EPIC PROGRAM ACHIEVEMENTS

2022 EPIC Summer Workshop

Content

i. Year 1 EPIC Accomplishments (July 2021 – June 2022)

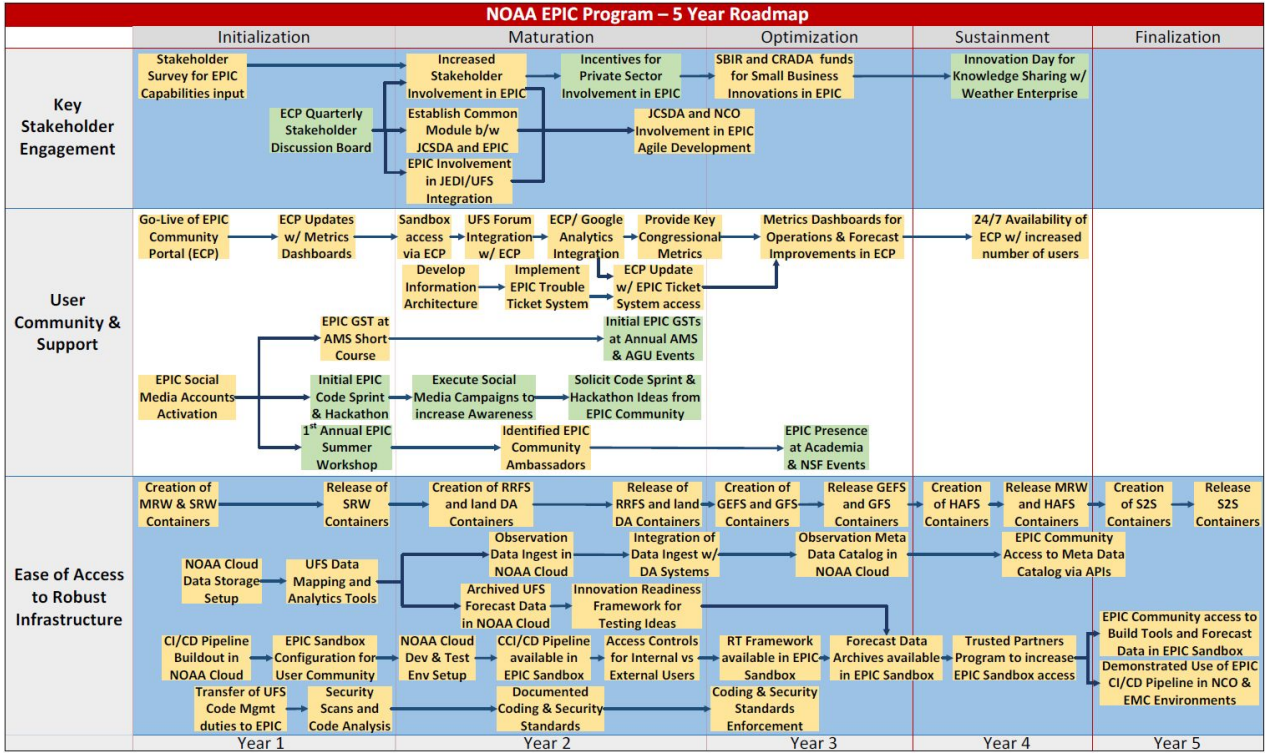
ii. Year 2 EPIC Accomplishments (July 2022 – Present)

Year 1 EPIC Accomplishments

July 2021 – June 2022

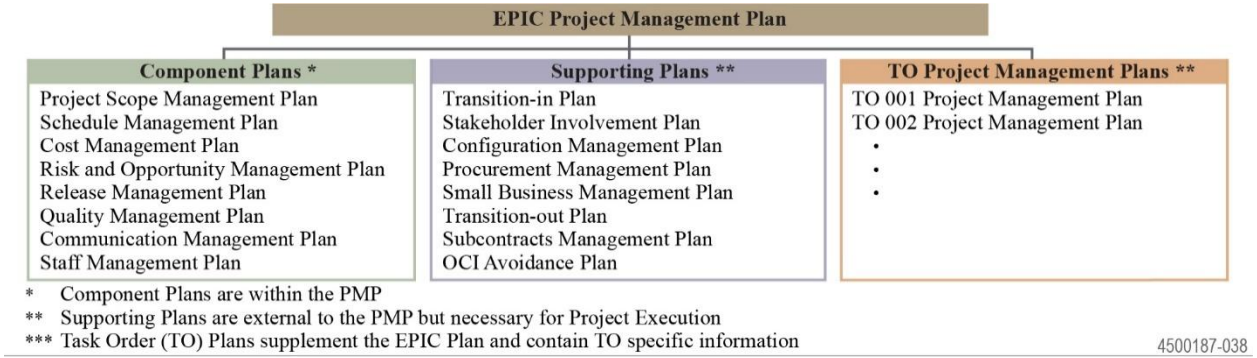
EPIC Vision and Mission

- The vision of EPIC is to enable the most accurate and reliable operational numerical forecast modeling in the world
- The mission of EPIC is to become the catalyst for community research and modeling system advances that continually inform and accelerate advances in our nation's operational forecast modeling systems.
- The EPIC 5-Year Contract Strategic Plan lays out the EPIC contract roadmap for implementing the EPIC mission and achieving the EPIC vision.



