SUSTAINMENT MANAGEMENT SYSTEM (SMS) SUMMIT 2025

July 9th, 2025

U.S. ARMY

US Army Corps of Engineers®

ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

U.S. ARMY

WELCOME!

2025 Sustainment Management System (SMS) Virtual Summit

Hosted by the **National Academies of Sciences** and the **Federal Facilities Council**

Facilitated by the Sustainment Management Technical Center of Expertise (**SMS-TCX**)

AGENDA REVIEW

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Wednesday, July 9, 2025

All times in US Eastern.

0830-0835	**Welcome,** SMS TCX Chief
0835-0840	**National Academies/Federal Facilities Council Updates,** Director FFC
0840-0900	**Keynote,** Deputy Assistant Secretary of Defense for Infrastructure Modernization & Resilience
0900-0930	**Keynote,** CERL Director
0930-0945	Break
0945-1030	**SMS TCX Updates, SMS TCX Chief**
1030-1400 1030-1115 1115-1200	**Buildings End-to End Demo** – Import, Inventory, and Assess – Workspace creation, Field App, Workspace QA/QC
1200-1300	Lunch
1300-1400	**Buildings End-to End Demo (cont.)** – Metric Roll up, Work Analysis, and Power BI Reporting
1400-1430	**Domain Highlights** – Utility Overview
1430-1445	Break
1445-1515	**Working Group Updates** – Working Group Status Updates
1515-1600	**Help/ Training Content**
1600-1700	**Research Topic Overview** – E-SMS Innovation Lab

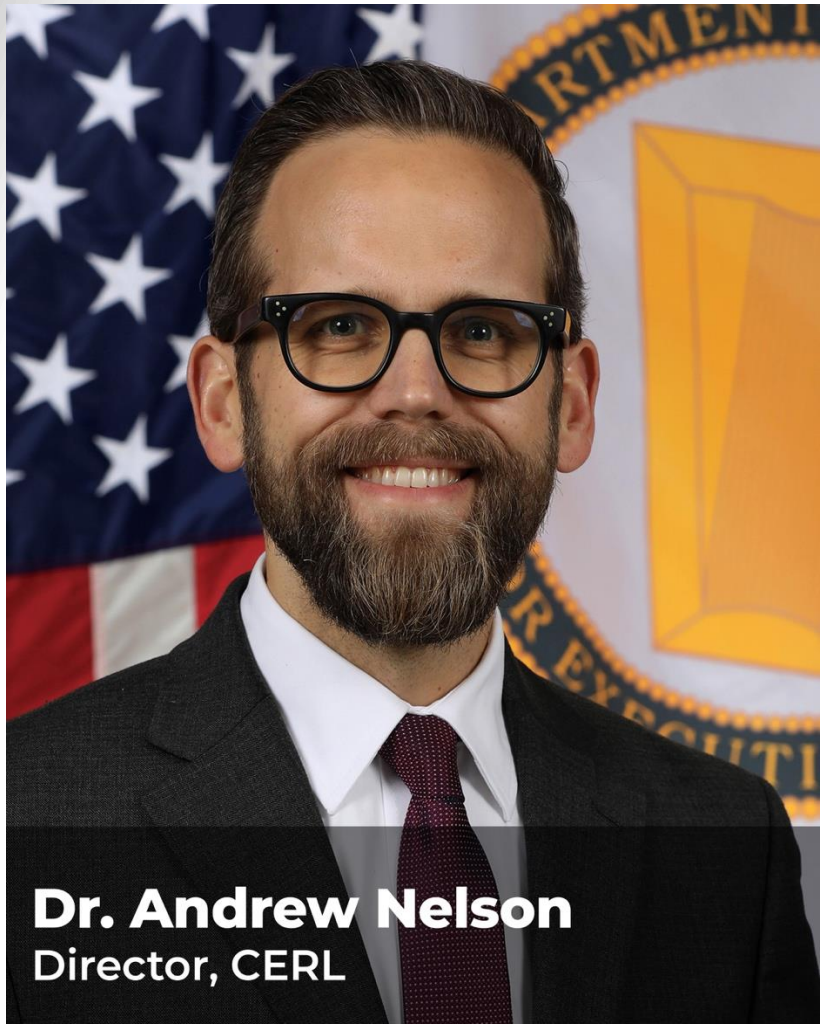
NATIONAL ACADEMIES / FEDERAL FACILITIES COUNCIL UPDATE

Event Page/Agenda: https://www.nationalacademies.org/event/45241_07-2025_federal-facilities-council-2025-sustainment-management-system-sms-summit

Sessions livestreamed via Zoom Webinars. Sessions will be recorded and intended to be posted following the event.

Questions can be submitted via the Zoom Q&A feature, and we'll answer as many as time allows.

DR. ANDY NELSON KEYNOTE



Dr. Andrew (Andy) Nelson is director of the U.S. Army Engineer Research and Development Center's (ERDC) Construction Engineering Research Laboratory (CERL) in Champaign, Illinois. As the CERL director, he is responsible for the activities of a highly interdisciplinary team of approximately 300 federal and contracted staff conducting research in materials and structures, energy, training lands and heritage, emergency and operational support, warfighter engineering and installation readiness.

Dr. Nelson has served in numerous roles throughout ERDC including as the CERL technical director for Infrastructure Science and Engineering, director of the ERDC International Research Office, which is based in London, and chief of the CERL Energy Branch. He began his career as a research physicist at CERL, with a diverse research portfolio including energy efficient mitigation of biological particulate contamination in indoor air, quantification and atmospheric impacts of the biogeochemical nitrogen cycle and water purification/treatment for contingency operations. In addition to these permanent assignments, he completed a one-year assignment as a visiting researcher at the U.K. Defence Science and Technology Laboratory at Porton Down through the U.S. Army Engineer and Scientist Exchange Program and was detailed to the Office of the Assistant Secretary of the Army for Installations, Energy and Environment in 2016 as the ERDC liaison officer.

Dr. Nelson holds a B.A. in Physics from Illinois Wesleyan University and M.S. and Ph.D. degrees in Environmental Engineering from the University of Illinois at Urbana-Champaign. He has received multiple Army Civilian Service Awards including the Meritorious Civilian Service Award and has been recognized with the ERDC R&D Achievement Award and the ERDC Outstanding Team Award, among others. He was received the Association of Environmental Engineering and Science Professors outstanding master's thesis award and was a DoD Science, Mathematics, and Research for Transformation Scholarship recipient in 2009.

https://www.erdc.usace.army.mil/About/Leadership/Bio-Article-View/Article/2701622/dr-andrew-nelson-sstm/

U.S. ARMY

U.S. Army Corps of Engineers

Service to the Nation Since 1775

Lincoln Memorial – 1922 | Washington Monument – 1884 | U.S. Capitol – 1800

Military Construction and Combat

The Pentagon - 1941

ESSAYONS!

Since 1775

Mississippi River and Tributaries Project – 1928-Present

Panama Canal - 1914

Bonneville Dam – 1937

Kennedy Space Center - 1962

U.S. ARMY

Army S&T Enterprise

Where USACE And ERDC Align in the Army Science & Technology Enterprise

POLICY, BUDGET AND OVERSIGHT

Secretary of the Army

Under Secretary of the Army

Assistant Secretary of the Army for Acquisitions, Logistics and Technology (ASA(ALT))

Deputy Assistant Secretary of the Army for Research and Technology (DASA(R&T))

OPERATIONAL AND S&T PROGRAM EXECUTION

Army Futures Command (AFC)

- Medical Research and Development Command **(MRDC)**
- Army Artificial Intelligence Integration Center **(AI2C)**
- Combat Capabilities Development Command **(DEVCOM)**

U.S. Army Corps of Engineers (USACE)

ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

U.S. Army Engineer Research and Development Center

U.S. Army Space and Missile Defense Command (SMDC)

- Space & Missile Defense Command Technical Center **(SMDTC)**

Headquarters, Department of the Army (HQDA) G-1 Personnel

- U.S. Army Research Institute for Behavioral and Social Sciences **(ARI)**

Non-Traditional Laboratories

- Army Cyber Capabilities Development Integration Directorate
- Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense **(JPEO CBRND)**
- U.S. Army Training and Doctrine Command **(TRADOC)** Army Medical Center of Excellence **(MEDCoE)**
- U.S. Military Academy
- Army Cyber Command **(ARCYBER)** Technical Warfare Center
- Deputy Under Secretary of the Army, Army Analytics Group **(AAG)**

CRREL	CERL	GRL	CHL	ITL	EL	GSL
Cold Regions Research and Engineering Laboratory	Construction Engineering Research Laboratory	Geospatial Research Laboratory	Coastal and Hydraulics Laboratory	Information Technology Laboratory	Environmental Laboratory	Geotechnical and Structures Laboratory

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ERDC Locations

Seven Laboratories in Four States

ERDC Headquarters
Vicksburg, Mississippi

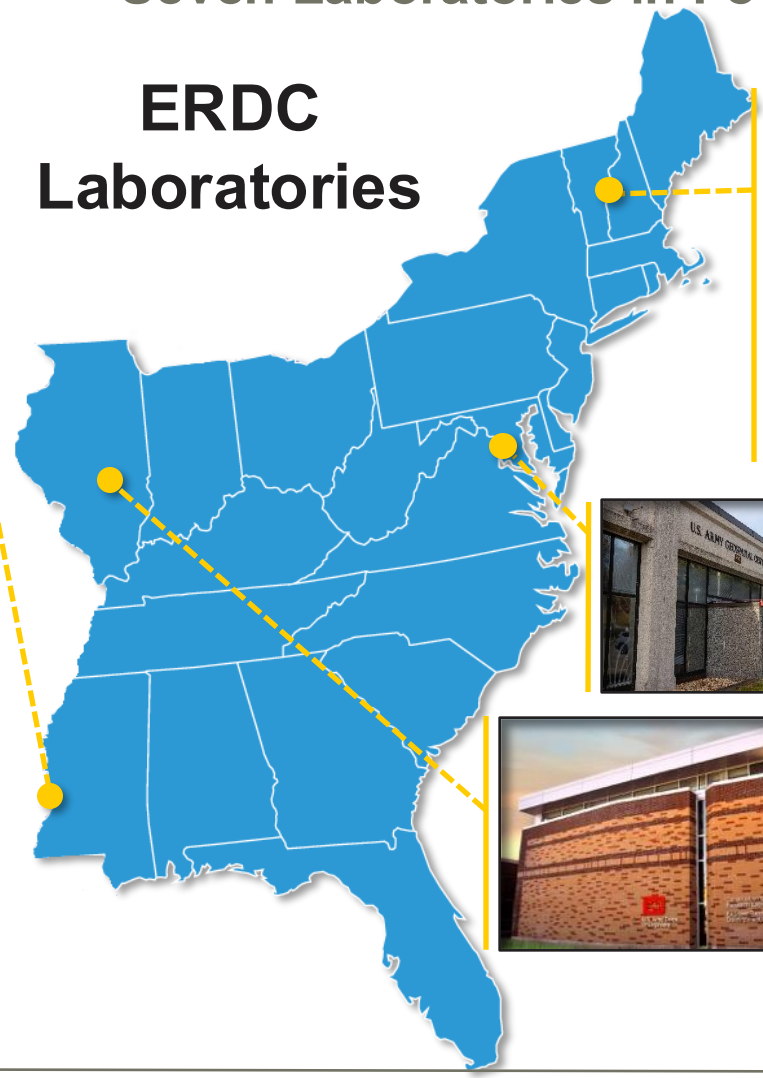
Coastal and Hydraulics Laboratory (CHL)

Environmental Laboratory (EL)

Geotechnical and Structures Laboratory (GSL)

Information Technology Laboratory (ITL)

ERDC Laboratories



Cold Regions Research and Engineering Laboratory (CRREL)
Hanover, New Hampshire

Geospatial Research Laboratory (GRL)
Alexandria, Virginia

Construction Engineering Research Laboratory (CERL)
Champaign, Illinois

Field Offices

Permafrost Tunnel Research Facility
Fox, Alaska

Alaska Research Office
Fairbanks, Alaska

Lewisville Aquatic Ecosystem Research Facility
Lewisville, Texas

Contingency Base Integration Technology Evaluation Center (CBITEC)
Fort Leonard Wood, Missouri

Field Research Facility
Duck, North Carolina

Corbin Field Station
Woodford, Virginia

Extreme Exposure Station
Treat Island, Maine

ERDC International Research Office
London, England

A World-Class Research & Development Organization that Discovers, Develops and Delivers New Ways to Make the World Safer and Better Every Day

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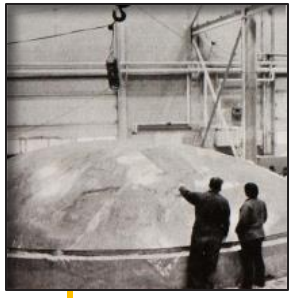
ERDC's History

Solving Challenges Has Been Our Mission From Year One

Flood of 1927 – Origin of CHL

Arctic Research – Origin of CRREL in 1961

Construction Engineering Research – Origin of CERL in 1968



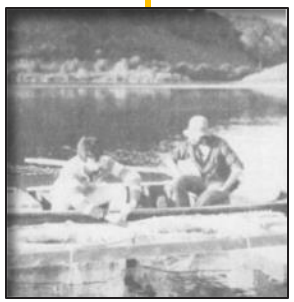
1980s: First Supercomputer – Origin of ITL

2023 – ERDC's 25th Anniversary

1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030

WWII: Portable Airfields– Precursor to GSL 1932

Topographical Engineering – Origin of GRL in 1967



1970s: Environmental Research – Origin of EL

1998 ERDC established

MILESTONE WORK

- ★ **2001:** ERDC research saves lives during 9/11
- ★ **2005:** Post-Katrina Analyses
- ★ **2017:** Hurricane Recovery (Harvey, Irma & Maria)
- ★ **2020:** COVID-19 Pandemic Response
- ★ **2024:** Francis Scott Key Bridge collapse
- ★ **2025:** Lithuania Recovery Effort

