Developing Defense Applications using Military Analyst and MOLE

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Schedule

- 75 minute session
  - 60 – 65 minutes
    - Agenda next slide
  - 10 – 15 minutes Q & A following the lecture
- We will save and answer your questions at the end
- Cell phones and pagers
- Don’t Forget Session Surveys!

Please save your questions for the end of the presentation

Agenda

- Introductions
- Defense Solutions Quick Tour
  - Military Analyst
  - MOLE
- What's New at 9.3
  - Code Snippets
- Integration Scenarios
  - Demos
- Resources
- Q & A

Introductions

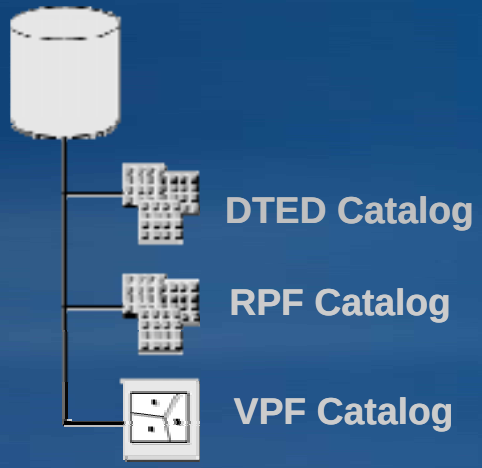
- Who are we?
  - Defense Solutions
- Who are you?
  - Defense/Intel Developers?
  - Non-Defense Developers?
  - New to Defense Solution Extensions?
  - Desktop?
  - Engine?
  - Server?
  - .NET?
  - Java?
  - Non-Windows (Linux/Unix)?

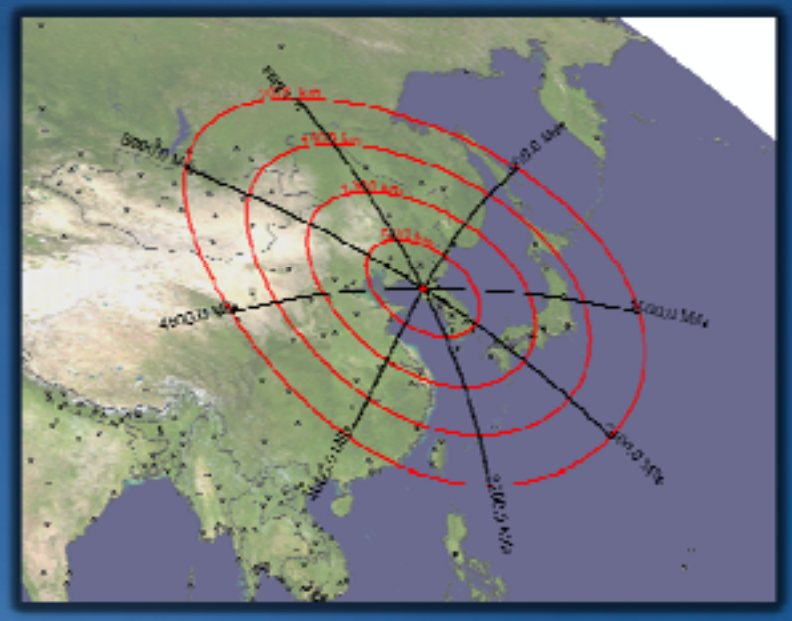
Military Analyst

ArcGIS Military Analyst

Overview

- Extends ArcGIS core functionality
- Data Management
- Military coordinate formats
- Geodetically accurate distances
- Terrain analysis
  - 2D and 3D
- Primary Users
  - Intelligence analysts
  - Geospatial analysts
  - SIGINT analysts
  - CJMTK Developers



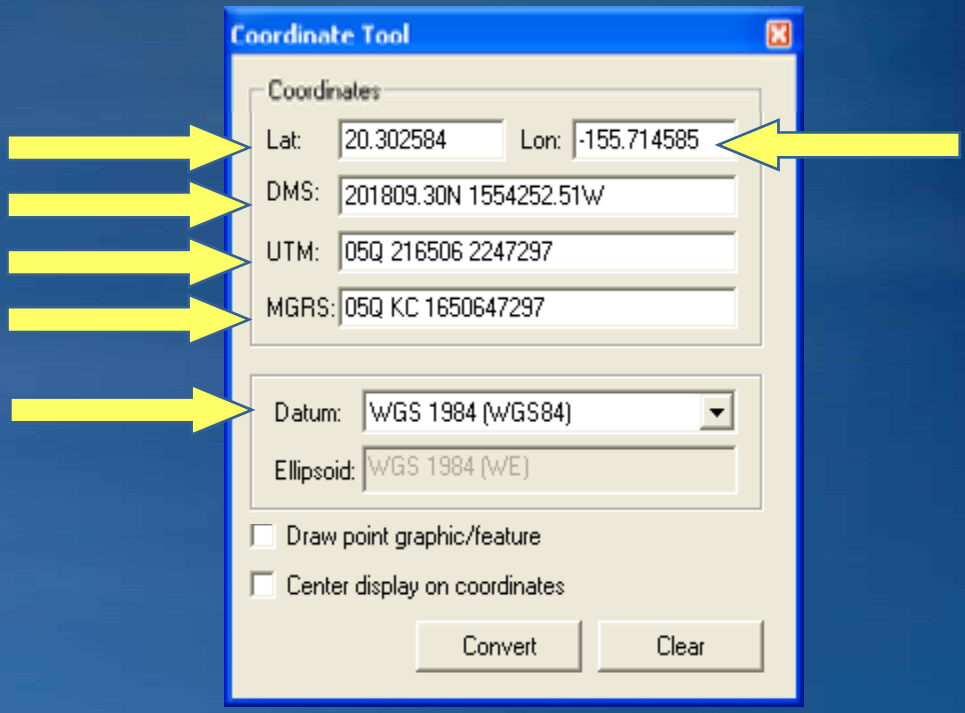


Military Analyst Overview

- Coordinate tool
  - Enhanced coordinate parsing
- Geodesy tools
  - Measure geodetically accurate distances
- Data management
  - Loading large MA catalogs
- Geoprocessing integration
  - Geometry Importers & Data Loaders
  - Data Converters, Viewsheds, and more!
- ArcGlobe integration
  - Interactive tracing for Fly Through
- API (Application Programming Interface)

Coordinate Tool

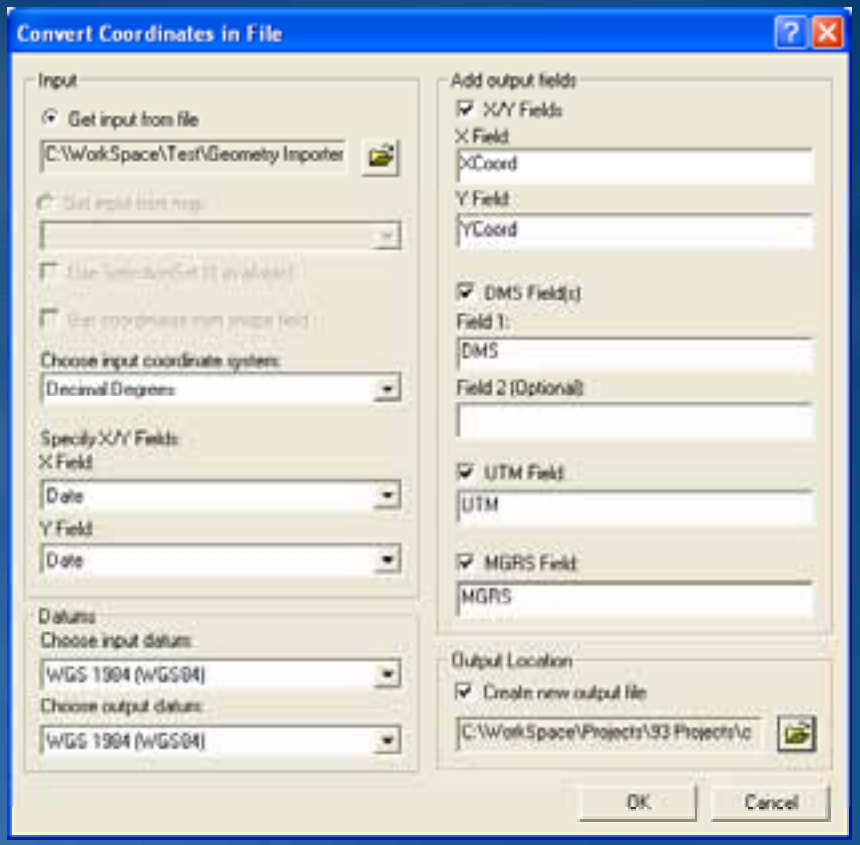
- Convert between DD, DMS, UTM and MGRS
- Draw point on screen and center on coordinates
- Integrated into geodesy and terrain tools
- DMS coordinate parsing with N/S/E/W and +/- hemisphere indicators and coordinate delimiters as space or “/”
- At 9.3, it incorporates a new model based on ArcGIS coordinate systems. (Formerly based on GeoTrans).