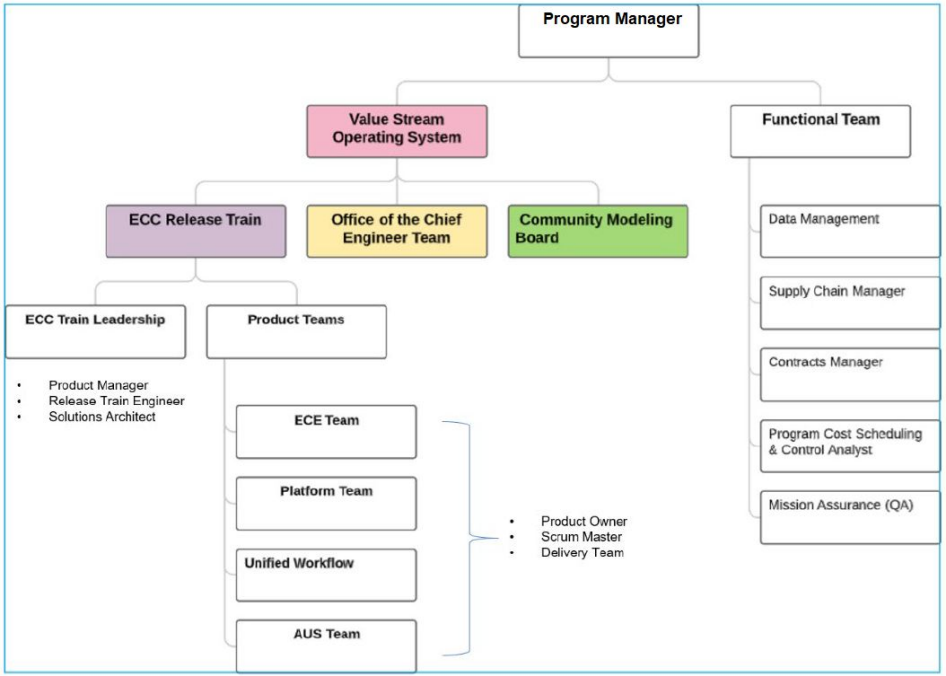
EPIC Project Management Plans

The 100% completed EPIC Contract Project Management Plan (PMP) consists of the following component plans, supporting plan, and Task Order PMPs and the Project Management Plans for both Task Order 1 and Task Order 2. The following documents have been delivered as part of this completion:



EPIC Contract Management

- Organizational Structure consists of a Value Stream and a Functional Stream
- Value Stream is where Agile Development work is conducted. It consists of an Agile Release Train, with 4 Agile Product Teams underneath.
- Functional Stream is where Business Office work is conducted. It consists of Contracts, Finance, Supply Chain, and Quality Assurance Teams.
- 2x Weekly Program Status meetings between Raytheon and EPIC Program Team (EPT)
- Weekly Technical Exchange meetings with Raytheon and EPIC Stakeholders
- Bi-Monthly Contract meetings with Raytheon, EPT, and Acquisition and Grants Office (AGO)
- Weekly and Monthly Status Reports, along with Spend Plans, across all Task Orders
- EPIC approved deliverables are stored in Google Drive.

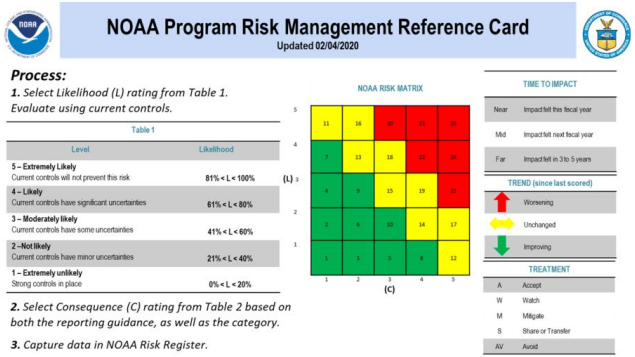


EPIC Risk Management

- Create a Risk template in JIRA to track all Risks across the EPIC Program, with Likehood and Consequence rating that fully align with the NOAA Project Risk Management Reference card.
- Established monthly reviews of the EPIC Program Risk Registry, with NOAA EPT.
- Track Risks at the Agile Release Train and Agile Product Team Levels, as tickets and dashboards within JIRA Risks.

