Army National Guard: Common Installation Picture

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Agenda

- Introduction
- Goals/Purpose of Common Installation Picture program
  - History of CIP processes
  - Integration with the Regulations/QAP’s
- CIP Components
- Processes
- Long Term Results
- Project Milestones and Major Accomplishments
- Benefits of Current Tools/program
  - Customizable - Any rules for any type of GIS data
    - Add additional layers to Rules
    - Minimum requirements for contract submitted data
The National Guard Bureau (NGB) manages a set of geospatial data which comprises up to 60 vector layers selected from the SDSFIE v 2.6. This Common Installation Picture (CIP) is used by Army Reserve National Guard (ARNG) States/Territories and Headquarters to visualize information associated with ARNG missions. The following document describes the CIP Quality Assurance Program (QAP) process for the collection, standardization, and maintenance of the CIP geospatial data.
Introduction

➢ Quality Assurance Plans (QAPs)
  ▪ Defines Feature Classes
  ▪ Defines minimum Attribution
  ▪ Defines Relationship to Environmental Regulation or Real Property Policies

➢ Data Model
  ▪ Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE)
  ▪ CIP - Subset of 60 Feature Classes
    • ILI datasets - built infrastructure, Real Property
    • ILE datasets - soils, wetlands, environmental hazards
  ▪ Provides Standardized Platform that captures a majority of Real Property assets
Introduction

CIP as a Process

- Iterative process by nature (goal is improvement year to year)
- Four Custom Geoprocessing Tools to automate QA/QC process
  - Tool 1 – Name and geometry checks
  - Tool 2 – Spatial checks; Real Property comparison
  - Tool 3 – Attribute checks
  - Tool 4 – Layer Extraction Tool
- States utilize tools to produce standardized SDSFIE 2.6 datasets
  - States Run Tools and make corrections based on tool outputs
  - Minimum attribution in compliance with ARNG QAP’s
- Extract data to send to NGB for QA/QC
- NGB Aggregates all States CIP data into Nationwide dataset
CIP – Regulations and Memos

- IGI&S Regulations
- OSD
  - Defense Installation Spatial Data Infrastructure Group
    - Oversight of DOD IGI&S investment
    - DISIDI CIP
  - ARMY
    - Installation Geospatial Information and Services
      - AR 115-13 Installations Geospatial Information and Services (IGI&S)
  - Master Planning
    - NGR 210-20 Real Property Development Planning for ARNG
    - NG PAM 210-20 Real Property Development Planning for ARNG
- Many other regulations which support Geospatial Data Collection
Goals and Purpose of CIP

- Integration with RP regulations (QAP’s based on RP)
- History
- Benefits
Purpose of CIP

- **Headquarter Level**
  - Support Headquarter Level Data Request
  - Supports Headquarter Analysis
  - Insight into State’s Data holdings

- **State Level**
  - Satisfy SDSFIE Compliance requirement
  - Reduce “ad hoc” data calls
  - Data Development priorities in the absence of local requirements
Goals

- Standardize 54 State and Territory datasets
- Generate one standardized Nationwide dataset
- Assist in Real Property Reconciliation
  - Automates Real Property Validation with GIS data
- Provide Baseline for ISR Reporting on GIS program
History of the CIP

- Started as annual data call
  - NGB requested data annually
  - NGB took data and loaded into SDSFIE 2.6 compliant databases,
  - NGB generated “to-do list” of issues regarding quality for the States

- Weaknesses
  - Ended up with two data sets (State and NGB) that had diverged during the process
  - At best, edits were required in two databases or did not end up in production data
  - Process lacked transparency
  - Elements of the data checks were unclear
  - Lacked flexibility
    - Schedule and data schema
Benefits of New Approach

- **Goal** - provide value at State while satisfying ARNG-ILI/ILE requirements
- **Flexibility**
  - Four open windows to deliver data
  - Tools run at installation or state wide level
- **Transparency**
  - Allows States to utilize tools and understand process
- **Customizable**
  - State GIS personnel customize layers and attributes to check
  - Work with “CIP+” datasets
- **Dual Purpose**
  - Provides a systematic data QA for state’s production dataset
CIP Components

- Program Management
- Guidance Documentation
- Data Model
- Databases
- Custom Geoprocessing Tools
Program Management