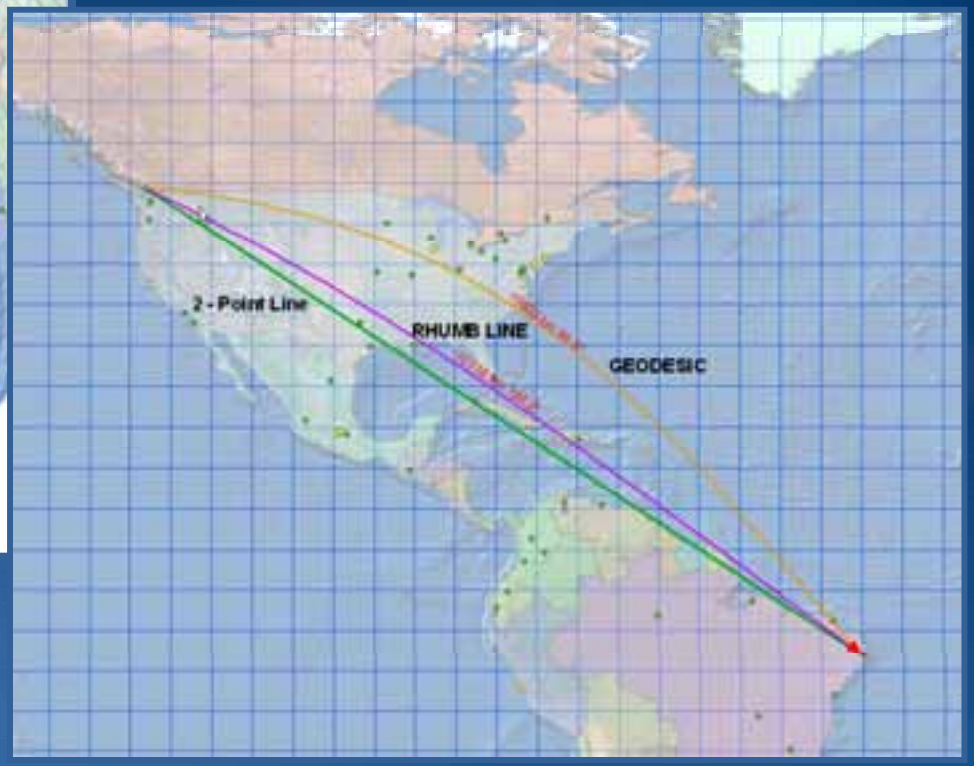
Other Coordinate Tools

Convert Coordinates in File

- **Batch coordinate conversion based on Coordinate Tool**
- **Input can be table or point feature class**
  - **Support for tables in *.XLS, *.txt, *.cvs**
- **Converts between DD, DMS, UTM and MGRS**
- **Option to output to *.DBF, Personal, File or ArcSDE Tables**
- **Convert Coordinates In File for Geoprocessing**



What are Geodesy Lines?

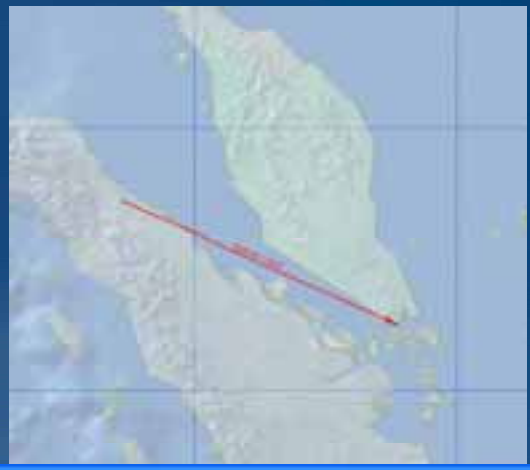


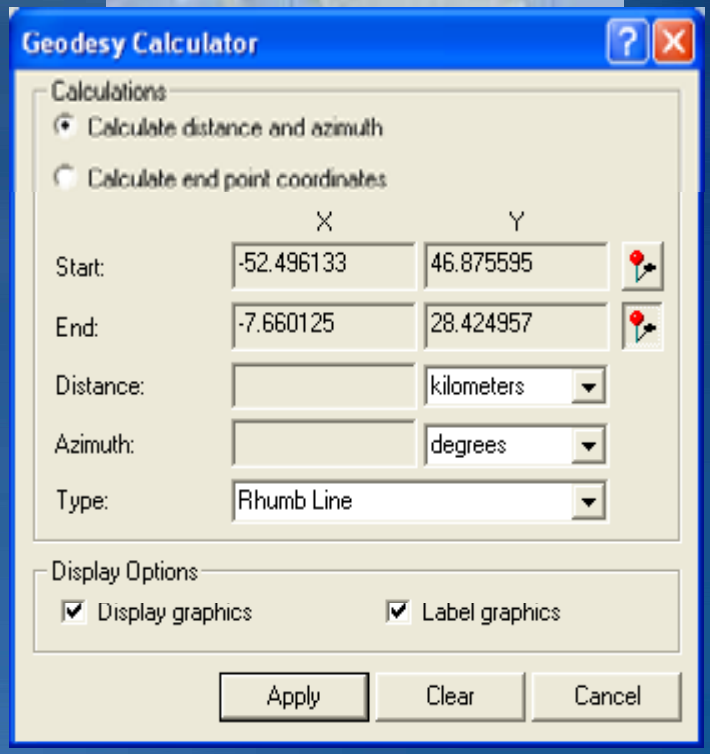
- Spatially accurate and geodetically correct in any projection
- Geodesy Lines
  - Geodesic: shortest distance between 2 points on a spheroid
  - Great Circle: shortest distance between 2 points on a sphere
  - Rhumb Line: line of constant azimuth (straight line in Mercator)

Geodesy Tools

Geodesy Calculator

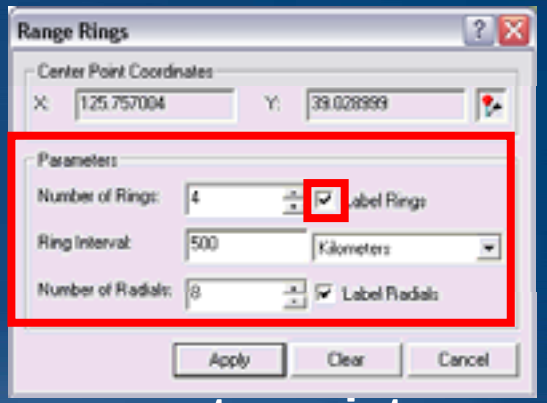
- **Geodesic, Great Circle or Rhumb Line graphic and labels**
- **Finds bearing and distance between two points**
- **Finds end point using start point, bearing and distance**
- **Graphics update as Data Frame coordinate system changes**