U.S. ARMY

ERDC's People are Our Greatest Strength

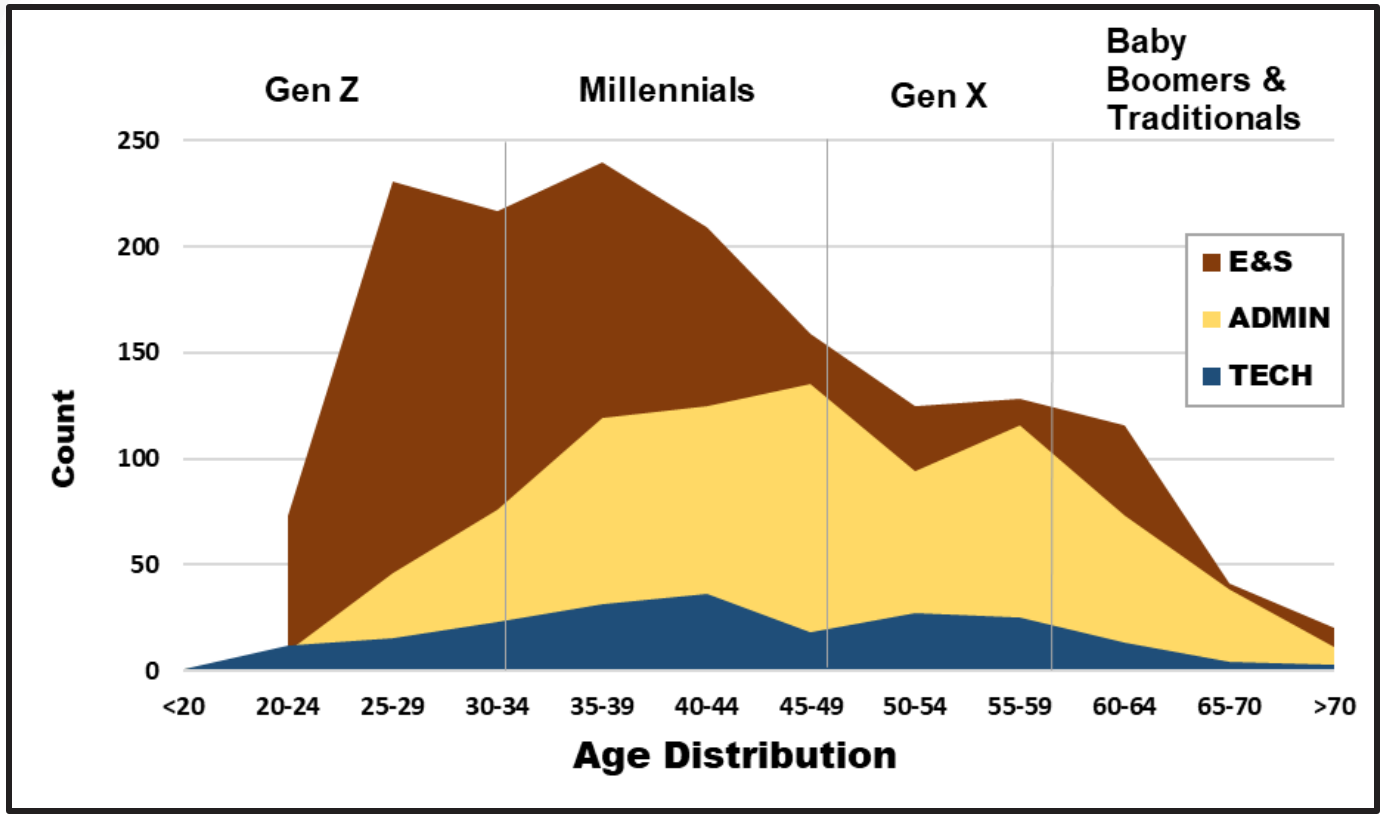
Highly Qualified, Highly Motivated to Solve Complex Challenges

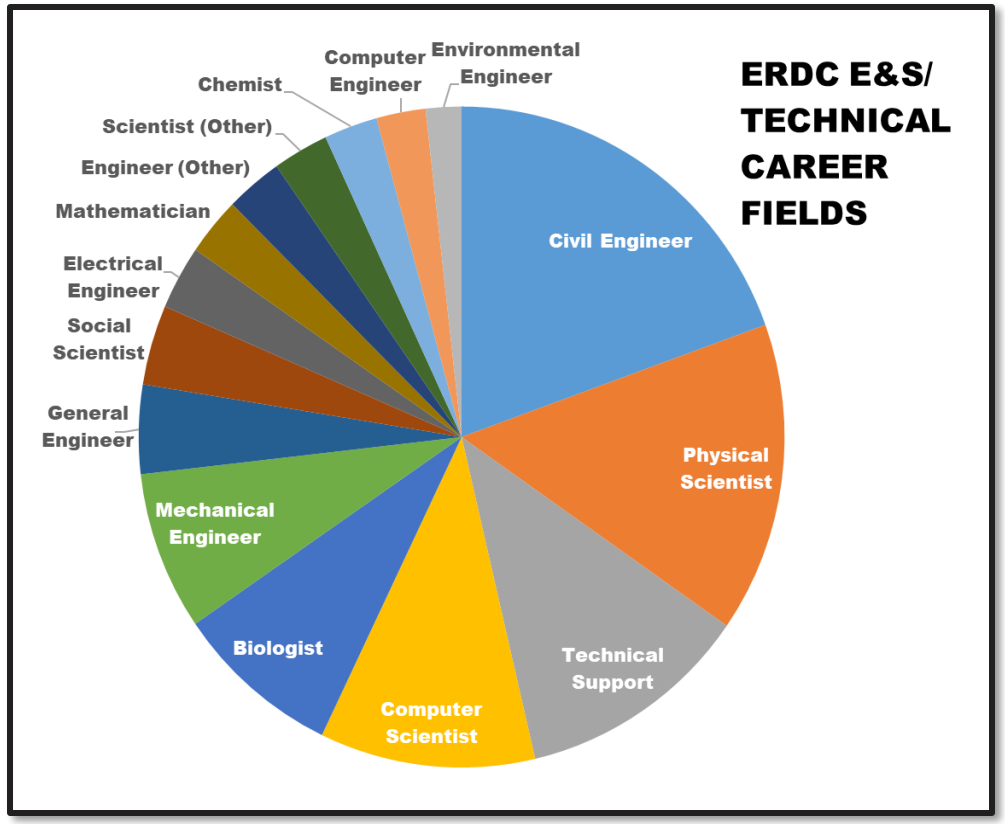
Civilian FTE Employees
2,610*

Engineers & Scientists (E&S)
1,559

E&S w/Advanced Degrees
1,049

E&S w/PhDs
452





* Does not include other workforce population segments: student trainees, temp positions, active-duty military, AFP Interns, or contractors. Data reflects as of 09 MARCH 2025

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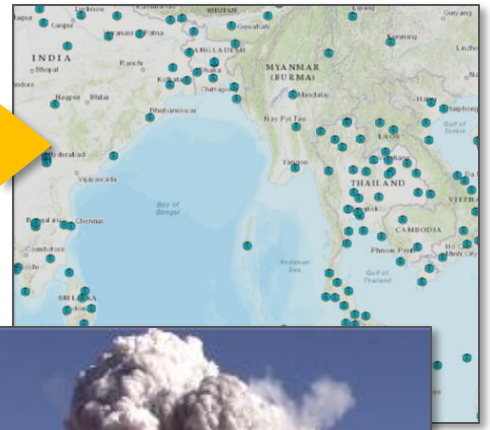
ERDC Core Competencies

Unique Innovative Capabilities for the Nation & Warfighter

BATTLESPACE TERRAIN MAPPING AND CHARACTERIZATION



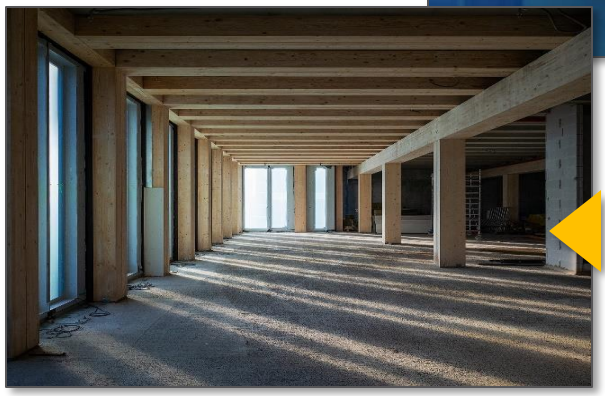
COASTAL, RIVER AND ENVIRONMENTAL ENGINEERING

COLD REGIONS SCIENCE AND ENGINEERING

BLAST AND WEAPONS EFFECTS ON STRUCTURES AND GEO-MATERIALS

COMPUTATIONAL PROTOTYPING OF MILITARY PLATFORMS

CIVIL AND MILITARY ENGINEERING



MILITARY INSTALLATIONS AND INFRASTRUCTURE

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ERDC's Synergy

We Excel at Extending Innovation Across Different Mission Spaces

U.S. ARMY WATERCRAFT AND SHIP SIMULATOR

Developed for CIVIL WORKS

A civilian pilot practices guiding barges down a river under specific wave and current conditions.

Now Supports WARFIGHTERS

A Warfighter pilot practices driving a bridge erector boat (BEB) to place portions of an Improved Ribbon Bridge in a waterway

The same U.S. Army Watercraft and Ship Simulator and research team that supports USACE's Navigation mission…

…also supports our Warfighters as they plan logistics-over-the-shore operations overseas.

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Building Strong Relationships

Examples of Army, USACE, Academia, Government and Industry Relationships

7 of 12 Army PEOs

PEO Aviation · PEO Soldier · PEO CS&CSS · PEO Missiles and Space · PEO IEW&S · PEO STRI · PEO C3T

98 Universities

Oregon State University · Texas A&M · Bowling Green State University · Marquette · Dartmouth · Georgia Tech · Illinois · Jackson State University · Vanderbilt · Alcorn State University · West Virginia · University of Southern Mississippi · Alabama · University of Mississippi · Kansas · Penn State · MIT · University of Georgia · North Carolina · UCLA · University of Alaska Fairbanks · University of South Alabama · Purdue University · Oklahoma State · University of Florida · Ohio State · Universidad de Puerto Rico · Virginia Tech · LSU · Arizona State · University of Delaware · Michigan State · University of Missouri · Clemson University · Tennessee · Carnegie Mellon University · New Mexico State

30+ Federal Agencies (Excluding DoD, Tri-Services)

NASA · Department of Homeland Security · Department of Transportation · Department of the Interior · National Geospatial-Intelligence Agency · USGS science for a changing world · Cybersecurity & Infrastructure Security Agency · USDA United States Department of Agriculture · Federal Aviation Administration · NOAA National Oceanic and Atmospheric Administration · U.S. Department of Commerce · Department of Veterans Affairs · NSF · Department of Energy · FEMA · TVA · Environmental Protection Agency · Department of Justice · Sandia National Laboratories

145 Industries

Raytheon · Kenall · SOL Engineering Services · EPRI Electric Power Research Institute · Applied Research Associates, Inc. · Harris · Eaton · Alden · Definitive Logic · Martin Ecosystems · MWOBS Mount Washington Observatory · esri · BAE Systems · Lockheed Martin · Quantum Signal · The Nature Conservancy · leidos · Matterport · Booz Allen · Censeo Insight · Kontek

CONNECT: Mechanisms & Authorities

- Other Transaction Authority (OTA) (Civil Works and Military Programs)
- Broad Agency Announcement (BAA) Authority
- Cooperative Ecosystem Studies Units (CESU) National Network

ERDCWERX Innovation Ecosystem Investment

Identifying New Partnerships and Collaboration Between Industry and ERDC

ERDCWERX creates a streamlined path for collaboration and partnerships with Industry and Academia

ERDCWERX is located inside the Mississippi Center for Innovation & Technology (MCITy) building in downtown Vicksburg, MS.

Public Website for Doing Business with ERDC
https://www.erdc.usace.army.mil/Business-With-Us/Technology-Transfer/

ERDC Licensing Opportunities
https://www.erdcinnovation.org/

https://https://techlinkcenter.org/labs/erdc/090a42b4-2b75-46b7-ad95-7a445cf5aece

ERDCWERX Ecosystem
https://www.erdcwerx.org/

An Innovation Roundtable at ERDCWERX on 12 July 2024.

U.S. Army Corps of Engineers

9 Divisions
44 Districts

ERDC International Research Office
London, England

INTERNATIONAL PARTNERS

Australia · Canada · Brazil · Chile · Germany · Israel · Italy · Netherlands · Norway · Sweden · Switzerland · UK

Andy Nelson, PhD, SES
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Construction Engineering Research Laboratory
U.S. Army Engineer Research and Development Center
U.S. Army Corps of Engineers

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SMS TCX OVERVIEW

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The Sustainment Management System Technical Center of Expertise (SMS-TCX) provides infrastructure maintenance planning and management solutions through research, development, implementation, and sustainment of new and existing technologies to help agencies understand their facilities and infrastructure portfolio, alignment to mission requirements, and current and future financial requirements.

The SMS-TCX team engages with all real property asset management stakeholders to discover, develop, deliver, and sustain innovative solutions that increase operational awareness, business intelligence, analytics, automation and proactive planning to improve resilience, readiness, and efficiency.

R&D domains include but are not limited to installation infrastructure characterization, assessment, forecasting, cost accounting, capital optimization, O&M, energy use and reduction, cyber security, construction and major renewal, and mission alignment.

Discover

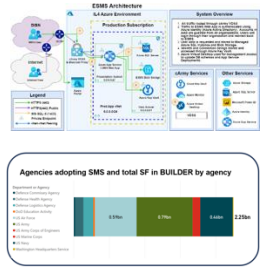
Develop

ENTERPRISE SUSTAINMENT MANAGEMENT SYSTEM

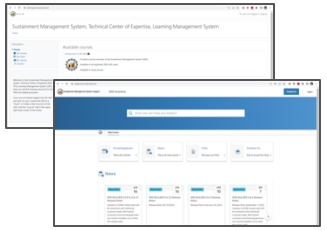
BUILDINGS FUELS PAVEMENT RAIL UTILITIES WATER CONTROL WATERFRONT

BUILDER

Deliver



Sustain



CURRENT OPERATING ENVIRONMENT

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"Readiness of our installations directly correlates with our ability to create combat power and project combat power."

