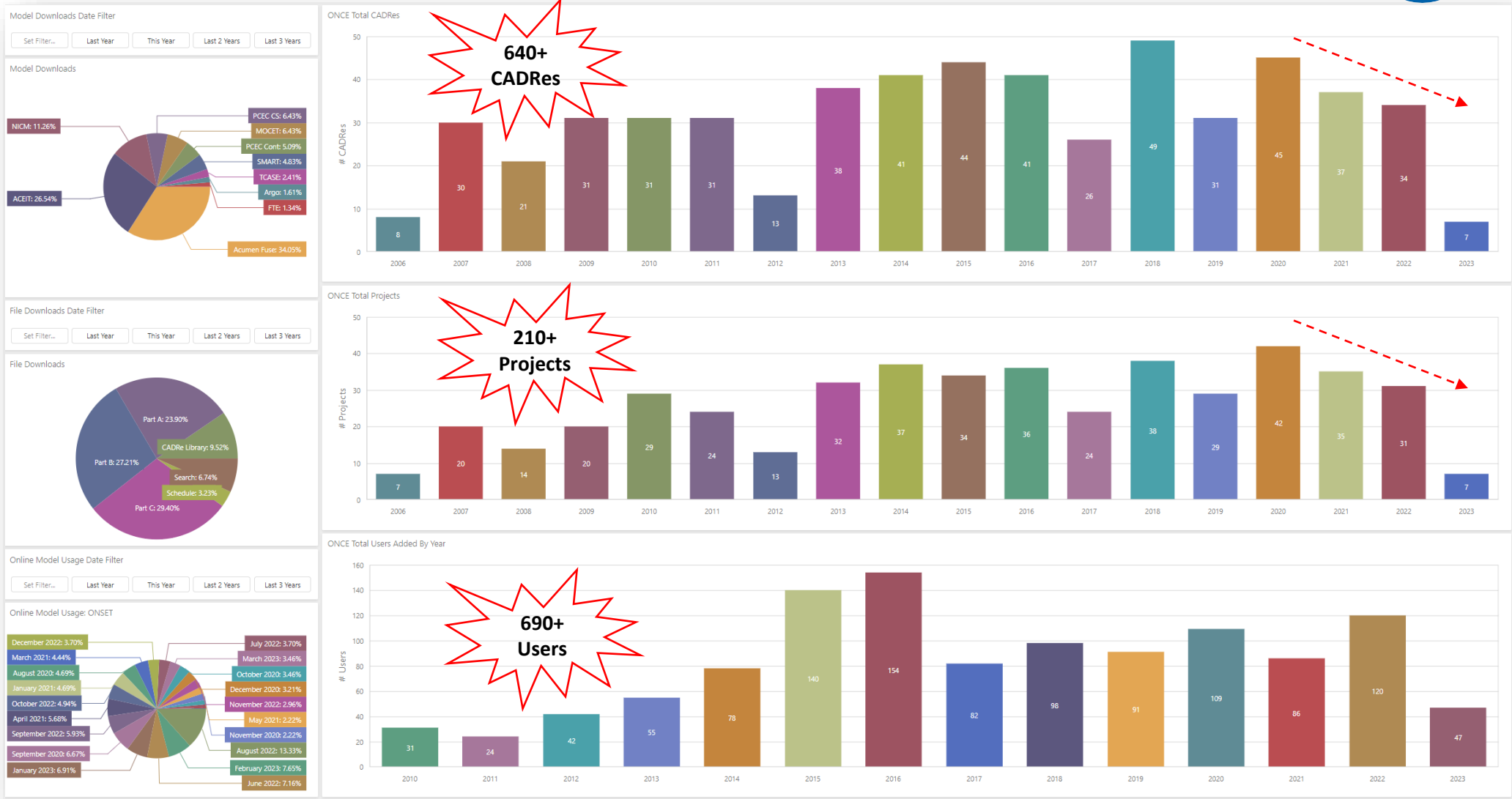
Total Size: 308GB (+14GB)
79k (+2k) documents