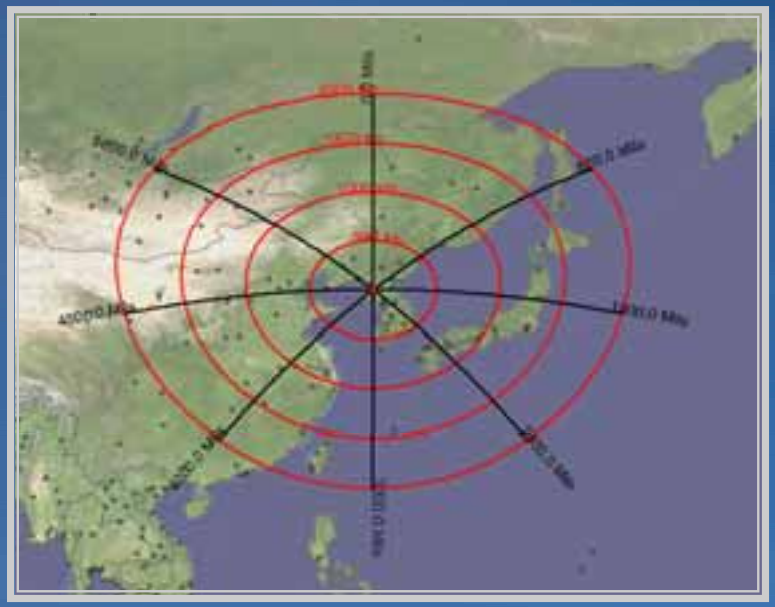


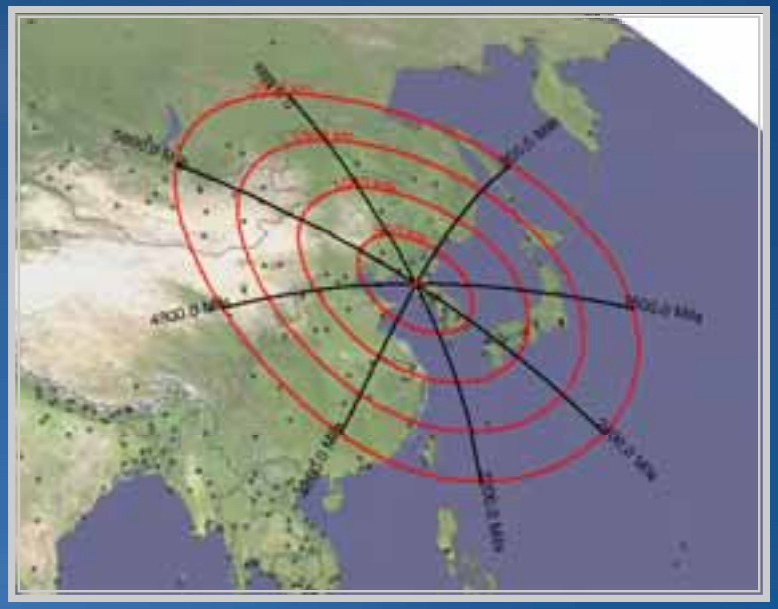
Geodesy Tools

Range Rings Tool



- **Projected ellipse Graphics**
- **Uses: determine aircraft ranges, weapons systems ranges.**
- **Concentric rings based on a specified distance from a center point**
- **Enter an observer point (CT), number of rings, distance between the rings, and number of radials**
- **Graphics update as coordinate system changes for data frame**

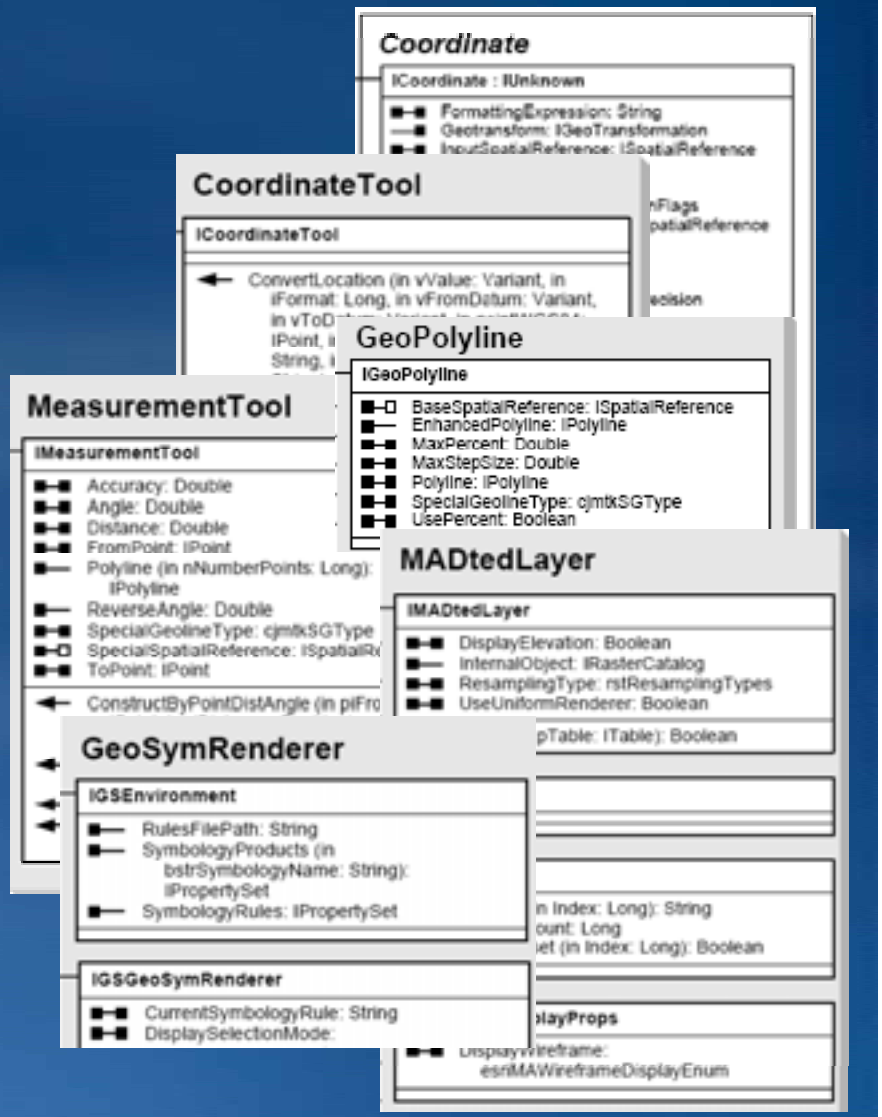




Military Analyst

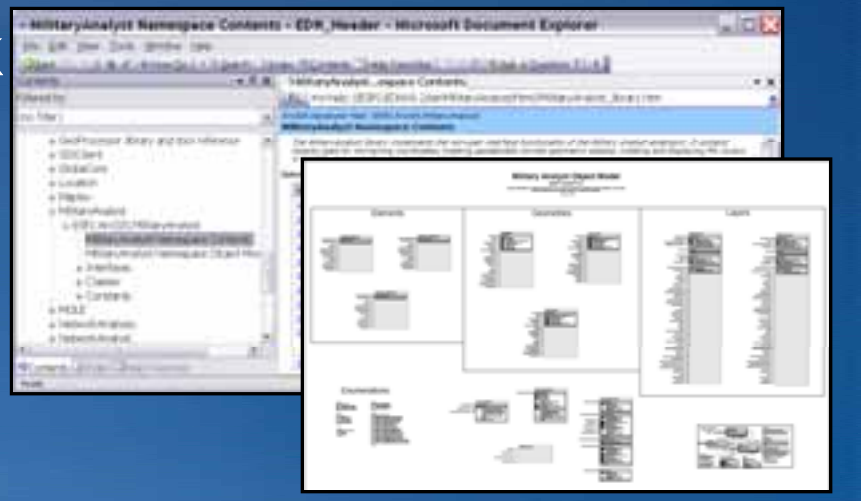
Development Overview

- API for Military Analyst
- Military Analyst Library
  - Coordinate tool
  - Geodesy
  - MALayers
  - GeoSym
- Samples available in
  - COM, .Net, Java, and Cross Platform C++
- Geoprocessing Environment