Requirements to Support Warfighter

- Need for adequate facilities to support warfighter missions and families
- Need for accurate reporting of condition and cost of maintenance backlogs for DoD's facilities (GAO High Risk Report – Feb 2025)
  Requirement to address overall condition and specific progress of select facility types (e.g., housing, transportation, maritime, innovation / RDT&E infrastructure) as identified in the NDAA
- Need for data-driven decision-making to identify and prioritize increasing backlog of infrastructure investment needs and limited available resources to address those needs
- Requirement to plan beyond current year needs

Real Property Reality

- Aging Infrastructure
- Limited availability of SRM funding has increased critical backlog
- Siloed, manual, and inconsistent processes for condition assessment of various facility types

WHAT IS E-SMS

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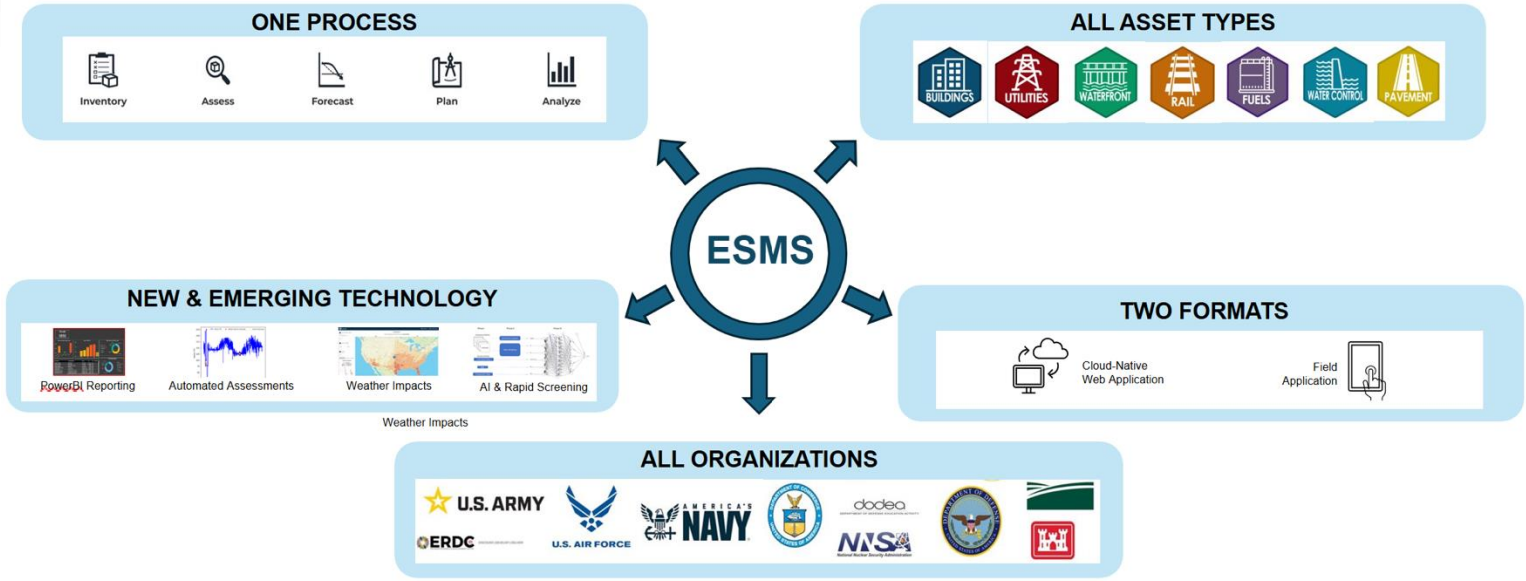
A consolidated, all-in-one platform for facility assessment, performance modeling, investment, and forecasting information for all real property domains and all organizations.



Benefits

- Provides one **secure** and **standardized condition assessment** across DoD for **all real property assets**
- Improves decision making by more **accurately communicating risk / probability of failure** to leadership
- Utilizes facility and assessment information to reduce workload on installation personnel by leveraging knowledge-based inspection methodology
- Expertise in emerging technologies embedded in evolution of program (e.g., CERL research outcomes on degradation models, costs, etc. can be directly incorporated into E-SMS)

UTILIZATION OF E-SMS DATA

E-SMS data is used to support **readiness** and **resourcing** decisions. Recent requests of SMS results used to support Congressional, DoD and Service / Agency decisions include:

Readiness Support

- Facility conditions for all buildings as well as condition for select facility types
- Backlog / Deferred Maintenance and Repair (DMR) Costs
- Recent requests include condition and backlog information on barracks, child development centers, motor pools, and hospitals. Also includes SFFAS 42 DMR Audit reporting

Planning Decision Support

- Decision support for planning of SRM and MILCON infrastructure investments
- Development of SRM requirements
- Validation of MILCON requirements
- Ability to conduct what-if / trade-off analysis
- Recent requests include
  - Comparison analysis of degradation over the FYDP for 100% sustainment funding vs other varying levels down to 75%
  - 30-year scenario based on multiple rebalanced facility investment plans

Funding Decision Support

- Validation and Prioritization of SRM funding decisions
- Validation and Prioritization of MILCON funding decisions

INVENTORY PROFILE

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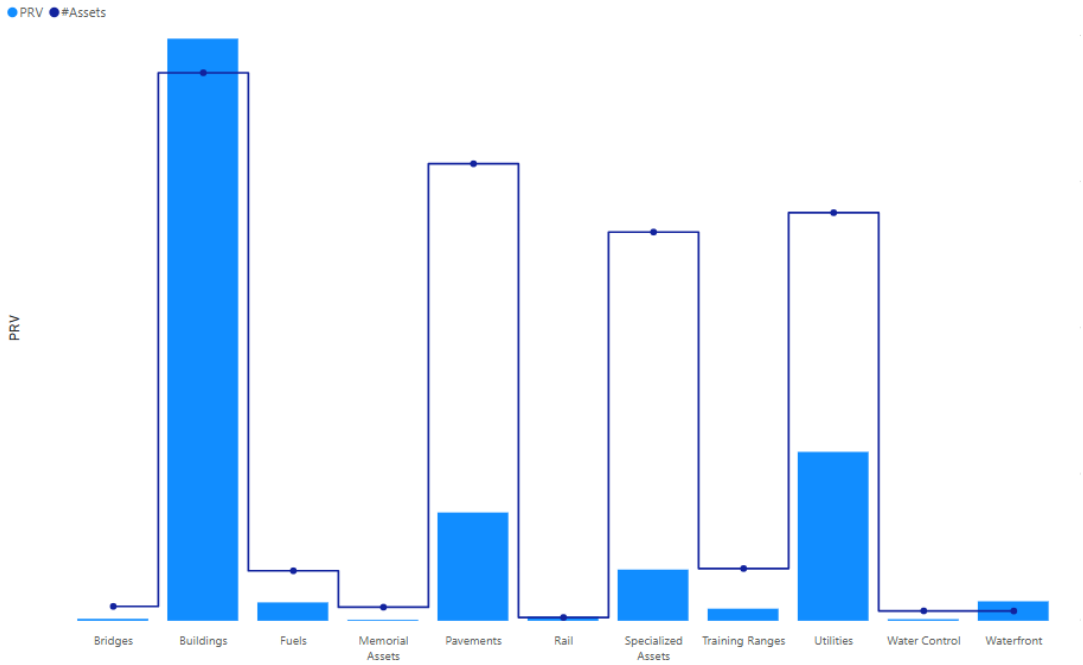
E-SMS Domain Profile



DoD's real estate portfolio is the largest in the federal government

- more than **710,000 assets** (buildings, structures, and linear structures)
- located on over **4,800 sites worldwide**
- on **over 26 million acres of land**

VIEWS OF E-SMS

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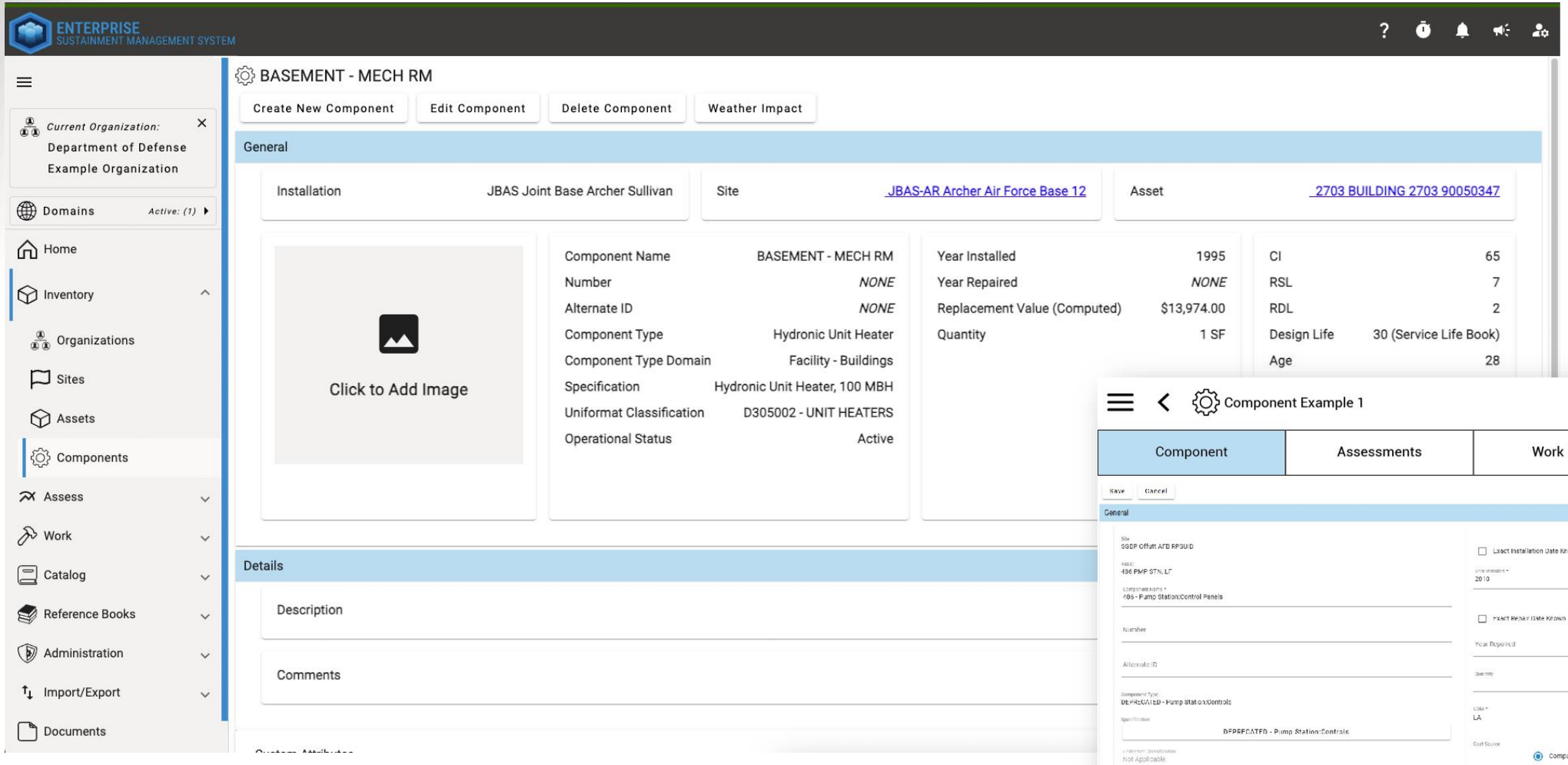

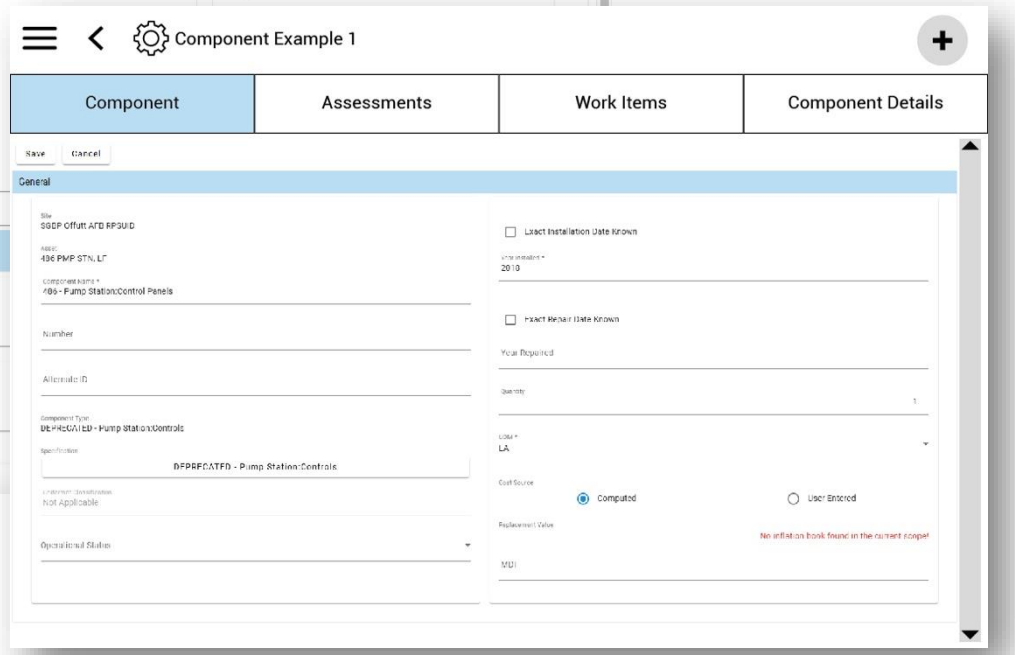

E-SMS WAY AHEAD

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FY25

- Issuance of ATO
- E-SMS Field Application Development
- Standardization of E-SMS Functions (via DoD WGs)*
- Buildings IOC – Begin Onboarding
- GIS Import Capability
- E-SMS Domain Preparation (via Domain WGs)
- Training Curriculum Developed

