Synthetic Environment Core (SE Core)

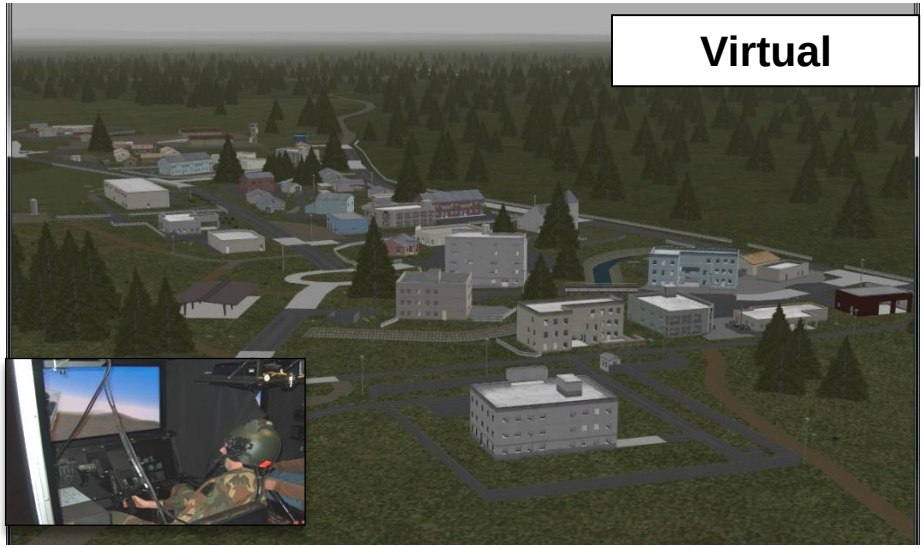
3D Geospatial M&S Summit Follow On

SE Core
PM ITE – PdM WTI

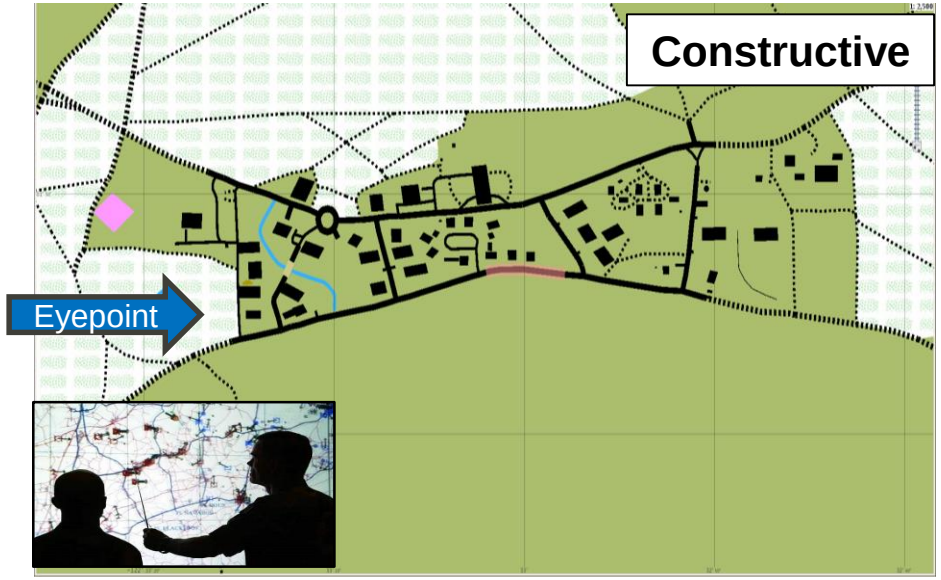
Classification: UNCLASSIFIED
Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Enabling a Common Training Environment

(Integrated Training Environment (ITE) and Constructive)



- Integrated and interoperable training environment for Live, Virtual, Constructive, Gaming simulations and simulators.
- Terrain correlated across multiple systems
- Common representation of static and moving models.
- Virtual, Constructive and Gaming entity mapping.
- Common damage, standard behaviors provided by Virtual One Semi Automated Forces (OneSAF).
- 1:250K, 1:50K, 1:25K and 1:12.5K map scales.



Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Mission

The Synthetic Environment Core (SE Core) program generates a common *environment*, standard *static and common moving models*, *common computer generated forces,* and *common tools and standards* that support Army training for system and non-system training aids, devices, simulators and simulation systems (TADSS) in the live, virtual, constructive, and gaming simulation systems.