- Constant Improvements to Process
  - ‘Living Program’ is adaptable - responsive to Stakeholder feedback
  - Tool enhancements and upgrades
  - Direct feedback to Users on how to improve the data

- Training
  - DCO- Individual hands-on training sessions

- CIP Technical Support Center
  - Deal with issues from users
  - Answer Questions/concerns from users
Guidance Documentation

- Quality Assurance Plans
  - Based on OACSIM QAP’s
  - Modified for ARNG requirements
  - Defines Geospatial Elements
    - Feature Classes
    - Definitions
    - CATCODES
    - Attributes

- Documentation
  - Tool Specification documents
  - ‘How To’ documents

Layer Extraction Tool Specifications

**Overview**

This tool can be used before running QAP Tool 1 to create a copy of your Production database for final delivery to the National Guard Bureau. This tool will function on an SDE connection as well as personal and file geo-databases. It will only pull out the required ARNG QIP Feature classes found in the ARNG QIP for State Model Database and will exclude any non-QIP attribute fields. The tool will produce a Personal File Geo-database.

This tool can also be used after running all the QAP tools to generate a ARNG QIP compliant database. It is recommended to use this tool to create a working copy of your database, but if you desire to keep a full working copy of your database, this tool can be used after running the three QAP tools to generate an ARNG QIP database.

An empty personal geo-database (GIF model) will be provided which acts as a template for the tool. The tool steps through this template and imports the Feature Classes and attributes from the target database.

**Inputs:** State data (geo-database or SDE database Connection); ARNG QIP for State (provided in GKD Package)

**Outputs:** state_extraction_projected_gaocodelk

**Function:** This tool utilizes geoprocessing tools and python code to import state data into an ARNG SDIFIE 2.6 QIP compliant database. The ARNG QIP model database is an empty shell containing only the required feature classes attribute values and domain values for this data request. The tool will only import data from the State Database that is found in the QIP model database. If your Database contains more Feature Datasets or Feature Classes than found in the QIP model, they will be excluded from the output database. In addition, if there are feature Datasets or Feature Classes in the Model Database that are not populated in the States Database they will removed from the output database.

**Components and Functionality**

**User Interface**

As with the previous tools, the graphical user interface provided by the geoprocessing framework will be used for user input, messages and output (See Figure 1). For the user input, the tool will accept geo-databases (personal or file and SDE Database Connections).
Data Model

- SDSFIE 2.6

- CIP is a subset of 60 Feature Classes
  - Representing Real Property and Environmental
  - Standardized subset of ‘Recommended’ Attributes
    - Documented in QAP
    - Rules Database

- Benefits of using a standard data model
  - Provides a unified data structure and organization across the National Guard
  - Provides a standard naming convention for fields and attributes
  - Facilitates sharing of data & development of common GIS tools
  - Simplifies Aggregation of multiple Databases
  - Provides foundation for automated QA/QC process
Databases

- ‘Logic’ Behind the Tools
  - Allows for Modification Without Re-writing the Tools
  - Can be used for Quick Reference

- Rules database
  - Feature Classes
  - ‘Recommended’ Attributes
  - Domain Values
  - Primary Key
  - Error messages for Tools
Databases

PRIDE database

- Current Real Property Inventory
  - Facility Id provides link from PRIDE to records in GIS
  - Installation Id = Site Code
  - CATCODE
  - Quantity/Unit of Measure

- CATCODE Cross walk
  - Aligns SDSFIE feature classes to ARMY CATCDs
  - Able to Validate RP Facility is in the Correct FC
Custom Geoprocessing Tools