FY26

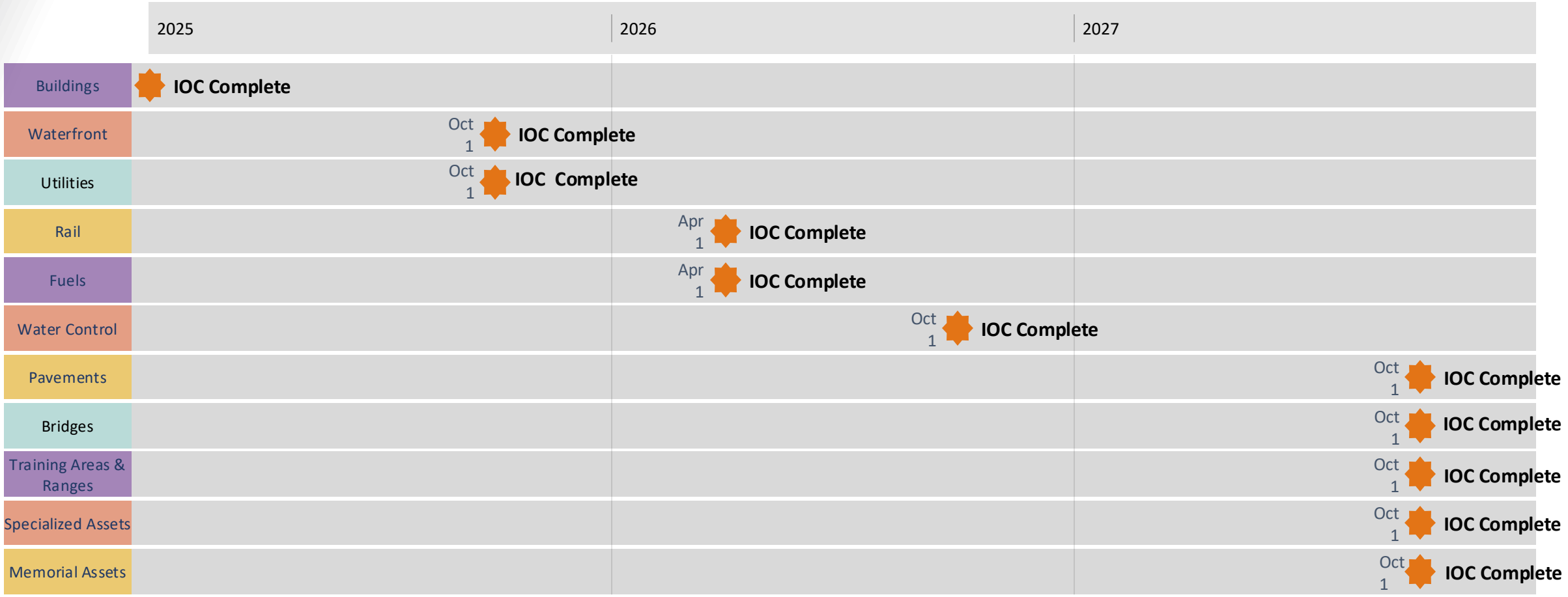
- E-SMS Field Application IOC
- Continue Buildings Onboarding
- Standardization of E-SMS Functions (via DoD WGs)*
- E-SMS Domain Preparation (via Domain WGs)
- Training Development
- Waterfront IOC
- Utilities IOC
- Fuels IOC
- Rail IOC

FY27 and Beyond

- Standardization of E-SMS Functions (via DoD WGs)*
- E-SMS Domain Preparation (via Domain WGs)
- Water Control IOC (FY27)
- Pavements IOC (FY28)
- Bridges IOC (FY28)
- Training Areas & Ranges (FY28)
- Specialized Assets (FY28)
- Memorial Assets (FY28)

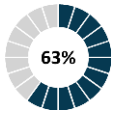
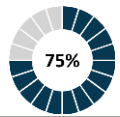
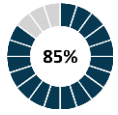
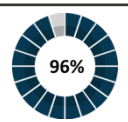
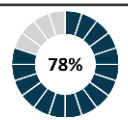
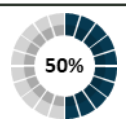
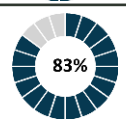
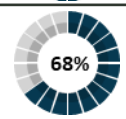
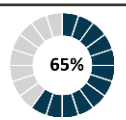
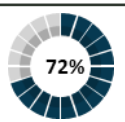
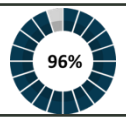
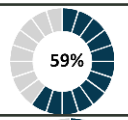
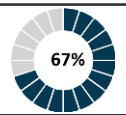
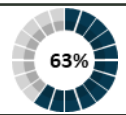
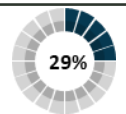
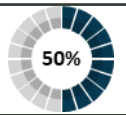
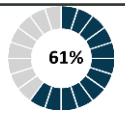
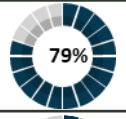
*DoD Working Groups: Cost, Data Quality, CI Metrics, Assessor Qualifications & Training

E-SMS DOMAIN SCHEDULE



- Initial Operating Capability (IOC) = E-SMS has critical functionality for domain and organization can begin onboarding (e.g., BUILDER parity has been achieved in E-SMS Buildings)
- Timeline dependent on external variables and subject to change

E-SMS DOMAIN IOC STATUS (AS OF '25 SUMMIT)

	Real Property Inventory	Component Inventory	Assessment	Metrics	Work Analysis	Reporting	Overall Progress	Primary Actions	Customer Preparation Activities
Buildings								IOC for buildings has been achieved. SMS team will finalize field application and integrate functionality ratings.	Onboarding of Services / Agencies
Utilities								Utilities will align with most Buildings methodology and features. SMS team will complete component reference data (component catalog and costs), grouping feature, and will solution ArcGIS component updates.	Review and Align Utilities data (GIS, CMMS, other)
Waterfront								SMS team will finalize component reference data (component catalog and costs), assessment criteria and integration into system. Metrics and work analysis calculations will primarily mirror buildings domain.	
Rail								Rail leverages criteria, methodology from legacy Railer. Requirements are currently being reviewed by SMEs and will be integrated into system.	
Fuels								SMS team coordinating with DLA to finalize component reference data (component catalog and costs), and assessment criteria.	
Water Control								SMS team will finalize component reference data (component catalog and costs), assessment criteria and initiate integration into system.	
Pavement								Pavement leverages criteria, methodology from legacy PAVER. Requirements are currently being reviewed by SMEs and will be integrated into system.	Review and Align GIS data. Coordinate with SMS team for current E-70 files.
Bridges								SMS team will develop component reference data (component catalog and costs), assessment criteria and initiate integration into system	
Training Areas & Ranges								SMS team will develop component reference data (component catalog and costs), assessment criteria and initiate integration into system	
Specialized Assets								SMS team will develop component reference data (component catalog and costs), assessment criteria and initiate integration into system	

E-SMS ONBOARDING

- Begins with each Domain IOC
- Each service / agency onboarding will include 3 phases: Intake, Staging, and Production
- A customized schedule is developed for each service / agency
- Training and strategic communications is critical for successful implementation

E-SMS BRANDING / LOGO UPDATE

The Enterprise Sustainment Management System (E-SMS) Web Application is a cloud-based solution that brings all real property infrastructure domains under the umbrella of a single SMS application. Performing long-range work requirement projections across domains allows for comprehensive analysis of options and related effects. E-SMS provides increased control of user permission definition, teaming, and application; updated business intelligence reporting capabilities; and improved user experience.

LOGO STORY

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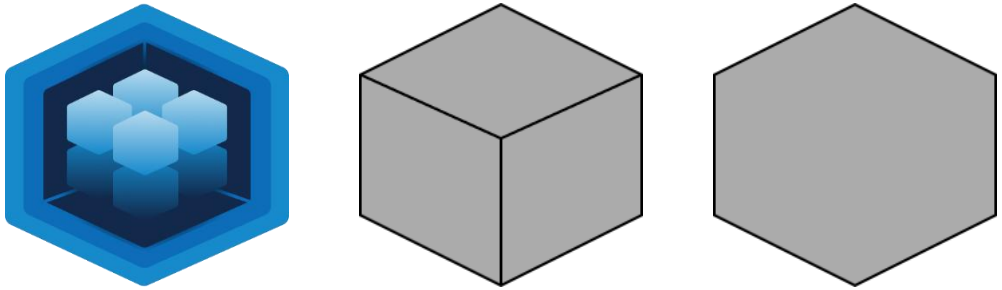
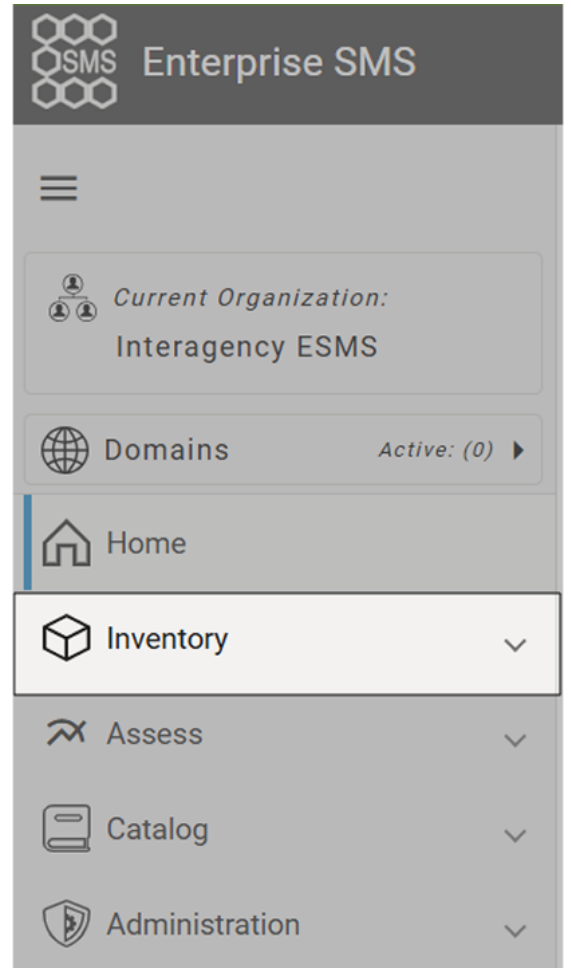


The nesting cubes represent the layers of inventory, as well as paying homage to the hexagon badges SMS has historically used to represent E-SMS and domains.

SMS



Forecast

Plan

Analyze

ENTERPRISE
SUSTAINMENT MANAGEMENT SYSTEM

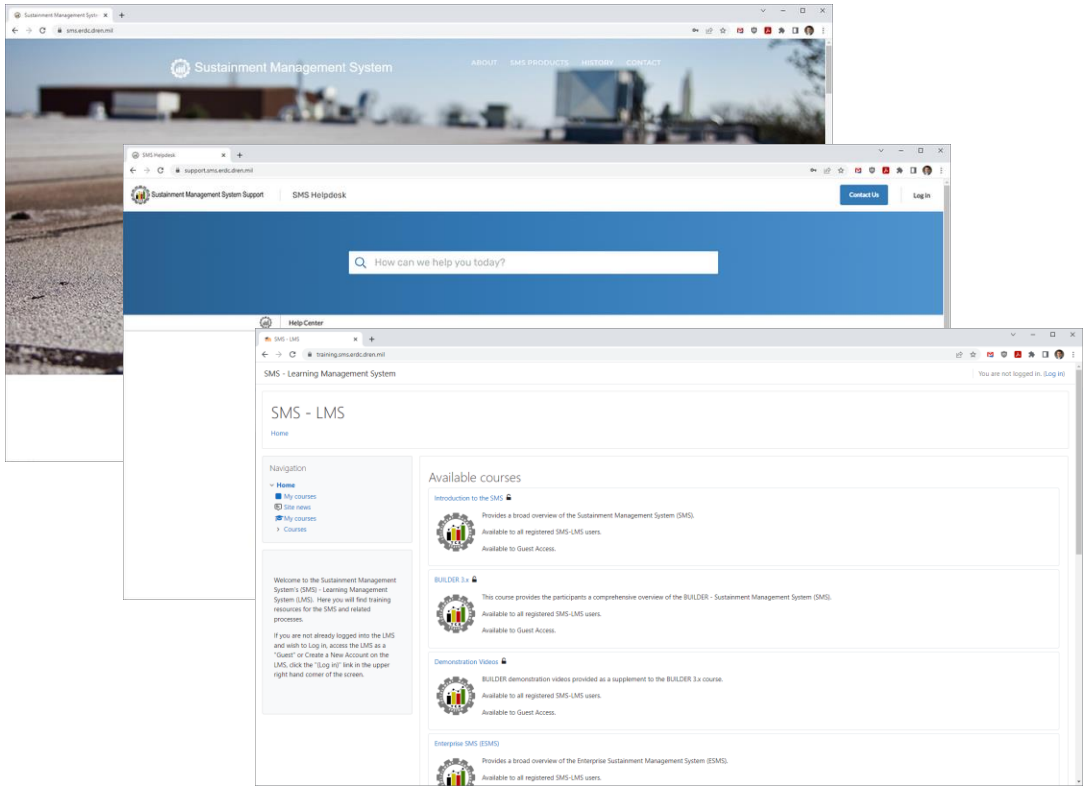
ENTERPRISE
SMS

SMS INFORMATION RESOURCES

SMS General Information Website
https://www.sms.erdc.dren.mil/

SMS Support Site
https://support.sms.erdc.dren.mil/

SMS Training Site – Learning Management System
https://training.sms.erdc.dren.mil/



MR. MARK SINDER – DASD-IMR

Mr. Sinder is currently serving as Deputy Assistant Secretary of Defense for Infrastructure Modernization and Resilience. In this role, he is charged with ensuring strategic alignment of DoD's physical infrastructure with warfighter requirements, to include development and execution of policies, guidance, and procedures for basing, real property management, geospatial information and services, and the construction, operations, maintenance and repair of DoD's worldwide infrastructure portfolio.