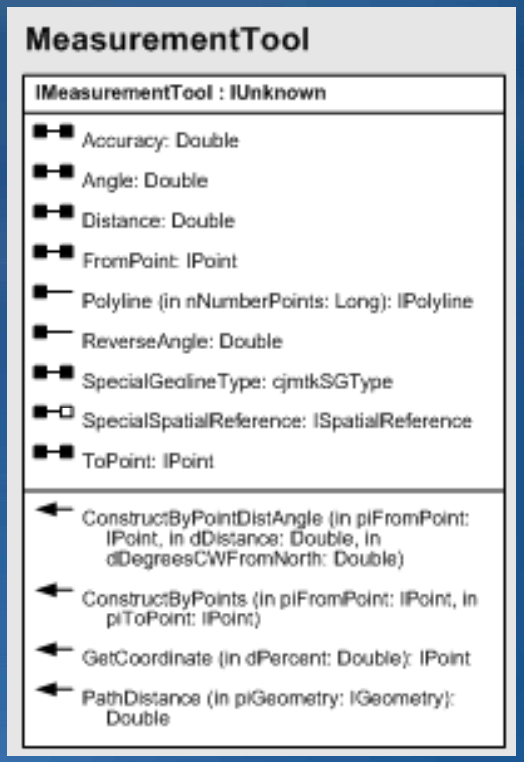
Military Analyst
Developer API Components

- API
  - Coordinate tool, Geodesy, MA Layers
  - No UI components (Terrain Analysis, Globe, conversion tools)
  - Supported on:
    - Desktop, Engine
    - Windows, Solaris, Linux
    - Java, .NET, VC++, Motif, GTK, VB, VBA
- SDK
  - Samples Integrate with core SDK
    - Java – Windows and Solaris
    - VB/VBA, .NET, VC++ - Windows
  - Component help
  - OMD
  - EDN



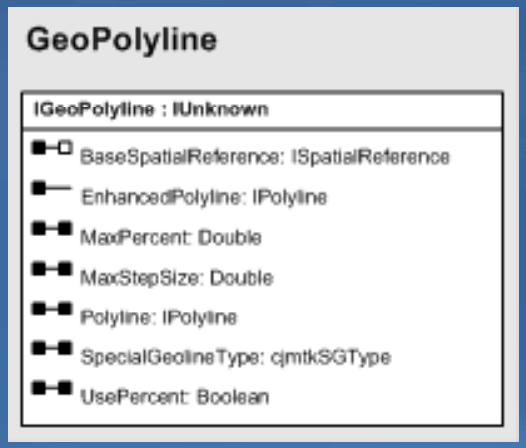
Military Analyst
Geodesy API

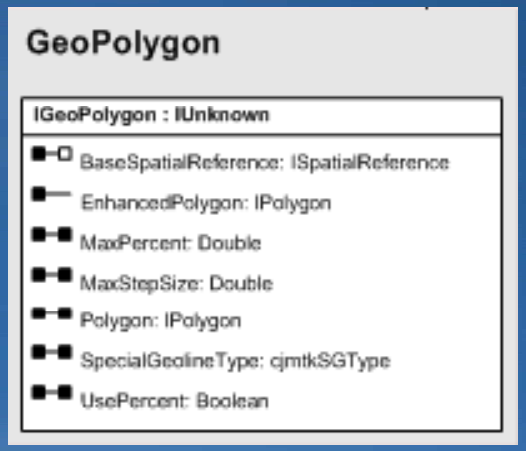
- **Measurement Tool**
  - Calculate distance and azimuth of GeoPolyline types
  - Geodesic, Great Circle, Rhumb Line
  - Engine behind Geodesy Calculator

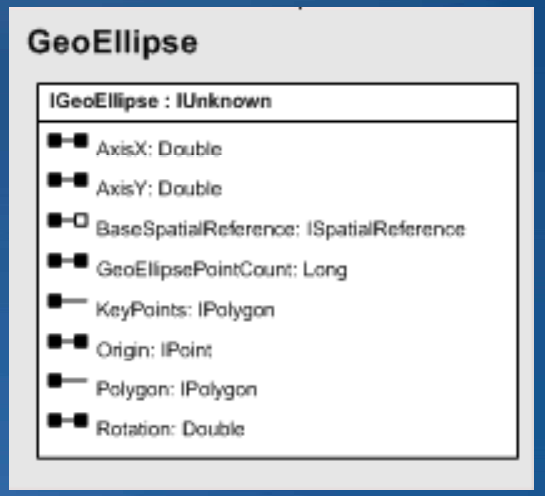


Military Analyst
Geodesy API

- **Graphic Elements**
  - Special graphic element representations of Geo-geometries
  - No geodesic geometry type
- **Geometries**
  - GeoPolyline, GeoPolygon, GeoEllipse
  - Spheroid-aware representations of standard ArcObjects geometry types





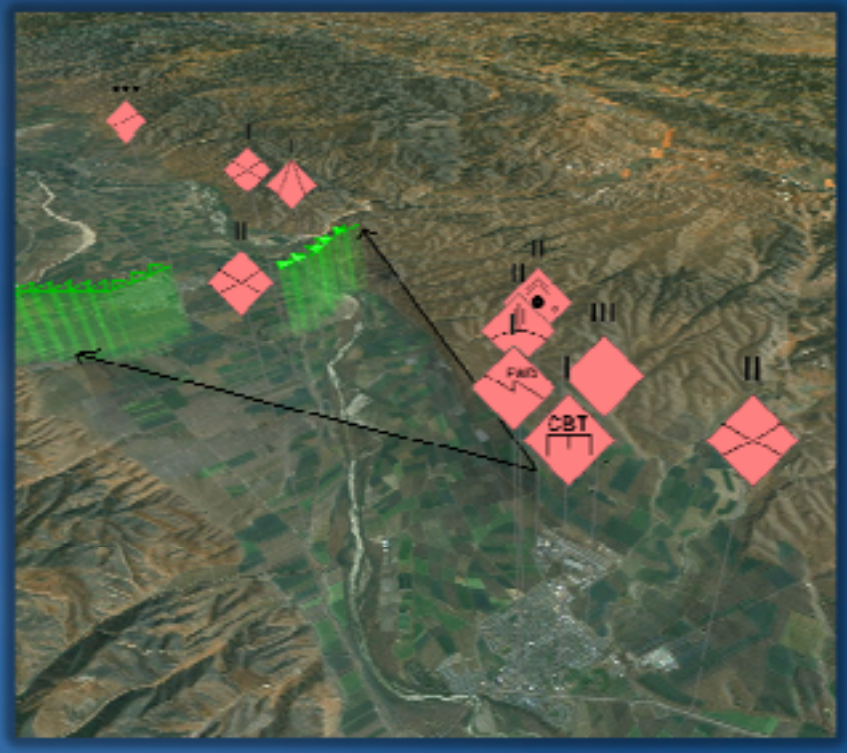


MOLE
(Military Overlay Editor)

Military Overlay Editor (MOLE)

Overview

- Extends ArcGIS core functionality by adding support for creating and managing standard Military Overlays
  - DoD MIL-STD-2525B
  - NATO APP6A
- Military Symbology
  - Force Elements
  - Tactical Graphics
  - 15 Character SID Code
- Primary Users
  - CJMTK Developers
  - SIGINT Analyst
  - Intel Analyst