Filter Results: EPIC Current PI Risks - All

T	Key	Summary	Risk Statement	Status	Assignee
!	ECC-40	(ECE) Not having access to the platforms that will be called for displaying metrics.	If we do not have access to these various platforms, then we will not be able to design and implement this dashboard widget.	CLOSED	Jamiel Farhat
!	ECC-43	Access to all tier 1 HPC Systems	If team members don't have access to the HPC systems, then the work will be delayed or blocked	RESOLVED	Cam Sherrell
!	ECC-165	Need Resources to Support SRW & MRW	If resources don't onboard, we will not have capacity to support SRW & MRW	OWNED	Stylianos Flampouris
!	ECC-168	Meetings with 3rd Party - ACIO	If the 3rd party doesn't happen in a timely manner, work will be delayed/blocked	ACCEPTED	Keven Blackman
!	ECC-163	ELK Components Fail	IF one of the ELK components fail to run, we will need to find a new solution	MITIGATED	Marcus Delponte



NOAA Program Risk Management Reference Card

Updated 02/04/2020

Process:

1. *Select Likelihood (L) rating from Table 1. Evaluate using current controls.*

Table 1

Level	Likelihood
5 – Extremely Likely Current controls will not prevent this risk	81% < L < 100%
4 – Likely Current controls have significant uncertainties	61% < L < 80%
3 – Moderately likely Current controls have some uncertainties	41% < L < 60%
2 –Not likely Current controls have minor uncertainties	21% < L < 40%
1 – Extremely unlikely Strong controls in place	0% < L < 20%

NOAA RISK MATRIX

(L) (C)

TIME TO IMPACT

Near	Impact felt this fiscal year
Mid	Impact felt next fiscal year
Far	Impact felt in 3 to 5 years

TREND (since last scored)

Worsening

Unchanged

Improving

TREATMENT

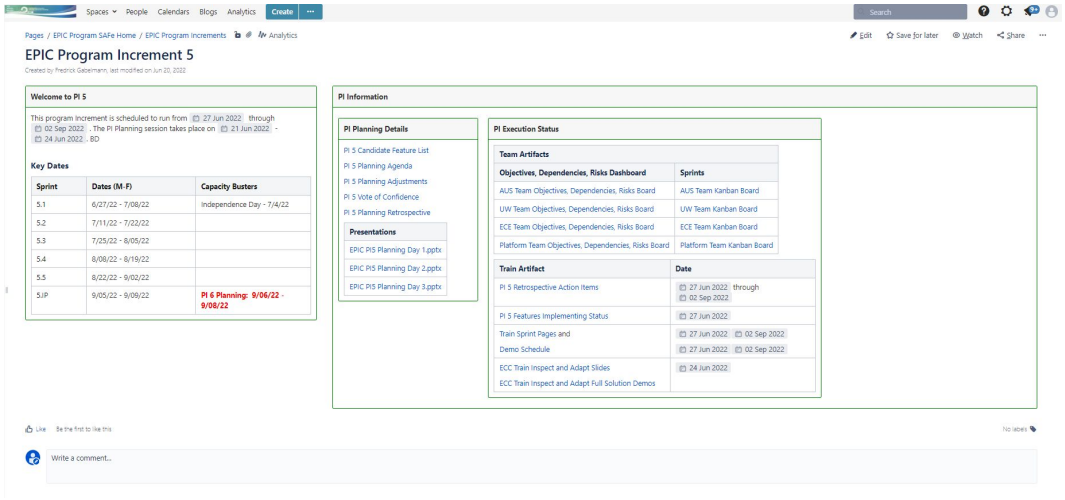
A	Accept
W	Watch
M	Mitigate
S	Share or Transfer
AV	Avoid

2. *Select Consequence (C) rating from Table 2 based on both the reporting guidance, as well as the category.*