Prior to this assignment Mr. Sinder served as the Director, Installations Division (OPNAV N4I) under the Deputy, Chief of Naval Operations for Fleet Readiness and Logistics.

From 2020-2023, Mr. Sinder served as the Director of Operations (N3) for Commander, Navy Installations Command.

Prior to this appointment, from 2019-2020, Mr. Sinder served as the Executive Director for Naval District Washington (NDW).

Mr. Sinder began working in the Department of Defense environment in 2003 in variety of positions principally on Chief of Naval Operations staff and for Commander, Navy Installations Command.

Mr. Sinder is a native of Champaign, IL and graduated from the College of William and Mary with a Bachelor of Arts in Economics and Political Science.

https://www.acq.osd.mil/eie/leadership/mark-sinder.html

DEMO OF E-SMS PART 1

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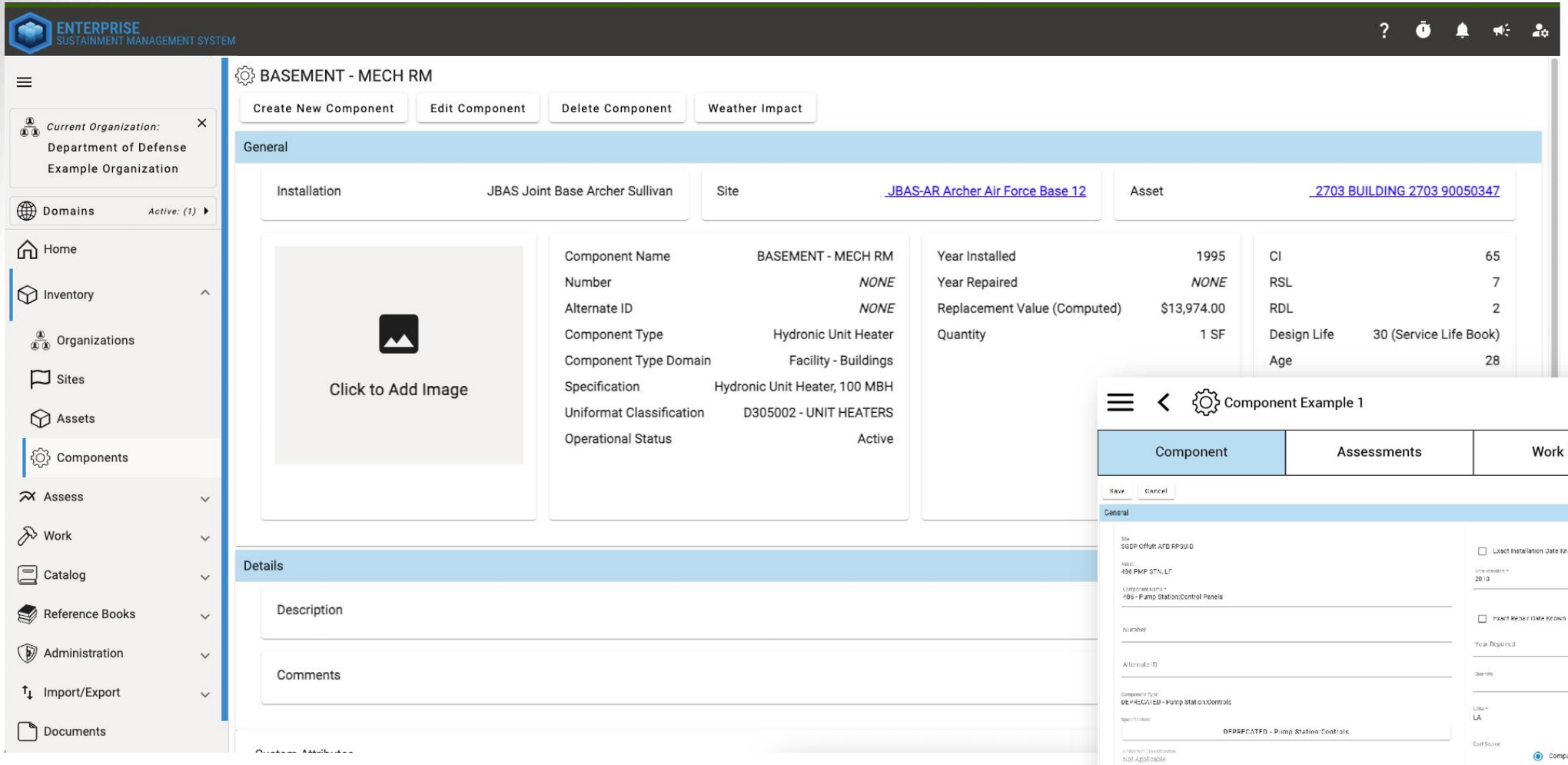
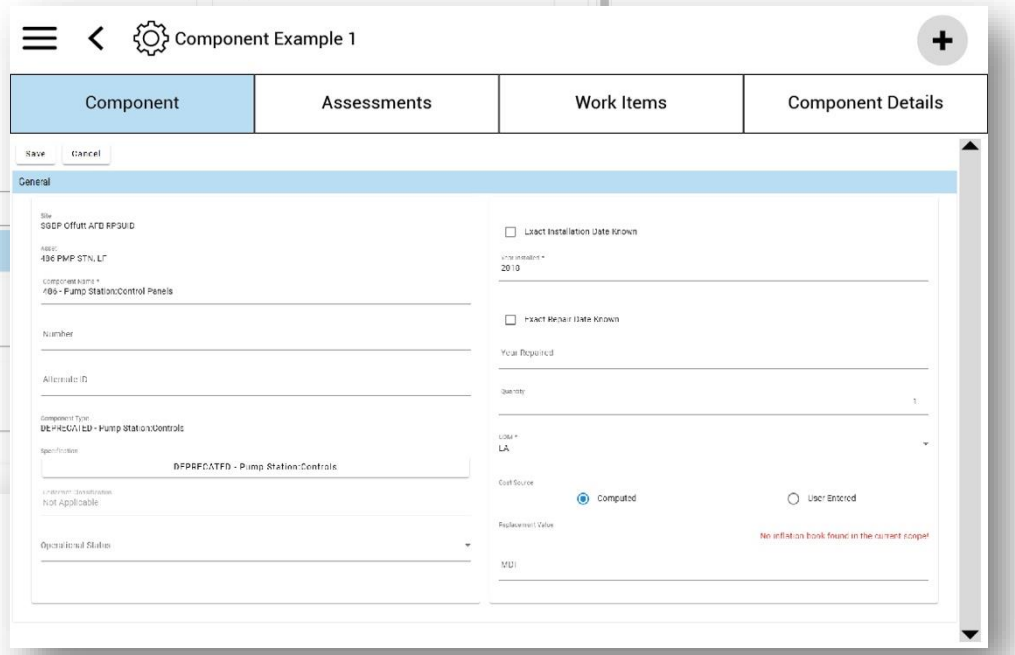




LUNCH

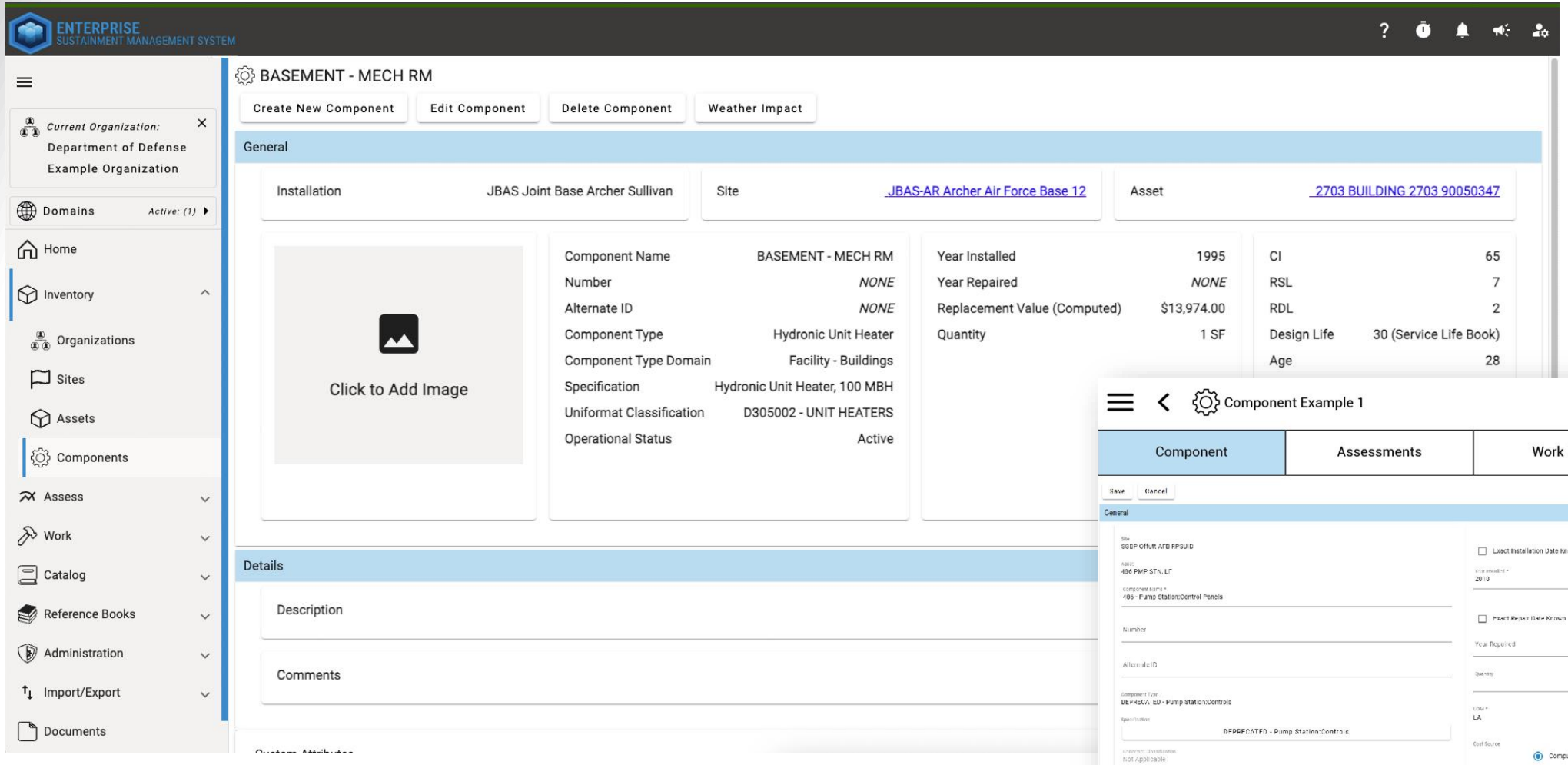
U.S. ARMY

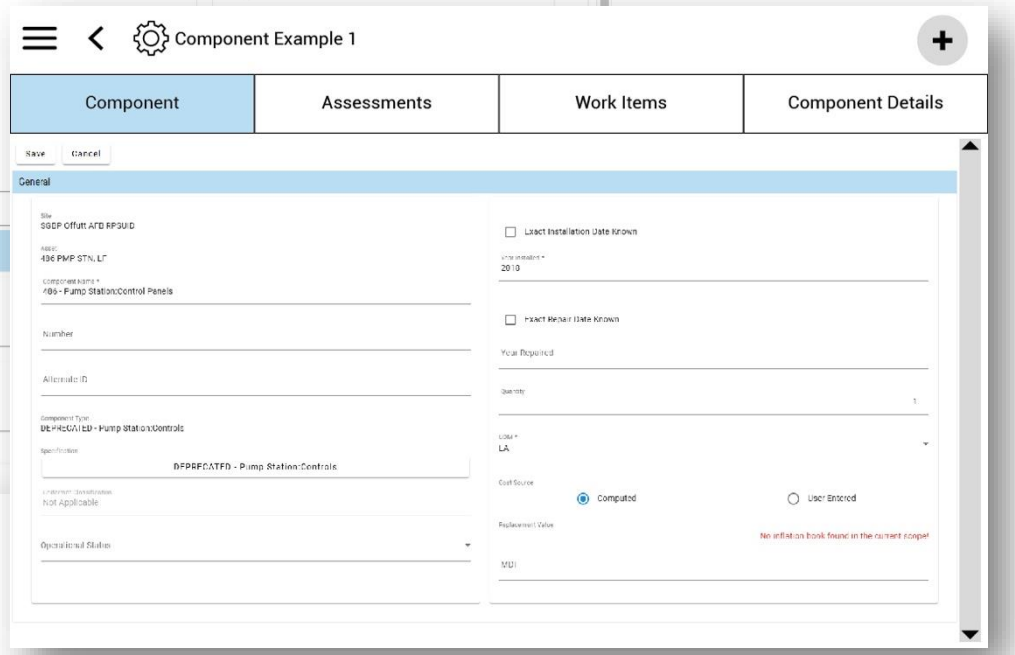
Resuming at **1:00 PM**
Eastern Time

DEMO OF E-SMS PART 2

U.S. ARMY

ERDC





ENTERPRISE SUSTAINMENT MANAGEMENT SYSTEM (ESMS) UTILITIES DOMAIN UPDATE

USACE-ERDC-CERL
SMS – TCX
July 2025

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US Army Corps of Engineers®

UTILITIES SMS UPDATE

Update and Demonstration

FY25 Focus Areas
Inventory

- Refining Utilities SMS Data Models
  - Continue to Harmonize with GIS via the SDSFIE
    - Sync terminology with GIS from each Service
    - Thanks to Dave Labranche and his Program Team
  - Needed to Ensure Utilities Data Alignment with:
    - ESMS System Architecture
    - Actual Data Sources for DoD Utilities
    - Existing Cost Databases

- Developing Capability to Populate ESMS Utilities Databases
  - ESMS Generalized Importer
    - Recognizes the fact that quite a bit of Utilities data exists, but the format is not standardized
    - Enables Large Scale Database Imports
      - » Complex logic for bulk import
    - Current Focus has been for Initial Testing with USAF GIS data
    - Importer Will Also Interact with Other Data Sources – various CMMSs, Navy Utilities Tools, (Flexible)

