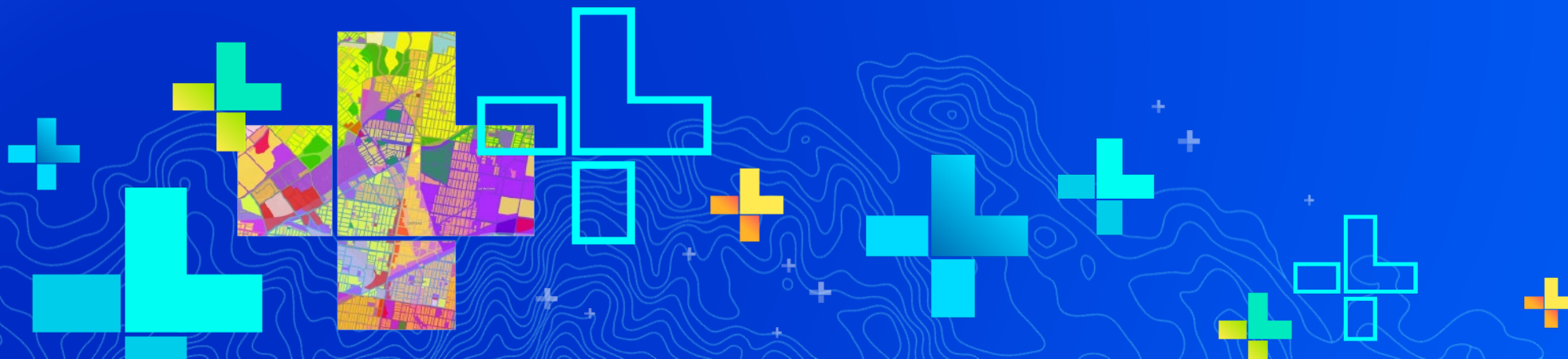




Esri Defense Mapping Cartographic Map Production

Bo King & G.C. Rice

SEE
WHAT
OTHERS
CAN'T



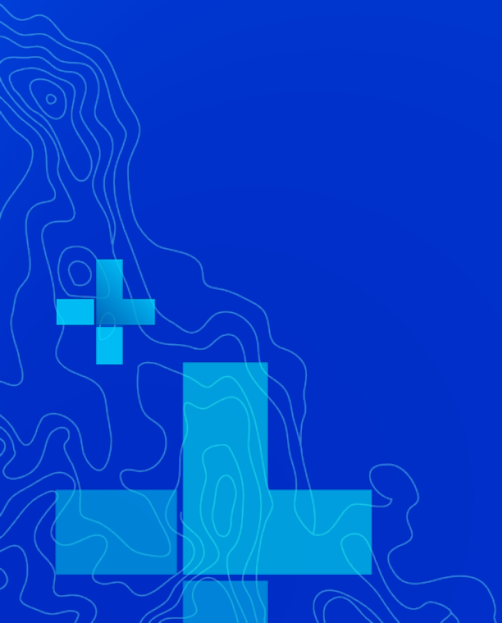
Agenda

- **Solution Overview**
- **Desktop Cartographic Production**
- **Multi-Scale Mapping using Generalization**
- **Product On Demand App (POD)**