Most Popular CADRes:
JUNO, ACE, Insight, NuStar

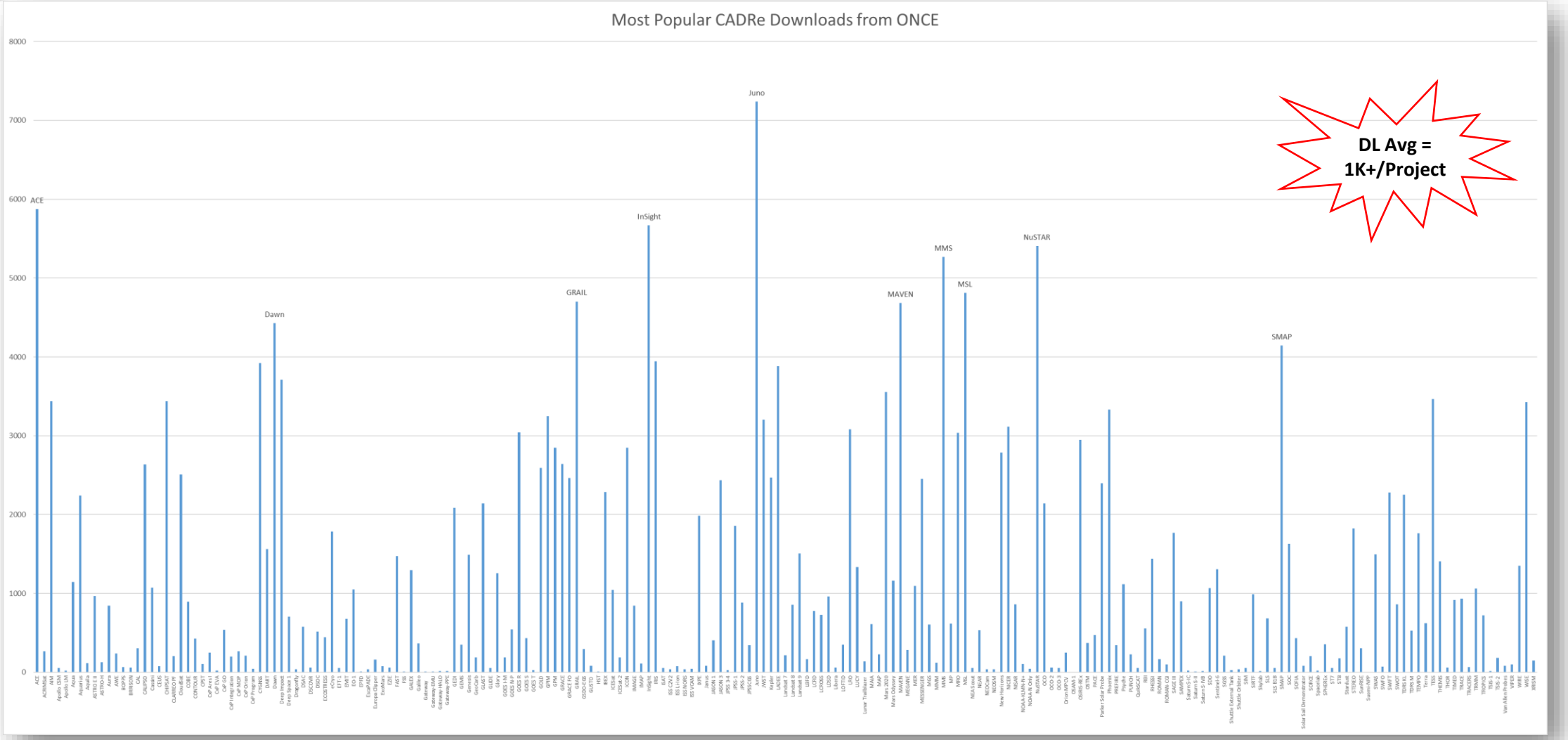
LRD is most popular CADRe Milestones

Online Model Usage:
30-40 Avg Users/Month

Includes both ASCoT and COMPACT



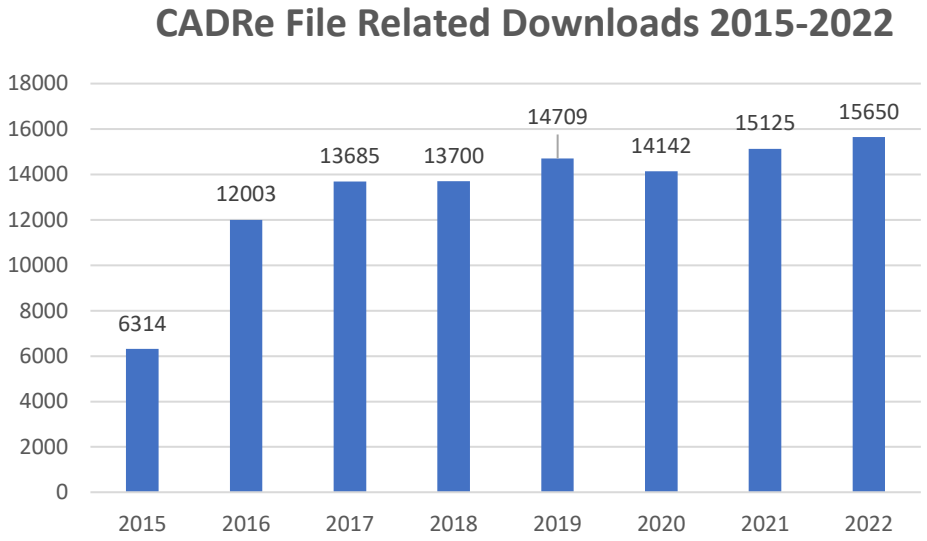
ONCE Downloads – CADRe Usage (230K Downloads)

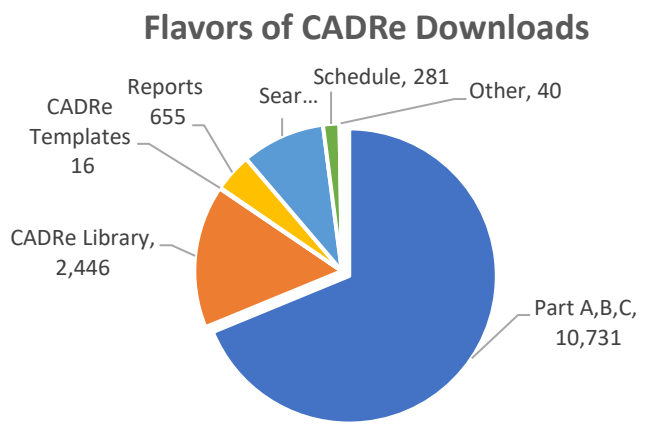


Top 10: JUNO, ACE, Insight, NuSTAR, MMS, MSL, GRAIL, MAVEN, DAWN, SMAP

ONCE Growth- CADRe Usage

CADRe has Experienced a 146% Usage Growth just since 2015





52 Feet

15,650 Files Downloaded in 2022 equals ~156,500 pages (10 pages/file)
Each page is approximately 0.004 Inches thick (per google)
This equals 626 Inches or 52 Feet

Approximately 52 Feet of CADRes & CADRe Source Documents Downloaded from ONCE Every Year!

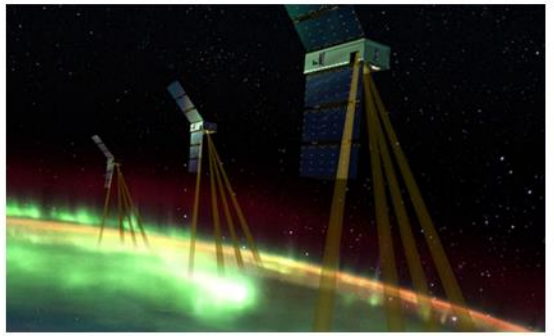
6 Feet

CADRe DATA

Online Data Entry

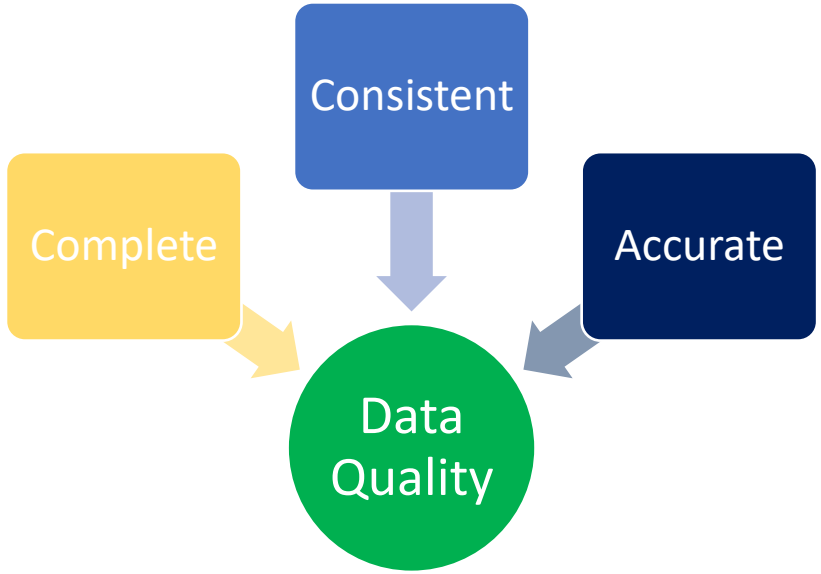
Online CADRe Entry: Status & Benefits

- **Current Status: Pilot with EZIE CADRe**
  - EZIE CDR CADRe approx. 75% Complete
  - Feedback from Pilot will inform next iteration
- **Next Milestones:**
  1. Initial Capability for limited rollout (2023)
  2. Full Capability for rollout to all CADRe Developers (early 2024)
- **Benefits:**
  - Improve data quality
  - Decrease time to upload/ingest data
  - Increase consistency and traceability
  - Improve CADRe Developer environment
  - Prior milestone brought forward: wbs, naming, etc.
  - Multiple entry methods: Online and Offline w/Template
  - Offline entry supports equations
  - Easy update/revision for new fields, adjustments, etc.