- Testing ESMS with Linear Asset Data
  - Linear asset data tests ESMS geometry and map viewer
  - Large GIS databases test the ESMS Generalized Importer

UTILITIES SMS UPDATE

FY25 Focus Areas
Inventory (Continued)

- Specifications Development Needed
  - BUILDER has some similar components but very limited
  - Developing Spec's for all Component Types in all Utilities Domains

- Specifications Approach is to Keep It Simple
  - Limited Number of Components
  - Limited Number of required Attributes
  - Sufficient to Enable SMS Analysis, but not overdesigned

  - Note: Can keep extra info in "custom attributes", but won't be in ESMS Specs

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UTILITIES SMS COMPONENT COUNTS

Water	Electrical	Natural Gas	Stormwater	Thermal	Wastewater
• Component Types: **16**	• Component Types: **20**	• Component Types: **12**	• Component Types: **20**	• Component Types: **13**	• Component Types: **11**

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SAMPLE FROM ESMS WATER PIPE SPECIFICATION

C	E	G	K	L	S	T	U	V	W	X
Component Type	Default Unitformat	Specification	Design Life	Terminal CI	Attribute 1 Name	Attribute 1 Value	Attribute 2 Name	Attribute 2 Value	Attribute 3 Name	Attribute 3 Value
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 2 in	60	40	Material	PVC	Diameter	2		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 2.5 in	60	40	Material	PVC	Diameter	2.5		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 3 in	60	40	Material	PVC	Diameter	3		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 4 in	60	40	Material	PVC	Diameter	4		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 5 in	60	40	Material	PVC	Diameter	5		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 6 in	60	40	Material	PVC	Diameter	6		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 8 in	60	40	Material	PVC	Diameter	8		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 10 in	60	40	Material	PVC	Diameter	10		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 12 in	60	40	Material	PVC	Diameter	12		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 14 in	60	40	Material	PVC	Diameter	14		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 16 in	60	40	Material	PVC	Diameter	16		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 18 in	60	40	Material	PVC	Diameter	18		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 20 in	60	40	Material	PVC	Diameter	20		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 24 in	60	40	Material	PVC	Diameter	24		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 30 in	60	40	Material	PVC	Diameter	30		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC, 36 in	60	40	Material	PVC	Diameter	36		
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, PVC	60	40	Material	PVC	Diameter			
Water Pipe	G301002 POTABLE WATER DISTRIBUTION	Water Pipe, Reinforced Concrete, 6 in	60	40	Material	Reinforced	Diameter	6		

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Material and Diameter Heat Map for Water Pipes

	Asbestos Cement	Cast Iron	Copper	Ductile Iron	Galvanized Iron	Galvanized Steel	HDPE	Other Material	Plastic	Polyethylene	PVC	Reinforced Concrete	Steel
0.5								596			141		
0.75		189	2149		77	326	220	1489		402	1810		54
1	69	266	2090		67	1098	1024	1502		970	7178		141
1.25	281	317	196	249	51	137	665	557		123	2754		30
1.5	326	284	594	28	167	373	691	971		343	3368		92
1.75	0	21	12	3	1	1	2	76		0	52		0
2	226	1734	1110	387	852	1102	1374	6444		389	8811		440
2.5	52	374	53	19	68	267	183	523		133	1348		79
3	240	1045	71	834	91	134	248	815		75	2972		182
4	392	2017	102	775	48	44	412	950		25	3195		583
5	6	29	0	4	1	1	16	75		1	111		242
6	9836	22193	80	6060	53	137	2177	3676		323	22568	175	2835
8	53	12807		3129		34	1569	2004		171	19469	104	1054
10	2015	4078		1100		57	652	574			5144	57	588
12	1406	2817		1924			427	436			4614	156	412
14	570	385		217			180	99			357	196	91
16	357	591		383			118	141			550	20	203
18	9	88		72			201	28			113	80	26
20	143	231		161				84			132	2	60
24	56	151		172				42			124	78	
30		110		77				45			18		
36		55		8				12			6		
48		11						0					
60		21						0					
72		101						0					
85								0					

Common Diameter Sizes

Accepted Diameter Range for PVC

Example:
There are 22,193 Pipes from GIS Layers WMainLine_L and WserviceLine_L which will map to the ESMS specification for “Water Pipe, Cast Iron, 6 Inch Diameter

UTILITIES SMS UPDATE

FY25 Focus Areas (Continued)

Assessment (Just Getting Started)

- Bulk Importer will Import Direct Rating-Type Assessments
  - Ongoing Work
  - Need to Harmonize/Standardize assessment methods
    - August Utilities Working Group Topic
    - Guidance will be developed as needed

UTILITIES SMS UPDATE

FY26 Focus Areas

- Complete ESMS Specifications for All Utilities
- Configure Importer for Each Data Source For All Users
- Develop Tools for Onboarding
  - Data Gaps
  - QA/QC Reports
- Configure Work Analysis for Utilities
- Develop Training Materials

Thanks to the Team!
Dr. Mike Grussing, Mike Mollineaux, Ryan Smith, Ray Butler, Juan Davilla-Perez

Demonstration (Ryan Smith)

BREAK

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ENTERPRISE SUSTAINMENT MANAGEMENT SYSTEM (E-SMS) CONFIGURATION SUPPORT PANEL (CSP)

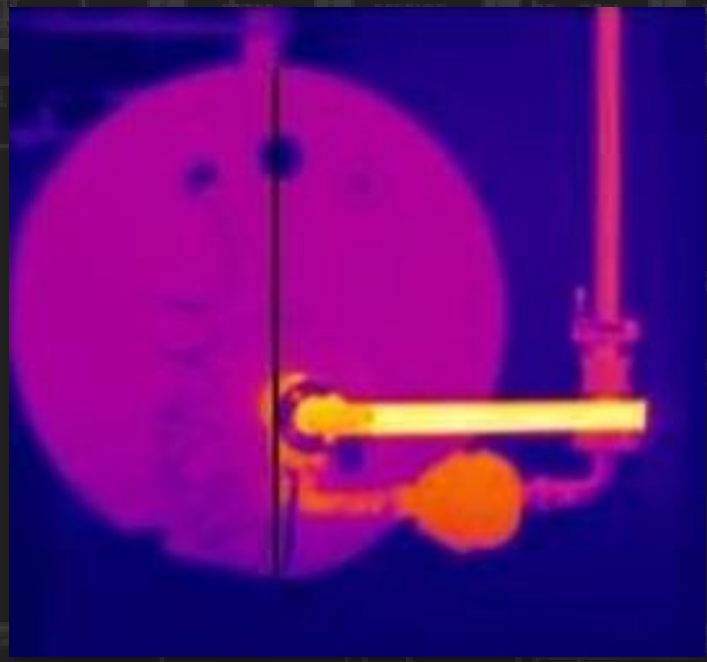
Denise Faldowski
E-SMS CSP Chair
Office of the Deputy Assistant Secretary of Defense for Infrastructure Modernization and Resilience (ODASD(IM&R))

Content covered by Jim Livingston (Army G9)

E-SMS HELP AND TRAINING CONTENT

Demonstrations of SMS Learning Management Site, ESMS Help Documentation, and SMS TCX Support Site

SMS INNOVATION LAB



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DISCOVERY: A CADRE OF RESEARCHERS

SMS LIFECYCLE

Discover

On-going work refining the art of asset management through algorithm and process development, data mining, and similar research efforts.

Develop

Taking new asset management practice discoveries and building tools that are leveraged by our industry partners.

Deliver

Provide Federal agencies assistance and guidance in the implementation of SMS tools and processes for maximum effectiveness.

Sustain

Application hosting, SMS Support helpdesk, and the various efforts required to provide SMS tools to Federal agencies.

National Nuclear Security Administration

Lawrence Livermore National Laboratory

BERKELEY LAB

Lawrence Berkeley National Laboratory

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

SUSTAINMENT MANAGEMENT SYSTEM TCX

AFIT Air Force Institute of Technology

NPS NAVAL POSTGRADUATE SCHOOL

ILLINOIS STATE UNIVERSITY

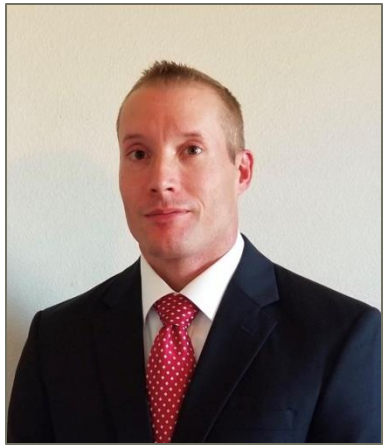
Illinois' first public university

MEET THE TEAM

U.S. ARMY

Matt Richards
Research IT Specialist
Data Mgt

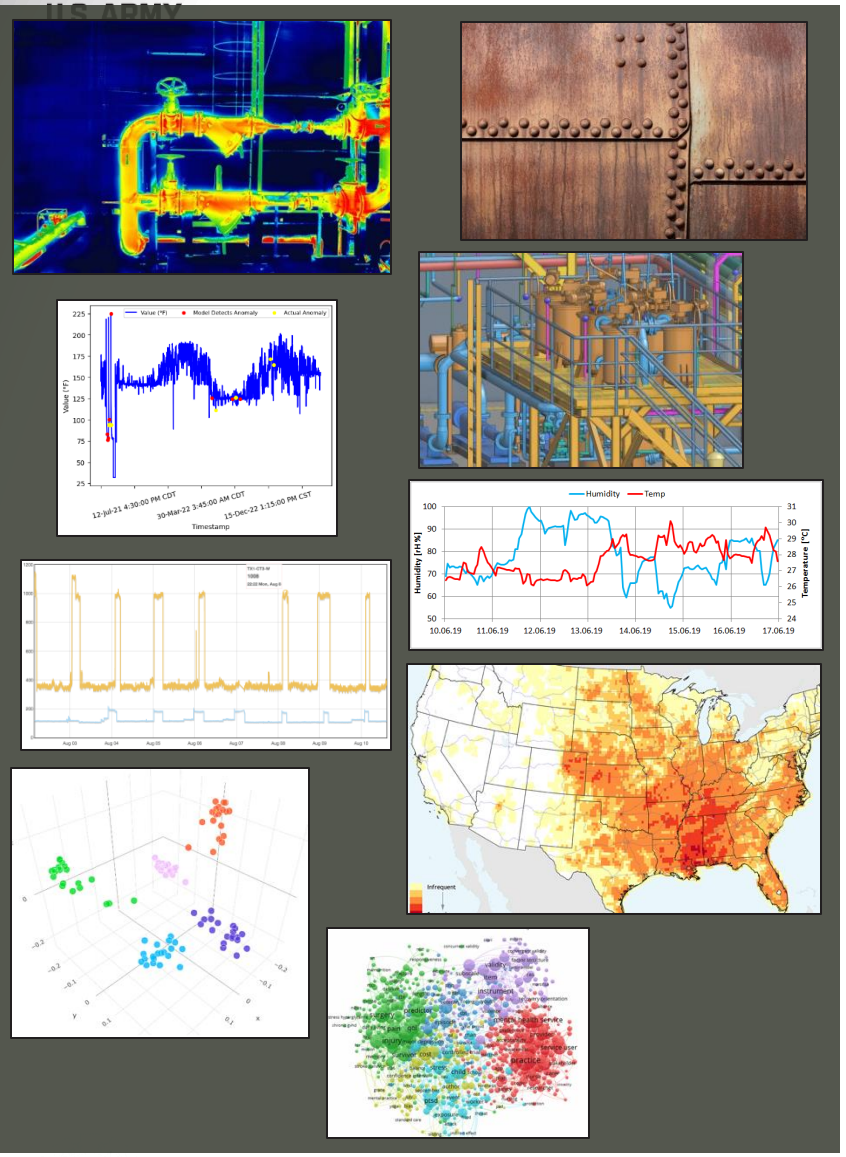
Brayden Riesberg
Data Scientist



Dr. Trevor Betz
Research Mechanical Engineer

Bob Skudnig
Research Mathematician

RESEARCH OVERVIEW



DATA IN

ESMS

Rating	SRM ☐ Needs
Green (+)	Sustainment consisting of possible preventive maintenance (where applicable)
Green	Sustainment consisting of possible preventive maintenance (where applicable) and minor repairs (corrective maintenance) to possibly few or some subcomponents.
Green (-)	
Amber (+)	Sustainment or restoration to any of the following: Minor repairs to several subcomponents; or Significant repair, rehabilitation, or replacement of one or more subcomponents, but not enough to encompass the Component-Section as a whole; or Combinations thereof
Amber	
Amber (-)	
Red (+)	Sustainment or restoration required consisting of major repair, rehabilitation, or replacement to the component- section as a whole.
Red	
Red (-)	

INFO OUT

DATA IN

Improving data quality and reducing cost…

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SENSOR INTEGRATION

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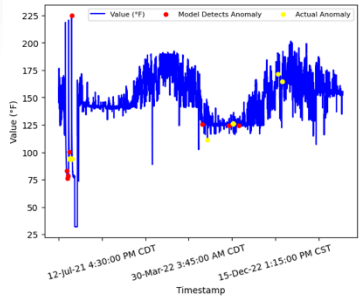
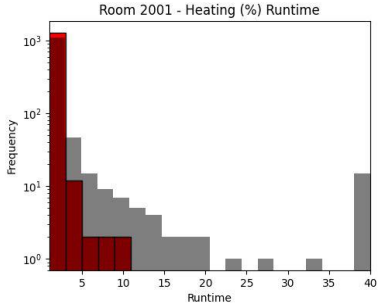
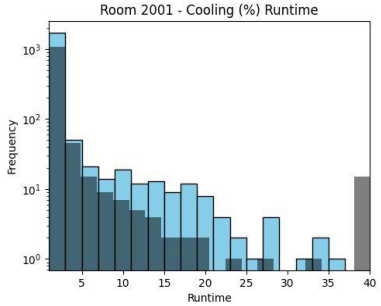
Anomaly Detection
– ML / neural network processing