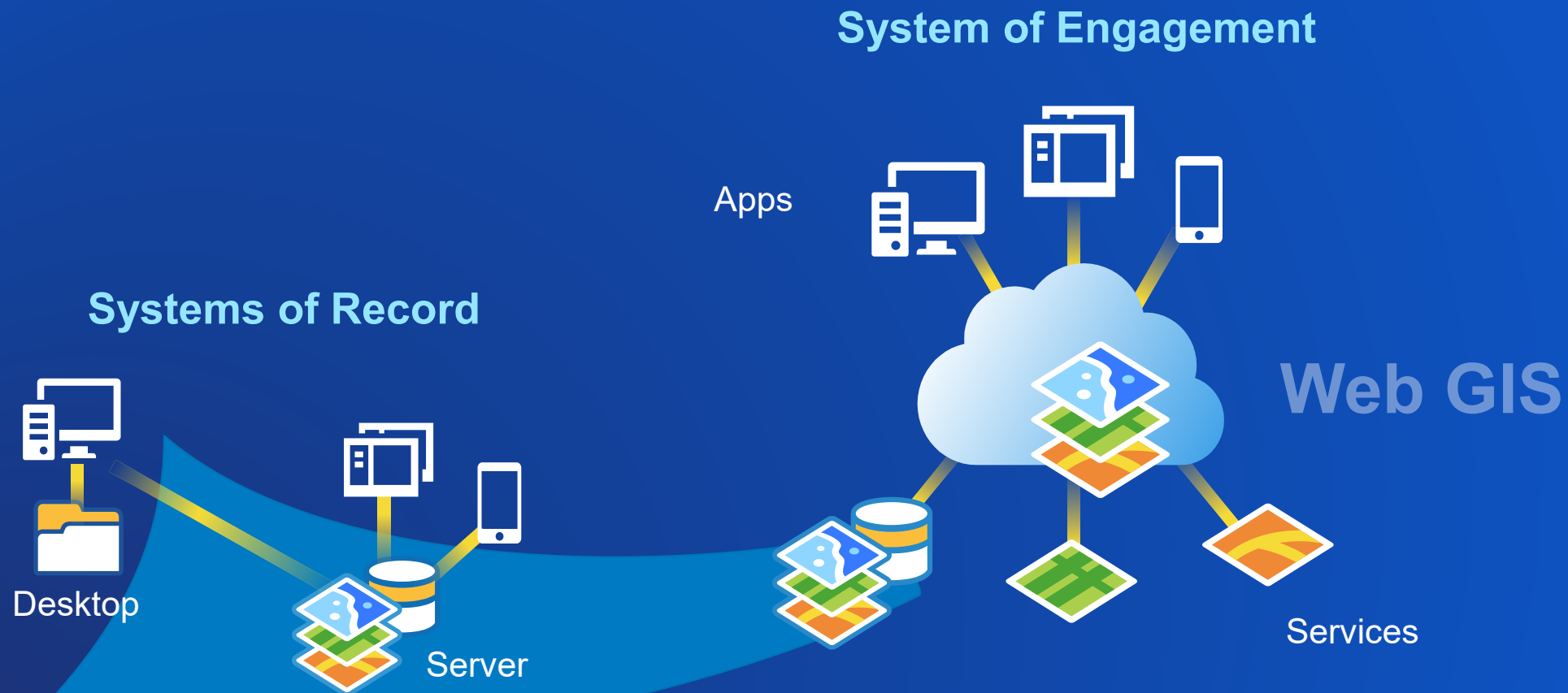
Solution Overview

Esri Defense Mapping



Esri Defense Mapping

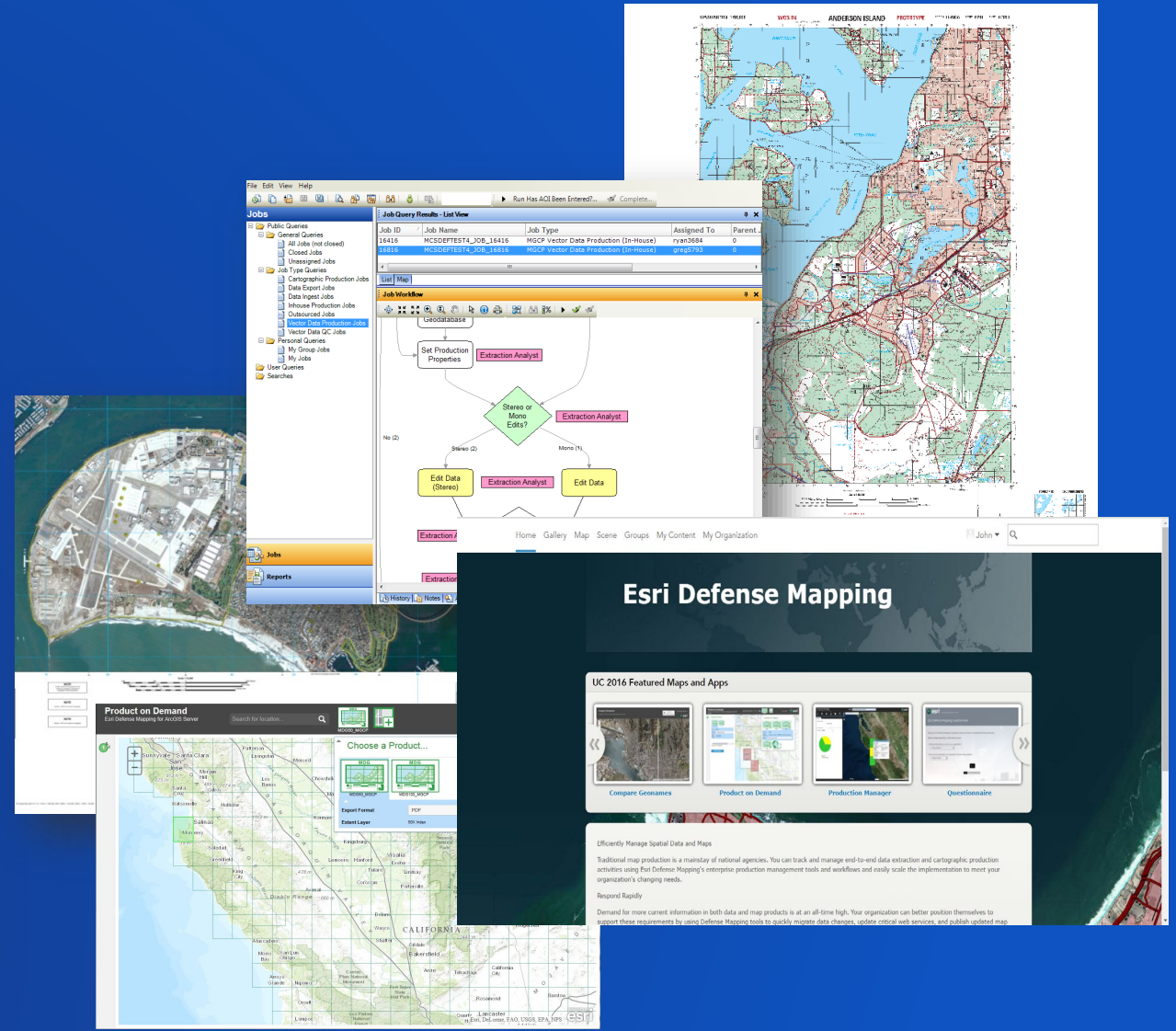
Leveraging the ArcGIS Platform



Esri Defense Mapping

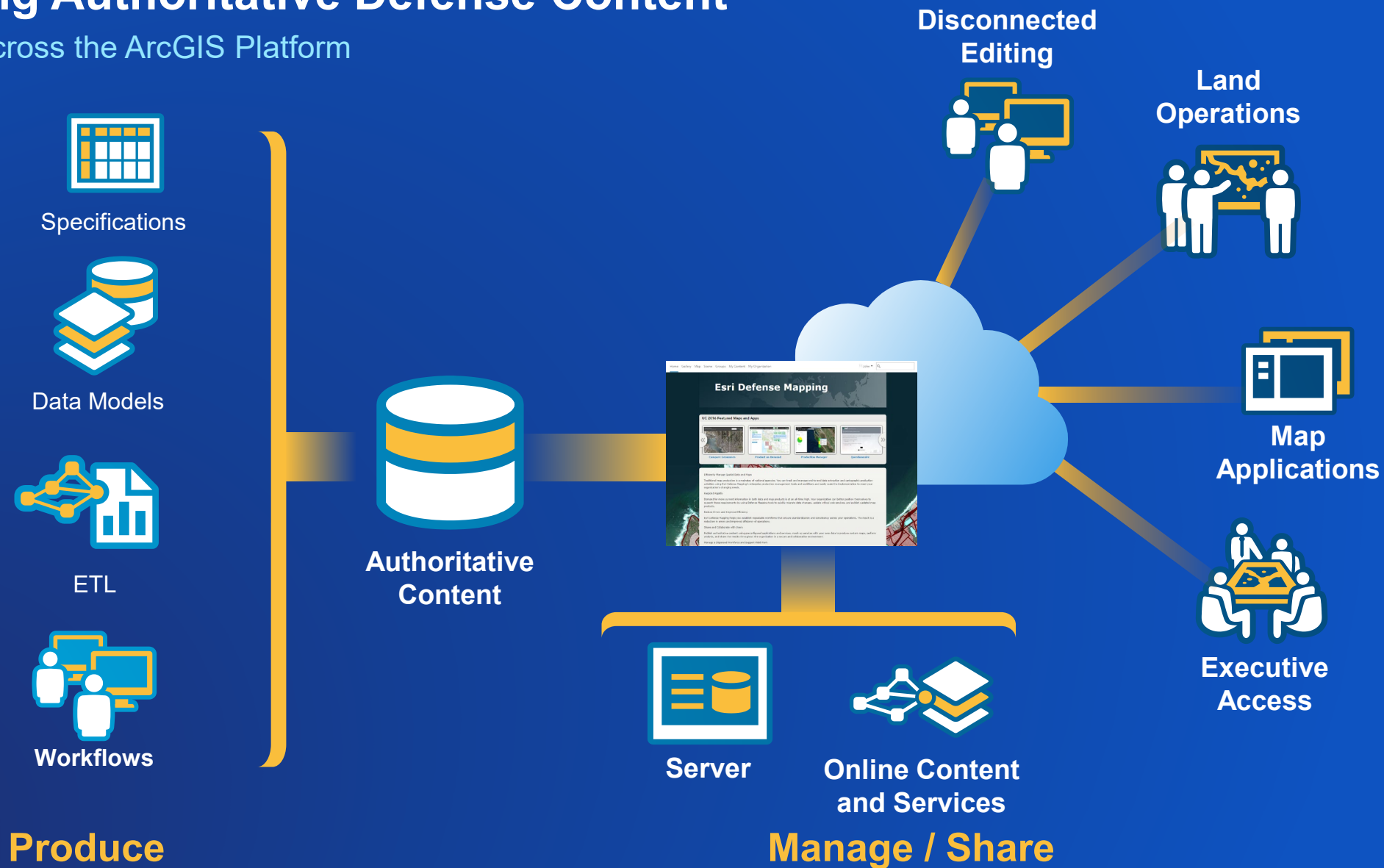
Produce, Manage, and Share Authoritative Content

- Defense Mapping as a Platform
 - **Produce** Authoritative Content
 - **Manage** Production Environment
 - **Share** and Collaborate



Providing Authoritative Defense Content

Integrated across the ArcGIS Platform



Esri Defense Mapping

An Extension to the ArcGIS Platform

- Specification Driven
- Geoprocessing Toolsets
- Predefined Edit Templates
- Quality Assurance / Control
- Cartographic Symbolology

Jobs

- Public Queries
 - General Queries
 - All Jobs (not closed)
 - Closed Jobs
 - Unassigned Jobs
 - Job Type Queries
 - Cartographic Production Jobs
 - Data Export Jobs
 - Data Ingest Jobs
 - Inhouse Production Jobs
 - Outsourced Jobs
 - Vector Data Production Jobs
 - Vector Data QC Jobs
 - Personal Queries
 - My Group Jobs
 - User Queries
 - Searches

Job ID	Job Name	Job Type	Parent Job	Due
1	DEFMAPDBDEV2_JOB_1	MGCP Create Authoritative Database	0	
401	DEFMAPDBDEV2_JOB_401	MGCP Create Data Warehouse	0	
402	DEFMAPDBDEV2_JOB_402	MGCP Create Operational Replica	0	
8815	MCSDEFTST4_JOB_8815	MGCP Cartographic Production (In-House)	0	5/4/
9215	MCSDEFTST4_JOB_9215	MGCP Cartographic Production (Outsourced)	0	5/8/
16816	MCSDEFTST4_JOB_16816	MGCP Vector Data Production (In-House)	0	7/10/

Import/Export Settings Help

Add Connection

- Database\VMX_Agency (default)
- GeoDatabases
- Job Components
- Job Types
- Priorities
- Status Types
- Step Types
- Task Assistant Workflows
- Workflows

Name

- LTDS Field Editing (In-house [Disconnected])
- LTDS Field Editing (Promote Changes)
- LTDS Field Editing (QC Changes)
- LTDS Ingest Data
- LTDS Vector Data Production (In-House [Crisis])
- LTDS Vector Data Production (In-House)
- LTDS Vector Data Production (Outsourced)
- LTDS Vector Data Production (Promote Changes)
- LTDS Vector Data Production (QC Outsourced Changes)
- MGCP Cartographic Production (Outsourced)
- MGCP Cartographic Production (Promote Changes)
- MGCP Cartographic Production (QC Outsourced Changes)
- MGCP Create Authoritative Database
- MGCP Create Data Warehouse
- MGCP Create Operational Replica
- MGCP Export Data
- MGCP Field Editing (In-house [Disconnected])
- MGCP Field Editing (Promote Changes)

Category

- LTDS
- LTDS
- LTDS
- LTDS
- LTDS
- LTDS
- LTDS
- LTDS
- LTDS
- MGCP
- MGCP

Job Workflow

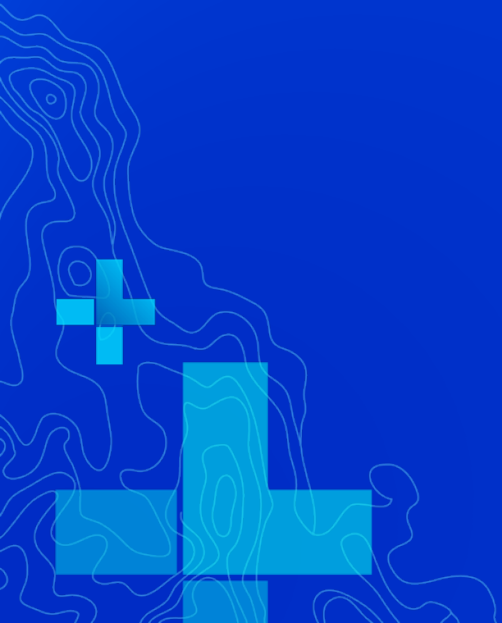
```
graph TD
    Start(( )) --> Copy[Copy Data to Local Drive]
    Copy --> Resource[Resource MXD to Local Geodatabase]
    Resource --> SetProp[Set Production Properties]
    SetProp --> Edit[Carto Editing]
    Edit --> Oper{Operating Locally?}
    Oper -- Yes (0) --> End(( ))
    Oper -- No (2) --> Copy
```

Defense Mapping Tools.tbx

- Cartography
- Banding
- Cartographic Refinement
- Grids and Graticules
- Map Document
- Data Management
- Features
- Generalization
- Geodatabase
- Topology
- Validation
- Hypsography
- Contours
- Spot Heights
- Utilities

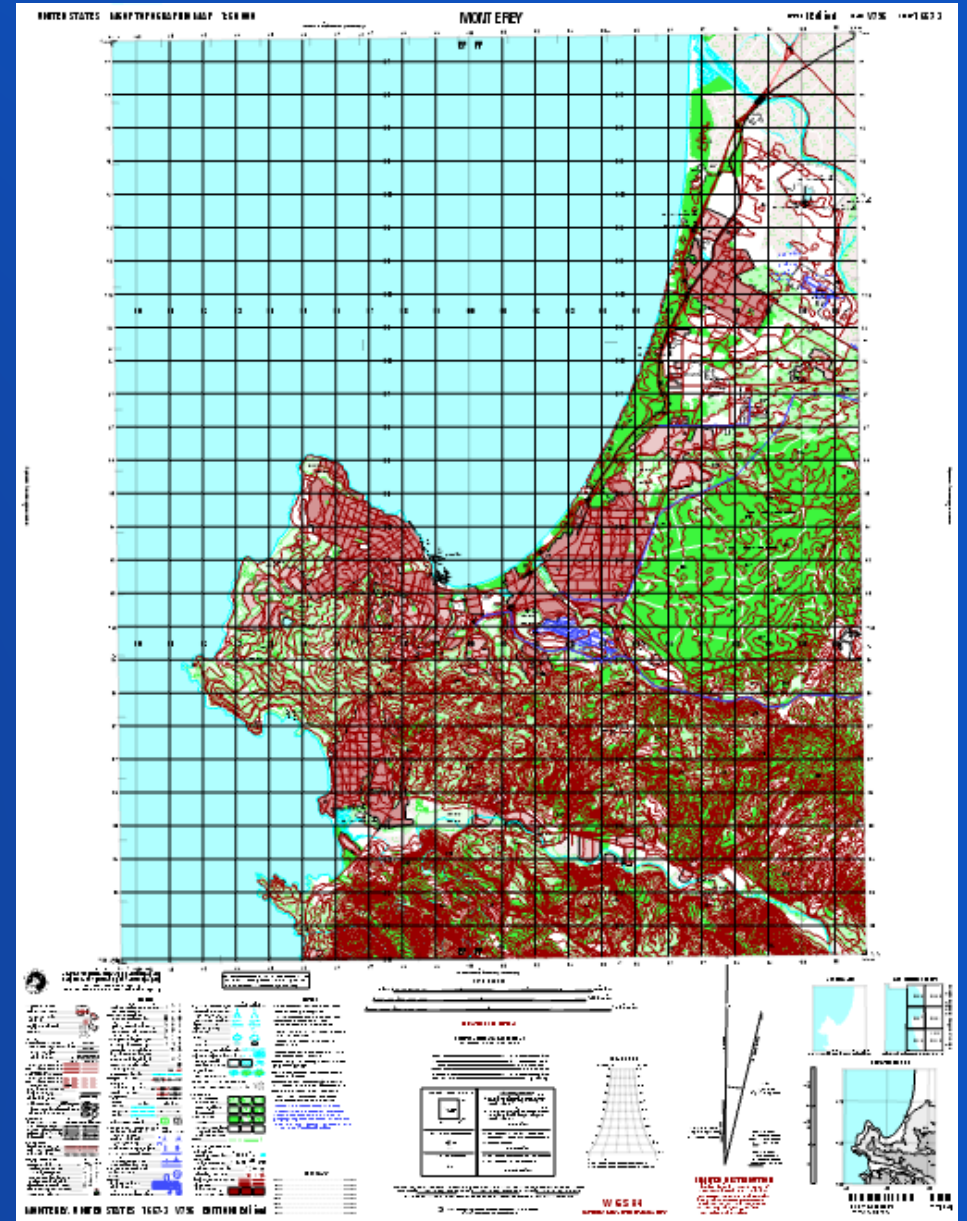
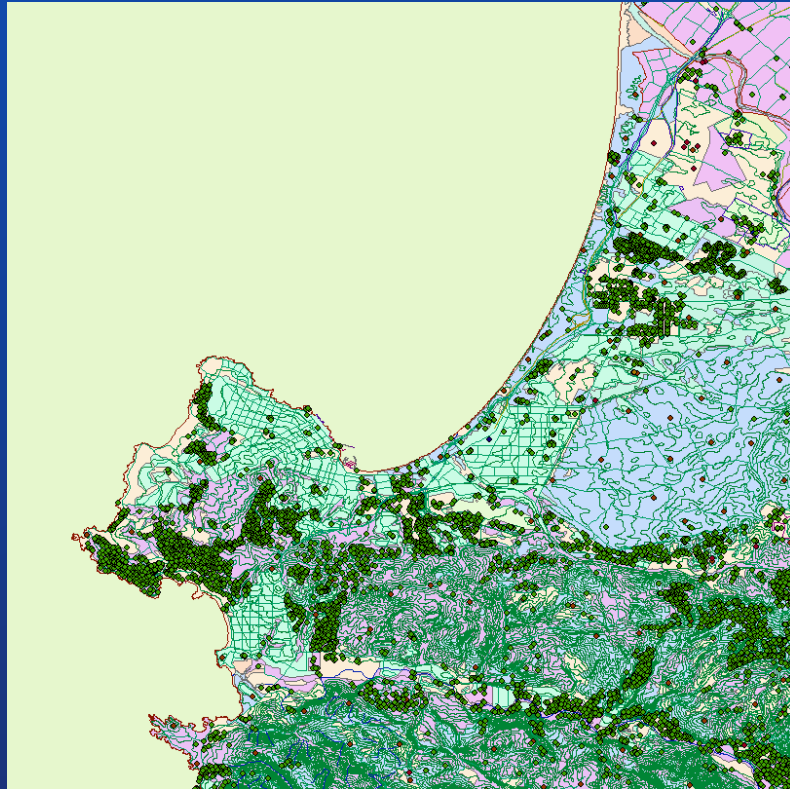
Cartographic Production

