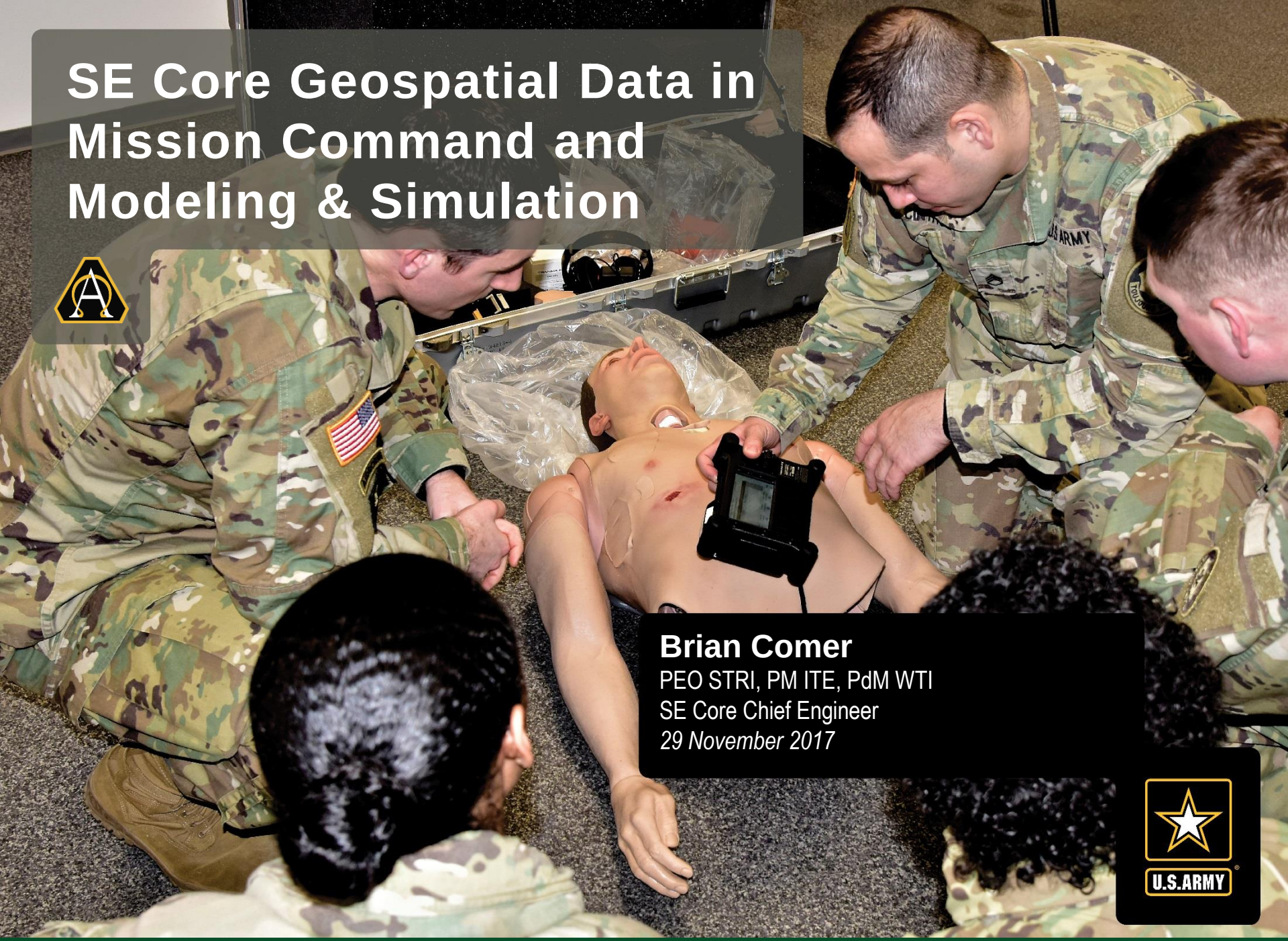
SE Core Geospatial Data in Mission Command and Modeling & Simulation