Military Symbology

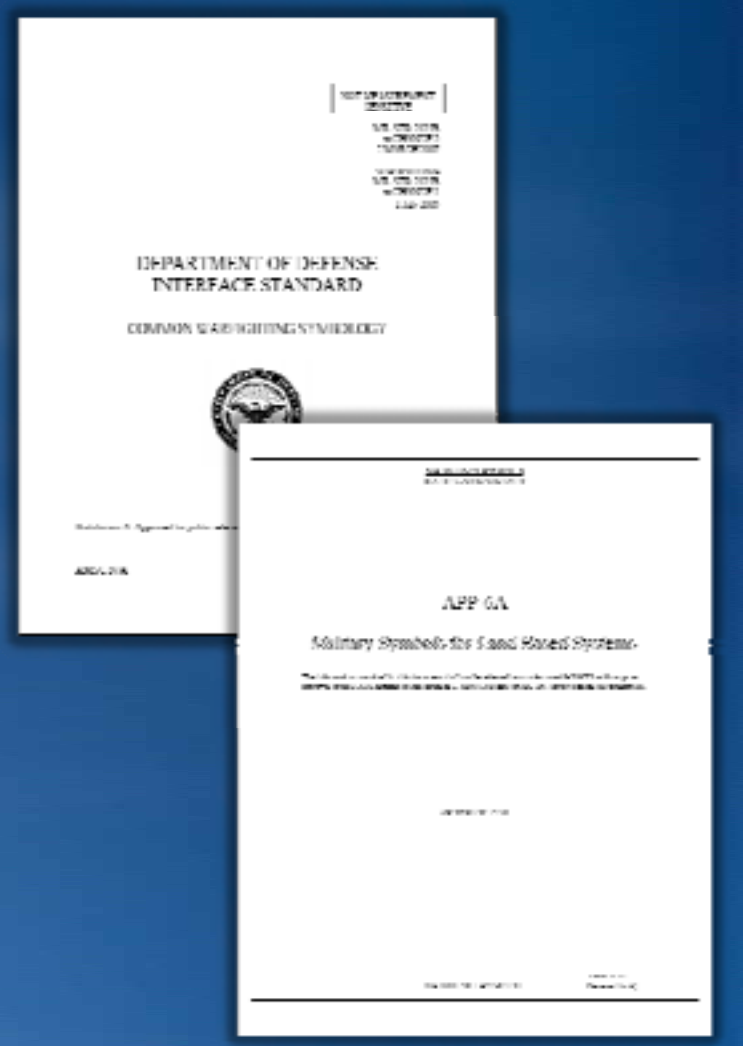
MOLE Supported Standards

MIL-STD-2525B w/ CHANGE 2

- DOD standard
- Guidelines for unit, equipment, function
- Criteria for modern battlefield scenario

APP6A

- NATO standard
- Joint manual with 2525B
- Same logic and structure

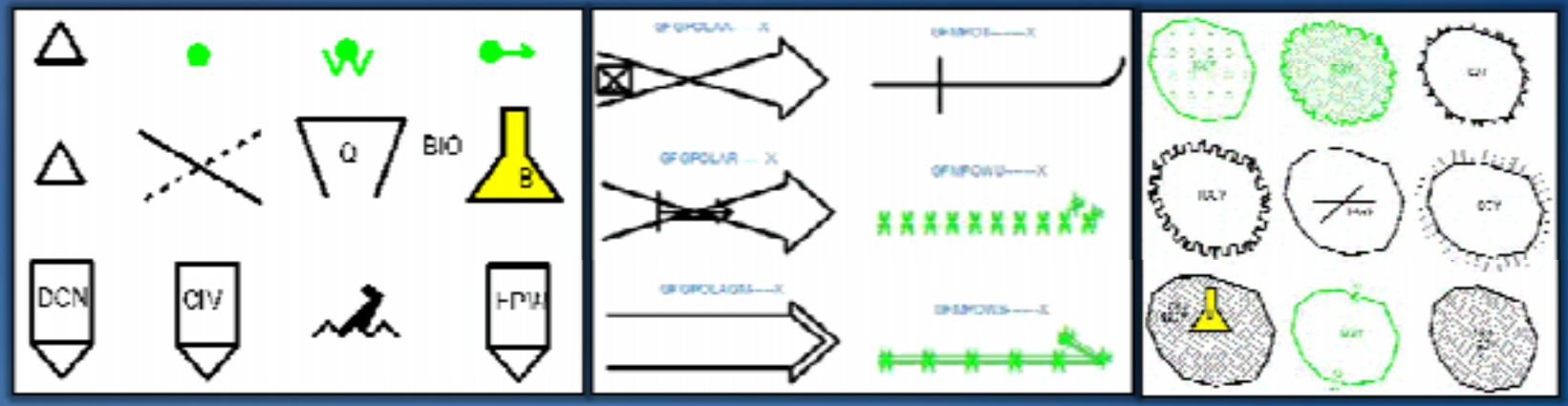


Military Symbology

Force Elements and Tactical Graphics

- **Force Elements**
  - **Units, Equipment, and Installations**
  - **SIGINT**
  - **MOOTW**

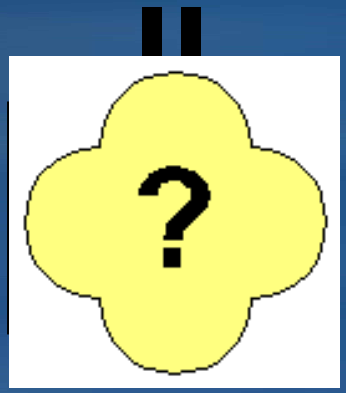
- **Tactical Graphics**
  - **Military Operations**
  - **METOC**



Military Symbology

Symbol ID Code

- Coding Scheme
- Affiliation
- Battle Dimension
- Status
- Function ID
- Type
- Echelon/Mobility
- Country Code
- Order of Battle

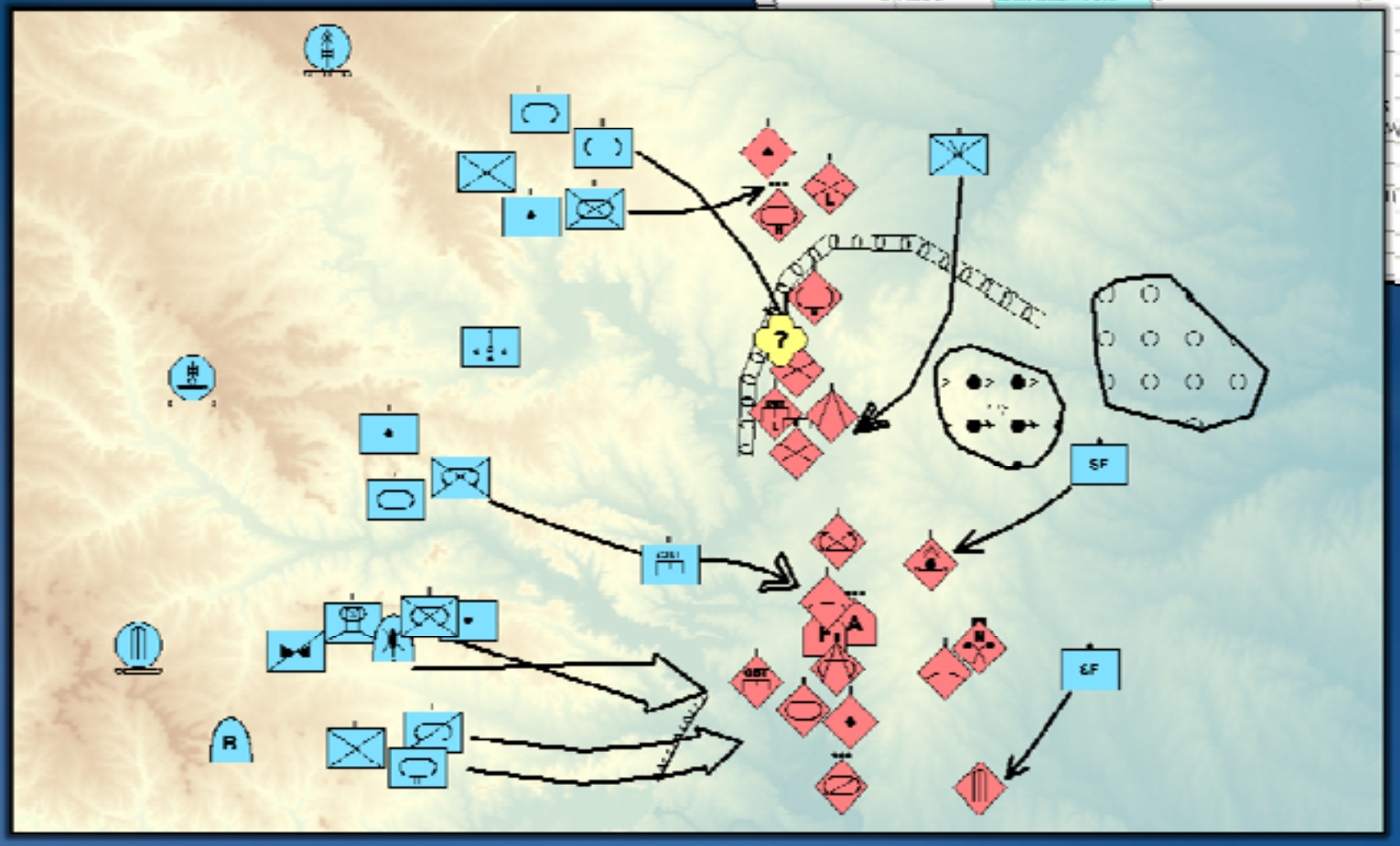


Mechanized Infantry - Battalion

Military Symbology

MOLE Layer Construction

OBJECTID *	Shape *	Symbol_ID	Name	
1	Point Z	OHOPM-------JZ-	80N	
2	Point Z	OHVPS----------	AS897	
3	Point Z	OHPG-------A---	765	
4	Point Z	SHGPUCA----FIRG	CBP	15
5	Point Z	SHGPUCIZ---FIRG	1	3
6	Point Z	SHGPUCIZ---FIRG	2	3