EZIE

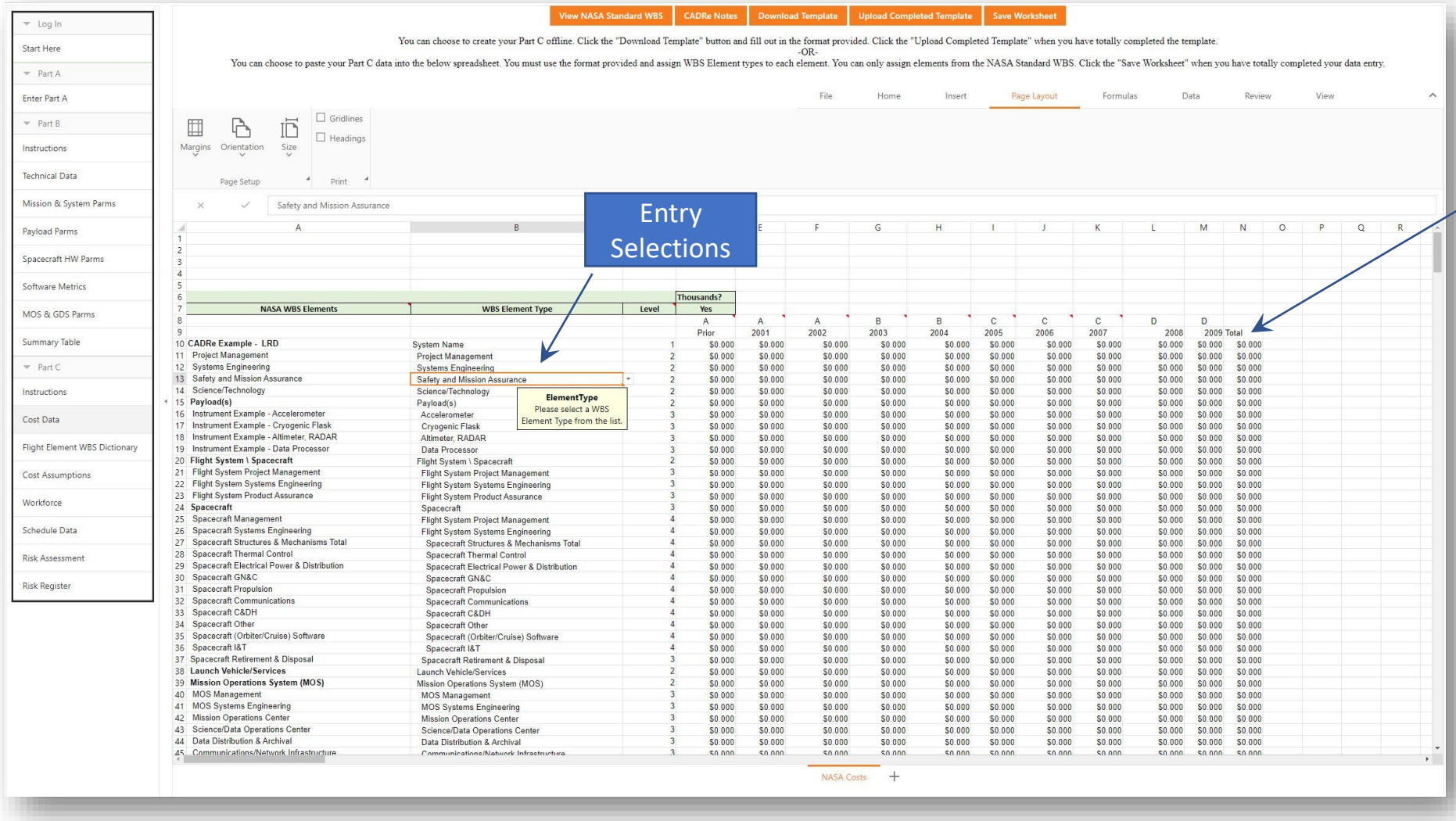
EZIE Mag 4 Kids



CADRe Entry – Online and Offline

- Data entry via Online Entry, Copy/Paste, & Offline Template

Online Data Entry Menu Items & Instructions



Online Entry, Copy/Paste, and Offline Template available

Online CADRe Entry – QA/Error Detection

- New CADRe entry process supports automated QA & error detection

CADRe Part B Technical Parameters Input Form

MISSION KEY PARAMETERS: EZIE - CDR

Mission Project Name	EZIE
NASA Program Source	* Program is required.
Mission Design Life, months	18
Num of Contractors	5
Num Govt. Organizations	1
Cruise Duration (months)	18
Primary Science Duration (months)	16
Target Body	Earth (Observing)
Mission Reliability Class	D
Mission Category	CAT 3
AO or Directed	AO Mission
Heritage Design Rating	Mod Design with High Heritage
Is there science during cruise?	Yes
Trajectory Class	LEO-Sun Sync
Power Mode	
Total Data Return	Gb
Total Dry Mass	kg
Total Dry Mass w/Cont	kg
Total Average System Power	W
Total Peak System Power	W
Orbital Periapsis	
Orbital Apoapsis	
Inclination, degrees	
Launch Vehicle	SpaceX Falcon 9
Third Stage?	No

Missing Data

MISSION KEY PARAMETERS: EZIE - CDR

Mission Project Name	EZIE
NASA Program Source	Earth Exploration
Mission Design Life, months	18
Num of Contractors	two Input is not a number
Num Govt. Organizations	1
Cruise Duration (months)	18
Primary Science Duration (months)	16
Target Body	Earth (Observing)
Mission Reliability Class	D
Mission Category	CAT 3
AO or Directed	AO Mission
Heritage Design Rating	Mod Design with High Heritage
Is there science during cruise?	Yes
Trajectory Class	LEO-Sun Sync
Power Mode	
Total Data Return	Gb
Total Dry Mass	kg
Total Dry Mass w/Cont	kg
Total Average System Power	W
Total Peak System Power	W
Orbital Periapsis	
Orbital Apoapsis	
Inclination, degrees	
Launch Vehicle	SpaceX Falcon 9
Third Stage?	No