3. *Capture data in NOAA Risk Register.*

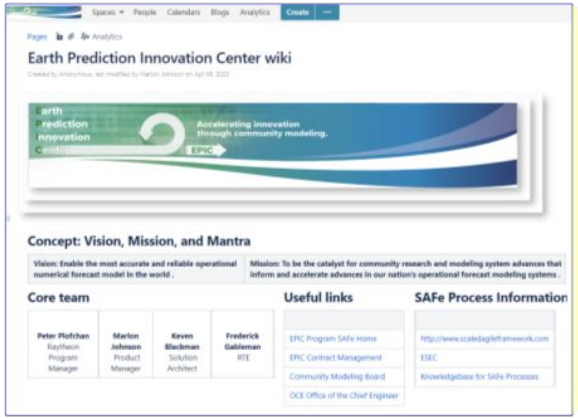
Scaled Agile Framework

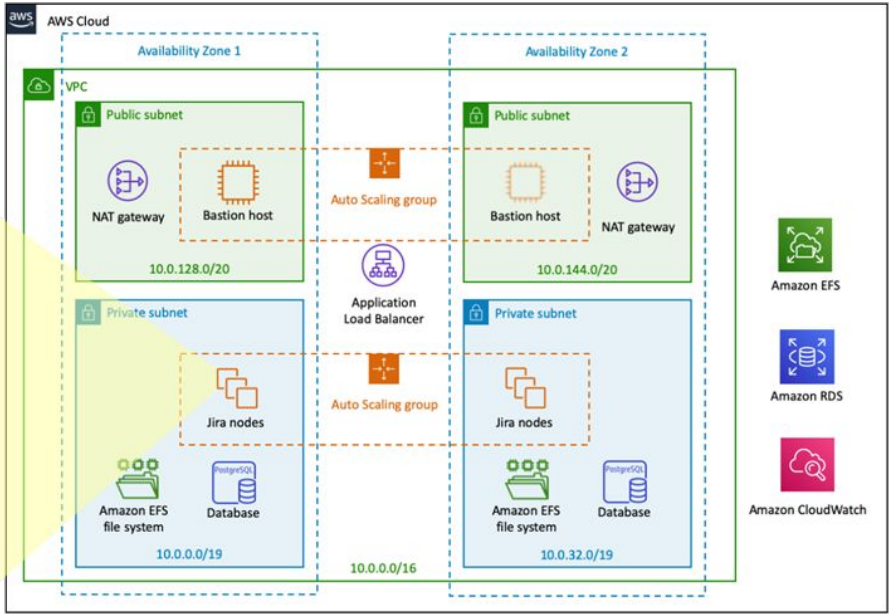
- EPIC consists of an Agile Release Train, with 4 Agile Product Teams underneath.
- Conduct 3-Month Program Increments (PIs), with PI Planning week, 5 bi-weekly Sprints, and Inspect & Adapt.
- Track the Team Backlogs for each Agile Team, including assigned Features, Objectives, and Stories, weekly.
- Prioritize the Program Backlog with the EPT, Agile Team Product Owners (POs), and EPIC Stakeholders, to determine Team Backlogs for the next PI.



Management of EPIC Work Products

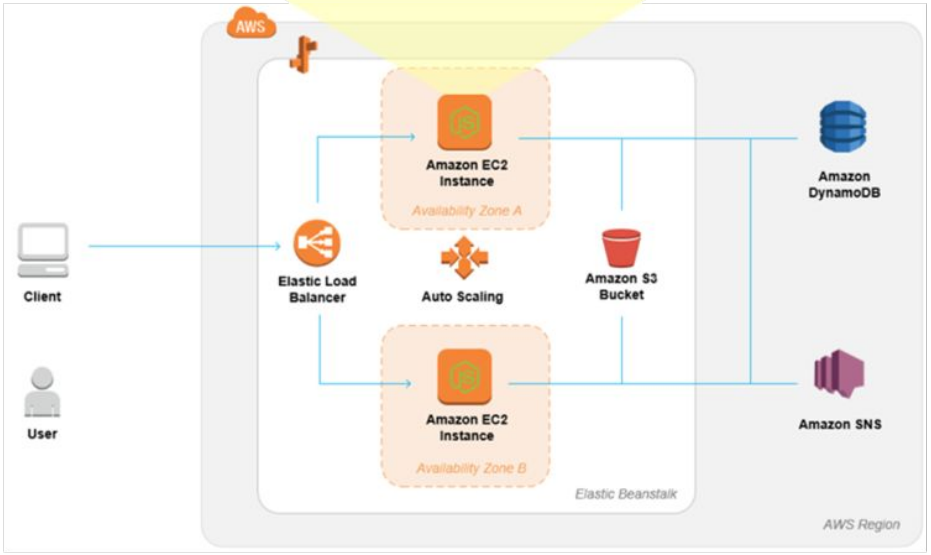
- JIRA is the issue tracking tool used to ensure all work conducted by Program Management and the Agile Release Train is being completed.
- Confluence is a wiki solution used for collaboration between EPIC Team members and stakeholders.
- JIRA and Confluence are hosted in the NOAA Multi-Cloud Platform.