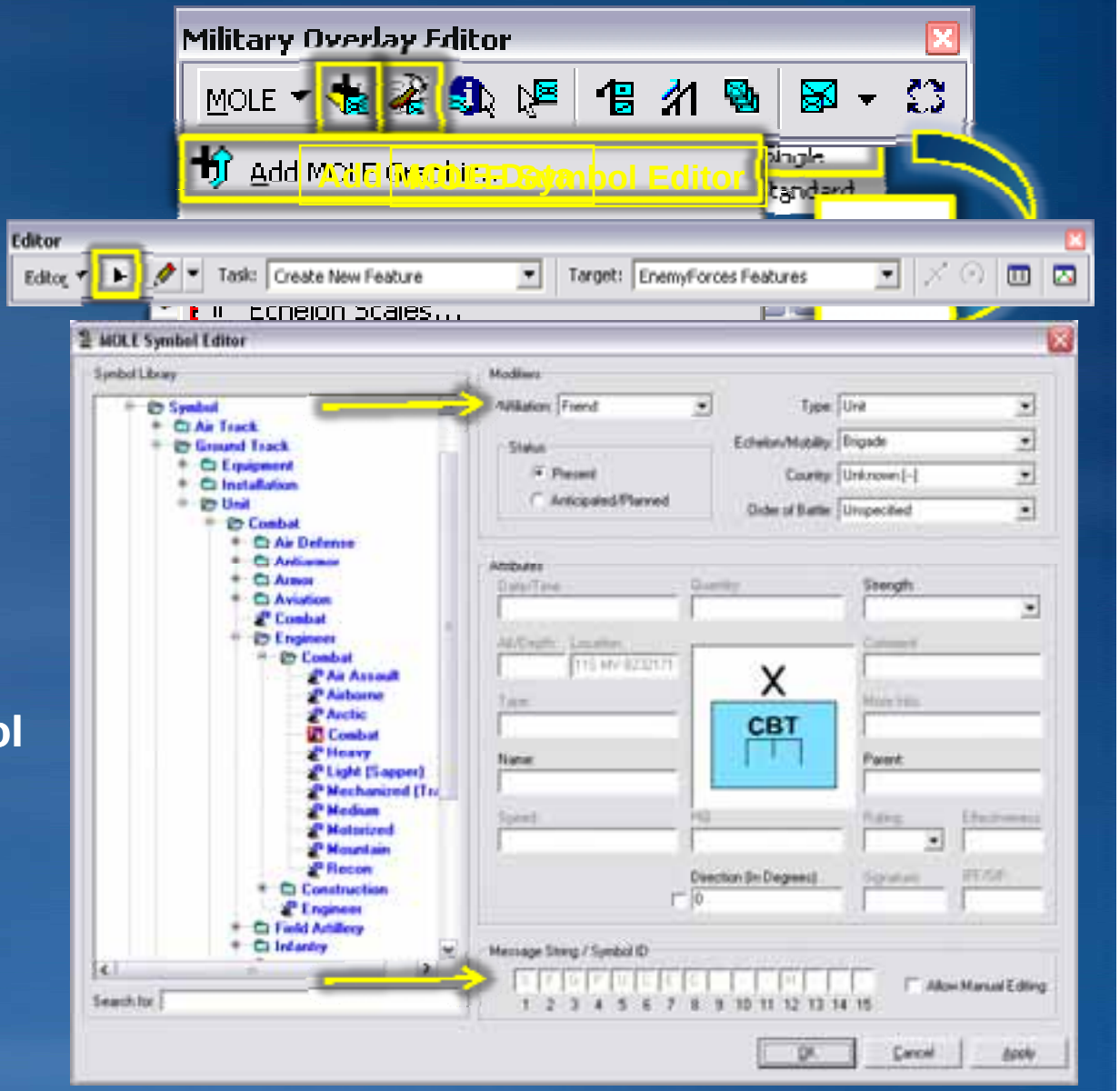


Feature Layer + 15 Char Symbol ID = MOLE Symbol Layer

Military Symbology

Create and Display MOLE Data in Desktop

- Add MOLE data
- Display MOLE Data
  - Group Layer
    - Feature Layer
    - Graphics Layer
- Create MOLE data
  - MOLE Symbol Editor
  - Add MOLE Graphic tool
- Add MOLE Fields
  - GP tools
  - Attribute table



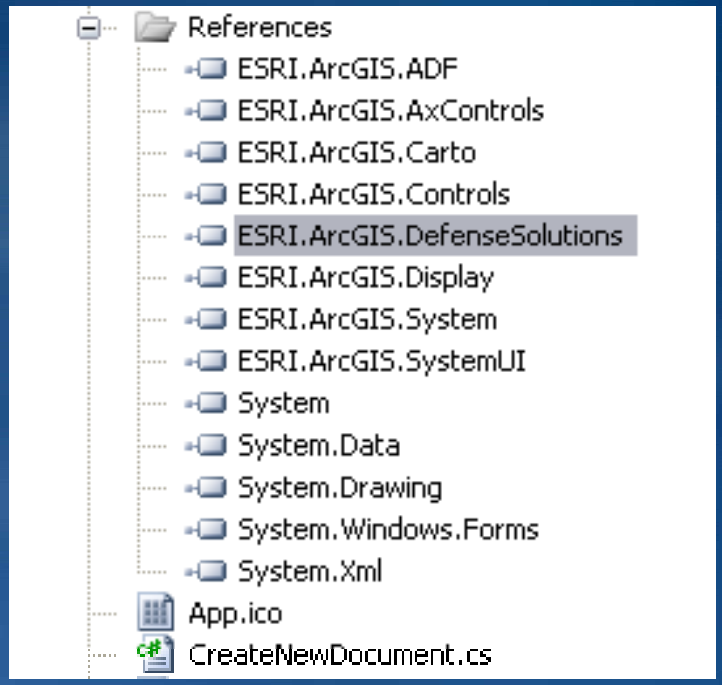
Defense Solutions – What's New at 9.3?