Aviation Combined Arms Tactical Trainer

Close Combat Tactical Trainer

Constructive Training

Games for Training

McKenna MOUT Site

Reconfigurable Vehicle Tactical Trainer

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Product Use Overview

SE Core delivers a Common Simulated Environment not just Terrain Databases!

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

SE Core ITE Confederates

2008	2010-2012	2013-2014	2015-2016	2017
Development of Terrain Process	CCTT (EPX) AVCATT ITE 2/25 STDGC 4.x	CCTT (EPX) AVCATT WARSIM HITS VBS3 JCATS AARS FireSim 3D Stealth (VBS) OneSAF JDLM MUSE (VRSG) GFT VBS3 ITE 13/47 STDGC 5.x	CCTT (EPX, VBSIG) AVCATT WARSIM, ERF HITS VBS3 JCATS AARS FireSim 3D Stealth (Veritas) OneSAF JDLM MUSE (VRSG/NVIG) GFT VBS3 ATEMC JNEM ITE 15/55 STDGC 6.x	CCTT (EPX, VBSIG) AVCATT WARSIM, ERF, MRF HITS VBS3 JCATS AARS FireSim 3D Stealth (Veritas) OneSAF JDLM MUSE (VRSG/NVIG) GFT VBS3 ATEMC JNEM ITE 15/57 STDGC 6.x and Beyond

SE Core architecture and software baseline are actively maintained to meet changing Confederate content and format needs

- Original Systems
- Additional LVC-IA / ITE Systems
- LVC-IA / ITE Systems Added

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

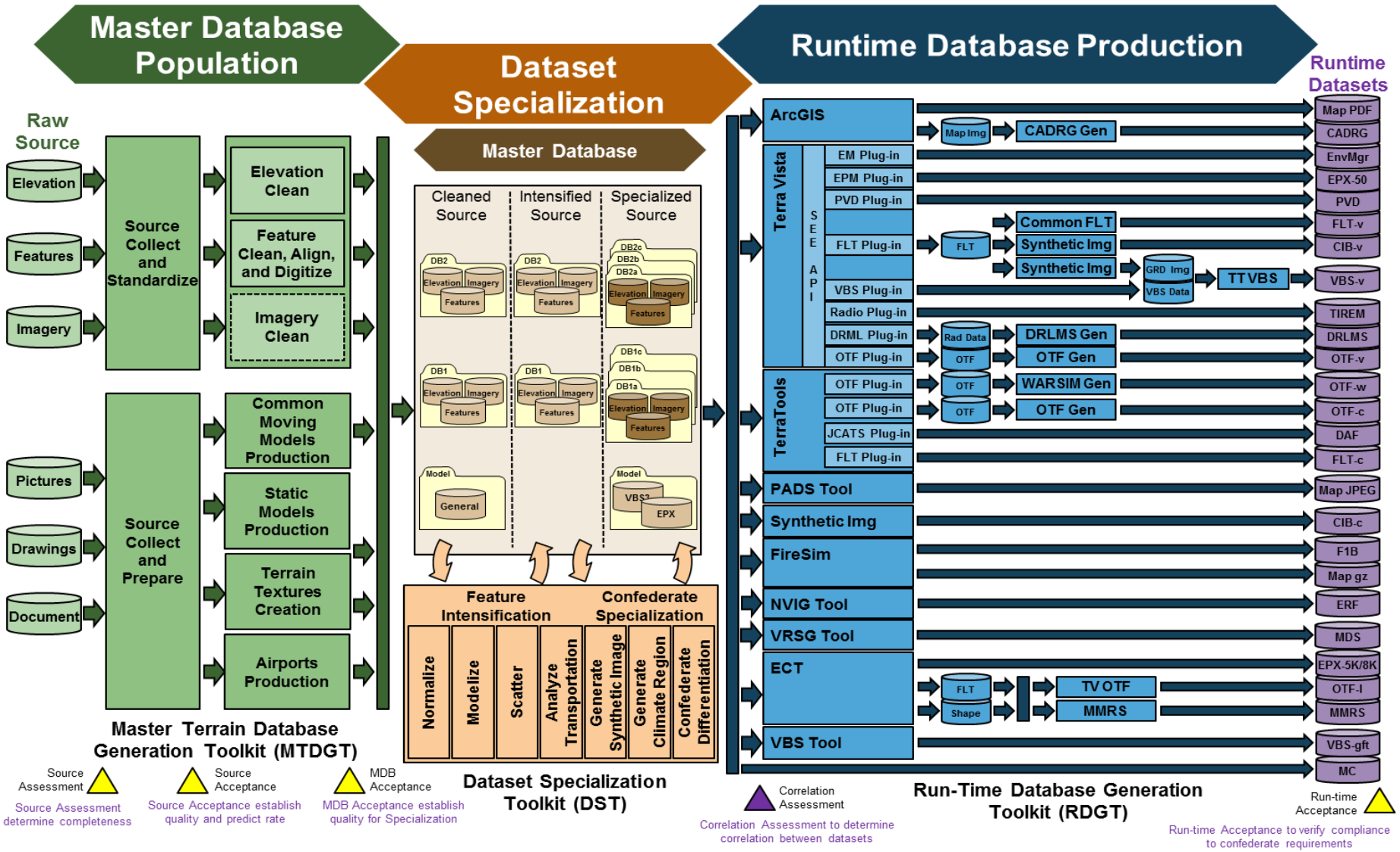
2016 Correlated Formats for ITE Confederate Systems