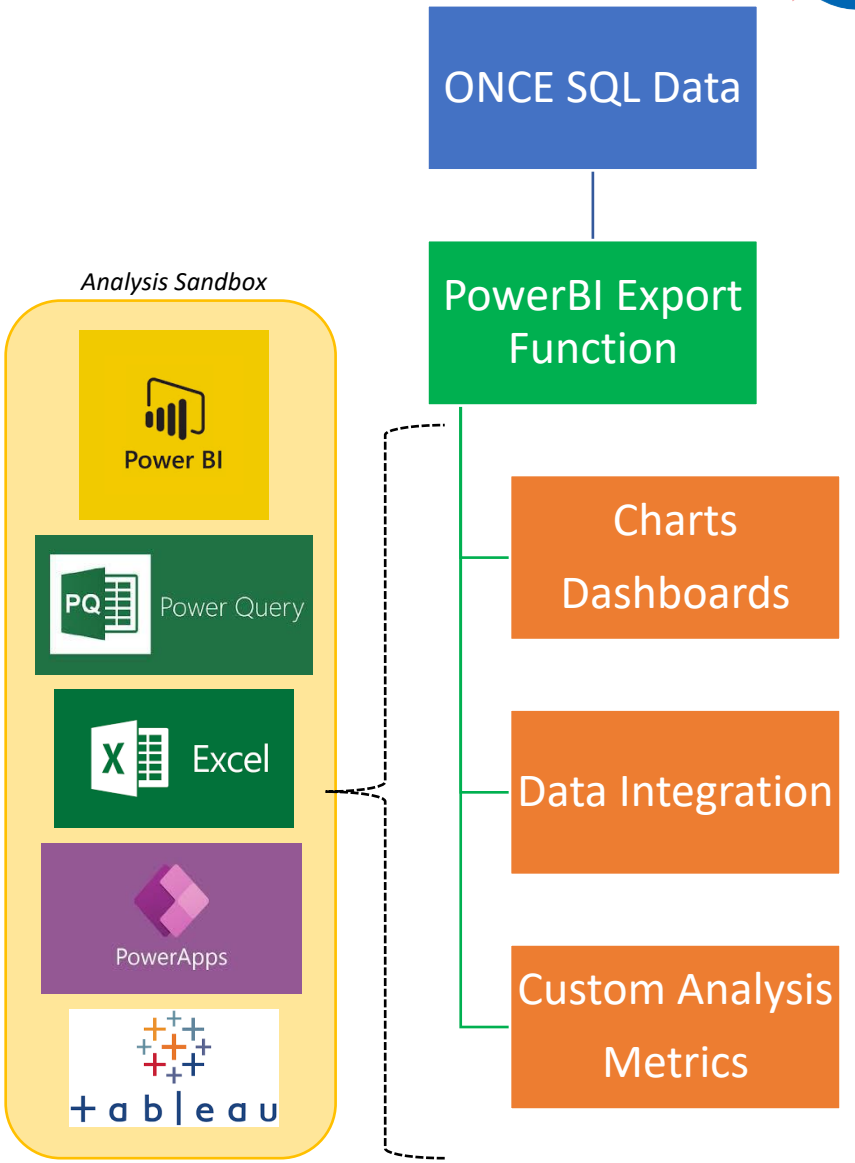
Incorrect Format

New User Reports Capability

PowerBI Export Format

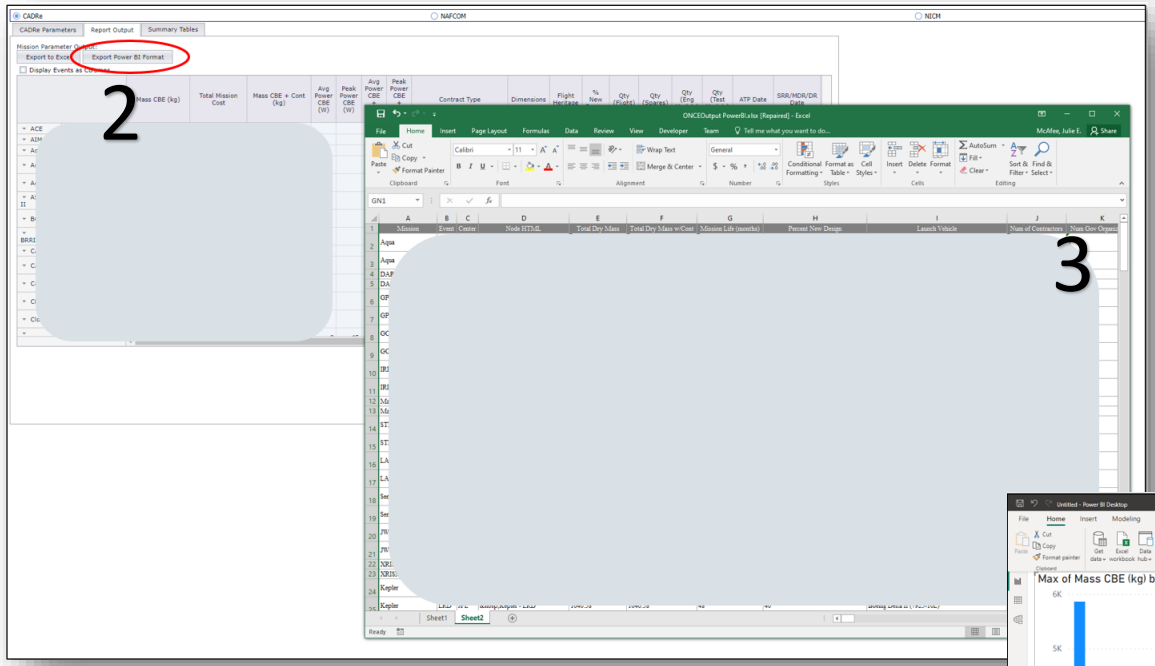
PowerBI Export Capability

- ONCE has added a specific export for MS PowerBI
  - Available on the User Reports menu item
  - OCFO is widely using PowerBI
  - NASA is deploying PowerBI Agency-wide
- Export is ready-to-go for PowerBI import
  - Columns, headers, names, data format, data types, units, individual row records, etc.
- User selects dataset and data to export
  - Excel file is created by ONCE
- User imports data into PowerBI
  - Build charts and dashboards
  - Conduct analysis
  - Create custom metrics
  - Perform data integration
- User can update dataset quickly and easily

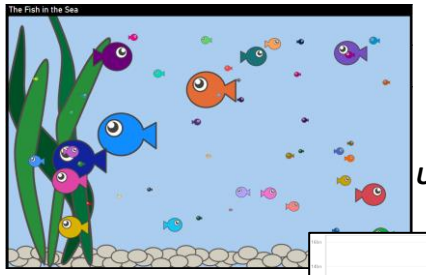


PowerBI Export Example

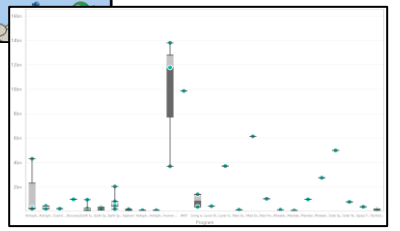
Select "Export PowerBI Format"



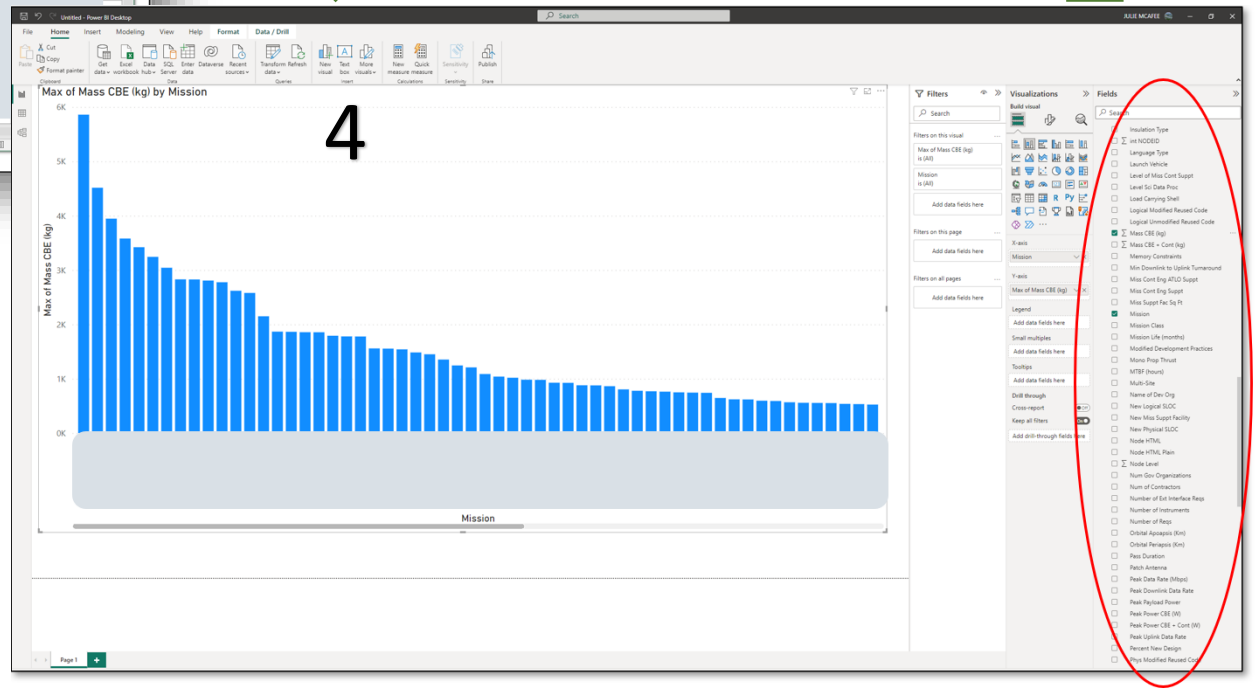
ONCE builds custom Excel file for PowerBI