Esri Defense Mapping for ArcGIS Pro



Cartographic Production

Expediting the Map Creation Process



ArcGIS Pro

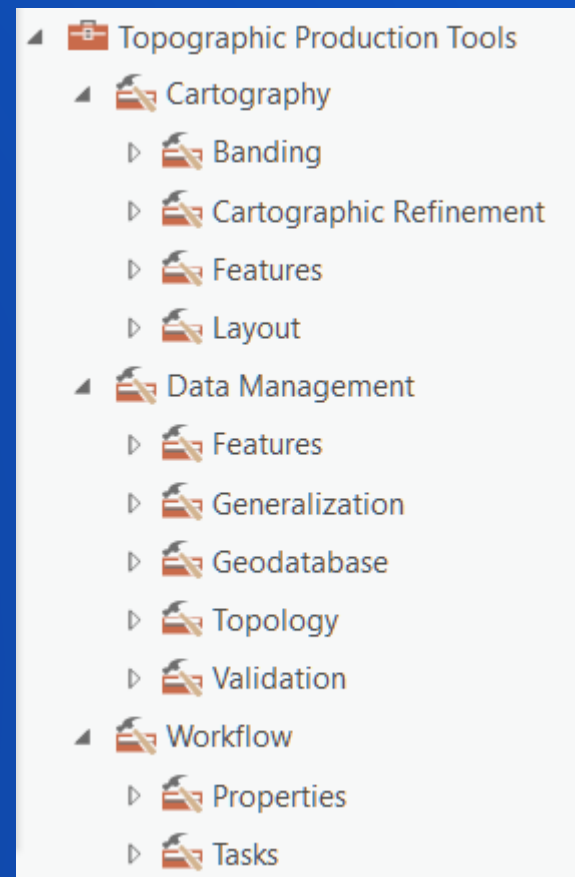
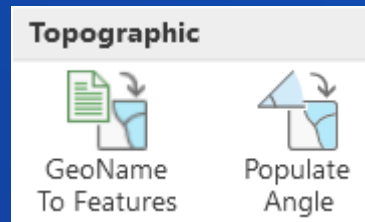
Esri Defense Mapping for ArcGIS Pro

- **Defense Mapping Extension**

- **Edit Tools**
 - **Modify Features**
 - **Create Features**

- **Topographic Production Toolbox**

- **Cartography**
- **Data Management**
- **Workflow**



Edit Tools

Esri Defense Mapping for ArcGIS Pro

- **Populate Angle**



- **Geoname to Feature**



- **Buildings**



- **Difference Polygon**



Topographic



GeoName
To Features



Populate
Angle

Create Structures

Point Features

Area less than625

Point Feature TemplateAircraft Hangar / intact (point) PS-04455

Curve Features

Create Features

building

BuildA

General Building / non-obstruction / intact / christian (area) P...

General Building / non-obstruction / intact / diplomatic (area)...

General Building / non-obstruction / intact / generic or i

General Building / non-obstruction / intact / hospital (area) PS...

General Building / non-obstruction / intact / house of worship...

uilding / non-obstruction / intact / islam (area) PS-0...

uilding / non-obstruction / intact / judaism (area) PS...

uilding / non-obstruction / intact / pagoda (area) PS...

uilding / non-obstruction / intact / petrol sale (area)...

uilding / non-obstruction / intact / school (area) PS-...

uilding / non-obstruction / intact / stupa (area) PS-0...

uilding / non-obstruction / intact / temple (area) PS-...

General Building / non-obstruction / not intact (area) PS-04692

General Building / obstruction (area) PS-04512

BuildP

Meters

Geoprocessing Tools

Esri Defense Mapping for ArcGIS Pro

- **Cartography**

- **Banding**
- **Cartographic Refinement**
- **Features**
- **Layout**

- ▲  Topographic Production Tools
 - ▲  Cartography
 - ▲  Banding
 -  Generate Elevation Bands
 - ▲  Cartographic Refinement
 -  Apply Building Offsets
 -  Apply Masks From Rules
 -  Apply Visual Specification To Map
 -  Calculate Bridge Offsets
 -  Make Masks From Rules
 -  Thin Spot Heights
 - ▲  Features
 -  Generate Adjoining Sheets Features
 -  Generate Elevation Guide Features
 -  Generate Spot Heights
 -  Generate Topographic Contours
 -  Identify Contours
 - ▲  Layout
 -  Make Grids And Graticules Layer
 -  Populate Map Sheet Info

Geoprocessing Tools

Esri Defense Mapping for ArcGIS Pro

- **Data Management**

- **Features**
- **Generalization**
- **Geodatabase**
- **Topology**
- **Validation**

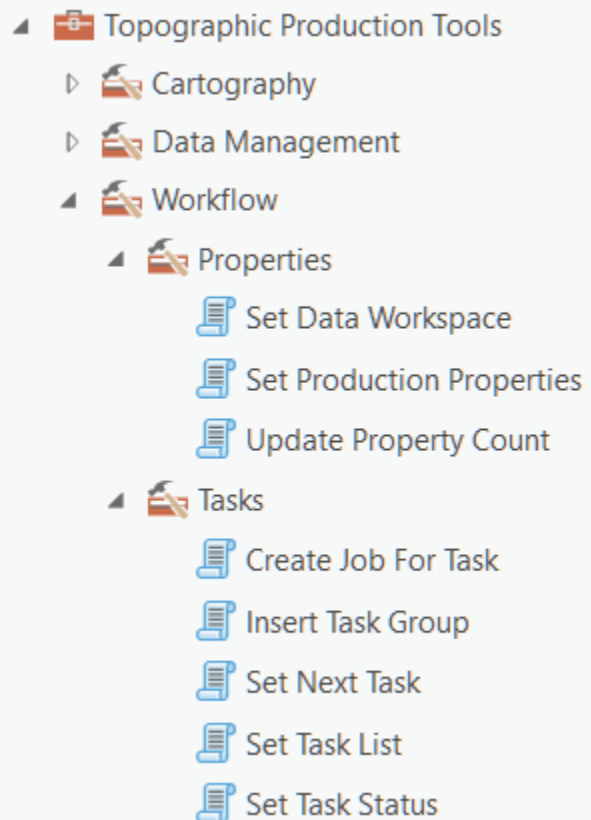
- ▲  Data Management
 - ▲  Features
 -  Calculate Default Values
 -  Calculate Metrics
 -  Remove Cutback Vertices
 -  Repair Self Intersection
 -  Split Features
 -  Update GeoNames
 - ▲  Generalization
 -  Eliminate Polygon
 -  Export Generalized Data
 -  Fill Gaps
 -  Identify Narrow Polygons
 -  Import Generalization Data
 -  Polygon To Centerline
 -  Remove Small Lines
 -  Thin Hydrology Lines

- ▲  Data Management
 - ▷  Features
 - ▷  Generalization
 - ▲  Geodatabase
 -  Export MGCP Metadata
 -  Geodatabase To Shape
 -  GeoNames To Geodatabase
 -  Import MGCP Metadata
 -  Load Data
 -  Unzip MGCP Cell And Import
 - ▲  Topology
 -  Export Topology
 -  Import Topology
 - ▲  Validation
 -  GAIT

Geoprocessing Tools

Esri Defense Mapping for ArcGIS Pro

- **Workflow**
 - **Properties**
 - **Tasks**

- 
- The screenshot shows the Geoprocessing Tools pane with the following structure:
- ▲  Topographic Production Tools
 - ▷  Cartography
 - ▷  Data Management
 - ▲  Workflow
 - ▲  Properties
 -  Set Data Workspace
 -  Set Production Properties
 -  Update Property Count
 - ▲  Tasks
 -  Create Job For Task
 -  Insert Task Group
 -  Set Next Task
 -  Set Task List
 -  Set Task Status

Support Files

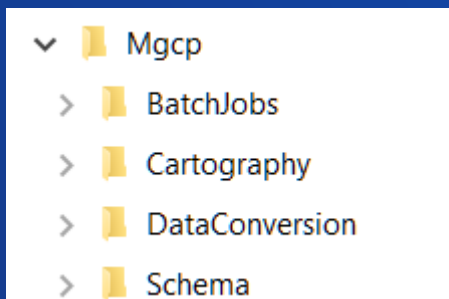
Esri Defense Mapping for ArcGIS Pro

- **Independent Install**

- **Default Location**

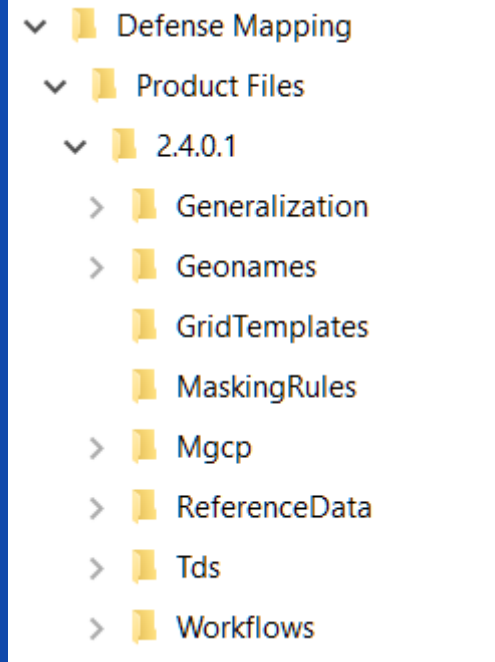
- C:\Users\Public\Documents\Defense Mapping\Product Files

- **Custom Location**



▼ Mgcp

- > BatchJobs
- > Cartography
- > DataConversion
- > Schema



▼ Defense Mapping

- ▼ Product Files
 - ▼ 2.4.0.1
 - > Generalization
 - > Geonames
 - GridTemplates
 - MaskingRules
 - > Mgcp
 - > ReferenceData
 - > Tds
 - > Workflows

