Making Every Mission Possible

Systematic Generation and Evaluation of EVS/SVS Databases

FAA SVS Workshop - Seattle
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February 14, 2006

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Systematic Generation and Evaluation of EVS/SVS Databases

- Agenda
  - Purpose
  - Background
  - Requirements
  - Standards
  - Process
  - Verification and Validation
  - Summary

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Systematic Generation and Evaluation of EVS/SVS Databases

- Purpose
  - Overview for “how to” develop a database to support EVS / SVS applications.

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Systematic Generation and Evaluation of EVS/SVS Databases

- Background
  - NASA Aviation Safety and Security Program
    - Jeppesen involved in 3 year program with NASA, Marinvent and the Technical University of Darmstadt
    - “Decrease the aircraft fatal accident rate …”
    - “Develop and demonstrate technologies that reduce aircraft accident rates …”

TECHNISCHE UNIVERSITÄT DARMSTADT

NASA

marinvent CORPORATION

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Systematic Generation and Evaluation of EVS/SVS Databases

- Background
  - Terrain, Obstacle and Airport Mapping Databases
    - Research existing data sources to support SVS requirements
    - Develop methods for capturing data
    - Define DO-200A processes
    - Build and maintain databases
    - Validate databases
    - Simulator Trials – Flight Trials

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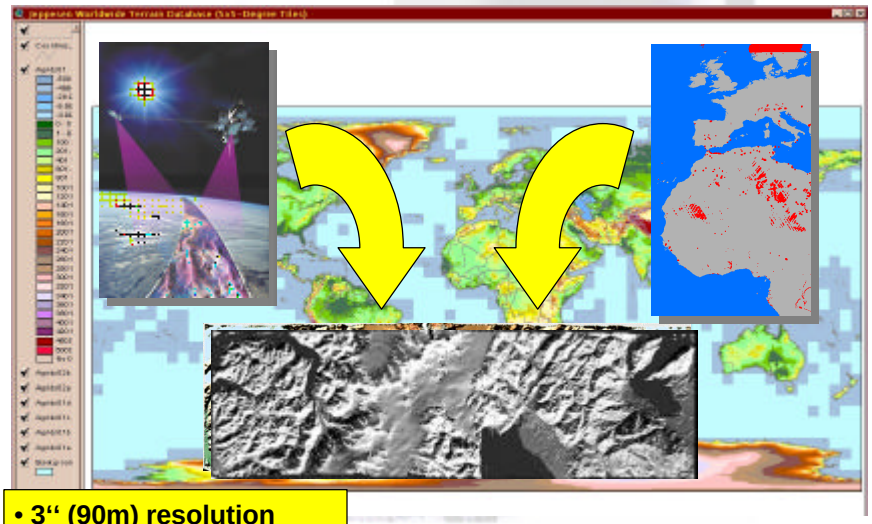
Digital Databases – SRTM TerrainScape



- **3‘‘ (90m) resolution**
- **20m accuracy, DO-200A**

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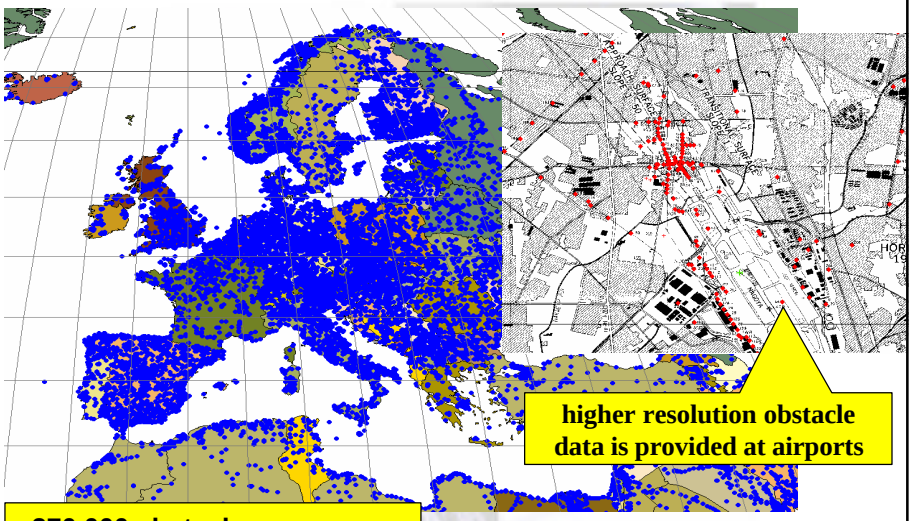
Digital Databases – Worldwide Obstacles