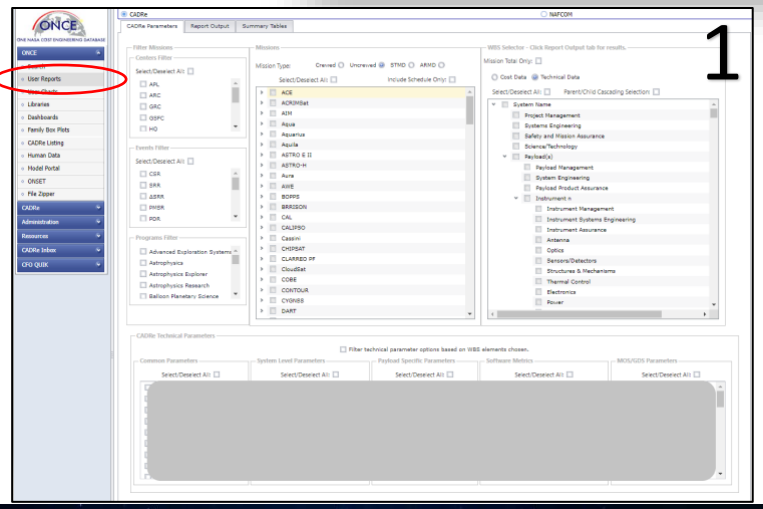


User can build variety of charts/dashboards



User imports into PowerBI and conducts analysis, builds charts/dashboards, etc.





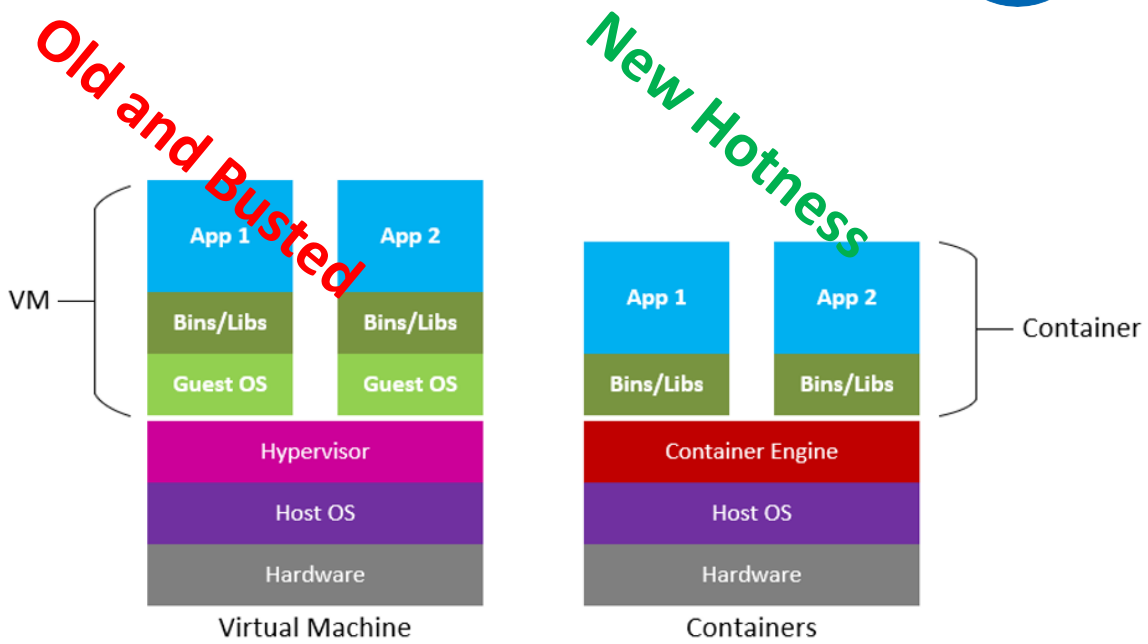
ONCE User Reports Menu Item to Select Data for Export

ONCE MODEL HOSTING

Container Capabilities

Model Portal Updates and Containers

- **ONCE offers several avenues for model distribution and hosting:**
  1. **ONCE Model Portal**
     - 9+1 models, More than 2,300 unique model downloads in the last 8 years
     - SEER by Galorath recently added (Instructions & License only)
     - Requires: Electronic Files and Licensing Information
  2. **Online Model Hosting**
     - ONSET (Online NASA Software Estimating Tools) w/ASCoT & COMPACT
     - Requires: Compatible Deployment Package (see ONCE Team for details)
  3. **Container Hosting**
     - ONCE is hosted on the AWS NASA HQ Managed Cloud Environment (MCE)
       - ONCE's Elastic Container Service (ECS) Fargate instance provides ability to host containers
       - Containers provide a standard way to host software products independent of their operating system
         - Allows products developed in different environments to be hosted within one URL
         - Containers can be operated without having to directly manage and maintain virtual machines
     - Requires: Container(s) (see ONCE Team for details)
- **Contact us to host and share your models: james.k.johnson@nasa.gov**



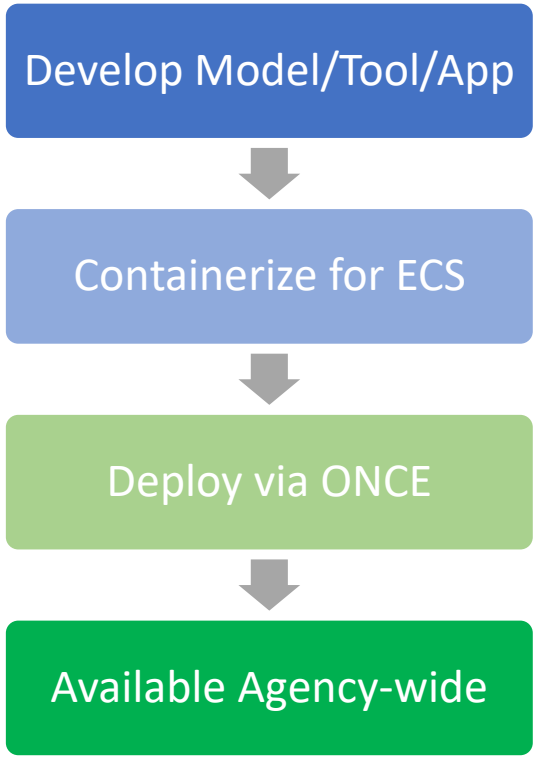
mce NASA • HQ

aws

AWS Fargate

Container Environment & Capabilities

- **Container Environment:**
  - Amazon Web Services Elastic Container System (AWS ECS)
    - Similar to Docker and Kubernetes
- **Capabilities:**
  - Host an online model/tool/app from other org's, Center, Partner, etc.
    - Available inside the NASA firewall
  - Easy and fast updates via AWS Command Line update service
  - Develop locally (incl OSS) and deploy independently to Agency-wide
  - Deploy inside NASA firewall *AND* internally at your organization
  - Full integration with NASA LaunchPad/PIV for Authentication
  - Full integration with NASA IdMax/NAMS for User Access Management
  - Elastic Load Balancing and Relational Database Service
  - Integration with NASA GitHub for code repository
  - Security and Management by NASA CIO
  - Tracking, Reporting, Notifications, Configuration Management
  - Easy to scale processing, memory, and storage resources
  - **Host a model/tool/app big or small!**



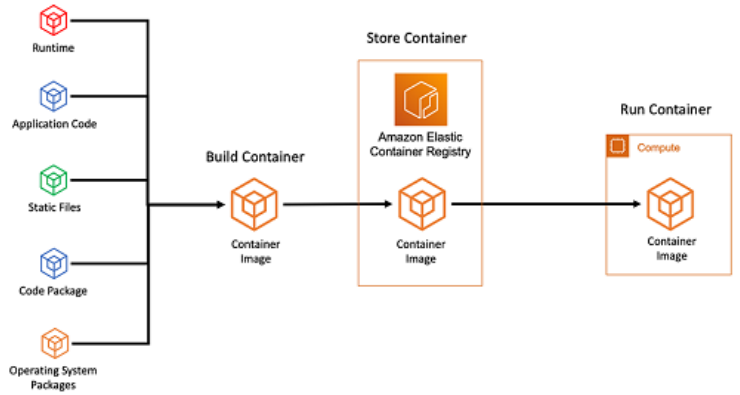
https://developer.ibm.com/articles/true-benefits-of-moving-to-containers-1/