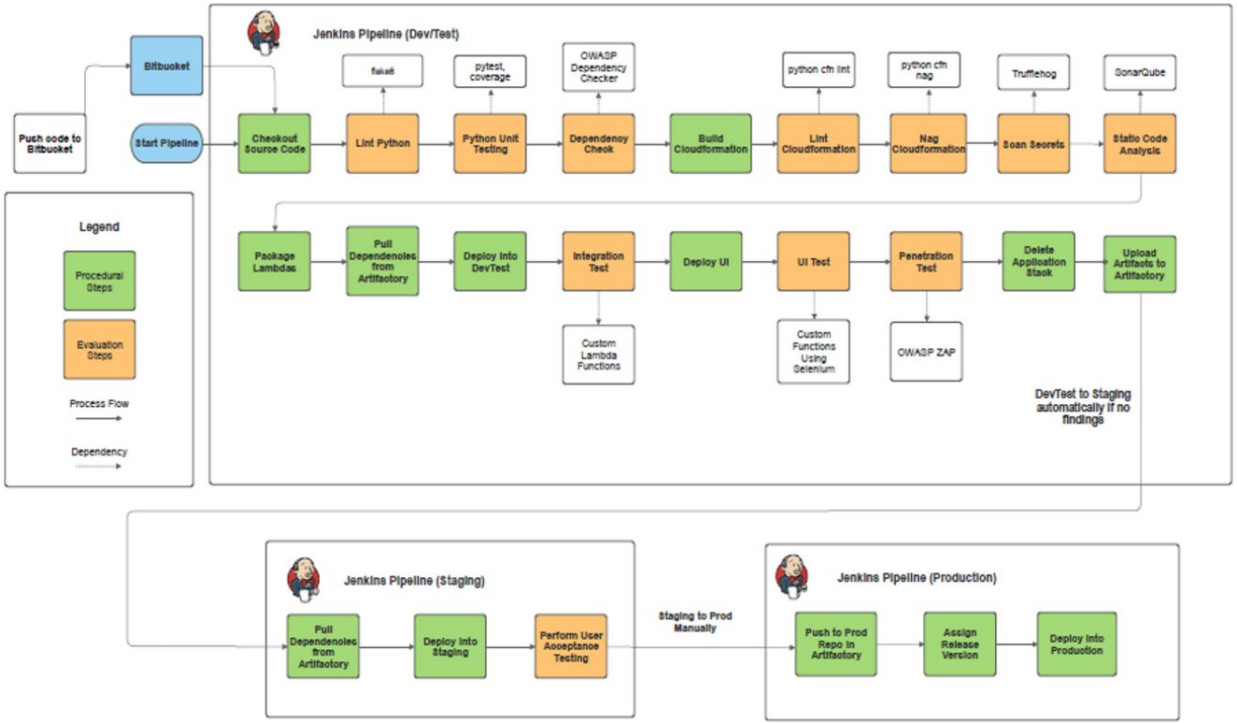
EPIC Community Portal

- The EPIC Community Portal (ECP) is the centralized location for the Weather Enterprise to access EPIC-related content, both internally (e.g., events) and externally (e.g., code repositories)
- The ECP went live in January of 2022, and is accessible at https://epic.noaa.gov/, and is hosted in the NOAA Multi-Cloud platform.
- The ECP was enhanced with the following:
  - Dashboards – Github Metrics, AWS Costs
  - Webinar – recording of the June 2022 AMS Short Course
  - FAQ Page – program and technical questions



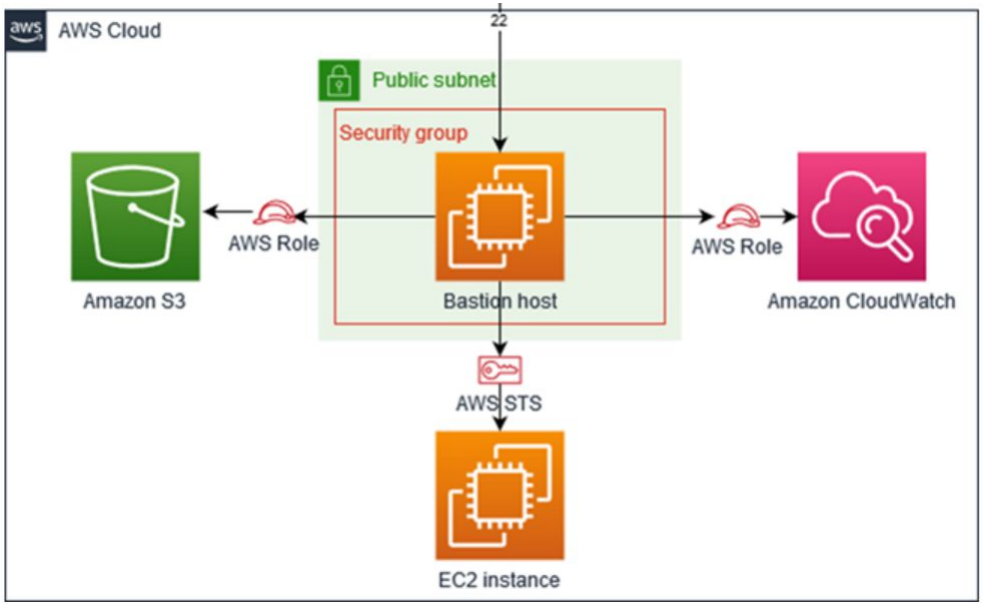
CI/CD Automated Build Pipeline

- A Continuous Integration/ Continuous Delivery (CI/CD) build pipeline was installed in the NOAA Multi-Cloud Platform, for automating the builds of UFS codebases.
- Jenkins is used to automate the build pipeline through orchestration, as UFS repositories work their way toward production.
- SonarQube is the static code analysis solution used for evaluating the codebases to make sure they are up to quality, security, and coding standards, before being pushed to production.