Format	Virtual			Constructive									Live	Gaming		Number of unique Products	
	AVCATT*	CCTT*	ATEMC*	AARS*	FIRESIM*	OneSAF*	WARSIM	WARSIM ERF*	JDLM*	JNEM	JCATS*	Muse	Veritas	HITS*	VBS3*	GFT		
Access (.mdb) Features				X	X												2	Two variants
CADRG MIL Maps (JOG, TLM)	X		X		X		X	X	X		X	X		X			1	
CADRG PFPS	X																1	
CIB MIL Imagery	X		X				X										1	
CIB PFPS	X																1	
DAF											X						1	
DAT				X													1	
DRLMS	X																1	
DTED	X		X			X	X	X			X	X					2	DTED 1/2
DTED/DMED (Source)	X																1	
Environment Manager	X	X															2	Two variants
EPX-50 CM2	X	X															2	Two variants
EPX-50 Terrain	X	X															2	Two variants
EURONAV	X																1	
F1B Elevation					X												1	
File GeoDatabase	X	X					X	X			X						3	Three variants
Filmbox CM2		X															1	
GeoTIFF Elevation										X							1	
GeoTIFF Imagery												X		X			2	Two variants
GeoTIFF Map										X							1	
JPEG2000 Maps				X													1	
VRSG (MDS) Terrain												X					1	
NVIG Terrain												X					1	
OpenFlight CM2	X	X															1	
OpenFlight Terrain	X	X											X				3	Three variants
OTF Terrain AVCATT	X																1	
OTF Terrain CCTT		X				X											1	
OTF Terrain WARSIM							X	X									2	Two variants
VBS P3D CM2		X													X	X	2	Two variants
VBS P3D Static Model		X													X	X	3	Three variants
VBS PBO Terrain		X													X	X	3	
PVD		X															1	
Shape w/FACC				X	X		X		X								4	Four variants
Text file (BMC)	X																1	
TIREM	X	X															2	Two variants

There is a cost to build and test each format. ***Available on AME**

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

SE Core Terrain Process



Distribution Statement A: Approved for Public Release – Distribution is unlimited.

SE Core Geospatial Data Production
End to End Process

The SE Core CVEM database generation process continually evolves utilizing USG equipment. Through technology insertic commercial-off-the-shelf (COTS) advancements, and in-house software development, this process will continue to change a the program moves forward.