New at 9.3

- 9.3 combines the best of classic Defense Solutions along w/ numerous new APIs & tools
- Military Analyst
  - Improved NGA data, geodesy & terrain analysis tools
  - Coordinate Tool
  - Coordinate Conversion API
- MOLE
  - MIL-STD 2525B (Change 2) & NATO APP-6A Symbology
  - MOLE Symbols API
- Defense Solutions
  - EDN Samples for using on ArcGIS Server

Migration from 9.2 to 9.3

- 9.2: MA & MOLE
  - Separate libraries:
  - MilitaryAnalyst
  - MOLE
- 9.3: Defense Solutions
  - Single library:
  - DefenseSolutions
- Migration document available in ArcGIS 9.3



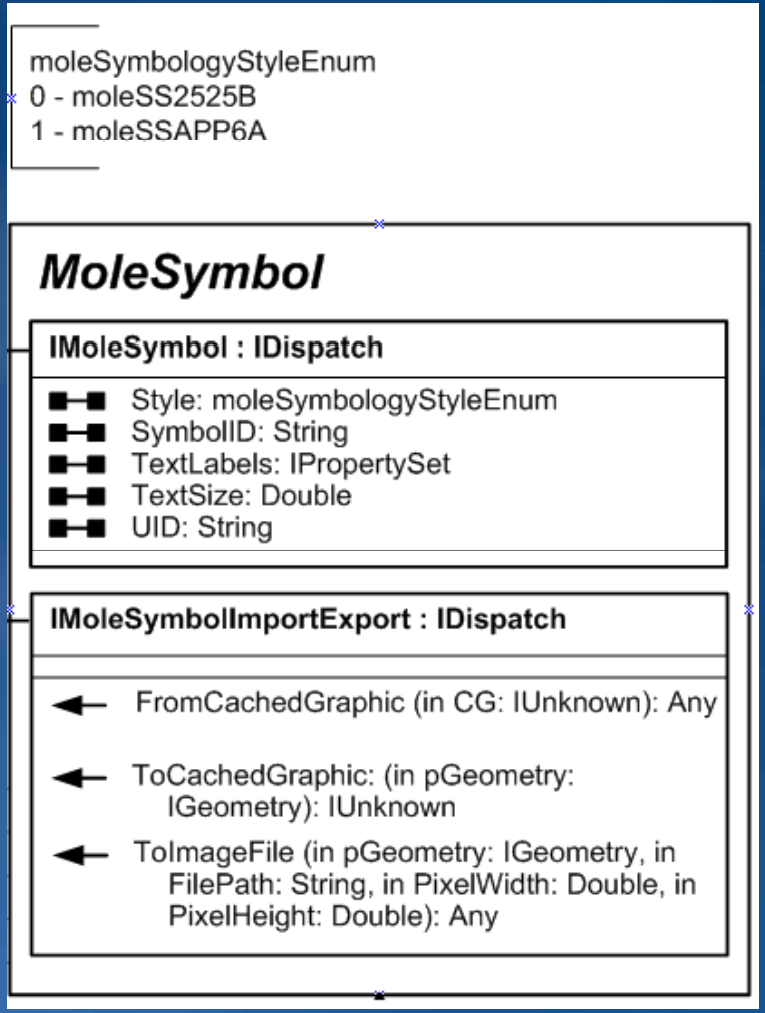
DefenseSolutions assembly reference in Visual Studio

New MOLE Approach:

MOLE Marker Symbols - New for 9.3

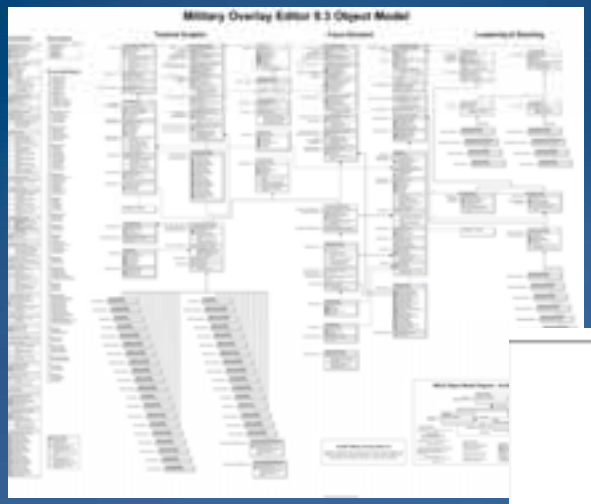
- **When to use?**
  - Don't need the many display customizations of full MOLE API
  - Don't want to use feature class
  - Only need MOLE functionality

- **Approach**
  - Carto/Display ISymbol
  - Use IMoleSymbol to set MOLE-specific properties
  - Use ISymbol to attach to MarkerElements, etc.

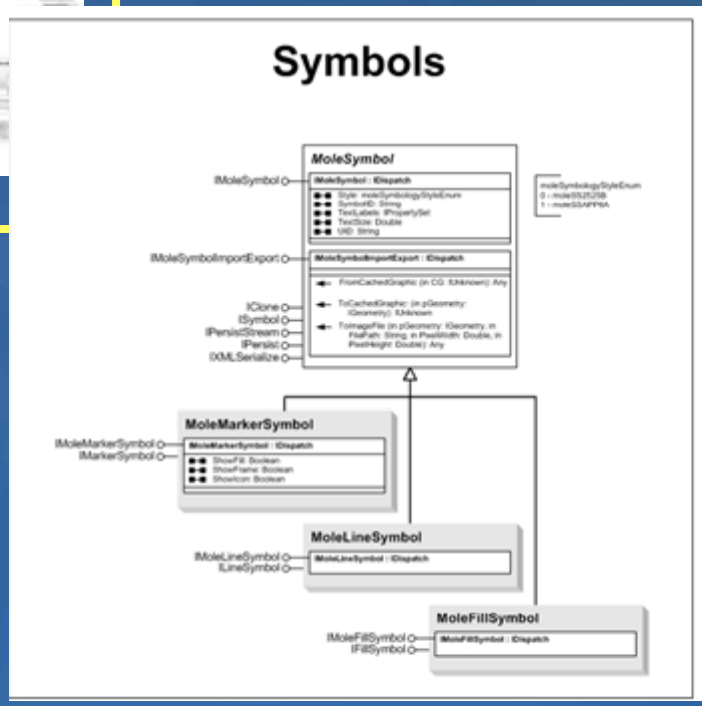


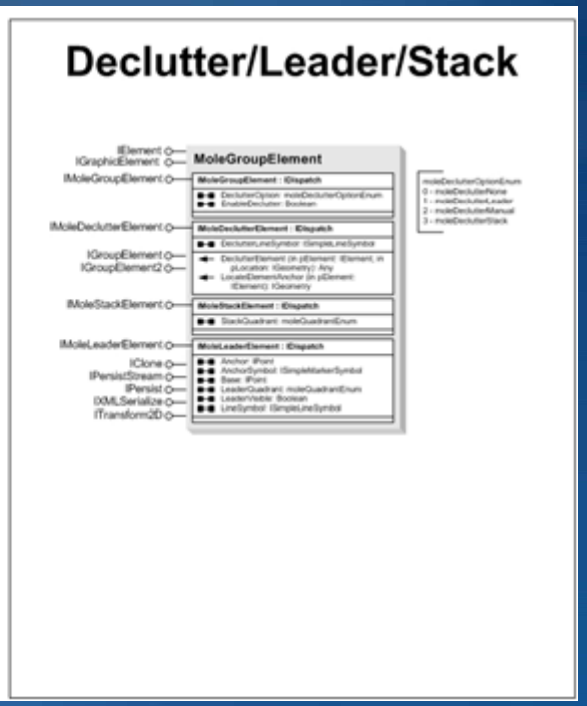
New MOLE Approach:

Marker Symbols (MOLE ISymbols)



How does it work?





- **MoleMarkerSymbol**
- **MoleLineSymbol**
- **MoleFillSymbol**
- **MoleGroupElement**

MOLE Marker Symbols Snippet

"MOLE in 6 Lines or Less"

- **Use IMoleSymbol to draw MOLE symbology in ArcMap**
  - **Tools > VB Editor**
  - **Run macro – specified MOLE symbol is drawn in the display**

```
Dim MoleMarker As IMoleSymbol
Set MoleMarker = New MoleMarkerSymbol
MoleMarker.SymbolID = "SUGPUCATL--DUSG"
Dim markerSymbol As IMarkerSymbol
Set markerSymbol = MoleMarker
markerSymbol.size = 64

Dim element As IMarkerElement
Set element = New MarkerElement
element.Symbol = MoleMarker
Set element2.Geometry = point ' point = X, Y

ActiveView.GraphicsContainer.AddElement element, 0
```

Python Tools

Overview

- At 9.3 Defense Solutions exposes numerous Geoprocessing (GP) tools as Python scripts
  - \ArcGIS\ArcToolBox\Scripts
- For example, Terrain Analysis Geoprocessing tools in Military Analyst 9.3
  - Linear Line of Sight, Linear Line of Sight from Features
  - Radial Line of Sight
  - Highest / Lowest Point by Extent, Highest / Lowest Point by Polygon
- Many others
  - Import Coordinates, etc.
- Python scripts can also easily be generated by exporting from ModelBuilder