Brian Comer
PEO STRI, PM ITE, PdM WTI
SE Core Chief Engineer
29 November 2017

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Agenda

SE Core Demonstrating Interoperability

- SE Core Master Database (MDB) Geospatial Data use with Mission Commands Systems
- SE Core Terrain and Model Data for Operation Blended Warrior (OBW)
- Converging Model and Simulation (M&S) Geospatial Data with the Mission Command (MC) Geospatial Data
- SE Core Master Database (MDB) Geospatial Data in CDB

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SE Core Master Database (MDB) Geospatial Data exported and formatted for use with Mission Commands Systems in support of simulation based JLCCTC Exercises

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SE Core MDB export to MC Terrain Products: *Task Summary*

- SE Core worked with Army Geospatial Center (AGC) to develop Mission Command (MC) System loadable geospatial data products
  - In support of a Joint Land Constructive Component Training Capability (JLCCTC) simulation training exercise based on Decisive Action Training Environment (DATE) 2.x
  - The DATE 2.x database represents an fictitious location with mountainous terrain and large complex cities, all bordered by two large bodies of waters
  - Due to the fictitious nature of DATE, real-world MC terrain products did not exist
- Primary task was to produce data products in support of the JLCCTC DATE 2.x based exercise
- Secondary task was to develop processes and procedures to ensure a repeated capability for future SE Core production requirements

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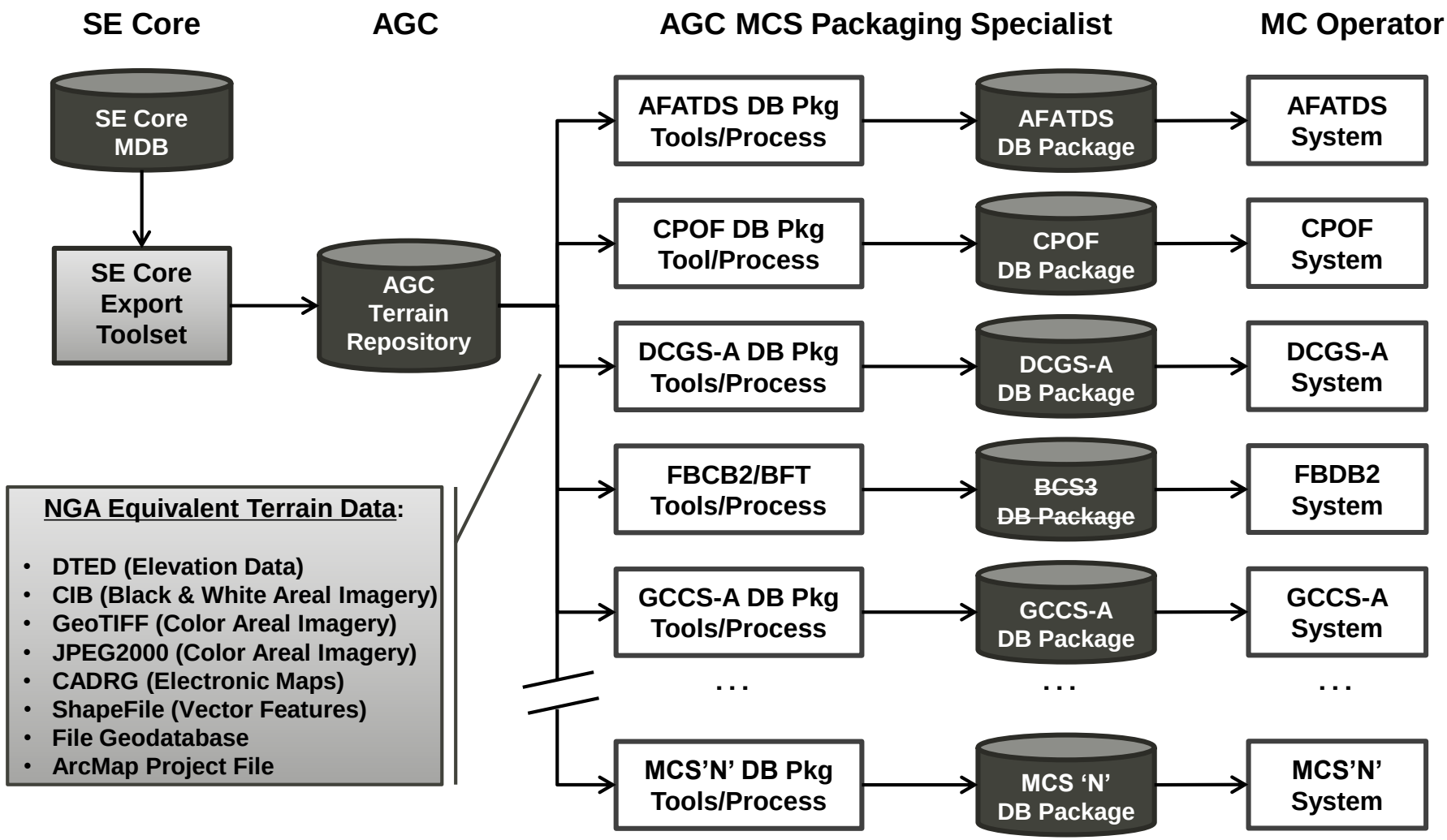
SE Core MDB exported to JLCCTC MC: *Process Concept*