Containers on ONCE: aView Example

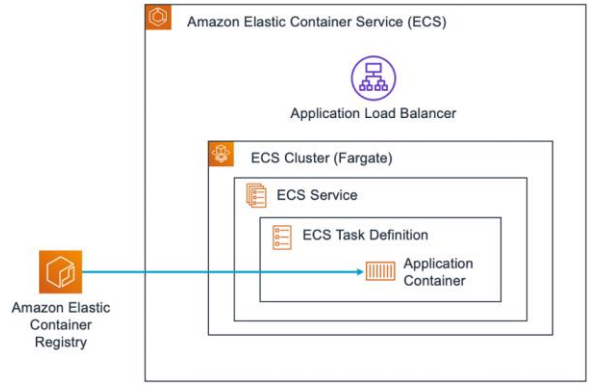
aView/App Menu Item

- Container hosting capability is fully integrated with ONCE
- Shoutout to Aerospace Corporation & MSFC Planetary Missions Program Office

Container/Application Requirements, Docs, & Templates



- **Container Image Requirements:**
  - Model/Tool Developers final delivery is an image file (Not source code)
  - Complete and static with a full snapshot of everything required to function
    - Libraries, dependencies, critical data, etc.
  - Run only a single application process
- **Documentation:**
  - Must provide documentation on design architecture (diagram, drawing, etc.)
  - All application dependencies must be documented (name, list, etc.)
  - Developers must maintain their code within a NASA approved Github repository
    - You can use your own repo but must transfer to NASA Git for deployment
  - Unique tag for each build using Git



- **Templates:**
  - Developers must follow the NASA "pipeline template" (CloudFormation) from AWS
    - Provided to all developers free-of-charge, enables features such as logging, load balance, etc.
- **Authentication:**
  - Developers should remove any built-in authentication or user access management
  - Containers must utilize NASA LaunchPad SAML2 SSO
    - Detailed information provided to all developers

SECURITY AND DATA PROTECTION

ONCE Access Information

Allowable Users/User Responsibilities

- **Allowable Users:**
  - NASA Civil Servants
  - NASA Contractor with active contract and NASA PIV badge
  - Other US Government Civil Servant with OCFO SID approval (requires documented agreement)
  - Other US Government Contractor with OCFO SID approval (requires documented agreement)
- **Unallowable Users:**
  - Academic/University Student (includes interns)
  - Foreign Nationals
  - Spacecraft Prime Contractors (exception via NASA Cost IPT Vendor Specific Data Package)
  - Instrument Prime Contractors (exception via NASA Cost IPT Vendor Specific Data Package)
- **User Responsibilities:**
  - All users must have acceptable justification for access to ONCE
  - Users accounts must be kept current
    - Periodic review of user accounts is required per NASA IT policy
  - Users can be subject to investigation, bans, disciplinary action, and/or criminal prosecution
    - US Federal Government Information System located behind the firewall with full monitoring and tracking
  - All users agree to all conditions on the ONCE NAMS request form and each login via Splash Screen

ONCE Access: Do's and Don'ts

- ✓ Do request a walkthrough of ONCE
- ✓ Do visit the public website on ONCE for more information and how-to access:
  - ✓ https://www.nasa.gov/offices/ocfo/functions/models_tools/CADRe_ONCE.html
- ✓ Do contact us: hq-oncesupport@mail.nasa.gov
  - ✓ ONCE Access
  - ✓ CADRe data inquiries
  - ✓ Data discrepancies
  - ✓ Security concerns
  - ✓ Other
- ✓ Do follow the CUI markings and NASA best practices for data security
- ✓ Do follow the NASA STI process for publishing and presenting
- ✓ Do follow the NASA Technology Transfer Program processes (e-NTR/SBIR/STTR/etc.)

- X Do not access ONCE or ONCE data from another user's account
- X Do not share ONCE data
  - X Do not include historical data from ONCE in public presentations
  - X Do not assume audiences or other organizations understand and/or are compliant with NASA policies
- X Do not distribute or share models or tools with unauthorized users
- X Do not use ONCE data for any other purpose than what is on contract with NASA
- X Do not sell data from ONCE (incl: trade, lease, rent, or other)
- X Do not use the data from ONCE in models or tools for sale without prior explicit approval from NASA
- X Do not put ONCE data into personal or other unapproved commercial cloud storage services (Google, Dropbox, etc.)
- X Do not keep ONCE data on your personal computer, and/or computers or data storage systems that are not compliant with NASA data protection policies

Support Updates

- **New ONCE Support Email Address: hq-oncesupport@mail.nasa.gov**
  - Help Desk: Questions, issues, requests, walk-throughs, technical support
  - Model Portal Updates & other ONCE communications from this address
  - Available in the NASA Global Address Book
- **Outage Notifications**
  - Automatic notifications in case of an outage
  - Support and contact information displayed for users

You should never see this, but if you do, we will know about it automatically!

Conclusion

- **ONCE is continuing to expand and provide new capabilities for users**
  - PowerBI export format enables many new capabilities & aligns w/Agency direction
  - KDP File Library expansion and examples increase knowledge & improves process
- **The team is prioritizing improvements that will increase data quality**
  - New approach to direct-entry of CADRe data is a significant improvement
- **ONCE offers the community a variety of methods to host models and tools**
  - Model Portal: Electronic files and license information
  - Container(s) via Amazon ECS with many advanced benefits
- **Users are reminded to abide by terms and conditions, to protect the data, and only use it for NASA work**
  - All of ONCE is now marked Controlled Unclassified Information (CUI)
  - Contact HQ OCFO SID with questions to avoid potential issues
- **Reminder:**
  - ONCE Virtual Demo / Training via Teams on 7 June at 1pm Eastern

Presentations:

Joe Mrozinski (NICM v10)
Eric Plumer (CADRe)
Melissa Hooke (COMPACT & Bayesian RoT)
Andy Prince (Complexity)
Justin Hornback (Canceling Projects)
Victoria Nilsen (Correlation of Residuals)
Drexler & Co. (JCL for Gateway)
Alford & Co. (JCL for HLS)
Marc Hayhurst (MOCET)
Sarah Lang & Justin McNeill (aView)
Rachel Sholder & Kathy Kha (Growth)
Jon Fleming & Kristen Kherer (EVM)

Shout-Outs:

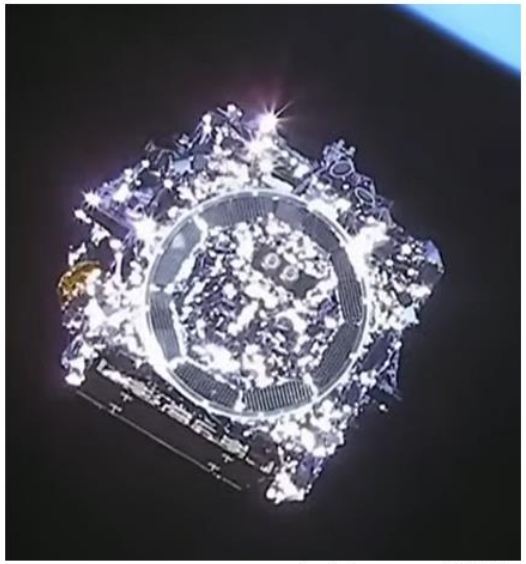
Margaret Vo Schaus, NASA CFO
Craig McArthur, SID Director
Robin Smith, Symposium Coordinator
Steve Shinn, DCFO
Doug Comstock, DCFO
Dave Mitchell, CPMO
Charles Hunt, SID APARC