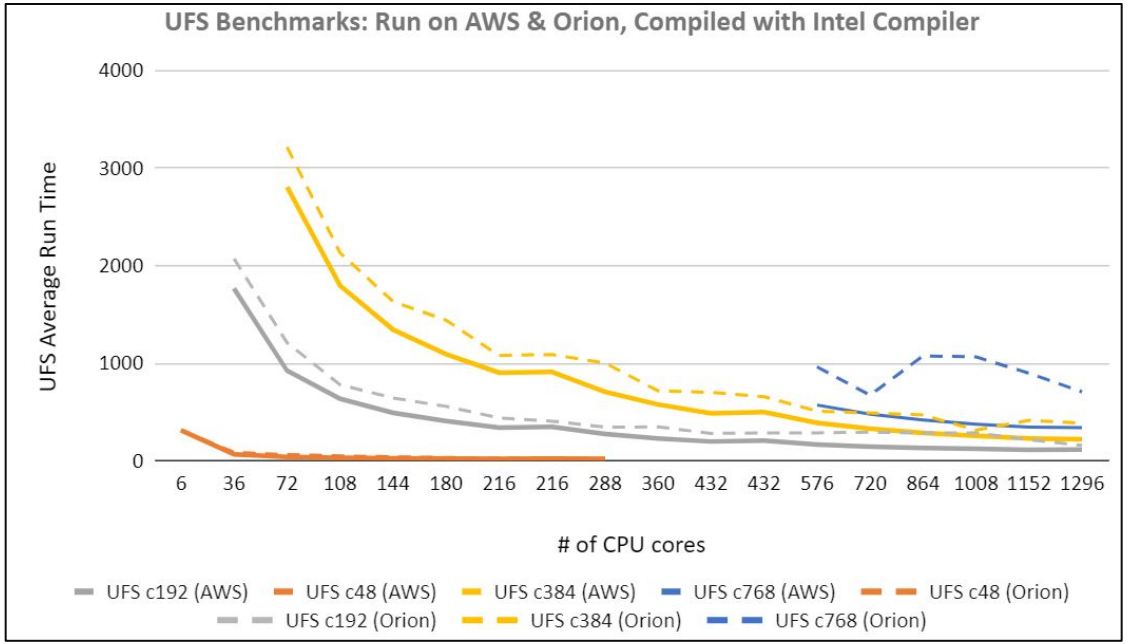
EPIC Cloud Sandbox

- The EPIC Cloud Sandbox is an AWS environment that is accessible by non-NOAA users, for EPIC-related purposes.
- It has been used by attendees of June 2022 AMS Short Course, along with the initial Code Sprint and Hackathon, to configure, run and evaluate the SRW Container that was developed on the EPIC Program.
- A scaled version of the CI/CD pipeline is currently being worked, to be installed in the EPIC Cloud Sandbox.



UFS Performance Benchmarks

- The Figure shows UFS weather model (WM) performance in Orion and Amazon Web Services (AWS, based on # of CPU cores used to execute each job, vs. the time to complete each job. This was conduc
- Expectations were that model performance (time to complete a given job) improves as more computational resources are added, but large jobs are generally more parallelizable than smaller jobs.
- Benchmarks results show that smaller jobs reach parallelization limits faster than larger jobs. With larger jobs, there is a clear limit where additional CPUs don't add appreciable performance gains.



UFS SRW Container Release

- The SRW Application was containerized in November of 2021, which is run using Singularity.
- The Figure shows the highest repository structure levels of the SRW Container version 2.0, which includes the gnu/ openmpi-based container.
- This SRW version was released in June of 2022.
- The SRW Container doesn't run through the Rocoto workflow due to complications from interacting with the batch scheduler (slurm/pbs/lsf).

Repositories	Release Branch	Tags*	Previous branch name	Current release branch name	Owner
ufs-weather-model	✔	ufs-srw-v2.0.0	release/public-v2	release-public-v3-SRW *	Jun Wang
UFS_UTILS	no	ufs_utils_1_7_0	release/public-v2	31271f7	Jeff/ Larissa/ George Gayno
UPP	✔	ufs-srw-v2.0.0	release/public-v2	release/public-v3 1dbcb0c4	Kate Fossell/Cam Sherrell
regional_workflow	✔	ufs-srw-v2.0.0	release/public-v1	release/public-v2	Gerard Ketefian/ DTC/EPIC
ufs_srwweather_app	✔	ufs-srw-v2.0.0	release/public-v1	release/public-v2	DTC/ EPIC

EPIC Data Management in the Cloud

Completed EPIC Data Initiatives for Contract Year 1

Cloud Data Storage

Cloud Data Storages Established for UFS Weather Model (UFS-WM) Regression Test (RT) datasets, SRW Application & Medium-Range Weather (MRW) Application datasets

- Established requirements & setup for SRW & MRW cloud data storage
- Acquired Identity Access & Management (IAM) credentials from BDP
- SRW cloud data storage contains data supporting cases unique to SRW 2.0 Release

Cloud Data Transferring

Utilization of Multi-Thread Uploader program to continue transfer of UFS-WM RT data to cloud

- Partitioned large files into chunks to assist in improving upload performance to cloud storage.
- Successfully transferred UFS-WM RT datasets to cloud storage

Creation of Multi-Thread Uploader program to transfer SRW data to cloud

- Partitioned large files into chunks to assist in improving upload performance to cloud storage.
- Successfully transferred SRW datasets to cloud storage & up-to-date

Data Management Support

Utilization of Data Tracker Bot program to continue UFS-WM data management support.