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DATE 2.x Data Format Tests: *Results Summary*

SYSTEM	CADRG	DTED	CIB	JPEG-2000	GGDM/VECTOR
Command Post of the Future (CPOF)	Passed	Passed	Not Required	Passed	Not Required
Advanced Field Artillery Tactical Data System (AFATDS)	Passed	Passed	Passed	Not Required	Not Required
Force XXI Battle Command Brigade and Below (FBCB2) / Joint Capabilities Release (JCR)	Passed	Passed	Passed	Passed	Not Required
Air and Missile Defense Workstation (AMDWS)	Passed*	Passed	Passed*	Not Required	Not Required
Distributed Common Ground System – Army (DCGS-A)	Passed*	Passed	Passed*	Passed	Passed
FBCB2/Joint Battle Command – Platform (JBC-P)	Passed	Passed	Passed	Not Required	Not Required

* Loaded successfully in system, exhibited some rendering anomalies

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SE Core MDB exported to JLCCTC MC: *Lessons Learn*

- Maps - CADRG
  - Unique compression, varying metadata, different organization, and unique Table of Content required in multiple systems
  - Unique Upper Case and Lower Case required in two systems
  - DCGS-A and AMDWS renders differently in different versions of ArcGIS
- CIB
  - Commercial tools did not create correct format, required GOTS tool
- VECTOR/GGDM
  - CPOF requires ArcGIS Raster Catalogs, ArcMap MXD and MIGs text files, which must be build prior to loading data, poor performance with dense data
  - DCGS-A requires use of ArcGIS Raster Catalogs, which is built on DCGS-A system
- Elevation - DTED
  - Worked great
- Imagery - JPEG-2000
  - Worked great

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Provide Terrain and Model Data for Operation Blended Warrior (OBW)

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OBW Terrain and Model Data: *Task Summary*