ADDITIONAL INFORMATION

BACKUP

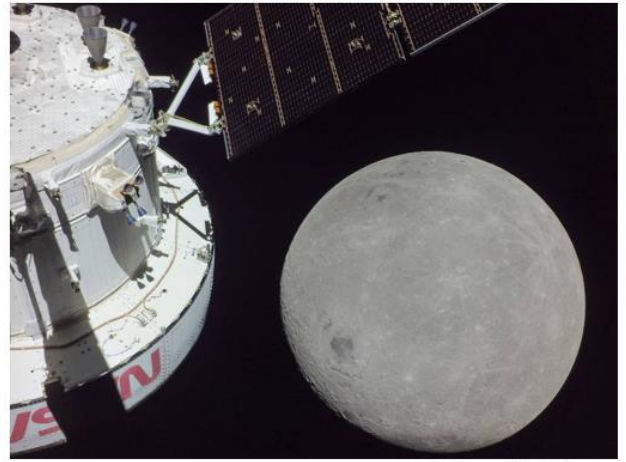
Additional ONCE Resources

- ONCE Support Email: hq-oncesupport@mail.nasa.gov
- ONCE CADRe website on public NASA.gov: https://www.nasa.gov/offices/ocfo/functions/models_tools/CADRe_ONCE.html
- ONCE website (NASA network only): https://oncedata.hq.nasa.gov
- How to request access: https://www.nasa.gov/sites/default/files/atoms/files/_once_user_access_request_form_tagged.pdf
- HQ ONCE POC: James Johnson, james.k.johnson@nasa.gov
- SAIC ONCE Team: Julie McAfee, julie.e.mcafee@nasa.gov, Mike Blandford, michael.blandford@nasa.gov
- HQ CADRe POC: Eric Plumer, eric.plumer-1@nasa.gov
- 2022 NCSS Presentation: https://www.nasa.gov/sites/default/files/atoms/files/45_once_2022_ncss_main_presentation_vsubmit.pdf
- 2019 NCSS Presentation: https://www.nasa.gov/sites/default/files/atoms/files/18_once_2019_ncss_main_presentation_vsubmit_tagged.pdf



Last images of JWST

TEMPO



Orion with Moon

JWST image "Pillars of Creation"

Resources on Containers, ECS, & Online Applications (Dash/Plotly)

- Develop data visualization interfaces in Python with Dash: https://realpython.com/python-dash/
- Video Introduction to Dash Plotly: https://www.youtube.com/watch?v=hSPmj7mK6ng
- Plotly Dash: https://plotly.com/dash/
- Dash for Beginners: https://towardsdatascience.com/dash-for-beginners-create-interactive-python-dashboards-338bfcb6ffa4
- Amazon ECS Containers Best Practices: https://docs.aws.amazon.com/AmazonECS/latest/bestpracticesguide/application.html
- Dockerize/Containerize a Dash App: https://towardsdatascience.com/dockerize-your-dash-app-1e155dd1cea3
- Dockerize/Containerize a Python Dash App: https://awstip.com/docker-ize-a-python-dash-application-and-deploy-it-to-cloud-717a7c25de5b

How I imagine the AWS ECS

This is why we have backups

The description in the plan

That AWS Engineer with the right privileges

What the budget can afford

Available documentation

ONCE & PowerBI Future

- Many potential futures…options balanced against constraints and resources combined with timing and enterprise actions…
- **Near-Term Goal:** Enable high-quality and repeatable data export in the correct format for all available datasets on ONCE
  - ONCE will be enabling Users to build their own PowerBI charts/dashboards
  - New Enhancement: Notify Users to re-run export when new Project or CADRe is added
  - New Enhancement: Save/Copy User Report settings for re-run export
- **Long-Term Goal:** Align ONCE with NASA enterprise and OCFO to take full advantage of automation and integration with PowerBI
  - This may include direct connection if/when made available by NASA
  - Users could be capable of building custom queries
  - Publishing online and/or via Sharepoint, MS Teams, etc.
  - ONCE could build and maintain a curated set of charts/dashboards
  - ONCE could host community-created charts/dashboards
  - Analysts could publish ONCE data with presentations online
  - Containerized Apps could be linked to the data with automation
  - Security policies can be enforced in the various “sandboxes”

SECURITY AND DATA PROTECTION

Controlled Unclassified Information (CUI)

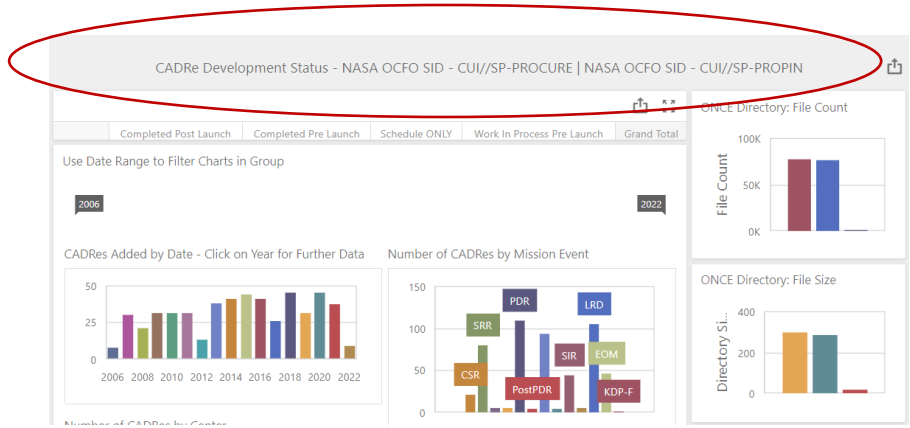
Terms and Conditions, NAMS, Splash Screen, and CUI

- **NASA Use Only**
  - Agree to use the data within ONCE for the purpose of performing work for NASA and that Contractors will only use the data when performing work on contract for NASA.
- **Eligible Users**
  - Agree they are a NASA employee, or an employee of an approved contractor company.
  - Agree they are not a university student, nor employee of an aerospace hardware prime contractor company.
- **Accounts and Monitoring**
  - Agree that by accessing ONCE you are consenting to monitoring and recording with no expectation of privacy.
  - Agree to abide by the Security of Information Technology Procedures and Guidelines (NASA NPG 810.1)
  - Understand that misuse of assigned accounts, sharing accounts, or accessing the accounts of others is not permitted.
- **Controlled Technical Data**
  - Agree not to disseminate or share controlled technical data in a manner that would violate applicable U.S. Export Control laws and regulations
  - Agree that they have not been disbarred, suspended, or otherwise deemed ineligible to perform work on U.S. Government contracts, or have previously violated U.S. Export Control laws
  - Acknowledge their individual responsibilities under applicable U.S. Export Control laws and regulations - including the obligation, under certain circumstances, to obtain an export license from the U.S. Government prior to the release of controlled technical data within the United States.
- **Model Portal**
  - Agree to follow the applicable license agreements for software models and tools that are available for download on the ONCE Model Portal.
  - Agree to not share the software models and tools outside of the ONCE Model Portal or in violation of the posted guidelines or license restrictions.
- **OCFO Data**
  - Agree to only access OCFO data with a legitimate business justification and prior approval from a HQ OCFO SID supervisor.
- **Splash Screen**
  - User reiterates their agreement to all responsibilities every time ONCE is accessed and the splash screen terms are accepted.