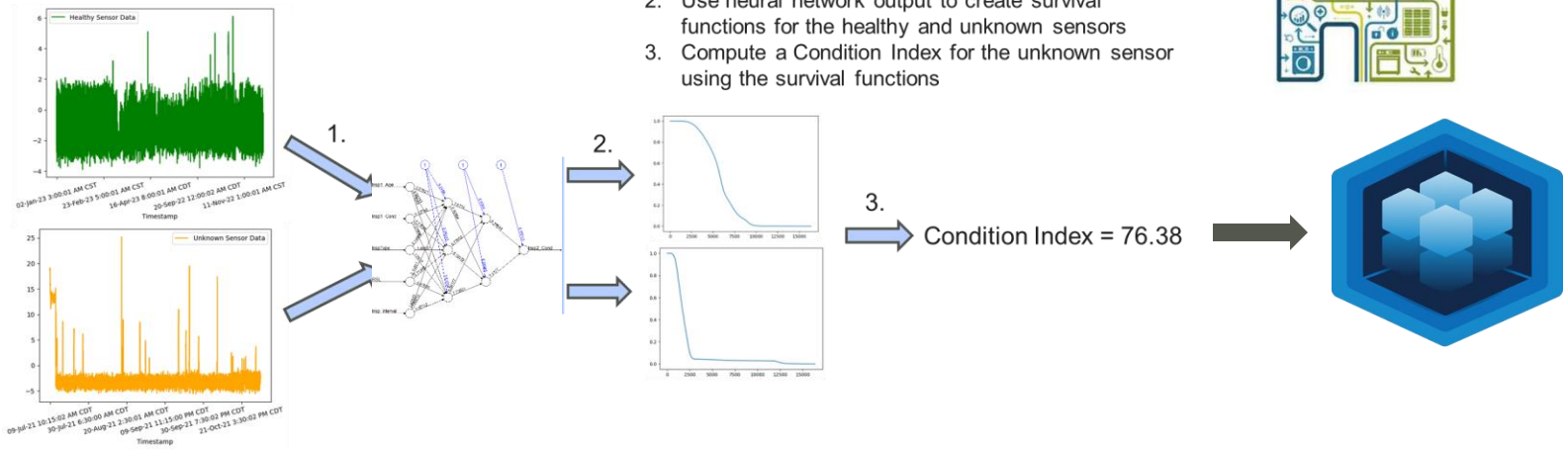




Automated Condition Assessment

Steps:

1. Input healthy and unknown sensor data into autoencoder neural network
2. Use neural network output to create survival functions for the healthy and unknown sensors
3. Compute a Condition Index for the unknown sensor using the survival functions



ERDC/CERL SR-01-23

Construction Engineering Research Laboratory

US Army Corps of Engineers®
Engineering Research and Development Center

Operations and Maintenance Engineering Technology

A Method Comparison of Algorithms for Predicting Equipment Condition Ratings in the Enterprise Sustainment Management System using Building Automation System Data

A Case Study at Tyndall AFB and the Engineering Research and Development Center, Version 1.0

Matthew E. Richards, Louis Bartels, PhD., Michael Grussing, PhD., Trevor Betz, Joseph Wittrock, Sam Dulin and Robert Skudnig

March 2023
Revised November 2023

DRAFT NOT APPROVED FOR PUBLIC RELEASE; distribution is limited to authors.

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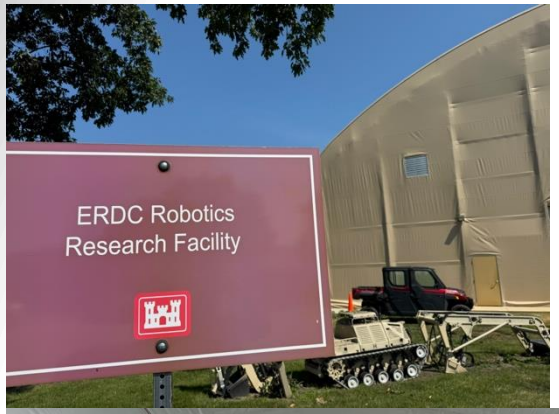
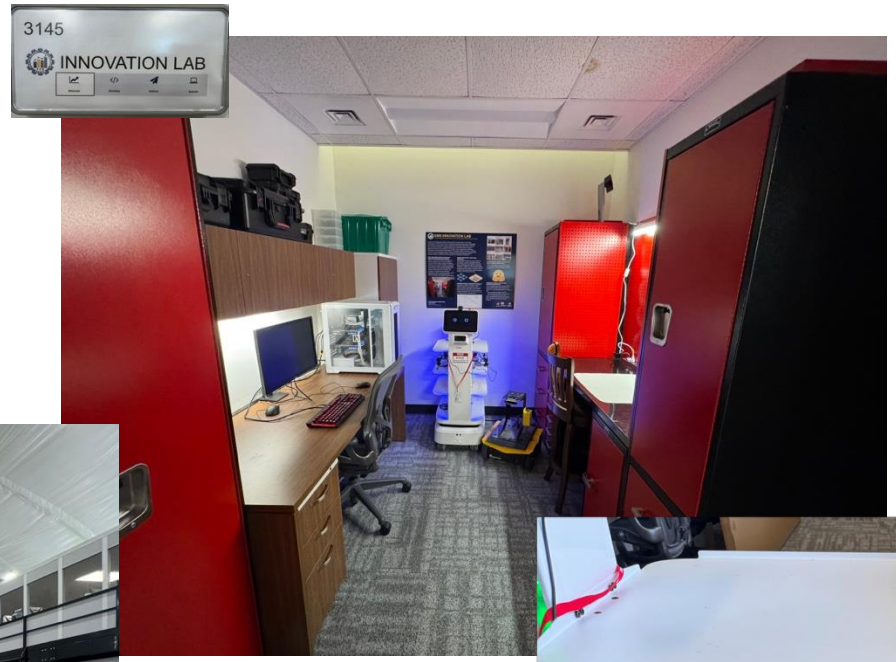
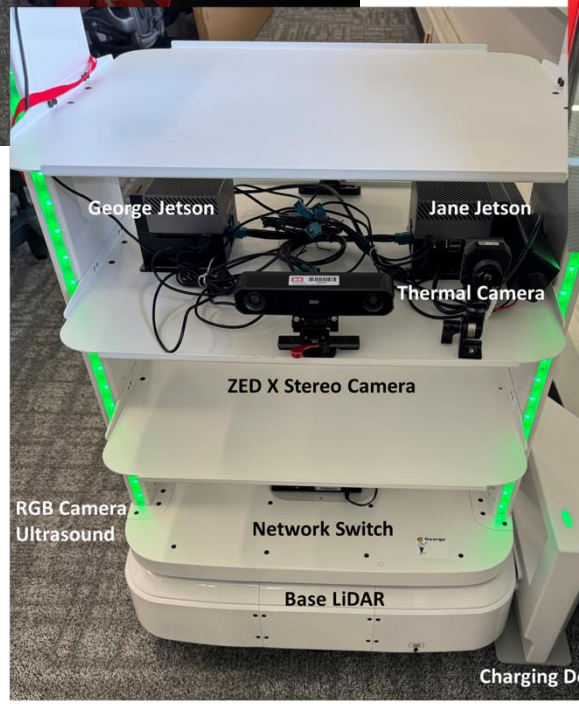
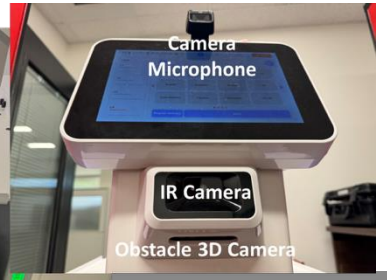
ROBOTIC INVENTORY AND CONDITION ASSESSMENT

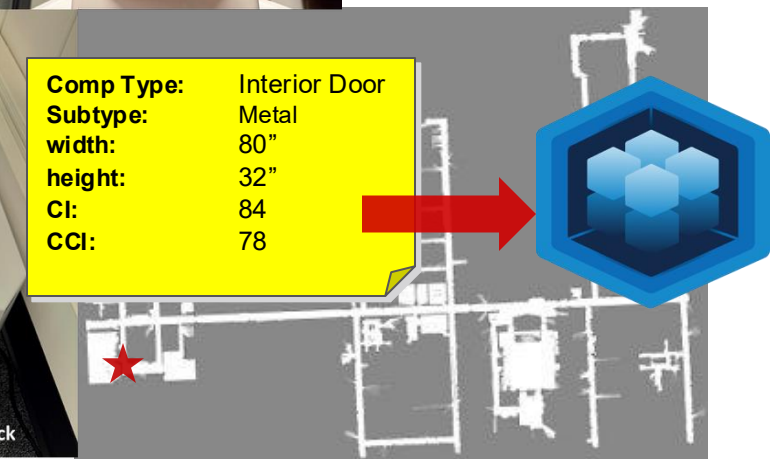
REAL-TIME OBSERVATIONAL SYSTEM FOR INFRASTRUCTURE EVALUATION (ROSIE)











ARTIFICIAL INTELLIGENCE ON THE EDGE

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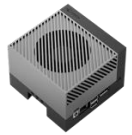
Edge Computing



NVIDIA RIVA

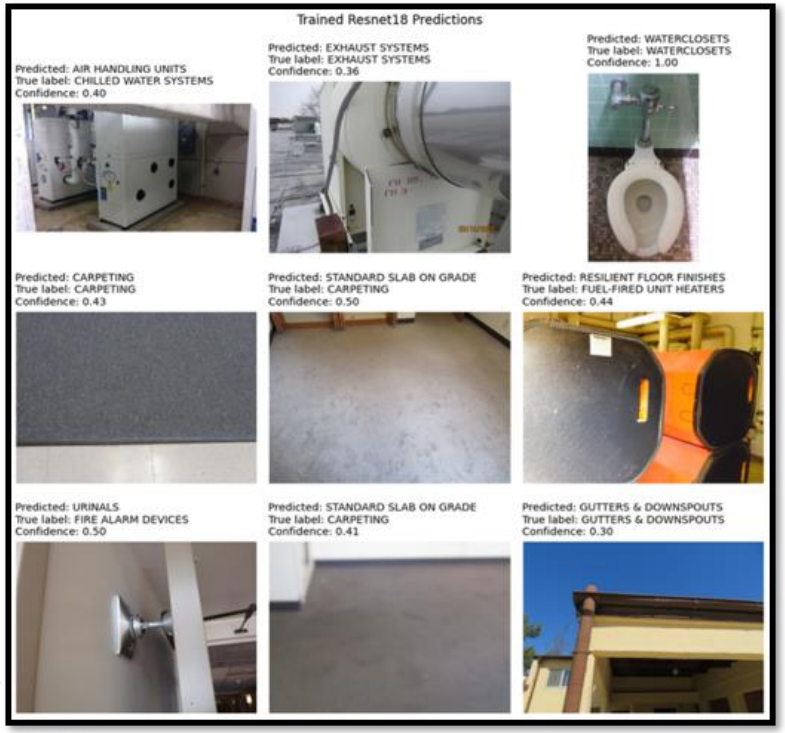
?

LangChain

Large Language Models (Ollama)

ESMS

Image Classification Trained On Historical SMS Data



Natural Language Request or Assessment from Sensors

Microsoft SQL Server

Retrieval Augmented Generative AI

LLM MODEL RESPONSE

Condition Assessment of the Overhead Door Observations:

- **Structural Damage:** Visible hole and rust on the upper section of the door indicate corrosion and material deterioration. Multiple dents, punctures, and physical damage on the lower panels compromise structural integrity.
- **Surface Condition:** The paint is peeling and uneven, exposing bare metal in places, which accelerates rust formation. Signs of long-term wear and neglect are evident.
- **Functional Concerns:** The "DOOR BLOCKED" sign and the overall appearance suggest the door may not be operational. Warping or misalignment is possible, which could interfere with opening and closing.
- **Environmental Exposure:** Salt residue near the base of the door indicates exposure to road salt, contributing to accelerated corrosion. Cold weather conditions likely exacerbate wear through freeze-thaw cycles.

Condition Index (CI) Based on the BUILDER™ SMS framework for Condition Assessment:

- **Baseline Condition:** A commercial overhead door typically has a service life of 20–30 years. Given the visible damage and lack of maintenance, this door is likely near or beyond its expected lifespan.
- **Condition Deductions:**
  - Structural damage: -30 points.
  - Corrosion and rust: -20 points.
  - Paint failure and exposure: -10 points.
  - Possible non-operational status: -10 points.
- **Estimated CI:** 30–40 (Poor condition).

Recommendations:

- **Immediate Repairs:** If the door is required for security or operation, replace damaged panels and repaint to prevent further rust. Inspect mechanical components (tracks, springs, motor) for functionality.
- **Replacement:** Given the extent of damage, consider replacing the door entirely. A new door will likely be more cost-effective than extensive repairs.
- **Preventive Maintenance:** Establish a regular maintenance schedule to clean, paint, and inspect the door to prevent future degradation.