- SE Core requested by PEO-STRI to prepare data for I/ITSEC'17 OBW
- PEO-STRI selected existing Joint-Base Lewis McCord as play box
  - Requested to prepare data as Distribution C, in source formats
  - PEO-STRI received "release for I/ITSEC'17 OBW usage" approval from all source providers except U.S. Homeland Security
    - SE Core removed features and feature with attributes from Homeland Security, replaced with alternative sources (all SE Core MDB source data retains data provide)
- PEO-STRI requested SE Core provide Common Moving Models
- PEO-STRI determined to post data on EDS-OBW website providing discovery and download
- PEO-STRI determined to provide a small inset of Dense Urban Environment (DUE) area to support ground scenario – Emerald City Inset (ECI)
  - Requested to prepare data as Distribution A, Unlimited Distribution
  - SE Core removed all distribution limited data
  - Determine to "scatter" small areas with deleted data
  - Requested to prepare a VBS3 database of small inset

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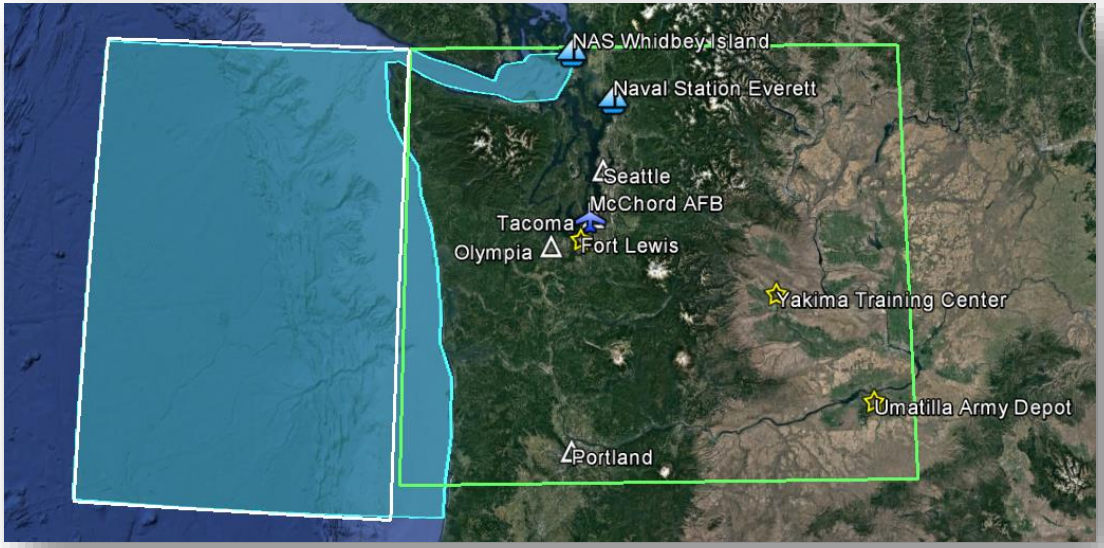
OBW Terrain and Model Data:
Pacific Northwest (PacNW) Dataset

- Terrain Size: 600km X 400 km
- Large Build Up Areas (BUAs)
  - Seattle, Portland, Tacoma
- Military Installations
  - JBLM (USA/USAF)
  - NAS Whidbey Island (USN)
  - Yakima Training Center (USA)
- 23 MOUT Sites
  - Includes enterable structures
- 26 Airfields
  - Includes runway markings, lighting
- Additional Details
  - Major landmarks models