- Detects & records timestamp datasets being pushed to the developing UFS-WM repository
- Ensures UFS-WM cloud data storage is up-to-date

Data Log Visuals

Creation of UFS-WM RT Log Extraction application which extracts, parses, & converts UFS-WM logs into visuals.

- Application parses, extracts, summarizes, & displays metrics from UFS-WM RT logs into plot figures.

Cloud Storage Details

Cloud Data Storage Information: UFS-WM RT Datasets	
Description	Unified Forecast System Weather Model (UFS-WM) Regression Tests Data
Resource Type	S3 Bucket
Amazon Resource Name (ARN)	noaa-ufs-regtests-pds
AWS Region	us-east-1
AWS URL	https://noaa-ufs-regtests-pds.s3.amazonaws.com/index.html

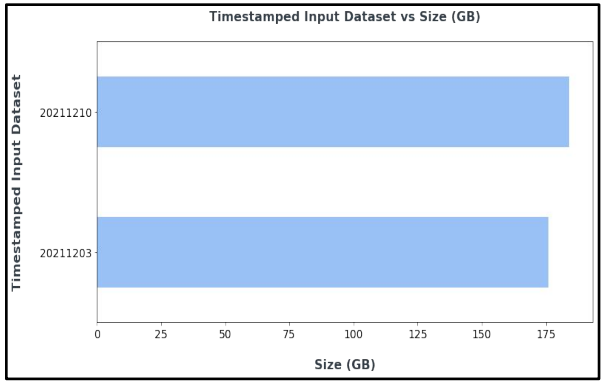
Cloud Data Storage Information: SRW Datasets	
Description	Unified Forecast System Short-Range Weather (UFS SRW) Application Data
Resource Type	S3 Bucket
Amazon Resource Name (ARN)	noaa-ufs-srw-pds
AWS Region	us-east-1
AWS URL	https://noaa-ufs-srw-pds.s3.amazonaws.com/index.html

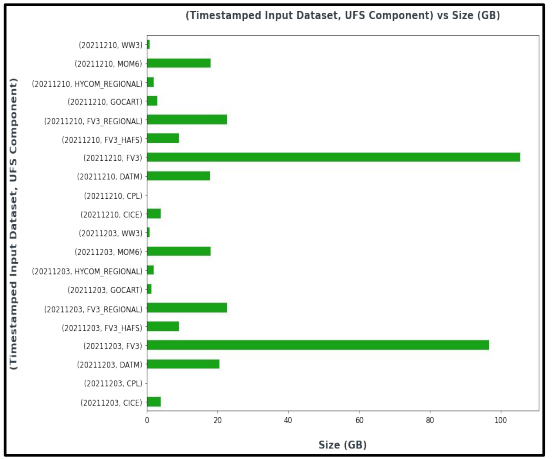
Cloud Data Storage Information: MRW Datasets	
Description	Unified Forecast System Medium-Range Weather (UFS MRW) Application data
Resource Type	S3 Bucket
Amazon Resource Name (ARN)	noaa-ufs-mrw-pds
AWS Region	us-east-1
AWS URL	https://noaa-ufs-mrw-pds.s3.amazonaws.com/index.html

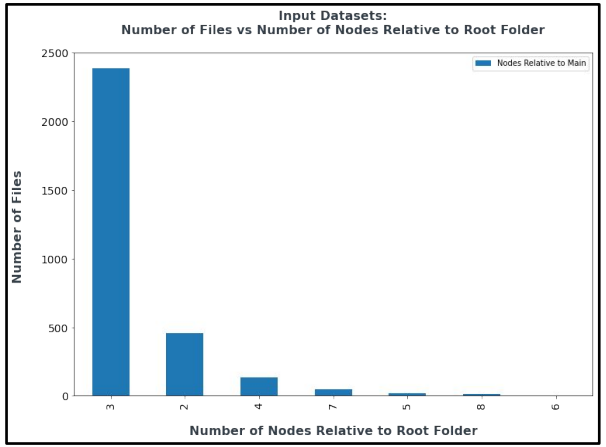
Data Analytics Tool

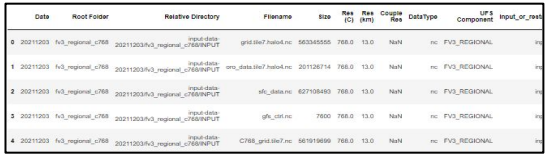
Tool Capabilities:

- Observe Data Storage Distribution Across Timestamps
- Observe Data Storage Distribution Across UFS Components
- Obtain Size of Datasets, Individual Files
- Observe Majority of Data Files Node (Depth) Location
- Detect Duplications
- Filter & Sort Data Filenames By Feature (e.g. UFS component, File Type, Resolution, Compiler, etc)
- Transfer Datasets & Details to a Format of Interest (e.g. .csv, dataframe)









	Date	Root Folder	Relative Directory	Filename	Size	Res (C)	Res (km)	Couple Res	DataType	UFS Component	Input_or_rest
0	20211203	fv3_regional_c768	20211203/fv3_regional_c768/INPUT	grid.tile7.halo4.nc	563345555	768.0	13.0	NaN	nc	FV3_REGIONAL	inp
1	20211203	fv3_regional_c768	20211203/fv3_regional_c768/INPUT	oro_data.tile7.halo4.nc	2011126714	768.0	13.0	NaN	nc	FV3_REGIONAL	inp
2	20211203	fv3_regional_c768	20211203/fv3_regional_c768/INPUT	sfc_data.nc	627108493	768.0	13.0	NaN	nc	FV3_REGIONAL	inp
3	20211203	fv3_regional_c768	20211203/fv3_regional_c768/INPUT	gfs_ctrl.nc	7600	768.0	13.0	NaN	nc	FV3_REGIONAL	inp
4	20211203	fv3_regional_c768	20211203/fv3_regional_c768/INPUT	C768_grid.tile7.nc	561919699	768.0	13.0	NaN	nc	FV3_REGIONAL	inp

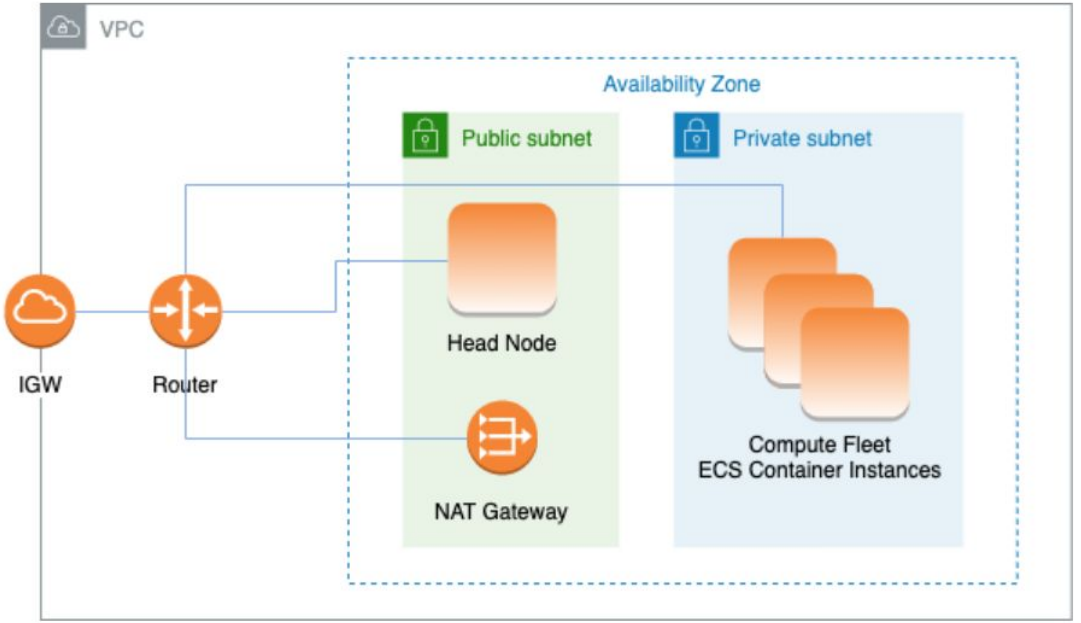
```
Total Timestamps for Input Datasets:
2

Storage Size per Timestamped Input Dataset (GB):
Date
20211203    176.097521
20211210    184.060458
Name: Size, dtype: float64

Overall Storage Size of All Timestamped Input Datasets (GB):
360.2

Overall Storage Size of All Timestamped Input Datasets (TB):
0.35
```

Year 2 EPIC Accomplishments

July 2022 – Present

Scalable UFS SRW Containers

- A new approach was recently discovered for running the SRW workflow using Rocoto inside the container on the host system, as if they are just a plain file on the host system.
- This approach eliminated host system complexities that had previously limited the use of Rocoto, which resulting in the SRW Container being able to only run on a single node at a time.
- With the new approach, the SRW Containers is now able to scale across multiple HPC nodes, which significantly improves runtime performance.



Automated Analysis of FORTRAN Code

- SonarQube doesn't support the ability to read FORTRAN code out the box.
- An open source plugin is available for SonarQube, that allows it to interpret FORTRAN 77 and 90.
- UFS-WM repositories have been forked and scanned with this upgraded SonarQube solution.
- There are 10,213 vulnerability findings in the UFS-WM repositories alone!
- An environment was recently setup where individuals can branch scan their own projects in the EPIC Cloud Sandbox before checking in that code.