INFORMATION OUT

Enhancing data value for improved facility insights…

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FAILURE PROBABILITY

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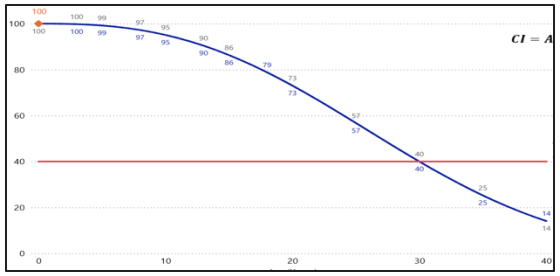
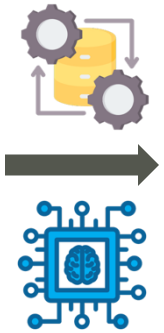
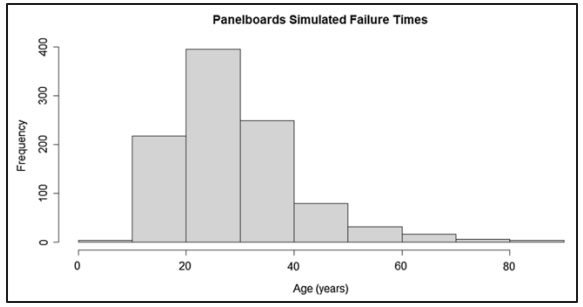
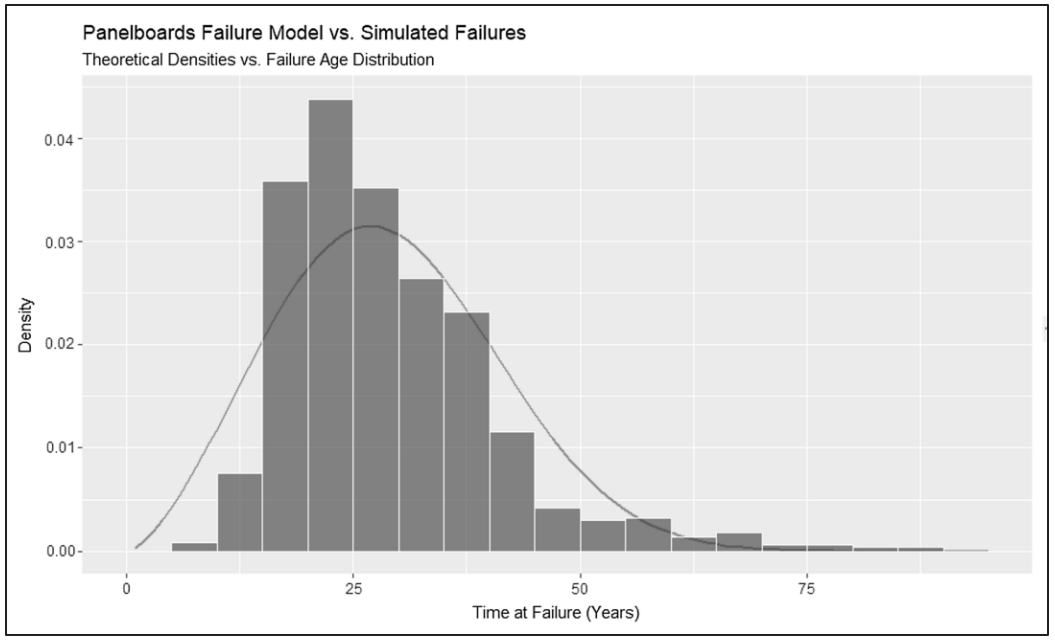


SMS Condition







$$CI(t) = A * \left(\frac{100}{CI_T}\right)^{-\left(\frac{t}{\theta}\right)^{\beta}}$$

Existing Reliability Estimation

Failure Likelihood

$$f(t) = \frac{-dCI(t)}{dt} = \frac{A\beta\left(\frac{100}{CI_T}\right)^{-\left(\frac{t}{\theta}\right)^{\beta}}\left(\frac{t}{\theta}\right)^{\beta}\ln\left(\frac{100}{CI_T}\right)}{100 * t}$$

Table 4. MSE values of degradation models

Component	Neural network	Industry
Panelboards	105.06	826.29
Low-slope roof systems	55.37	3,565.58

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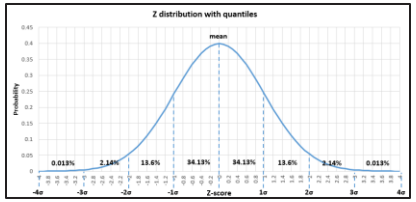
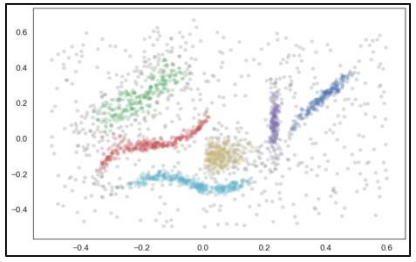
FAILURE CONSEQUENCE

How can we improve and standardize the Mission Dependency Index?

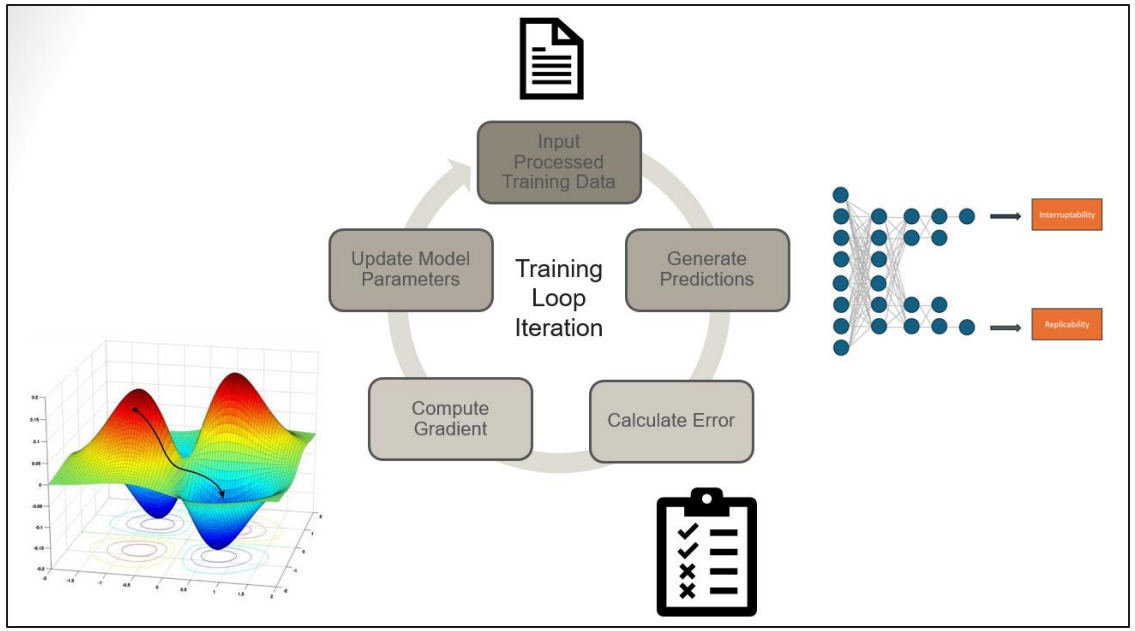
MISSION DEPENDENCY INDEX

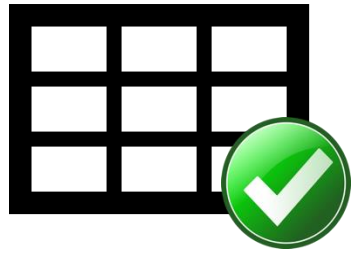
MDI	Question 1 INTERRUPTABILITY: How fast would the mission be impacted if the asset's operations were interrupted?			
Question 2 REPLICABILITY: How difficult would it be to replicate the asset's mission capabilities?	IMMEDIATE < 15 minutes	BRIEF < 24 hours	SHORT < 7days	PROLONGED > 7 days
IMPOSSIBLE	100	88	76	64
EXTREMELY DIFFICULT	92	80	68	56
DIFFICULT	84	72	60	48
POSSIBLE	76	64	52	40





Color	Red	Yellow	Green
Red	1	0	0
Red	1	0	0
Yellow	0	1	0
Green	0	0	1
Yellow	0	1	0





RISK ESTIMATION

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RPA Data

MDI Surveys

Data Processing

Neural Network Classifier

Mission Dependency Index

RPA Application

CONSEQUENCE

EXTREME

MAJOR

MODEST

MINOR

High Risk

Significant Risk

Moderate Risk

Low Risk

VERY UNLIKELY

UNLIKELY

LIKELY

VERY LIKELY

PROBABILITY

Behavior Comparison

Corrosion

Non-Corrosion

Topic Categorization

Latent Dirichlet Allocation

Inspection Comments

Component Application

Condition Index

Weibull Curve

Inspection Data

Data Processing

Neural Network Regressor

MAINTENANCE COST OPTIMIZATION FRAMEWORK

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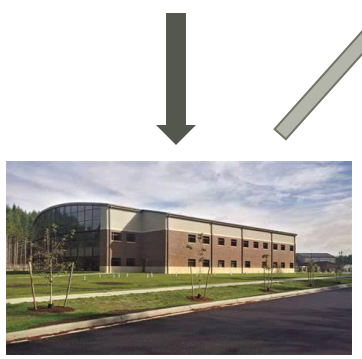

Facility A

Maintenance Plan 1

Comp.	1	2	3	4	5	6	7	8	9	10
FCU		Repair			Repair					
Slab								Repl.		
Wall		Repair								
Door			Repair					Repair		
Generator					Repair					

Maintenance Plan 2

Comp.	1	2	3	4	5	6	7	8	9	10
FCU					Repair					
Slab										
Wall		Repair								
Door								Repair		
Generator					Repair					

Maintenance Plan 3

Comp.	1	2	3	4	5	6	7	8	9	10
FCU		Repair			Repair					
Slab								Repl.		
Wall		Repair								
Door			Repair					Repl.		
Generator								Repl.		

10-year timeframe

Outcome:

$80k

FCI: 87

$30k

FCI: 65

$200k

FCI: 94

MAINTENANCE COST OPTIMIZATION FRAMEWORK

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Facility A

All Single-Decision Plans

	Do Nothing	Minimal Sustain	Moderate Sustain	Full Sustain	Restore	Renovation	Replace
1	35.23	37.14	52.47	64.54	93.15	93.15	93.15
2	35.23	44.25	59.21	77.50	95.09	95.09	95.09
3	35.23	51.04	76.37	81.90	96.68	96.68	96.68
4	35.23	52.35	79.28	88.87	97.93	97.93	97.93
5	35.23	68.33	86.03	94.07	98.84	98.84	98.84
6	35.23	69.33	89.27	95.36	99.45	99.45	99.45
7	35.23	70.75	90.82	96.35	99.81	99.81	99.81
8	35.23	71.22	97.08	98.68	99.97	99.97	99.97
9	35.23	71.57	97.64	98.91	100.00	100.00	100.00

	Do Nothing	Minimal Sustain	Moderate Sustain	Full Sustain	Restore	Renovation	Replace
1	0.00	0.00	7646.11	10892.60	92802.88	92802.88	92802.88
2	0.00	1919.62	13019.40	16785.33	92802.88	92802.88	92802.88
3	0.00	9506.88	20982.42	28318.35	92802.88	92802.88	92802.88
4	0.00	15127.80	32953.53	36560.31	92802.88	92802.88	92802.88
5	0.00	18364.22	39803.42	48035.75	92802.88	92802.88	92802.88
6	0.00	32218.98	50735.11	58875.21	92802.88	92802.88	92802.88
7	0.00	35354.29	57480.15	61195.86	92802.88	92802.88	92802.88
8	0.00	38801.46	60927.32	63819.30	92802.88	92802.88	92802.88
9	0.00	41262.07	66735.41	75918.20	92802.88	92802.88	92802.88

Optimization Methodology

MAINTENANCE COST OPTIMIZATION FRAMEWORK

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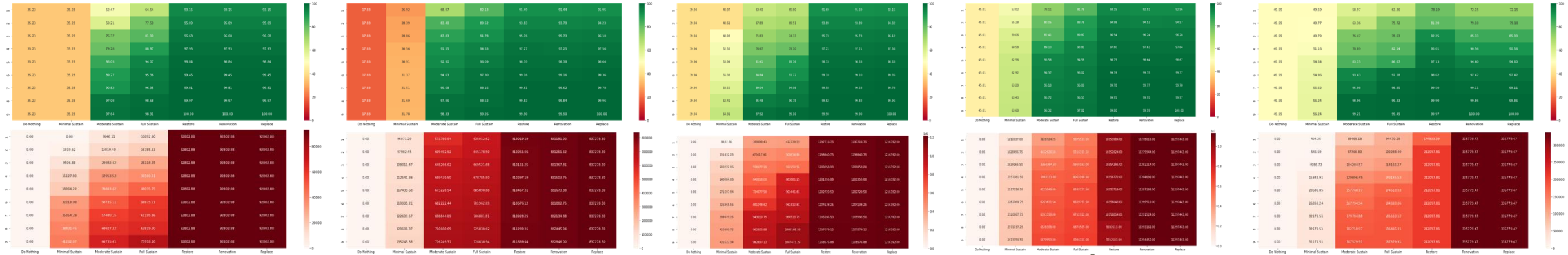
Sample Installation







Linear Programming

10-Year Maintenance Plan

MAINTENANCE COST OPTIMIZATION FRAMEWORK

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Methods Investigated

1. Genetic Algorithm
   - Based on natural selection / evolution
   - “Mutates” repair plans, selecting the one with highest “fitness”

2. Reinforcement Learning
   - Runs many trials to get a “reward” value for potential actions
   - Incorporates Markov models for uncertainty

3. Linear Programming
   - Evaluates cost/impact of repair plans
   - Select set of plans to give portfolio highest impact within budget

HOW CAN SMS DATA HELP WITH YOUR PROBLEM?

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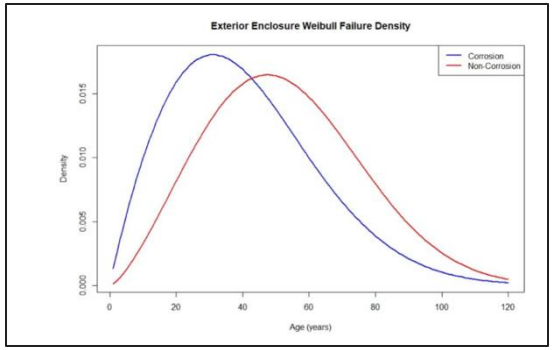
Examples

- Corrosion: *Can SMS data help quantify facility corrosion risk?*
  - *Natural language processing of inspection text*
  - *Identifies corrosion-prone components*
  - *Compares reliability to similar non-corrosion components*



- Energy: *Can SMS data help estimate energy use intensity when sub-metering isn't available?*
  - *Develop facility features like HVAC capacity, complexity*
  - *Integrated into larger machine-learning models*

- Mold: *Can SMS help identify facilities at greater risk of mold?*
  - *Natural language processing of inspection text as risk*
  - *Develop facility features like est. air-change capacity*
  - *Integrated into larger machine-learning models*

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THANK YOU!