- Automates QA/QC processes
- Utilizes external databases for rules and logic
- Iterative in Nature
  - State builds upon previous FY CIP Tool Corrections
  - Makes Corrections Manageable - able to run one feature class at a time
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Field Definition</th>
<th>Example Input</th>
<th>Required for Tools</th>
<th>Tool 1</th>
<th>Tool 2</th>
<th>Tool 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ID</strong></td>
<td>Access Auto Populate Field</td>
<td>N/A</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>analyst_narrative</strong></td>
<td>Descriptive text for what should be populated into the Attribute</td>
<td>This feature is measured in square yards. Select “SYD” from…</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tier</strong></td>
<td>Legacy Data for ‘Tier’ that FC was added to CIP</td>
<td>1,2,3</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>If the FC is associated with ILI or ILE</td>
<td>Installation or Environmental</td>
<td>Some</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>layer_name</strong></td>
<td>SDSFIE 2.6 CIP Feature Class Name</td>
<td>structure_existing_area</td>
<td>All</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Geometry</strong></td>
<td>Feature Class Geometry Type</td>
<td>Point, line, polygon</td>
<td>Some</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Attribute</strong></td>
<td>Feature Attributes to be checked by Tools</td>
<td>instln_id, facil_id, etc.</td>
<td>All</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>attribute_definition</strong></td>
<td>Definition of Attribute from SDSFIE or QAP</td>
<td>The unit of measure for area.</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>single_valid_value</strong></td>
<td>Populated if there is only one acceptable value for Attribute</td>
<td>M, FT, SFT</td>
<td>Some</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>can_be_null</strong></td>
<td>Identifies if Field can be Null for Result Message</td>
<td>YES or NO</td>
<td>Some</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Rules Name</td>
<td>Field Name</td>
<td>Field Definition</td>
<td>Example Input</td>
<td>Required for Tools</td>
<td>Tool 1</td>
<td>Tool 2</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>recommend_QAP_update</td>
<td>recommend_QAP_update</td>
<td>ID’s the Attribute that will contain the Primary Key</td>
<td>Primary Key</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>layer_name_error_message</td>
<td>layer_name_error_message</td>
<td>Corrective action if FC Name Does not match the CIP</td>
<td>Incorrect Layer Listed for Attribute</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>maximum_data_length</td>
<td>maximum_data_length</td>
<td>Field Length for Schema Standardization</td>
<td>16, 20, 9999, etc.</td>
<td>Some</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>exceeds_max_char_length_message</td>
<td>exceeds_max_char_length_message</td>
<td>Result if attribute does not match value in Max Data Lgth field</td>
<td>exceeds 16 characters</td>
<td>Some</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Formatting</td>
<td>Formatting</td>
<td>ID’s if the Field is a Number or String value</td>
<td>String, Integer, Double</td>
<td>Some</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrect_format_error_message</td>
<td>Incorrect_format_error_message</td>
<td>Corrective action message for incorrect ‘Formatting’ entry identified by Tool</td>
<td>Data Format Type needs to be changed to Character</td>
<td>Some</td>
<td></td>
<td></td>
</tr>
<tr>
<td>formatting_rule</td>
<td>formatting_rule</td>
<td>Description of what to populate into the “Formatting” field</td>
<td>Any Alphanumeric combination is Valid</td>
<td>Some</td>
<td></td>
<td></td>
</tr>
<tr>
<td>reference_domain_table</td>
<td>reference_domain_table</td>
<td>Specific Domain Table name for Attribute</td>
<td>d_uomdis, d_uomvol, d_boolen, etc.</td>
<td>Some</td>
<td></td>
<td></td>
</tr>
<tr>
<td>null_value_message_1</td>
<td>null_value_message_1</td>
<td>Result message for specific attribute it is associated with</td>
<td>Recommended Primary Key value.</td>
<td>Some</td>
<td></td>
<td></td>
</tr>
<tr>
<td>null_value_message_2</td>
<td>null_value_message_2</td>
<td>Result message for specific attribute it is associated with</td>
<td>Recommended format…</td>
<td>Some</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Custom Geoprocessing Tools:
Layer Extraction Tool

- Extract CIP Data from Larger Database/datasets
- Limits Extraneous Results in QAP tools 2&3
- Provides Easy Process for Deliverables
- Uses an Empty CIP Model to Build New Database
Custom Geoprocessing Tools:
CIP Auto QAP Round 1-Layer Name and Type Check

- Validates Database Schema
  - Feature Class Names
  - Geometry Type
- Utilizes Rules Database
  - Feature Classes Can Be Added or Removed
- Performs Geometry Check
  - Self Intersecting Polygons
  - Short Segments
- Provides Standardization For Other Tools
Custom Geoprocessing Tools:
CIP Auto QAP Round 2-Instln_id and Facil_id Check