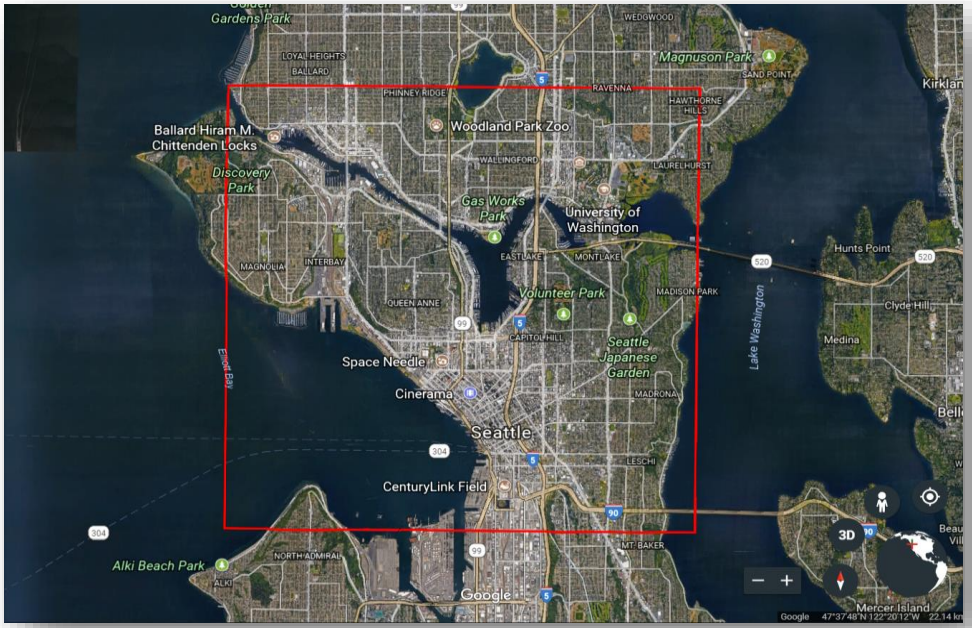
Geospatial Source Data

- Landmarks Models: OpenFlight
- Geotypical Models: OpenFlight
- Aerial Imagery: GeoTIFF (1meter)
- Elevation: DTED 2 (30 meters)
- Features: Shapefiles/EDCS
- Tactical simulation maps (TLM50/100, JOG-A): CADRG, GeoTIFF

PacNW Metadata available on interactive Esri site

OBW Terrain and Model Data: *Emerald City Inset (ECI) Dataset*

- Emerald City Inset is 10x10 Km area of Seattle, WA
- Representing a smaller Dense Urban Environment (DUE) database in source and VBS3
- Provided as Distribution A, No Distribution Agreement required



Emerald City Inset vector data available on interactive Esri site

Geospatial Source Data

- Landmarks Models: OpenFlight
- Geotypical Low Fidelity Models: OpenFlight
- Geotypical High Fidelity Models: FlimBox
- Aerial Imagery: GeoTIFF (1meter and 10 centimeters)
- Elevation: geoTIFF (5 meters)
- Features: Shapefiles/EDCS

OBW Terrain and Model Data: *Common Moving Models (CM2)*

- Posted subset of Common Moving Models (CM2), per planned scenarios
  - About 150 CM2s available on EDS-OBW
- All SE Core CM2s are posted to the Army Model Exchange for download: https://modelexchange.army.mil/
  - Generation 1, optimized for EPX-50 visual databases
  - Generation 2, Optimized for Gaming visual databases (GFT/CCTT VBS-IG)

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OBW Terrain and Model Data: *Data Sharing*

- To-date SE Core has made 25 OBW data deliveries
  - Leidos Live Training - EDS-OBW
  - MAK VT - Rockwell Collins
  - Dignitas - ICT
  - Aegis - ARL ATSD
  - Fidelity Tech Group - PM TRASYS
  - KadSci (ARL/STTC) - Bohemia Interactive
  - PEO STRI Games for Training - Lockheed Martin
  - OBW Integration Lab - TruSim
- To assist OBW activities
  - Developed OneSAF experiment of ECI
  - Developed rough version for MetaVR VRGS with PacNW and ECI
  - Support developed of OpenFlight of ECI

Requesting feedback from data consumers

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Converging Model and Simulation (M&S) Geospatial Data with the Mission Command (MC) Geospatial Data

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Converging M&S with MC Geospatial Data: *Converging Concept*