Map Templates

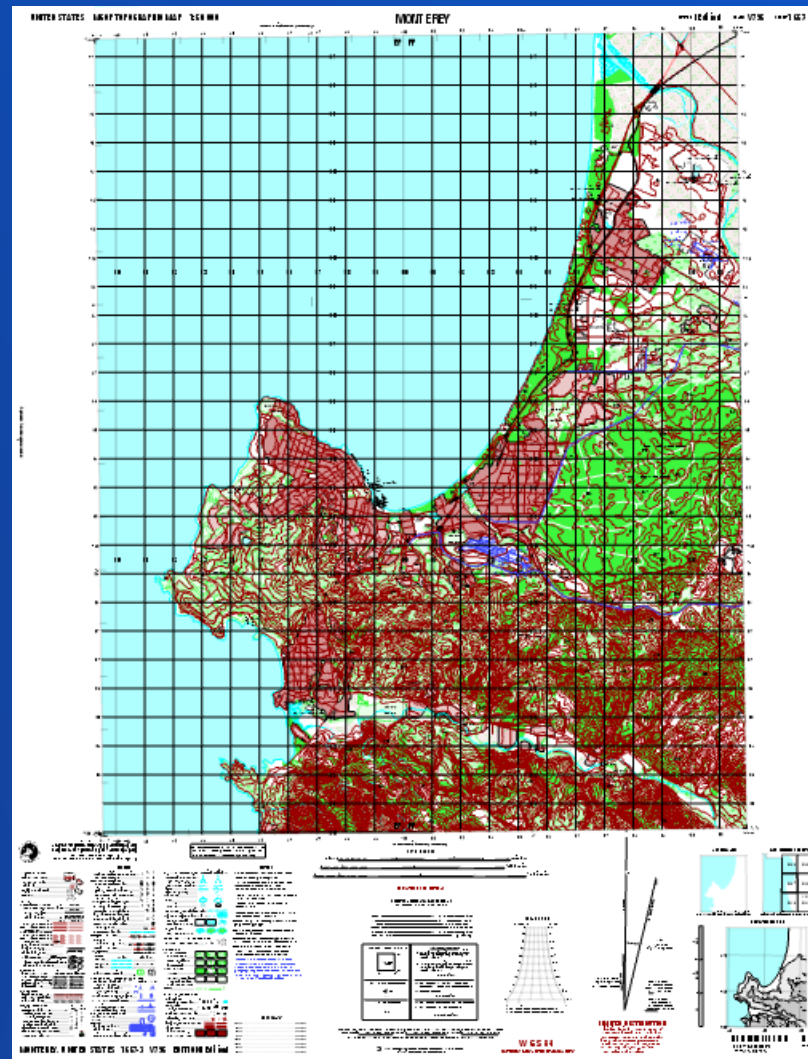
Esri Defense Mapping for ArcGIS Pro

- **MGCP Topographic Map**

- MTM50
- MTM100

- **TDS Topographic Map**

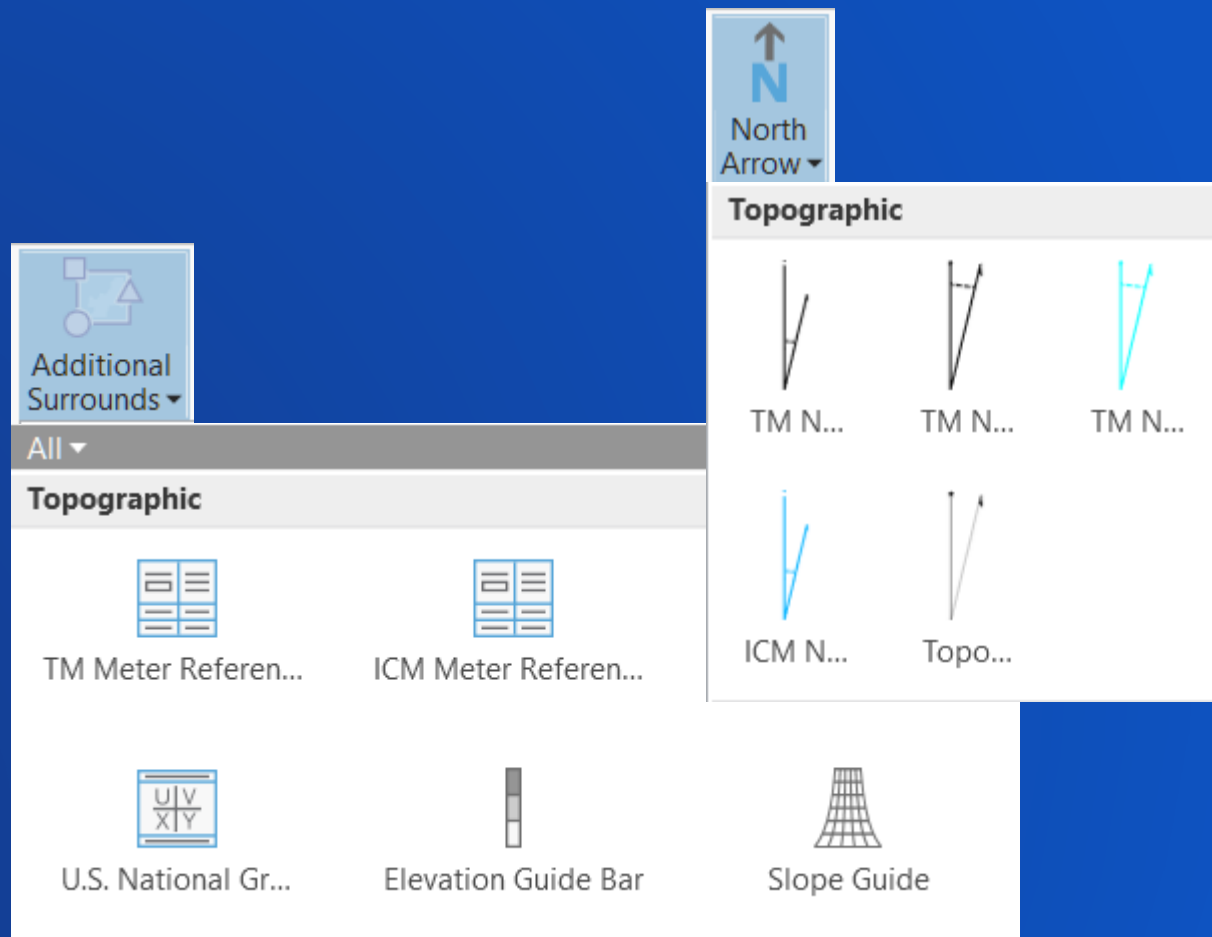
- TM25
- TM50
- TM100



Dynamic Elements

Esri Defense Mapping for ArcGIS Pro

- Elevation Guide Bar
- Meter Reference Guide
- Slope Guide
- TM North Arrow



Labels & Symbols

Esri Defense Mapping for ArcGIS Pro

- Label Expressions (Python)
- Symbol Expressions (Arcade)

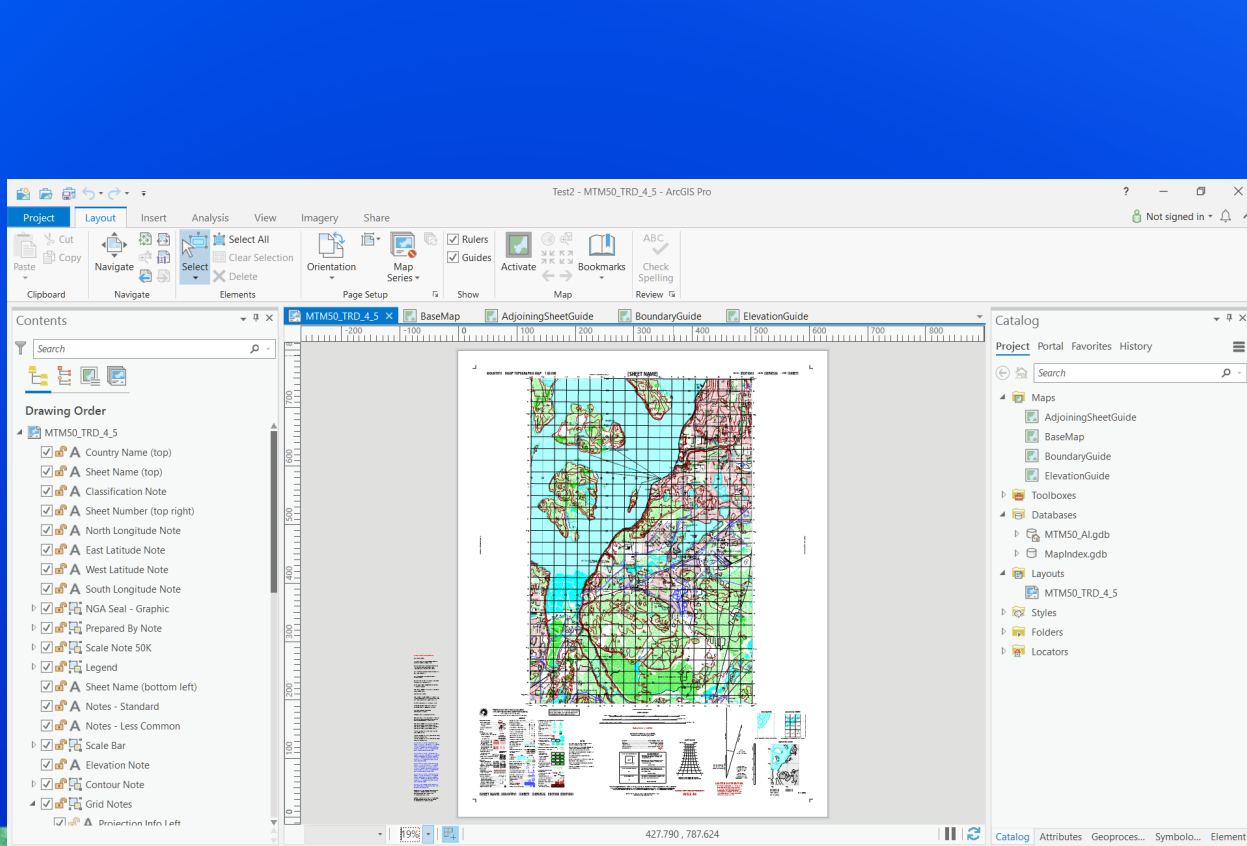
Expression

☒ Advanced

```
def FindLabel ([F_CODE],[FUN],[NAM],[ZVA],[IKO]):  
    import os,string  
    label = ''  
    fun = [FUN].lower()  
    fun = fun.replace('under construction','construction')  
    if [F_CODE] == 'GB030':  
        if [FUN] not in ('Fully Functional','Unknown'):  
            label = '({})'.format(fun)
```

Expression

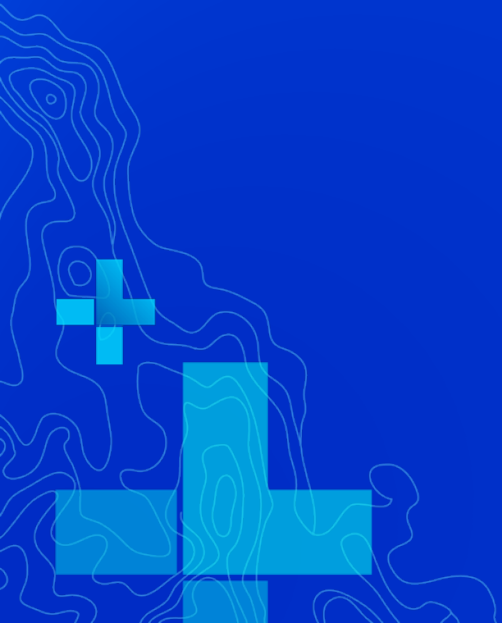
```
if ( $feature.F_CODE == "AL015" && $feature.HGT < 46 && IndexOf([6,0],  
$feature.FUN) != -1 && IndexOf  
([550,810,2,341,919,440,893,355,330,781,513,859,99,511,475,535,343,999,540,3  
51,582,501,601,563,572,643,626,720,486,887,610,604,480,0,350,530,362],  
$feature.FFN) != -1 )  
    return "General Building / non-obstruction / intact / generic (point)  
PS-04693";  
else if ( $feature.F_CODE == "AL015" && $feature.HGT < 46 && IndexOf([6,0],  
$feature.FUN) != -1 && IndexOf([931,930], $feature.FFN) != -1 && IndexOf  
([2,3,4,15], $feature.HWT) != -1 )  
    return "General Building / non-obstruction / intact / christian (point)  
PS-04695";  
else if ( $feature.F_CODE == "AL015" && $feature.HGT < 46 && IndexOf([6,0],  
$feature.FUN) != -1 && IndexOf([825,827], $feature.FFN) != -1 )
```