higher resolution obstacle data is provided at airports

- 270,000 obstacles
- permanent updates, DO-200A

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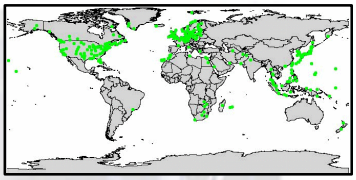
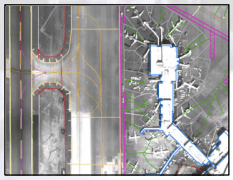
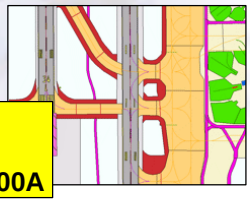
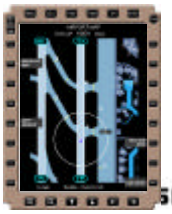
Digital Databases – 300 Worldwide AMDB









Jeppesen Ground Control Point
WGS 84 Photo-recognizable
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JEPPESEN,55 Inverness Drive East
Englewood, CO 80112-5498

- DO-272 (5m and 1.4m)
- 4.5 Mio data elements
- 64 airport surveys, DO-200A

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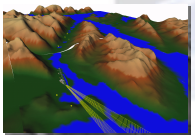
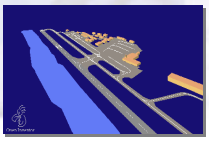
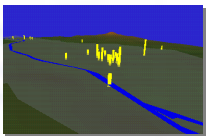
- Requirements
  - RTCA DO-276A / EUROCAE ED-98A "User Requirements for Terrain and Obstacle Data"
  - RTCA DO-272A / EUROCAE ED-99A "User Requirements for Aerodrome Mapping Information"
  - RTCA DO-291 / EUROCAE ED-119 "Interchange Standards for Terrain, Obstacle and Aerodrome Mapping Data"
  - ICAO Annex 15 Amendment 33, mandate to states for 2010 for Area 1 and Area 2 data – Terrain and Obstacle data

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- Standards
  - RTCA DO-200A / EUROCAE ED-76 "Standards for Processing Aeronautical Data"
    - Ensures quality assurance and data quality management for data processing to support aeronautical applications

RTCA

EUROCAE
The european organisation for civil aviation equipment

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Systematic Generation and Evaluation of EVS/SVS Databases

- **Data Quality defined by 7 Parameters:**
  - Accuracy
  - Resolution
  - Integrity
  - Traceability
  - Timeliness
  - Completeness
  - Format

"The integrity of data can be regarded as the degree of assurance that an aeronautical data element retrieved from a storage system has not been corrupted or lost while residing in a specified aeronautical data processing chain."

- Additional Definitions
  - Verification
  - Validation
  - Transmission
  - Position

"Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled."

"Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled."

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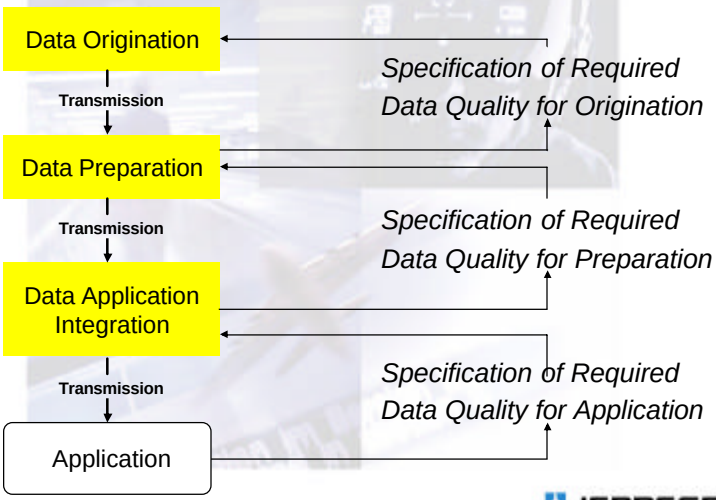