- Aligning U.S. Army Model and Simulation (M&S) Geospatial Data standards with Operational Mission Command (MC) Geospatial Data standards
- Supporting the Army's Command Post Computing Environment (CPCE) initiative to define a Common Operating Environment (COE) and a Standard and Sharable Geospatial Foundation (SSGF) for all MC systems
- Working with the Army Geospatial Center (AGC) in the development of a GeoPackage extension to support M&S
- Proposing a companion to NSG GeoPackage Profile to support the M&S data Profile
- Leveraging the Army's Ground-Warfighter Geospatial Data Model (GGDM) with the National System for Geospatial-Intelligence (NSG) Feature Data Dictionary (NFDD) feature codes and attribution
- Supporting members of the Open Geospatial Consortium (OGC) to help support the U.S. Army M&S needs

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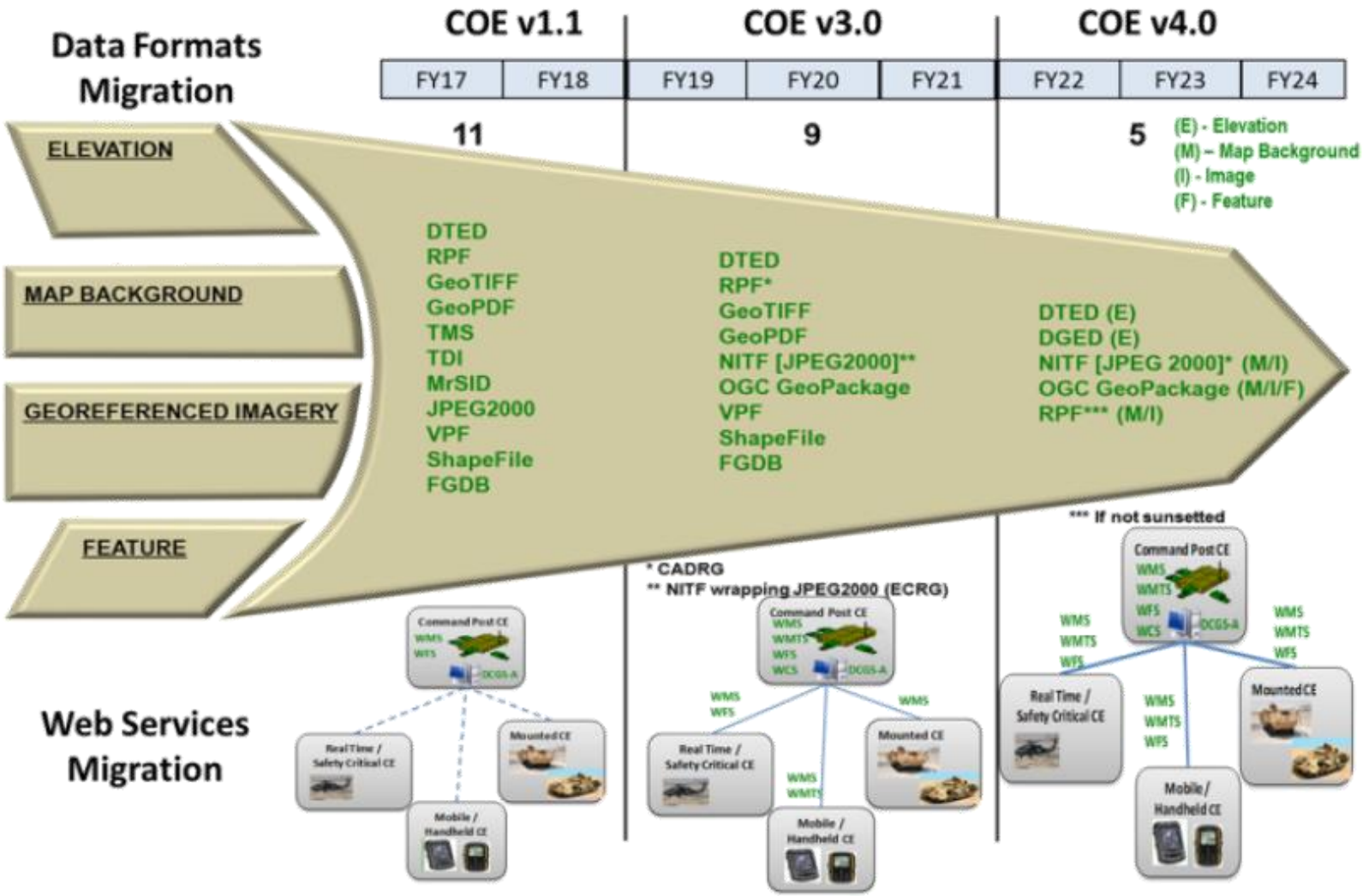
Converging M&S with MC Geospatial Data:
Standard and Sharable Geospatial Foundation (SSGF)