Map Production in ArcGIS Pro

Demo

Data Generalization for Multi-Scale Mapping



Multi-Scale Mapping

One database, multiple products

Best Scale Data



Automation

Multi-Scale Product



Multi-Scale Mapping

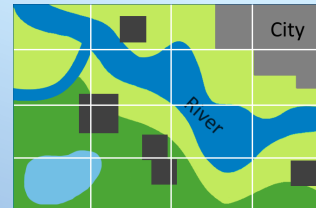
Best Scale
Data



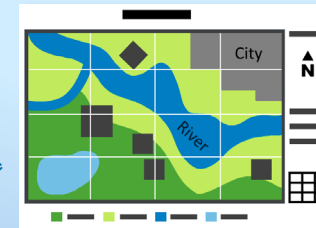
Prepare Data



Data
Generalization



Prepare
Cartographic Data



Cartographic
Finishing

Multi-Scale
Products

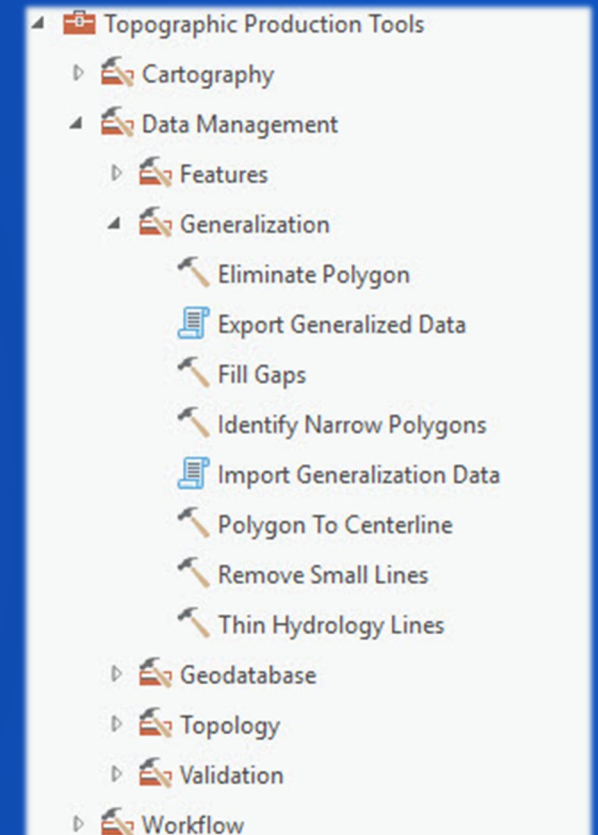
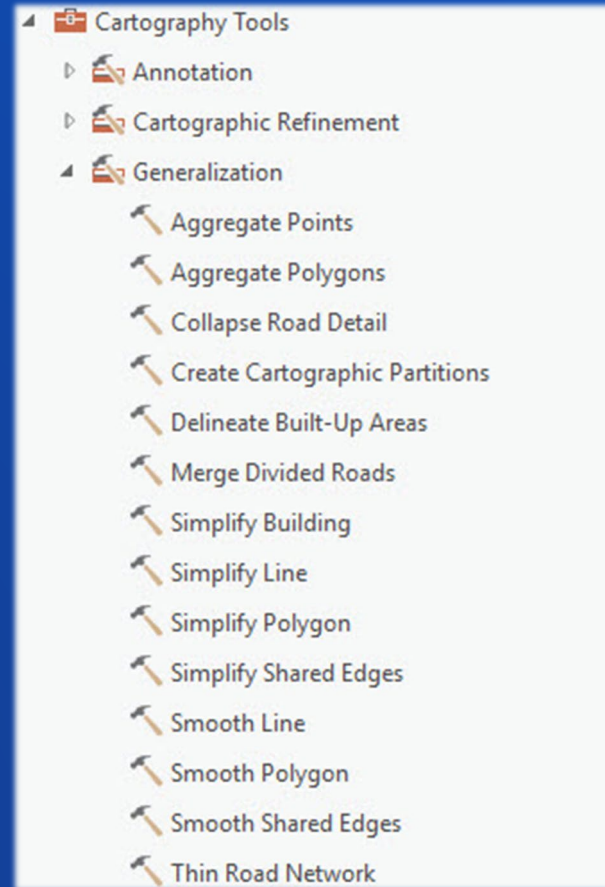


Data Automation

Map Automation

Generalization Techniques

- Simplify
- Smooth
- Eliminate
- Aggregate
- Collapse
- Thin
- Exaggerate



Generalization Tools in ArcMap

- **Analysis**

- Erase
- Identity
- Buffer
- Graphic Buffer
- Near
- Generate Near Table

- **Cartography**

- Aggregate Points
- Aggregate Polygons
- Collapse Road Detail
- Create Cartographic Partitions
- Delineate Built-Up Areas
- Merge Divided Roads
- Simplify Building
- Simplify Line
- Simplify Polygon
- Smooth Line
- Smooth Polygon
- Thin Road Network
- Detect Graphic Conflict
- Propagate Displacement
- Resolve Building Conflicts
- Resolve Road Conflicts
- Feature Outline Masks
- Update Override

- **Conversion**

- Feature class to feature class
- Table to Table

- **Data Management**

- Integrate
- Add Geometry Attributes
- Copy Features
- Delete Features
- Feature To Line
- Feature To Point
- Feature To Polygon
- Feature Vertices to Points
- Minimum Bounding Geometry
- Multipart To Singlepart
- Repair Geometry
- Split Line At Vertices
- Unsplit Line
- Add Field
- Calculate Field
- Append
- Copy
- Delete
- Dissolve
- Eliminate Polygon Part
- Make Feature Layer
- Select Layer By Attribute
- Select Layer By Location
- Get Count

- **Spatial Analyst**

- Topo To Raster
- Raster Calculator
- Polygon To Raster
- Point To Raster
- Raster to Point

- **Model Only Tools**

- Select Data
- Calculate Value
- Iterators
- Parse Path
- Get Field Value

- **Production Mapping**

- Aggregate Polygons
- Calculate Visual Specification
- Convert Polygons
- Delete Dangles
- Delete Polygons and Extend Lines
- Extend Polygon Sides
- Fill Gaps
- Generalized Shared Features
- Increase Line Length
- Increase Polygon Area
- Production Centerline
- Production Clip

- **Production Dissolve**

- Prune Hydro
- Remove Cutbacks
- Remove Self Intersections
- Repair Bad Geometry
- Split Narrow Polygons
- Thin Hydro Features
- Thin Spot Heights

- **Defense Mapping**

- Hydro Centerline
- Resolve Building Conflicts

Generalization Tools in ArcGIS Pro

• Analysis

- Erase
- Identity
- Buffer
- Graphic Buffer
- Near
- Generate Near Table

• Cartography

- Aggregate Points
- Aggregate Polygons
- Collapse Road Detail
- Create Cartographic Partitions
- Delineate Built-Up Areas
- Merge Divided Roads
- Simplify Building
- Simplify Line
- Simplify Polygon
- Simplify Shared Edges
- Smooth Line
- Smooth Polygon
- Smooth Shared Edges
- Thin Road Network
- Detect Graphic Conflict
- Propagate Displacement
- Resolve Building Conflicts
- Resolve Road Conflicts
- Feature Outline Masks

• Conversion

- Feature class to feature class
- Table to Table

• Data Management

- Integrate
- Add Geometry Attributes
- Copy Features
- Delete Features
- Feature To Line
- Feature To Point
- Feature To Polygon
- Feature Vertices to Points
- Minimum Bounding Geometry
- Multipart To Singlepart
- Repair Geometry
- Split Line At Vertices
- Unsplit Line
- Add Field
- Calculate Field
- Append
- Copy
- Delete
- Delete Identical
- Dissolve
- Eliminate
- Eliminate Polygon Part
- Make Feature Layer
- Select Layer By Attribute

- Select Layer By Location
- Get Count

• Spatial Analyst

- Topo To Raster
- Raster Calculator
- Polygon To Raster
- Point To Raster
- Raster to Point

• Model Only Tools

- Select Data
- Calculate Value
- Iterators
- Parse Path
- Get Field Value

• Topographic Production

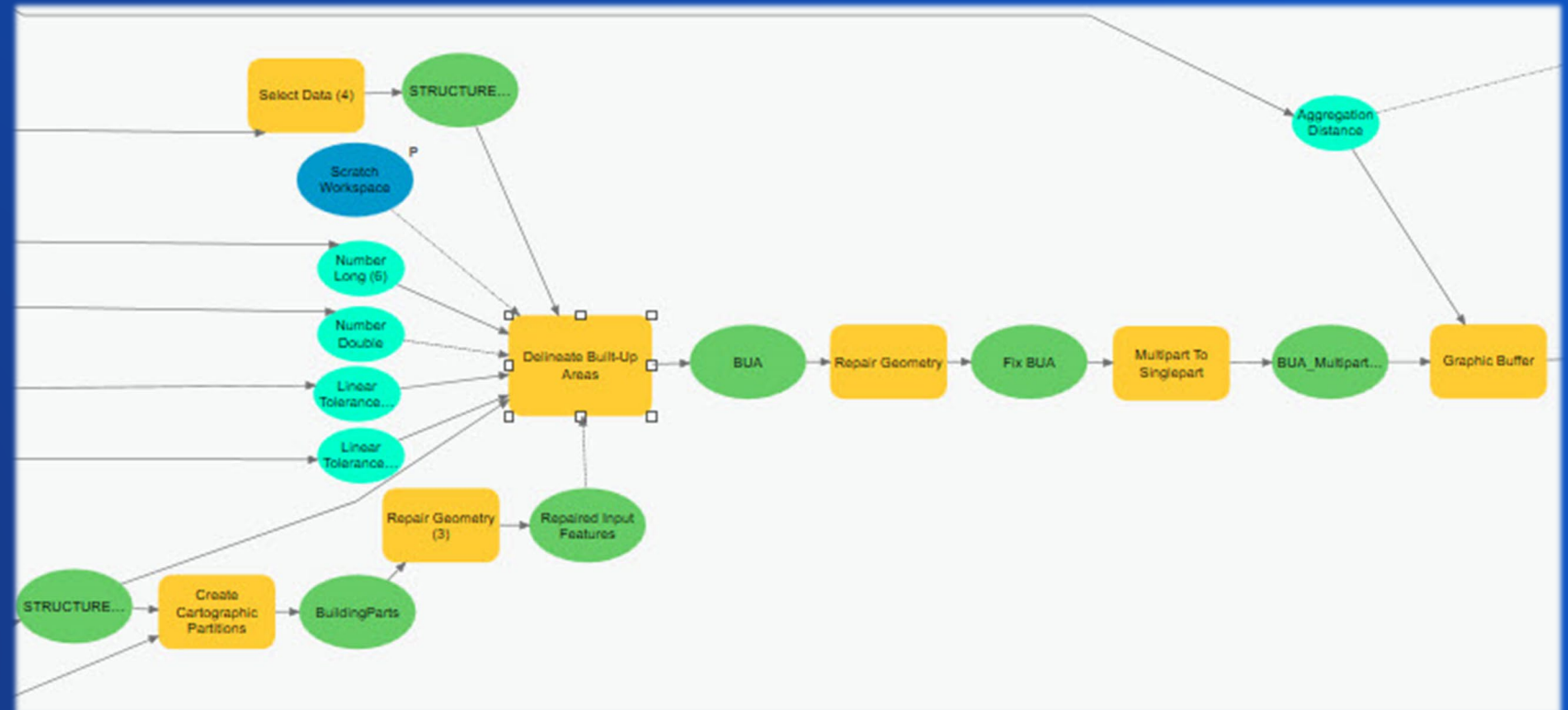
- Aggregate Polygons
- Eliminate Polygon
- Export Generalized Data
- Import Generalized Data
- Extract Data
- Load Data
- Remove Small Lines
- Delete Polygons and Extend Lines
- Extend Polygon Sides
- Fill Gaps