3.1 Database Request & Requirements Analysis

3.2 Source Data Collection, Standardization, and Conflation

3.3 Vector data processing

3.4 3D Model Generation

3.5 Airfield Vector Creation

3.6 Master Database Population

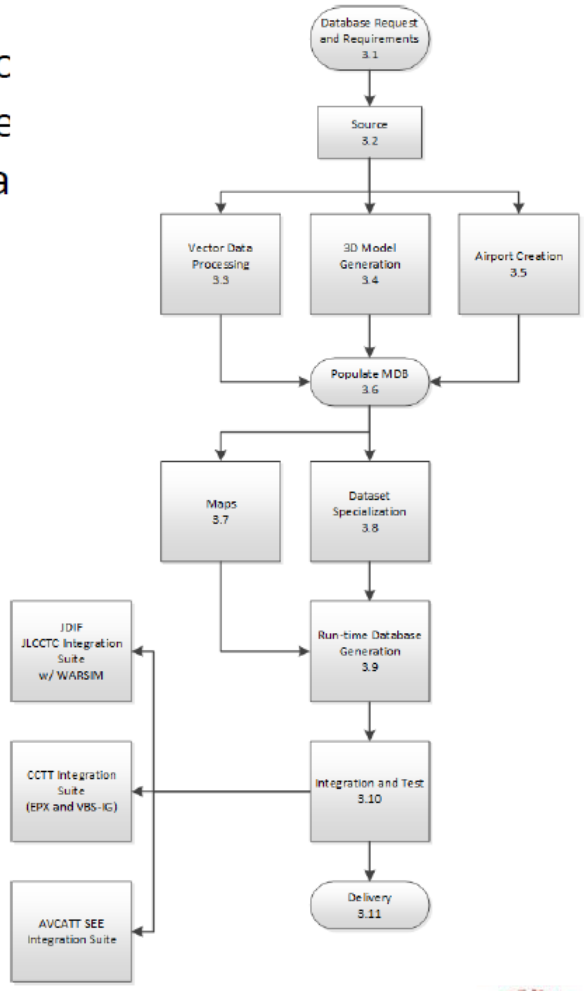
3.7 Map Generation

3.8 Data Specialization

3.9 Runtime Database Generation

3.10 Runtime Database Integration Test

3.11 Product Delivery



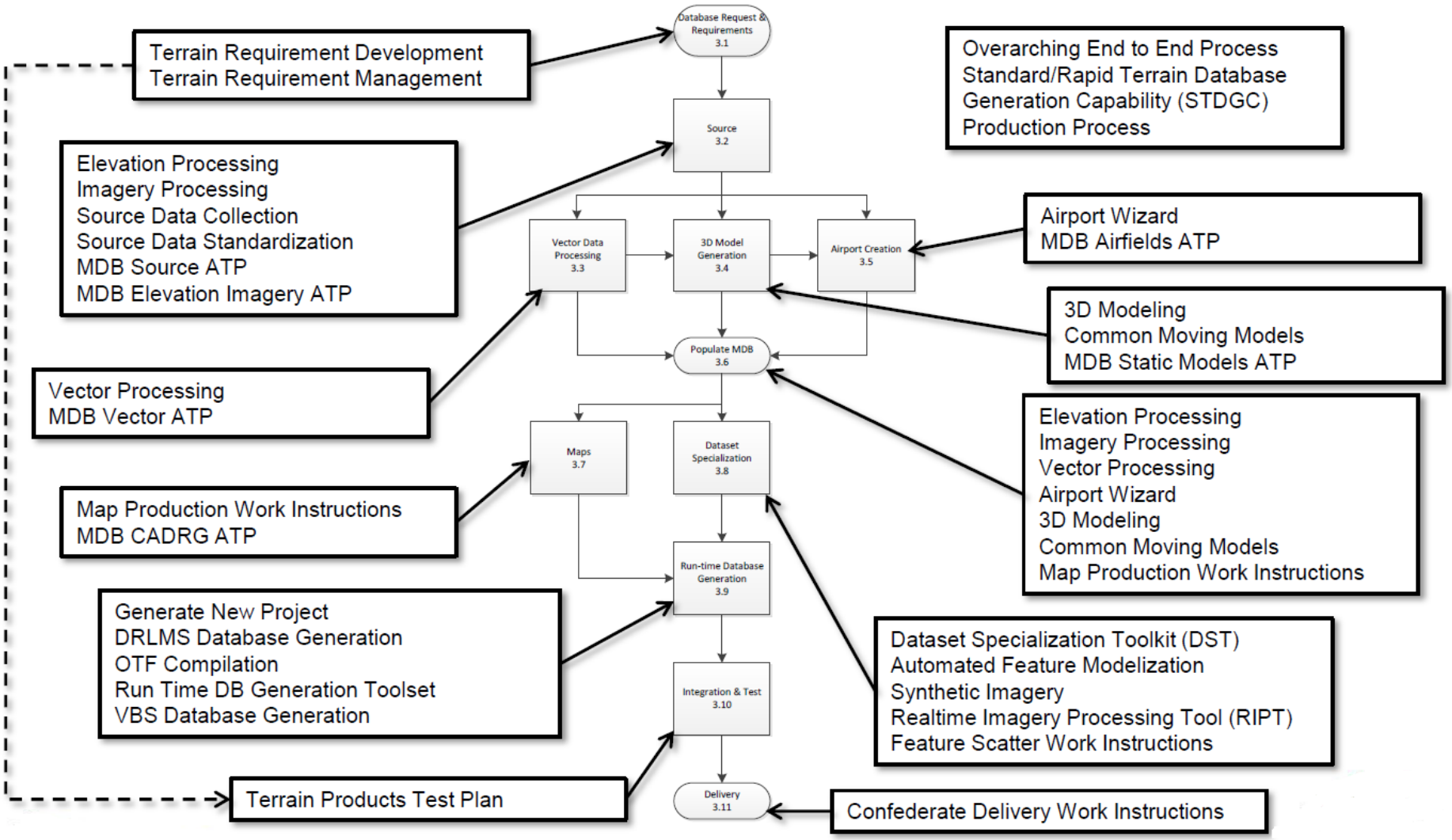
Distribution Statement A: Approved for Public Release – Distribution is unlimited.