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Converging M&S with MC Geospatial Data: *SE Core Sharing Format Consolidation*

	Current File Formats	Initial Migration	Long-term Migration
Imagery	GeoTIFF JPEG2000 Erdas Imagine (.img) LizardTech MrSID	JPEG2000 GeoTIFF LizardTech MrSID	JPEG2000 GeoPackage
Elevation	GeoTIFF .img DTED	GeoTIFF DTED	DTED GeoPackage
Vector Features	SDE Shapefile	SDE GeoPackage	GeoPackage
Models	OpenFlight Filmbox	OpenFlight Filmbox	X3D GeoPackage
Maps	CADRG GeoTIFF JPEG2000	CADRG GeoTIFF	CADRG GeoPackage

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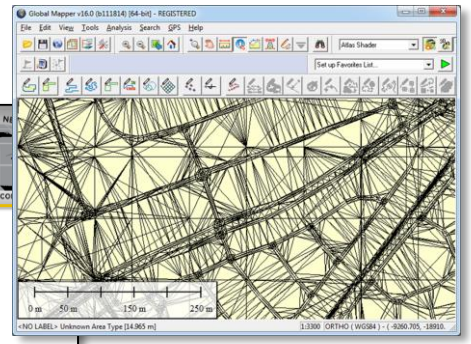
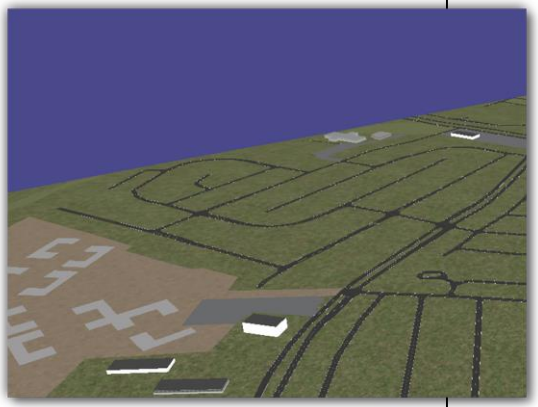
Converging M&S with MC Geospatial Data: *I/ITSEC 2017 Paper and Presentation*

- Experimenting with placing 3D Terrain Skin and 3D Models in a GeoPackage
- Benefits of using GeoPackage
  - Establish relationships between M&S and MC features (views, foreign keys)
  - Referential integrity prevents modifications that would corrupt relationships
  - Triggers have the potential to cascade changes to insure integrity
  - Self-describing and extensible
  - Add to existing data without breaking compatibility





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GeoPackage: Unifying Modeling and Simulation with Mission Command Geospatial Data

Kevin Bentley, Cognitics, Inc.

Michala Hill, Leidos

Ronald Moore, Leidos

Mark Johnson, Optimal Solutions and Technologies (OST) Inc.