- Generalize Shared Features (now in Cartography Toolbox)
- Increase Line Length
- Increase Polygon Area
- Polygon To Centerline
- Production Clip
- Production Dissolve
- Thin Hydrology Lines
- Remove Cutback Vertices
- Remove Self Intersection
- Repair Bad Geometry
- Identify Narrow Polygons
- Thin Hydrology Lines
- Thin Spot Heights
- Apply Building Offsets

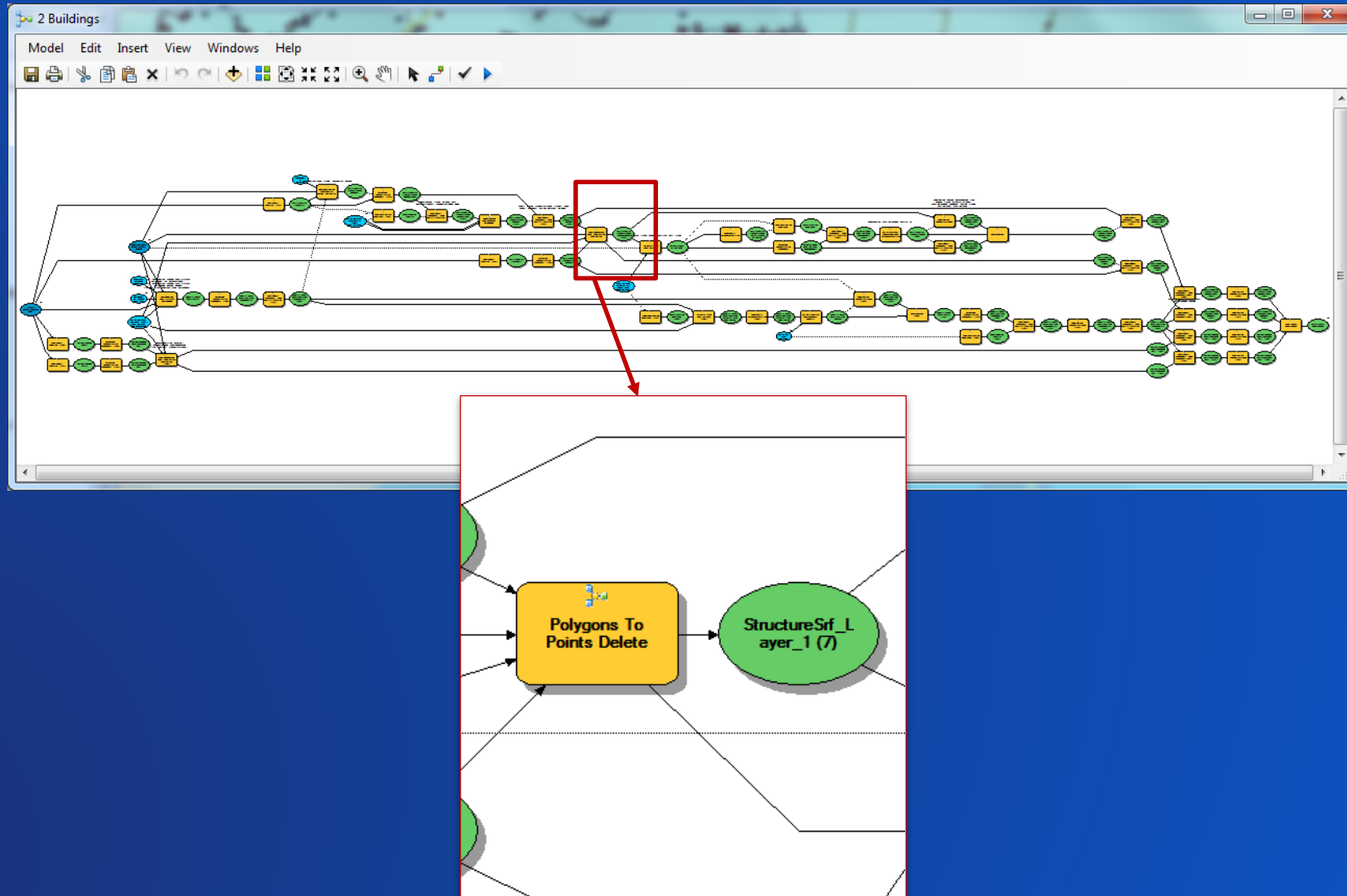
Color Scheme:
Available in Pro (2.4)
In Pro - Renamed/Moved
New in Pro
Not yet in Pro

Leverage Tools Within Models...

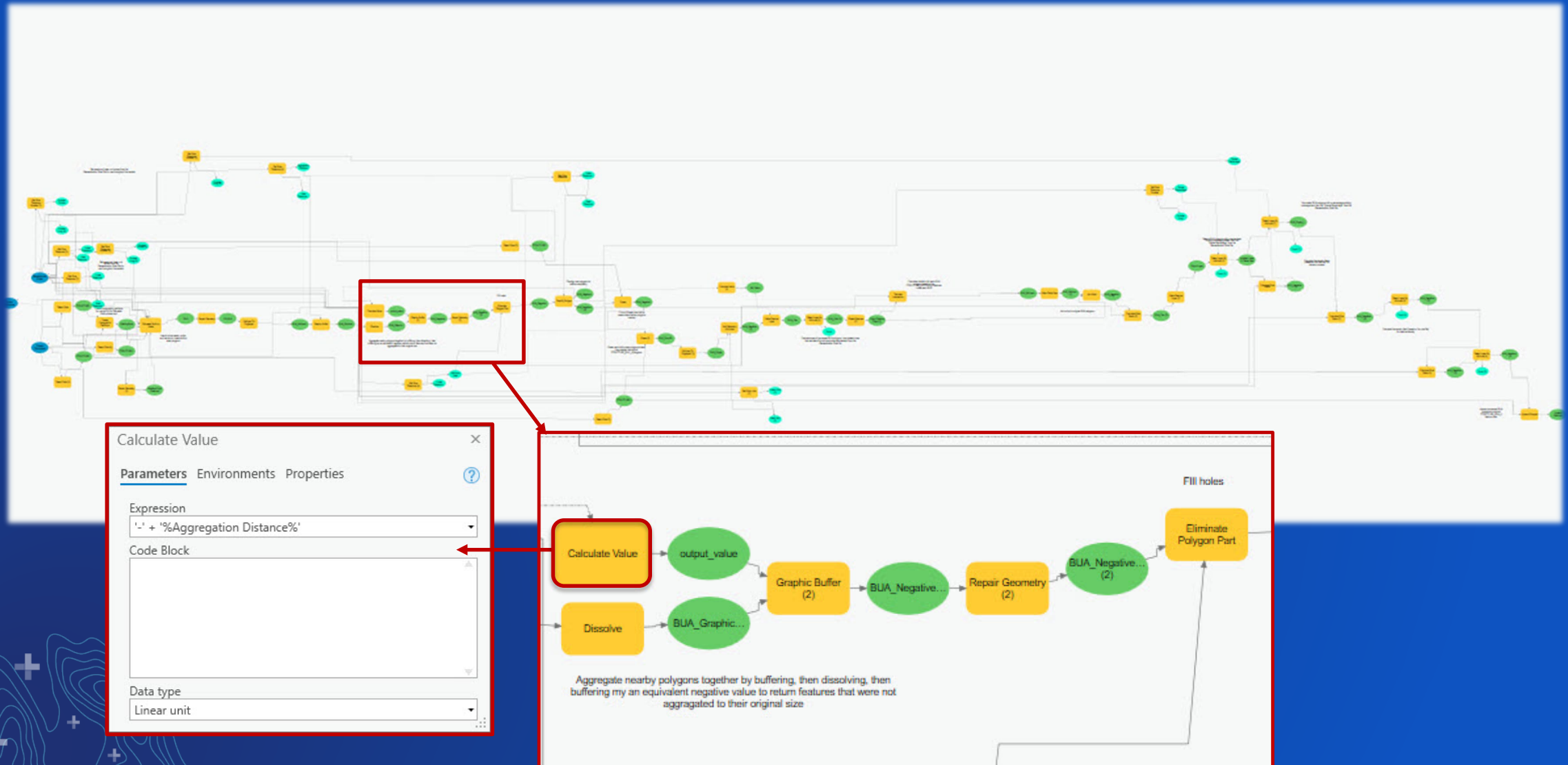
- Cartography Tools
 - Annotation
 - Cartographic Refinement
 - Generalization
 - Aggregate Points
 - Aggregate Polygons
 - Collapse Road Detail
 - Create Cartographic Partitions
 - Delineate Built-Up Areas**
 - Merge Divided Roads
 - Simplify Building
 - Simplify Line
 - Simplify Polygon
 - Simplify Shared Edges
 - Smooth Line
 - Smooth Polygon
 - Smooth Shared Edges
 - Thin Road Network
 - Graphic Conflicts
 - Map Series
 - Masking