SE Core Data Sources

- SE Core utilizes over 100 data sources, to include Government agencies like National Geospatial Agency (NGA), U.S. Dept. of Agriculture, U.S. Geological Survey (USGS), US Census Bureau, and U.S. DoD. Also vendors like Digital Globe, and open source information like OpenStreetMap
  - Chooses the best sources for each location. Conflate intersecting sources (combines best attributes of multiple sources)
  - Continually searches for new sources as better data become available (e.g. recent receipt of rich raw data from NGA/Leidos)
  - Collaborates with outside agencies (SOFPREP, NAVAIR Portal Source Initiative (NPSI))
  - Shares our data: SOFPREP, Air Force, Marine Corps, Navy, Stryker PM
- Criteria for data sources
  - Cost effective
  - Unclassified (SE Core is an unclassified program)
  - Data rights (ability to distribute data products to any Army customer)
- SE Core performs a Source Data Review before building terrain – assures adequate data
- Opportunities for additional data outside criteria
  - State, county and city municipalities
  - Department of Homeland Security

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

SE Core Geospatial Data Production End to End Process Work Instructions



Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Standards Activities (1/5)
SE Core Program Standards

- ITE Terrain Databases and Common Moving Models Standards
  - Common Moving Model Specification
    - Generation One – AVCATT EPX
    - Generation Two – Gaming, CCTT VBSIG
  - Data standards for SE Core Master Database (MDB) repository
    - Environmental Data Model (EDM)
    - Quality Content Specification (QCS)
    - Using industry “standard” formats including
      - Shapefile for features,
      - GeoTIFF for imagery and elevation, and
      - OpenFlight and FilmBox for 3D models.
- SISO Terrain Data Interchange and Interoperability Standards
  - Maintain the Army’s Virtual Distributed Interactive Simulation (VDIS) standards
  - Lead the DIS Enumerations Working Group
  - Maintains the Army’s Master Entity List (MEL), defining the mapping of the DIS Enumerations to terrain database objects and models within ITE training systems
  - Supports the SISO Reuse and Interoperation of Environmental Data and Process (RIEDP)