- Compares GIS Data to Real Property Inventory
- Validates Installation ID Attribute
  - Installation ID is in Real Property Inventory
  - Spatial Location of Feature
- Validates Facility ID
  - Exists in Real Property Inventory
    - Provides Result if it Does Not
- Validates Feature is in Correct FC
  - CATCODE of the Facility in RP Inventory
CIP Processes

- State Processes
- NGB Processes
State Processes

- Download latest package/Tools from GKO
- Run Tools on production data
- Make any modifications to data identified by tool results
- Extract Data from production database
- Send complete CIP database to NGB
An Aggregate will be produced after each submission window closes.
NGB Processes

- Download State Submitted data from GKO portal
- Run QAP Tools to identify any outstanding issues
- Make modifications to State data if necessary
  - Standardize UOM fields
  - Populate any NULL values if possible
  - Populate domains fields with coded values if needed
- Generate Reports for States to review
  - Spreadsheets for each tool and how to correct remaining issues
  - Post Reports and Data edits to back to GKO for States to review
- Once submission window closes, generate Aggregate from States that submitted
CIP Evolution

Advantages and Benefits

- Historical Approach
- Legacy Processes Limitations
- Current Program
- Advantages/benefits
Historical Approach

Army National Guard

Tier 4 CIP Process

1. **State** submits spatial data.
2. **Inventory and Review**: Check for installation area.
3. **Export State Metadata to XML**.
4. **State** standardizes data to SDSFIE 2.6 and runs geometry checks.
5. **State** provides spatial data (with NGB standardized metadata), associated documentation, summary checklist, and XML metadata files to state.
6. **State** makes corrections to required attributes and geometry and posts data via website.
7. **Final QA/QC Check**.
8. **State** makes corrections to metadata XML files and posts XML files to website.
9. **Final QA/QC Check**.
10. **State** submits spatial data to NGB national aggregate SDSFIE 2.6 data with NGB standardized metadata.
11. **NGB** returns XML files to the state.
Historical Approach

- **Strengths**
  - Data was standardized
  - Second pair of eyes on Data for QA/QC

- **Limitations**
  - Lack of flexibility with schedule
  - Inter dependencies on other parties
  - Black box of rules that generated checklist
Current Program

- **Strengths/Advantages**
  - Streamline CIP process with tools and program modifications
  - Real Property Reconciliation built into CIP workflow
    - RP reconciliation at state level - users know data best
  - Incorporate CIP process into current workflows
  - Customizable - Additional rules for any non CIP feature classes
  - Adaptable - feedback from States - able to modify processes and tools based on users needs

- **Benefits of QAP Python Tools**
  - Customizable
  - Rules are the business logic behind tools and are changeable
  - RP reconciliation - tools identify GIS features that are not in PRIDE
    - New tool will identify GIS not in PRIDE and PRIDE not in GIS
Inherent Value Added

- States can incorporate CIP process into current workflows
  - Minimum requirements for contractor submitted data
  - Run QAP tools as new features are added to database

- Less data gaps due to quarterly submissions
  - Multiple submission windows allow states to work on CIP data when most feasible for them
  - States have direct input to what edits are made to the data
  - Streamline process which empowers States to maintain data per NGB guidelines
Additional Benefits: Customized Rules

- CIP QAP Tools can be run on non-CIP feature classes
- Stand-alone database/tool format allows database modification
- Allows States to conduct QA/QC on any SDSFIE feature classes
- Allows for standardization of additional State feature classes and databases
Additional Benefits: Customized Rules

- Creation of duplicate Rules and PRIDE databases recommended
  - Required attributes need to be identified
  - Required attributes should be added into latest CIP_Rules database
  - PRIDE database should be cross referenced with feature class Army QAP, CATCODES may need to be added

- Tool results format will be unchanged allowing States to ensure all feature classes match CIP requirements
Milestones and Major Accomplishments

- Data Quality Improvement
- Most complete Aggregate
Data Improvements

- Feature Count for all Feature Classes has increased
  - 2009* – 203,009 Features
  - 2010* – 303,998 Features
  - 2013* – 318,749 Features

- Installation Area Feature Count
  - 2009 – 190
  - 2010 – 1,385
  - 2013 – 2,174

- Structure_existing_area Feature Count
  - 2009 – 11,672
  - 2010 – 29,168
  - 2013 – 29,421

*Minus road_centerline features. Previous submissions did not clip roads to a 1-mile radius around installations as in 2013
Questions?