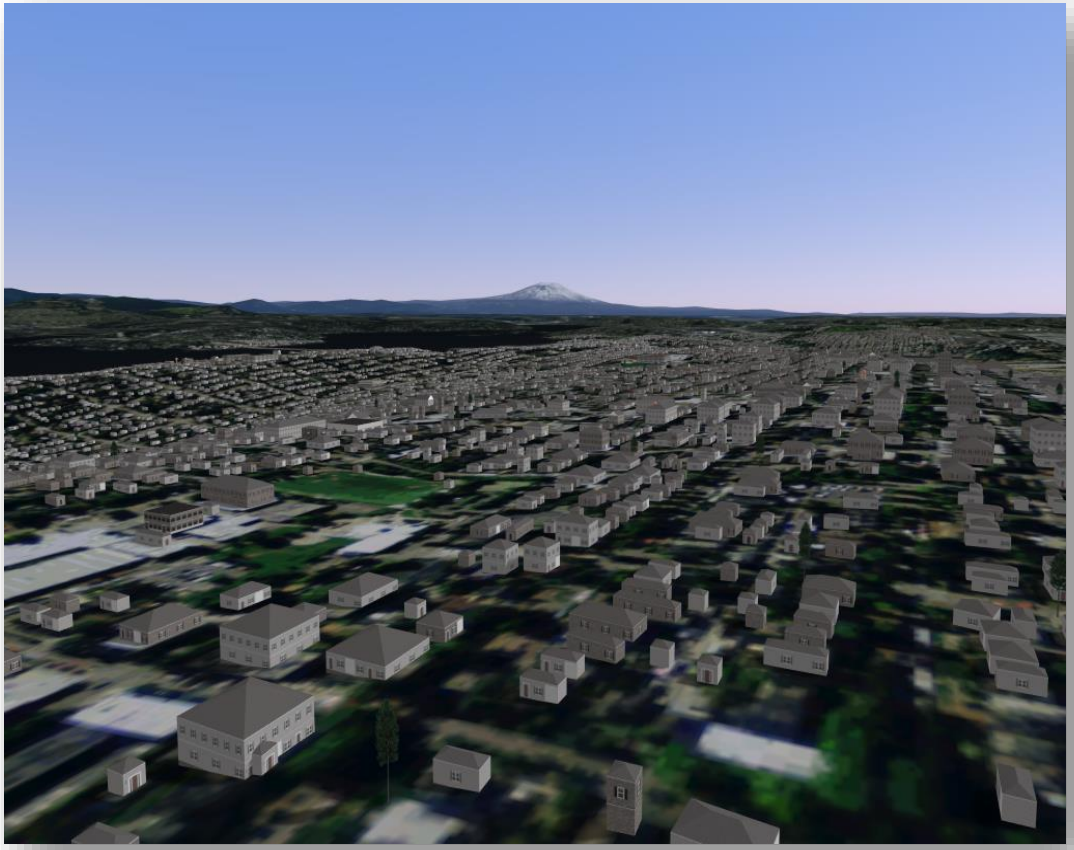
leidos

@IITSEC NTSAToday

Exporting PacNW Data to CDB 3.0 for Data Exchange Testing

PacNW Data to CDB 3.0: *Export Activities*

- SE Core partner CAE is supporting the export of SE Core Master Database Data to CDB
- SE Core is evaluating the capabilities of CDB to support the U.S. Army future sharing needs
- SE Core supports the OGC maturation of the CDB standard to support the U.S. Army Modeling and Simulation community



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PacNW Data to CDB 3.0: *Challenges Encountered*

- Difficulty in mapping several features to CDB
  - Linear rivers were mapped to linear canals
  - Bushes were mapped to hedgerow point feature
- Not all features were mapped to CDB
  - CDB 3.0 uses models for airports. SE Core source had vector data for airports (CDB 3.2 supports vector data for airports)
  - Some features dropped because there were multiple versions (point and areal buildings for example)
- TerraVista doesn't support GDB
  - Had to export GDB to Shapefiles and then import into TerraVista
- Duplicate features were ignored
  - SE Core stores multiple representation of features like footprints and points of the same feature

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Questions

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