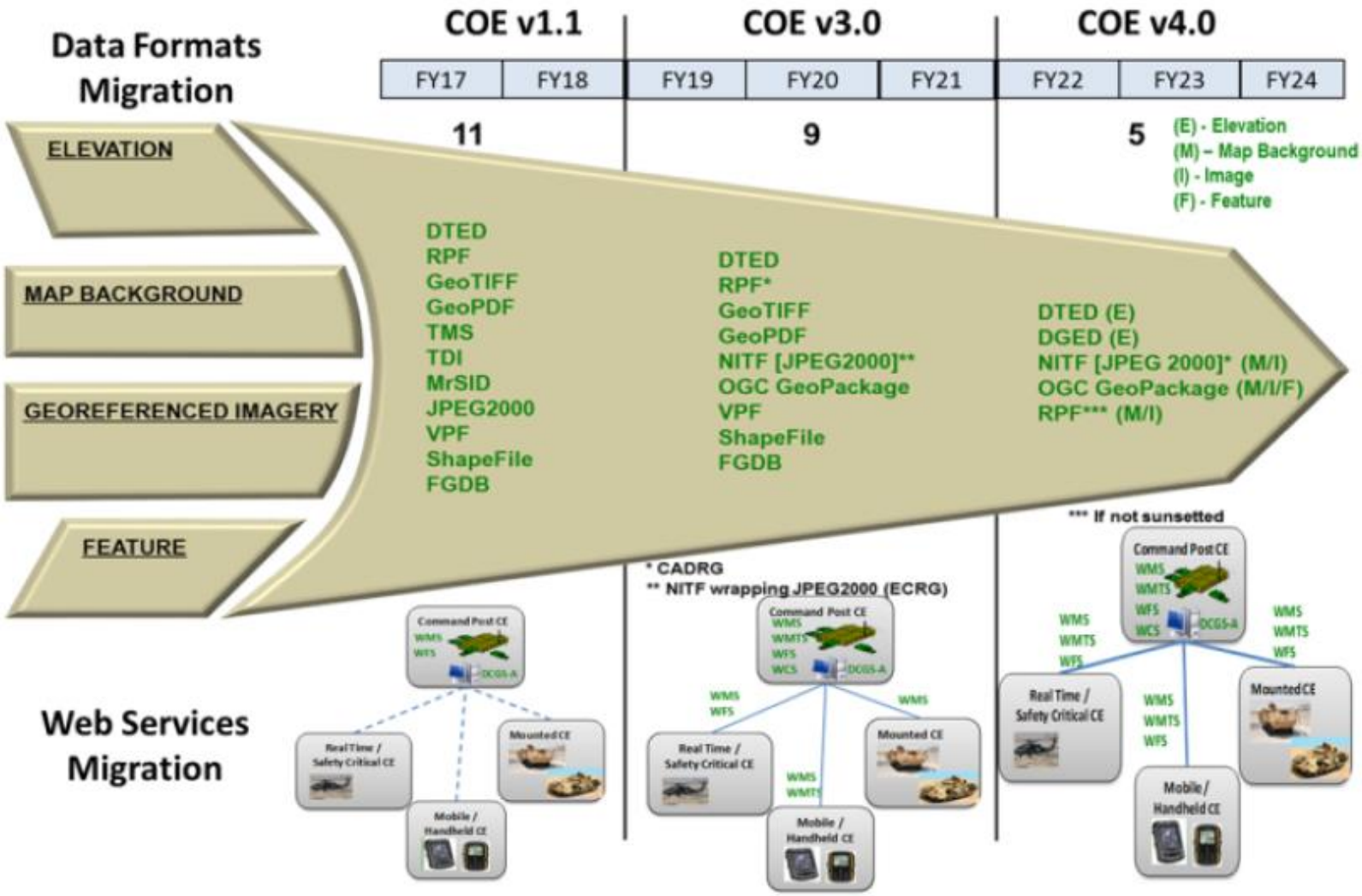
Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Standards Activities (2/5)
SE Core Sharing Standards

- Alignment of Army M&S and MC Geospatial data standards
  - Best long-term strategy for Army M&S geospatial data standardization is to align with the Army Operational Mission Command geospatial standardization activities
  - 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) and the OGC in the development of a GeoPackage Encoding Standard and
  - Proposing a companion to NSG GeoPackage Profile: PEO-STRI Profile for M&S data.
    - Sharing of SE Core produced CADRG maps, real and synthetic aerial imagery, elevation data, vector feature data, geospatial terrain data, 3D models, and texture data
    - Consistent with 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

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Standards Activities (3/5)
Standard and Sharable Geospatial Foundation (SSGF)



Distribution Statement A: Approved for Public Release – Distribution is unlimited.