...and Submodels



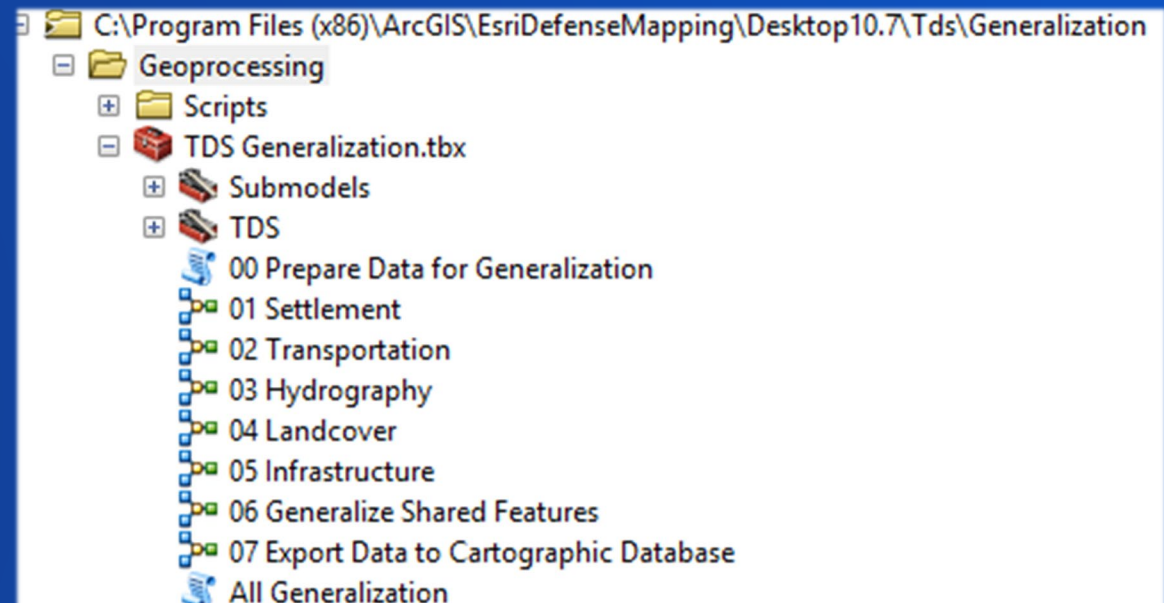
...and sometimes Python



ArcGIS 10.x - TDS Generalization in Esri Defense Mapping

50K to 250K Generalization of TDS 6.1 Data Schema

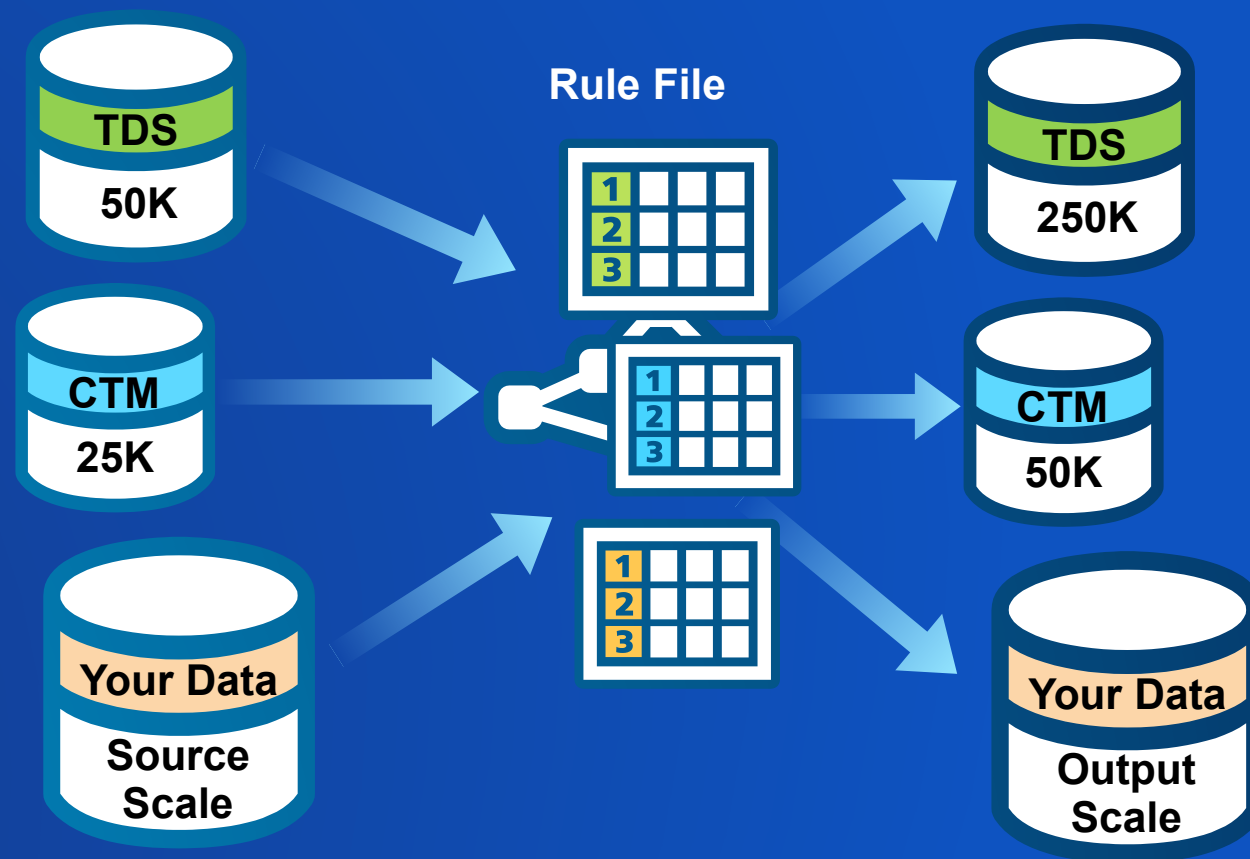
- Output Intended for 250K Product Creation
- Stand-alone toolbox with models and scripts



Generalization in Pro

Development Approach for Defense and Production Mapping

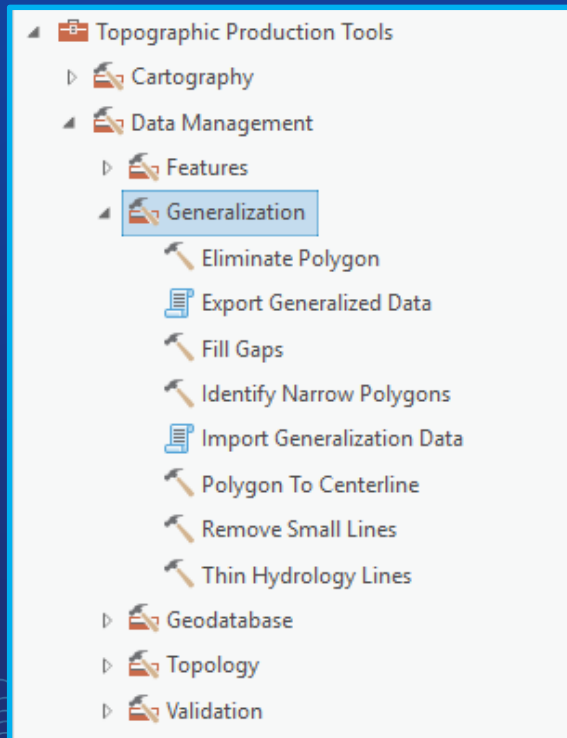
- One set of geoprocessing models
- Not dependent on data schema
- Not dependent on input or output scale



Defense Mapping and Production Mapping - Pro 2.4

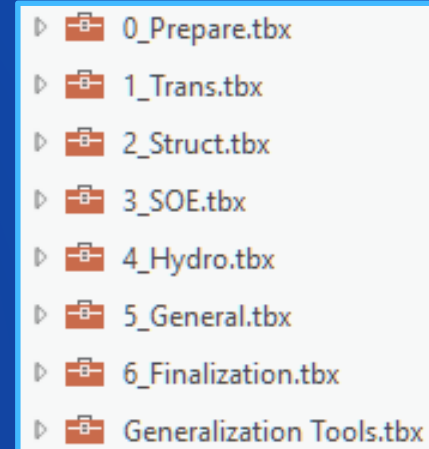
In the Box

Topographic Production GP Tools



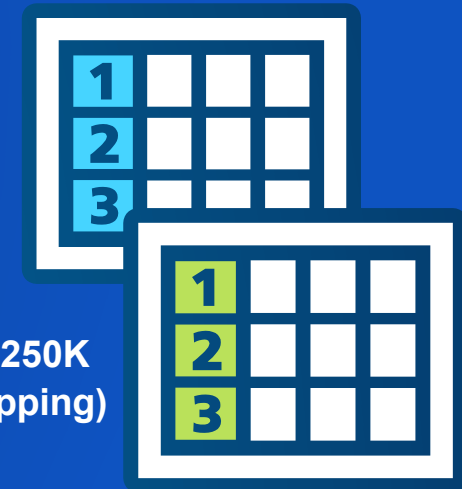
Included with Product Data Installers

Theme-Based Models

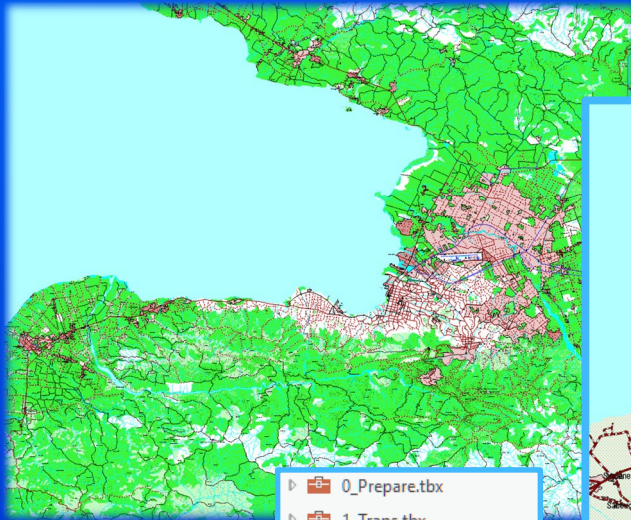


Generalization Rules

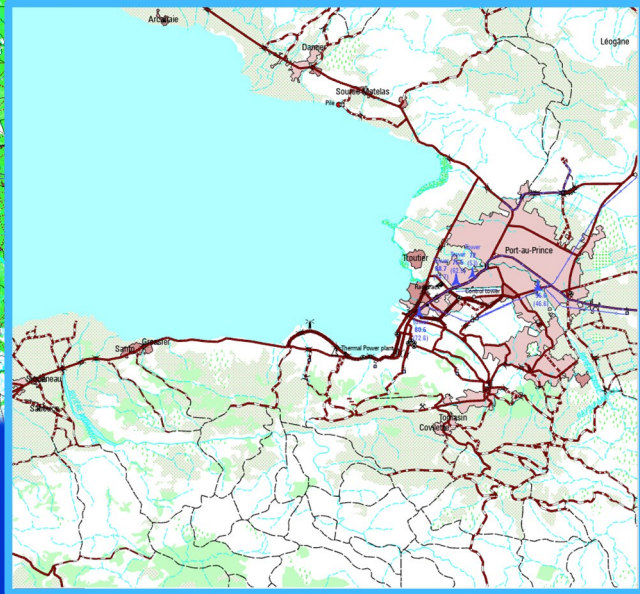
CTM 25K to 50K
(Production Mapping)



TDS 50K to 250K
(Defense Mapping)



- 0_Prepare.tbx
- 1_Trans.tbx
- 2_Struct.tbx
- 3_SOE.tbx
- 4_Hydro.tbx
- 5_General.tbx
- 6_Finalization.tbx
- Generalization Tools.tbx