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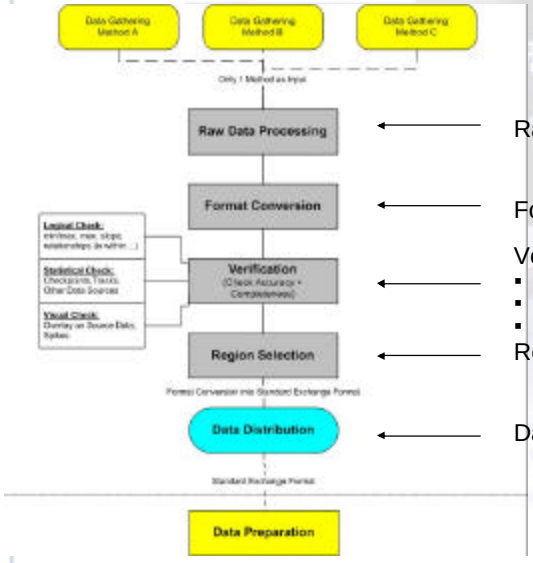
Data Origination Quality Model



Raw Data Processing

Format Conversion

Verification:
- *Statistical Check*
- *Logical Check*
- *Visual Check*

Region Selection

Data Distribution

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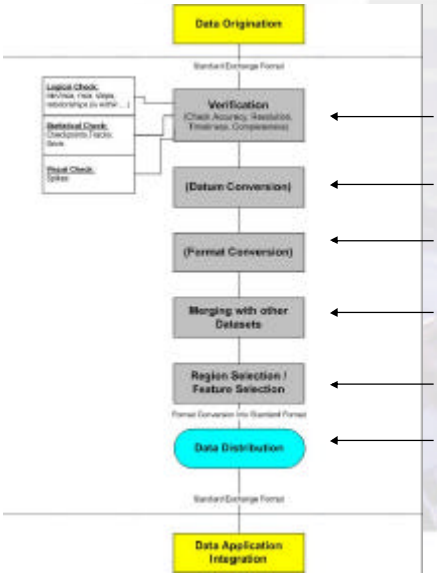
Data Preparation Quality Model



Verification:
- *Statistical Check*
- *Logical Check*
- *Visual Check*

Datum Conversion

Format Conversion

Merging with other Datasets

Region Selection / Feature Selection

Data Distribution

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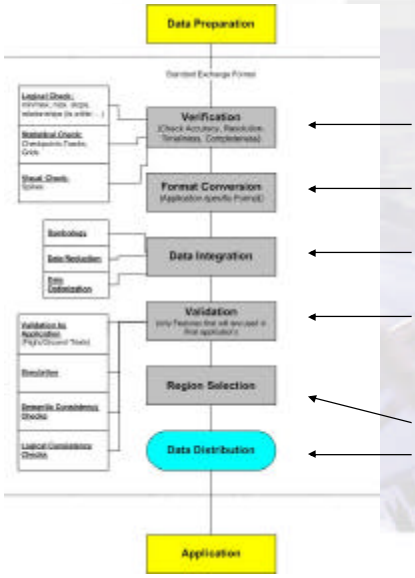
Data Application Integration Quality Model



Verification:
- *Statistical Check*
- *Logical Check*
- *Visual Check*

Format Conversion

Data Integration:
- *Symbology*
- *Data Reduction*
- *Data Optimization*

Validation:
- *Application*
- *Simulation*
- *Semantic Consistency Check*
- *Logical Consistency*

Region Selection

Data Distribution

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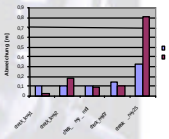
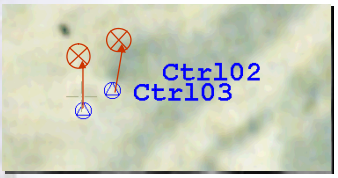
Data Verification

- **Verification that Data meets stated Accuracy Requirements**
  - **Statistical Approach**



  - **Specific Approach Depending on Type of Data** (Airport, Obstacle, Terrain)



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AMDB process – Establish Ground Control

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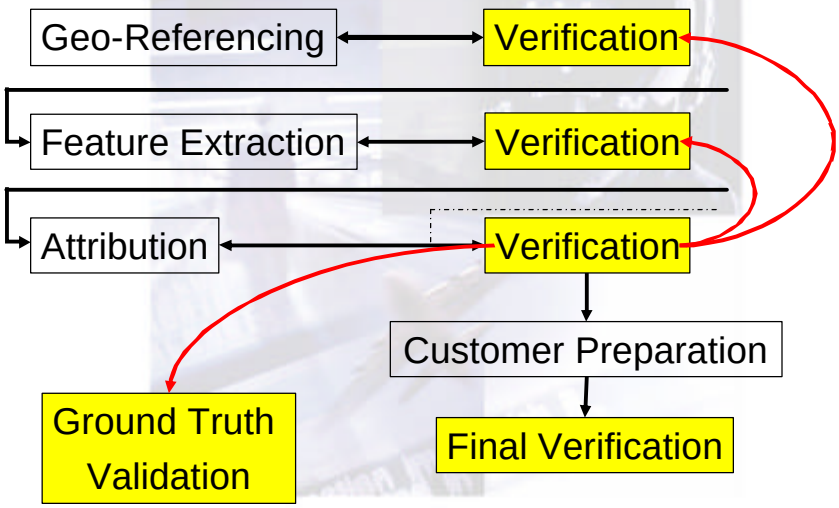
AMDB process – Verification