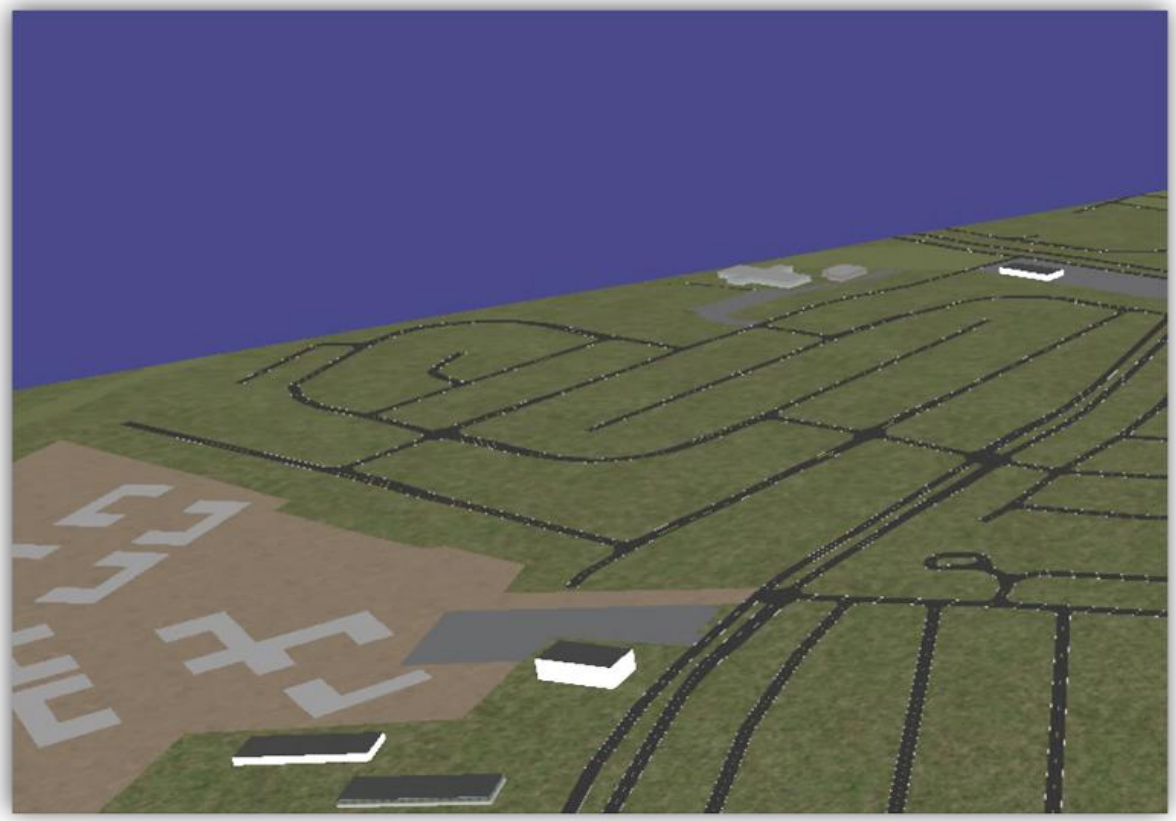
Standards Activities (4/5)
SE Core Format Consolidation

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

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Standards Activities (5/5)
SE Core GeoPackage Proof of Concept Work

- Investigating expanding GeoPackage standard for use in Modeling and Simulation (M&S)
- Demonstration a single database with visual and abstract objects can provide all of the data necessary to create database products for use in M&S



SE Core GeoPackage with polygonal geometry proof of principle prototype

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

SE Core POCs:

Lewis Bowman, Lead Engineer:
Lewis.y.bowman.civ@mail.mil

Frank Rhinesmith, Product Lead:
frank.d.rhinesmith.civ@mail.mil

Leonard ‘Bud’ Mervin, Project Director:
leonard.a.mervin.civ@mail.mil

WE WORK FOR OUR SOLDIERS… IT’S THE BEST JOB WE’VE EVER HAD!

U.S.ARMY

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Backup

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Real Aerial Imagery and Simulated Aerial Imagery Comparison

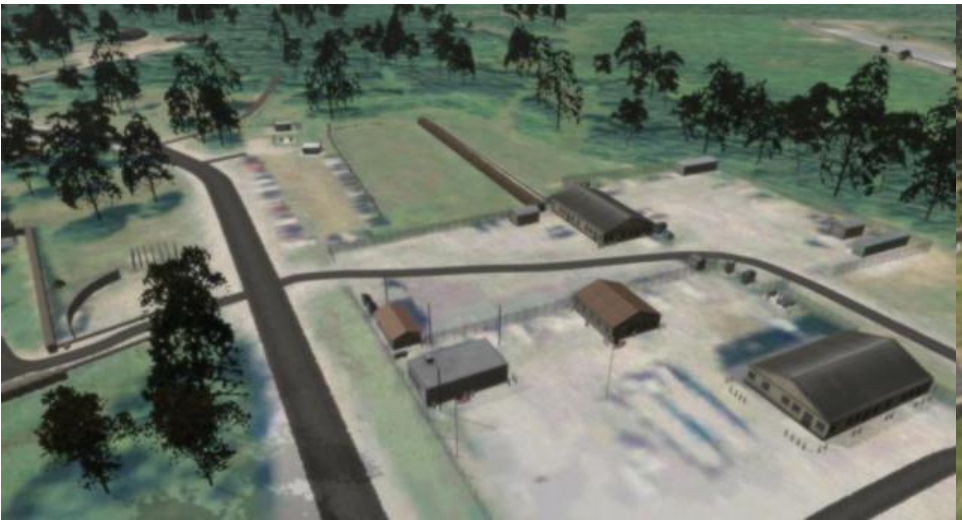
Real Aerial Imagery with Cloud Artifacts NVIG Database Example