ONCE Data, Dashboards, and Downloads are marked CUI!

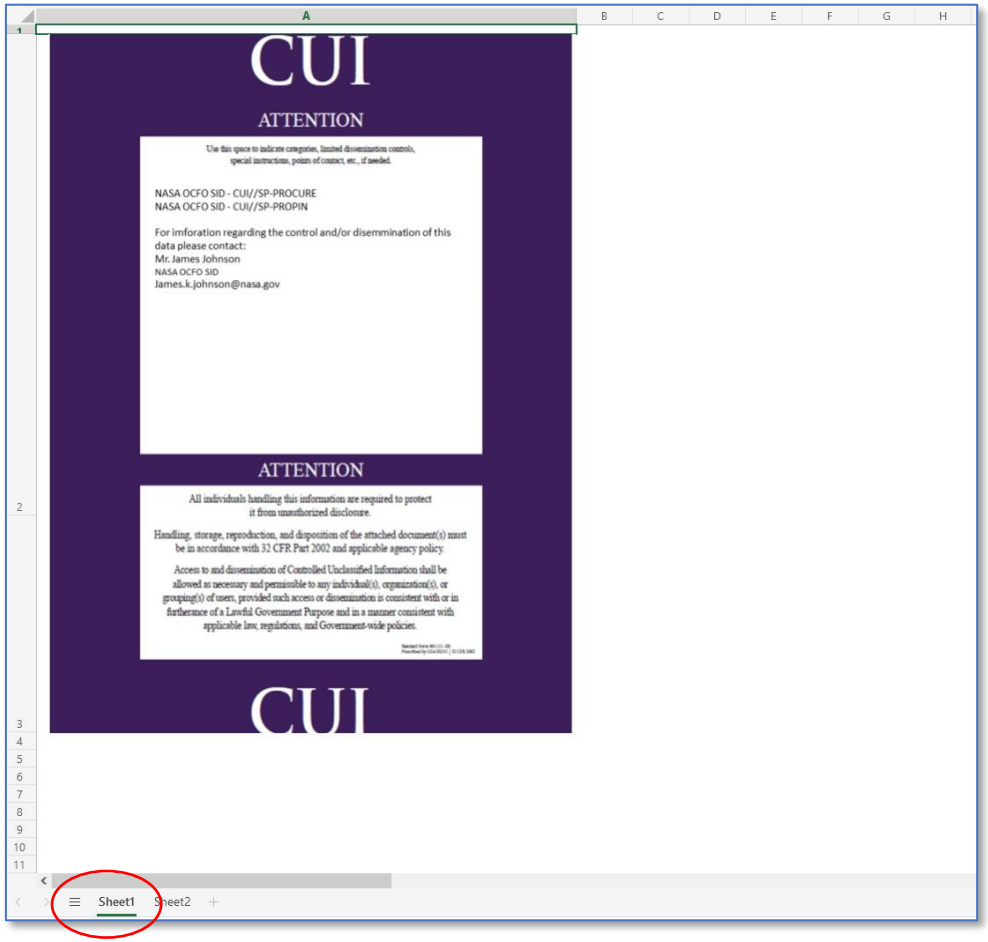
Integrating CUI into CADRe and ONCE

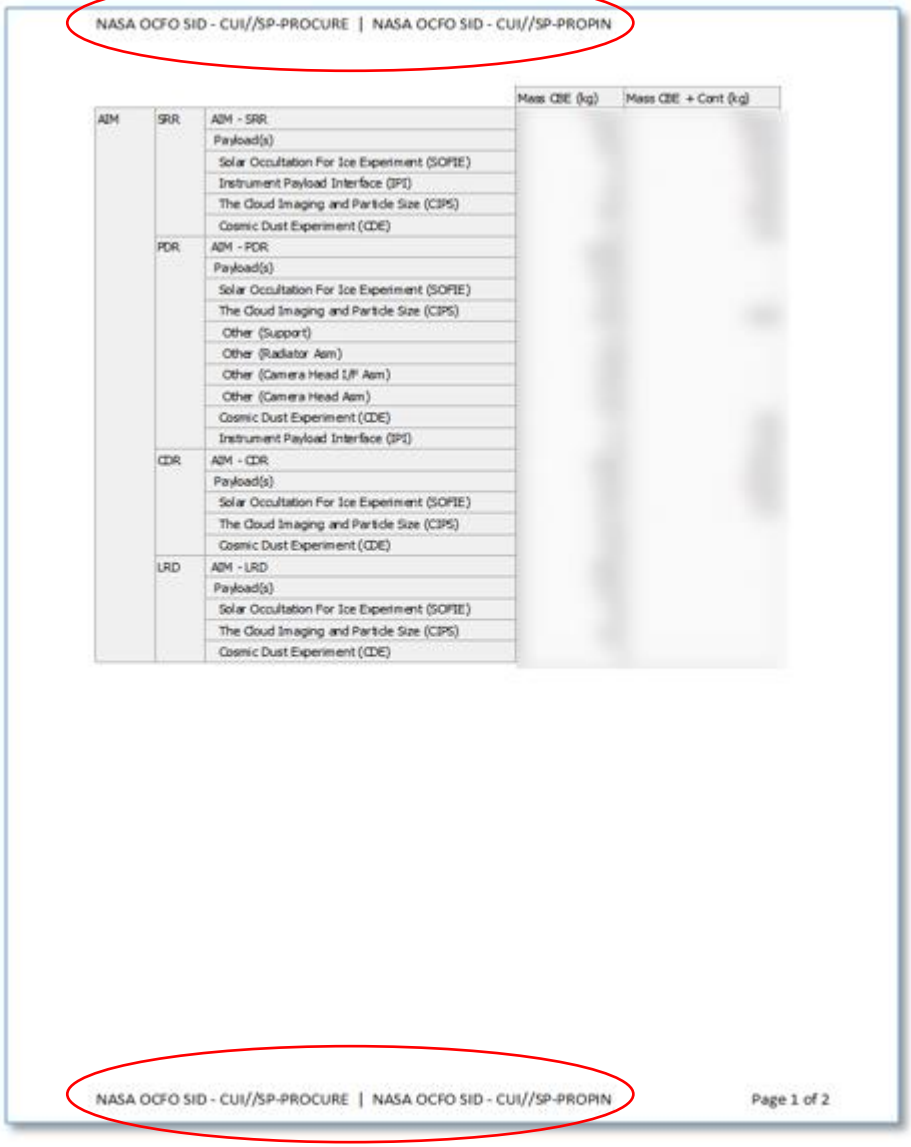
- Requirement to modify all systems to the standard identified in the 32 CFR 2002 by 31 December 2021
- ONCE Team spent from Fall 2021 to Early 2022 on planning and updates
  - Decision made to use CUI//SP-PROCURE and CUI//SP-PROPIN for all ONCE information
- Historical CADRe documents updated to include the CUI cover page and headers
  - Purple cover page added to all CADRe files
  - Over 1,500 documents (Part A/B/C)
  - Change-logs incorporate updates and document any future edits
- CADRe templates now include the appropriate CUI markings
  - Available for CADRe Developers and others
- ONCE now has required CUI markings in all applicable areas:
  - All dashboards and their exports include the applicable CUI cover page and headers
  - All exported files now include the applicable CUI cover page
  - All exported data (e.g. User Report data) include the applicable CUI cover page and headers



ONCE Export Example

CUI cover page added to first tab in Excel documents





CUI headers and footers integrated into exported data