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AMDB quality – ED-99/ED-76

Usable for situation awareness

- ED-99 (DO-272), medium quality (5m, CE90)
- ED-76 (DO-200A)
- integrity
  (routine for geometry: 10^{-3} by back-validation of final data)

Exceed DO-272 requirements

- traceability: is ensured by DO-272 compliance
  (attribute to each feature)
- timeliness: regular updates
  (triggered by essential changes on the airport)
- completeness: is assured
  (repeated generation and visual validation of feature)

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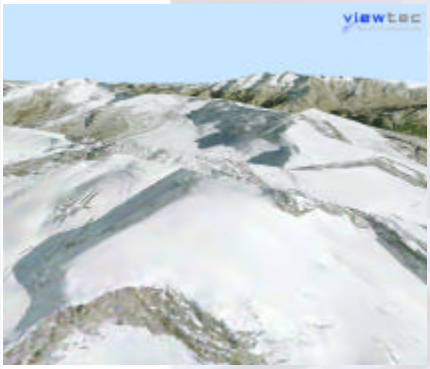
Current TAWS Model vs SRTM



TAWS 30 arc-second model

SRTM 3 arc-second model

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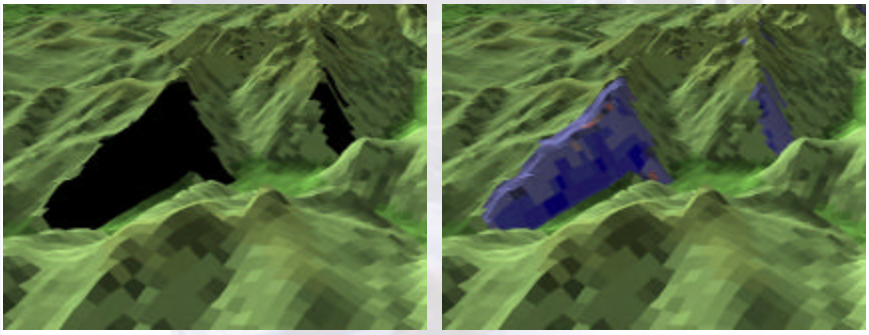
SRTM Void Fill Process



SRTM with Voids

SRTM with Voids Filled

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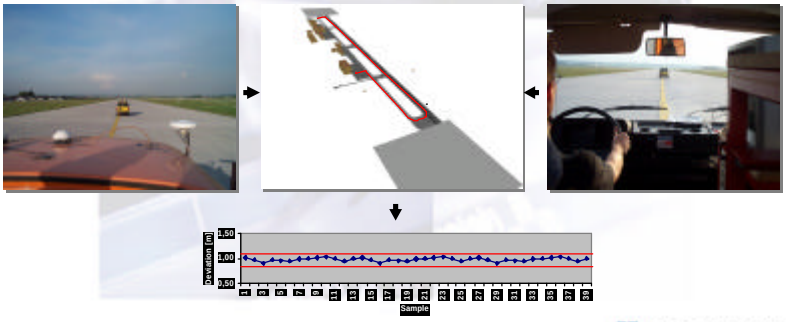
Data Validation

- **Validation that Data meets Quality Requirements for envisioned Application**
  - **Validation by Application**
  - **Statistical Approach**



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Jeppesen Products

1.0m (CE90)

1.4m (CE90)
Hi-Precision

5m (CE90)
Standard

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EFB Class 3 TPA - Future Application

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SVS – Terrain Demo Flight

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SVS – Reno OEO Validation

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Systematic Generation and Evaluation of EVS/SVS Databases

- Summary - Key Quality Elements
  - DO-200A compliant (FAA AC 20-DB, EASA)
  - Data integrity is maintained on every step of the process
  - All data can be traced to source
  - All processes are documented
  - Data is updated as needed or available

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- Questions??

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