Source Data Derived Simulated Aerial Imagery NVIG Database Example

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Imagery Artifact Removal
Ground Surface Imagery (1 of 2)

Using simulated aerial imagery supports automated material classification



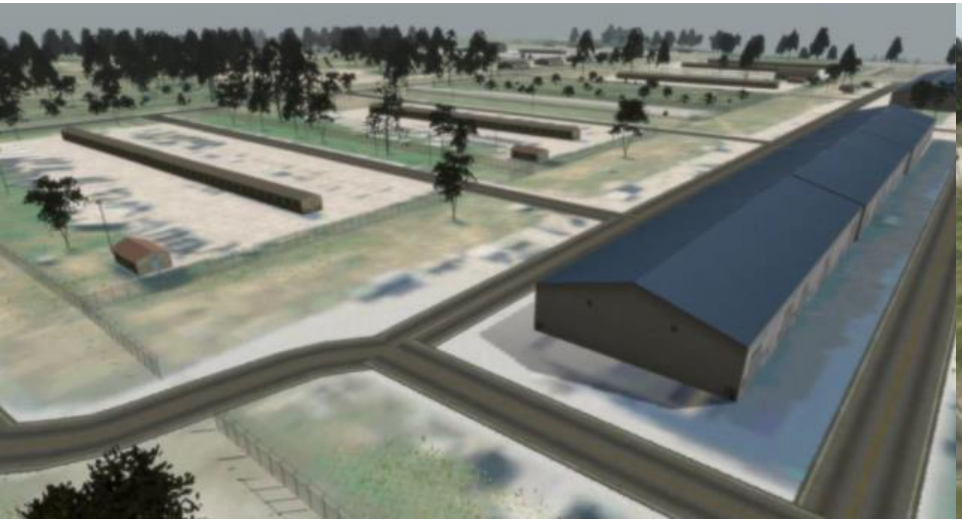
Real Aerial Imagery
VBS 3 Database Example

Source Data Derived Imagery
VBS 3 Database Example

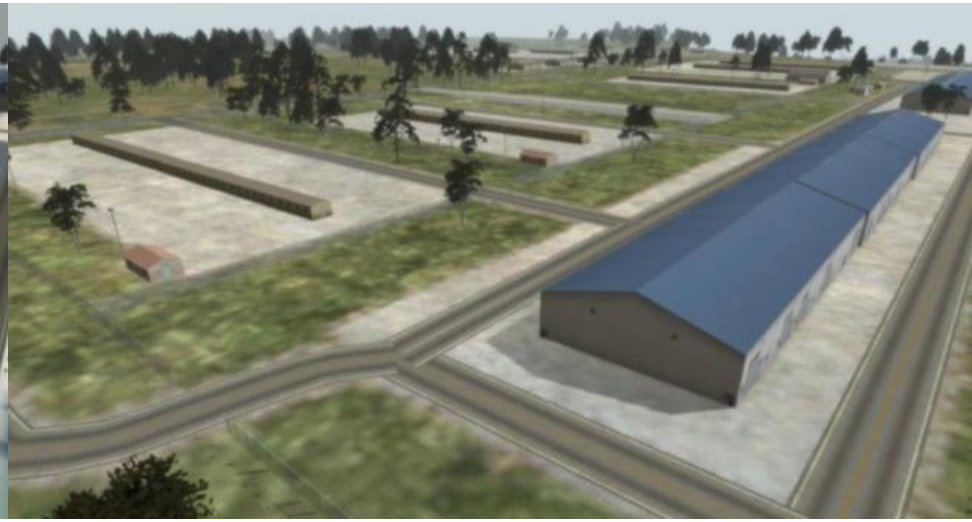
19

Distribution Statement A: Approved for Public Release – Distribution is unlimited.

Imagery Artifact Removal
Ground Surface Imagery (2 of 2)



Real Aerial Imagery
VBS 3 Database Example



Source Data Derived Imagery
VBS 3 Database Example

20

Distribution Statement A: Approved for Public Release – Distribution is unlimited.