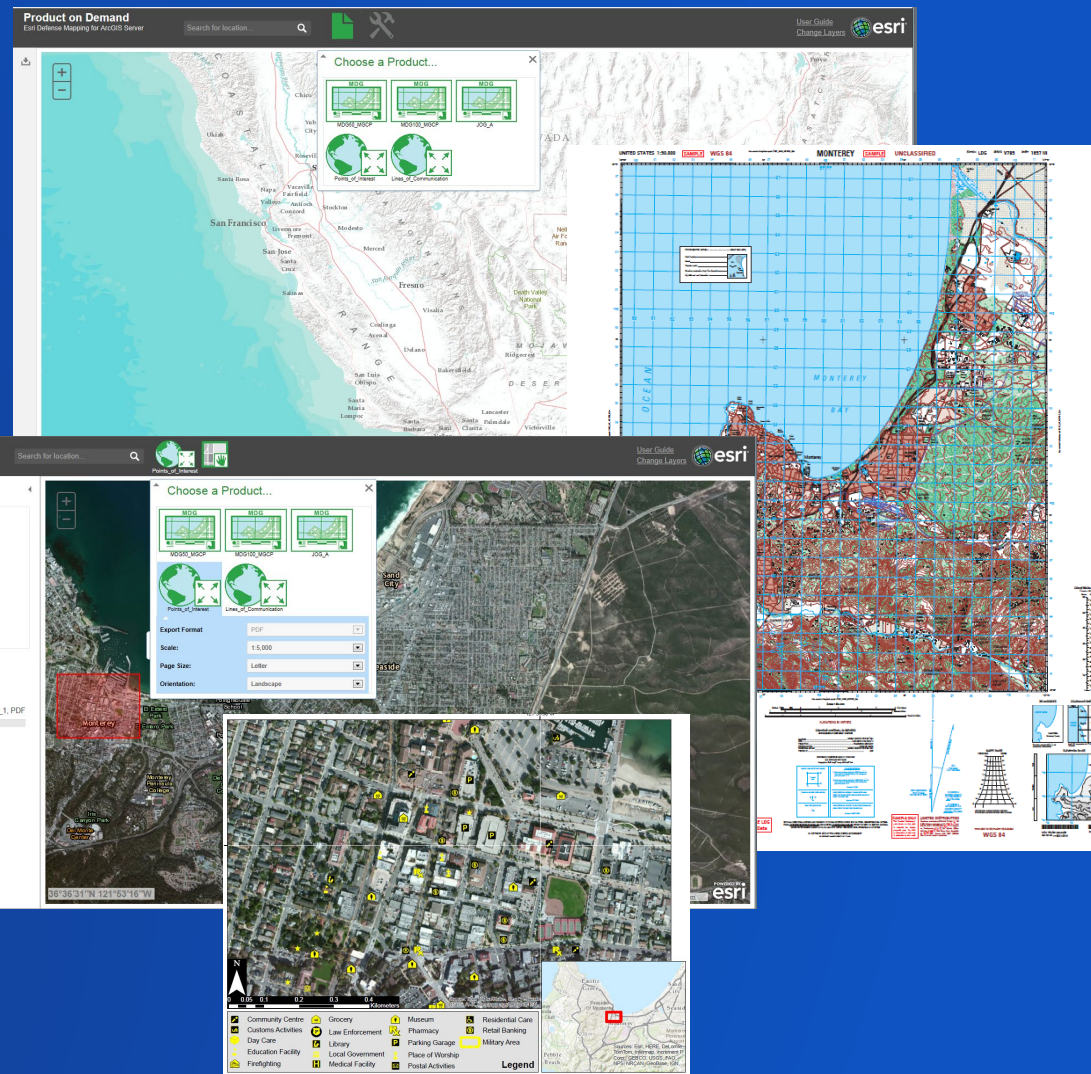
Generalization in ArcGIS Pro 2.4

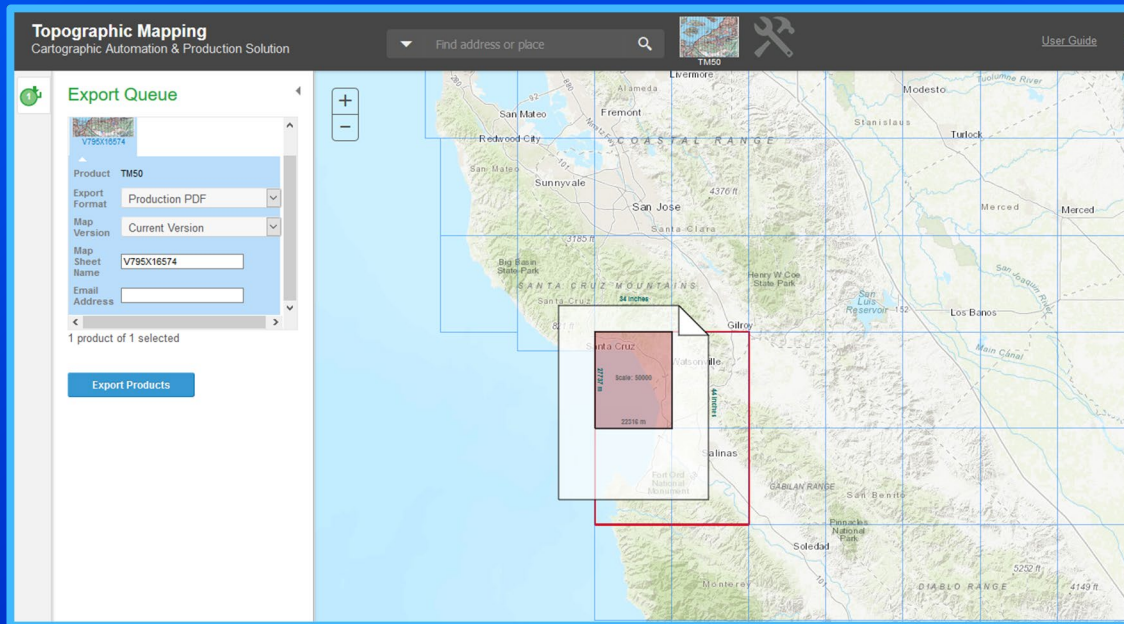
G.C. Rice

Topo Product On Demand (POD)

Esri Defense Mapping Web Application

- Installed with Esri Defense Mapping for Server
- Cartographic Production App
- Self-service
 - Defense Products
 - Civilian Products
 - Custom Products
 - Both Maps and Data





Product on Demand Application

G.C. Rice

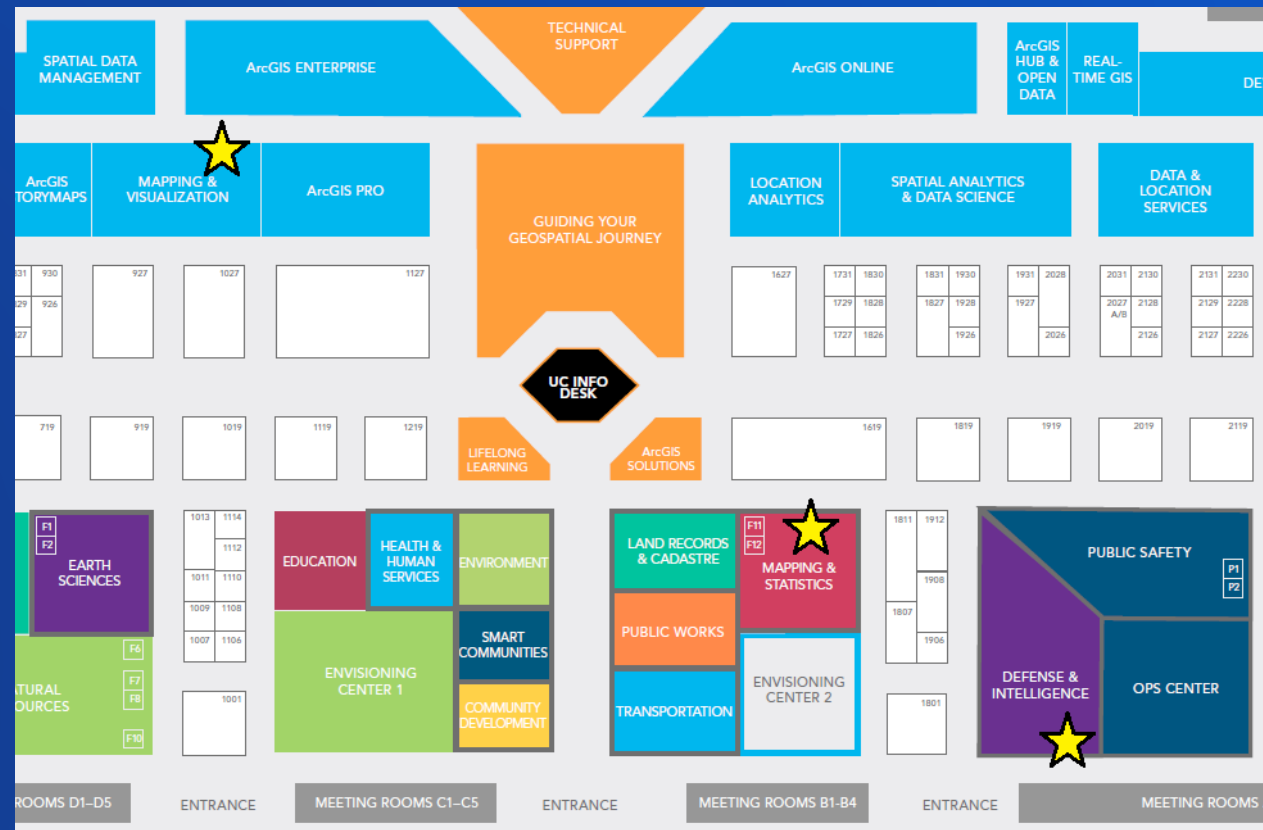
Additional Sessions

- **Esri Production Mapping: Advanced Cartography**

- Thursday @ 2:30 PM
- SDCC - Room 30 B

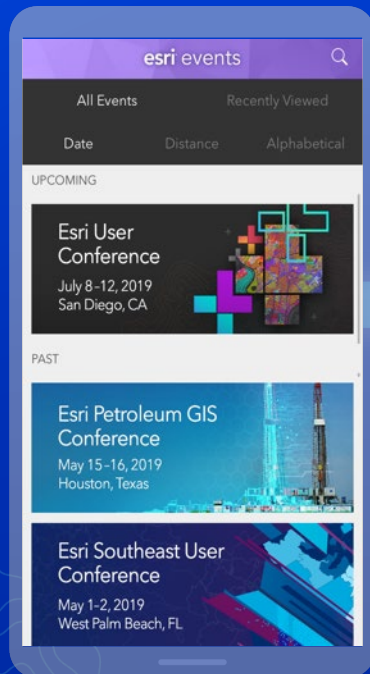
- **Showcase Locations**

- Mapping & Visualization
- Mapping & Statistics
- Defense & Intelligence

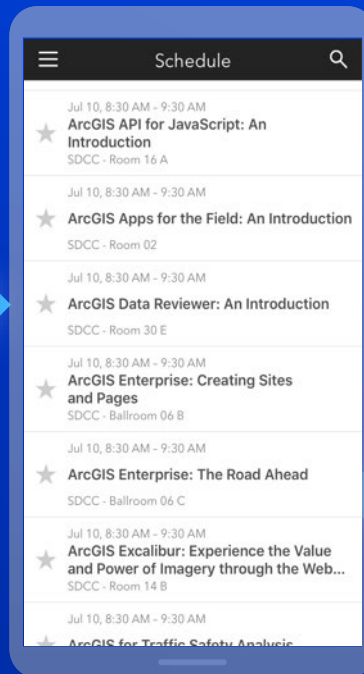


Please Share Your Feedback in the App

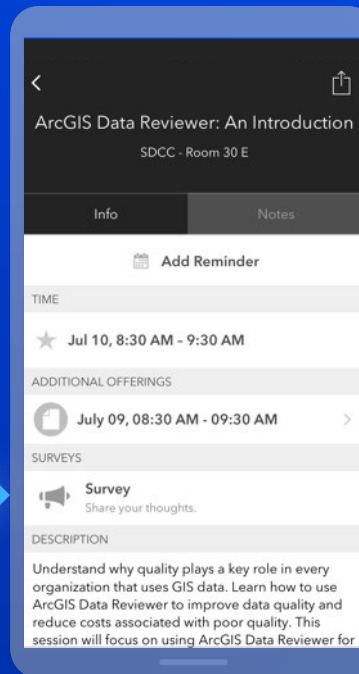
Download the Esri Events app and find your event



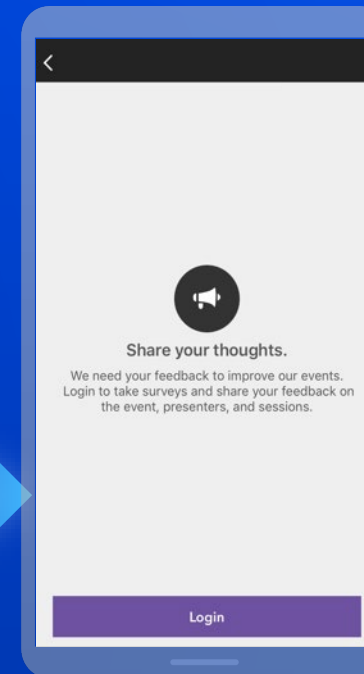
Select the session you attended



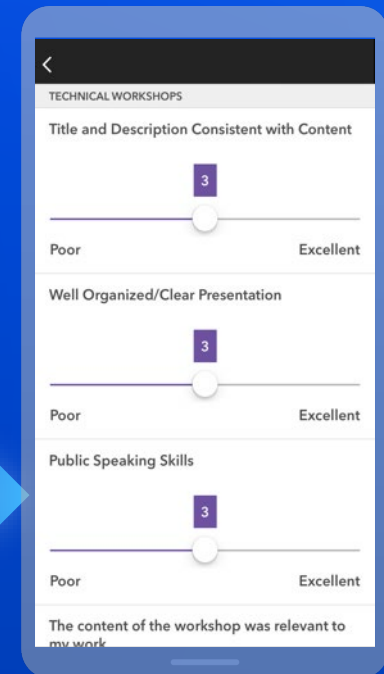
Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"





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