Python Tools

MA Geoprocessing Tools

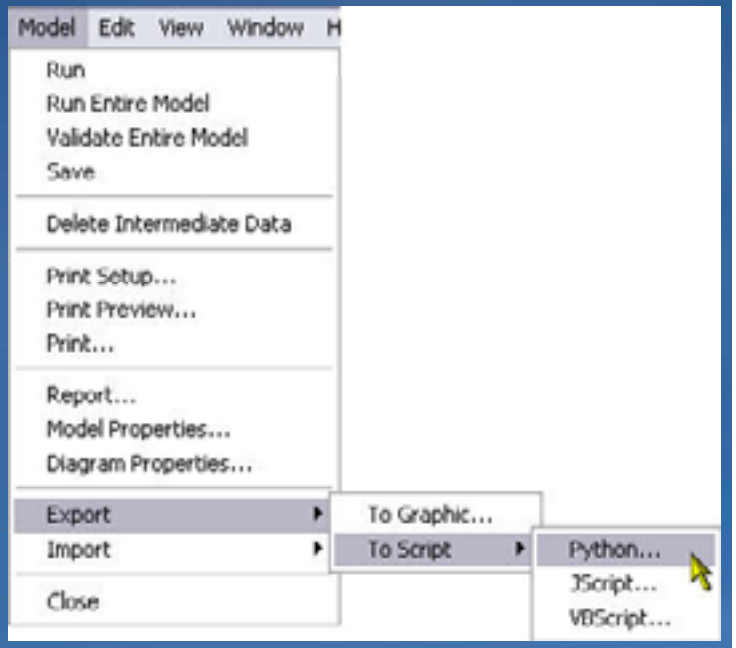
- **Sample Geoprocessing Python script**

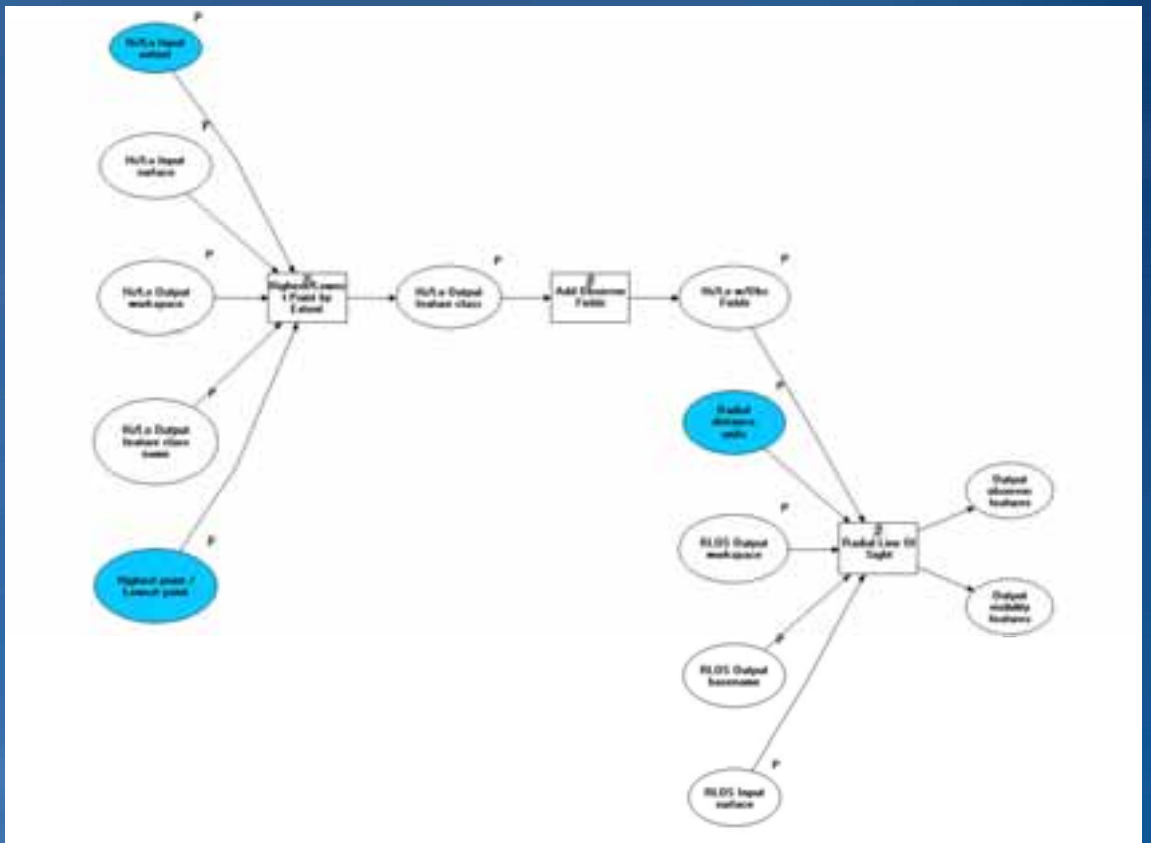
```
# Process: Highest/Lowest Point by Extent...
gp.HiLoByExtent_ma(Hi_Lo_Input_surface, Hi_Lo_Input_extent,
  Hi_Lo_Output_workspace, Hi_Lo_Output_feature_class_name,
  Highest_point___Lowest_point)

# Process: Add Observer Fields...
gp.AddObserverFields_ma(Hi_Lo_Output_feature_class)

# Process: Radial Line Of Sight...
gp.RadialLineOfSight_ma(Hi_Lo_w_Obs_Fields, RLOS_Input_surface,
  RLOS_Output_workspace, RLOS_Output_basename,
  Radial_distance_units)
```

Python Tools

MA Geoprocessing Tools

- **Use tools directly from ModelBuilder –or–**
- **Python scripts can easily be generated by exporting from ModelBuilder**

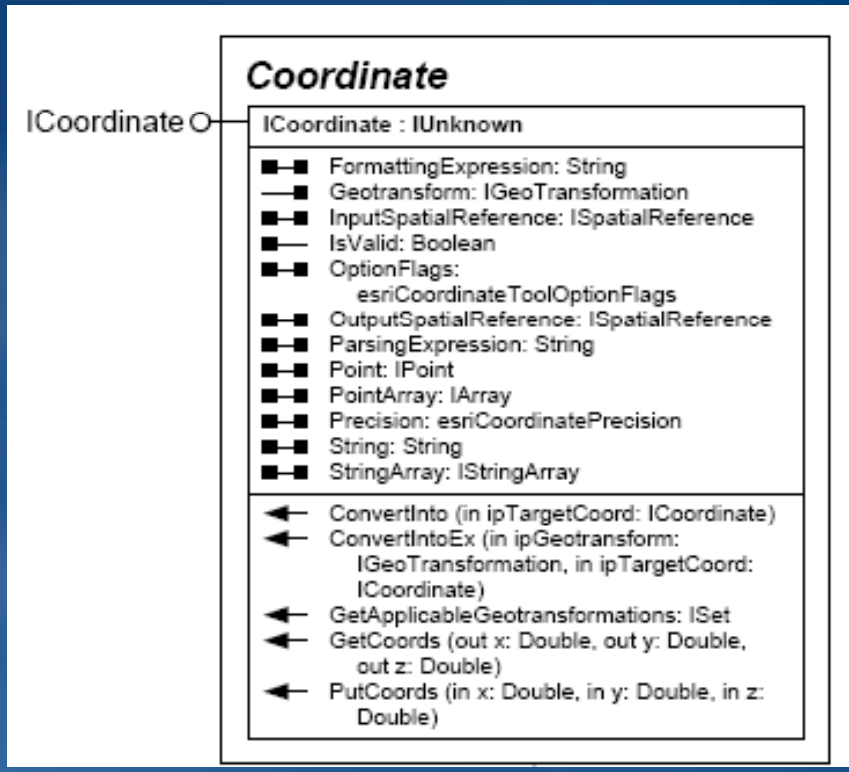




Coordinate Conversion API

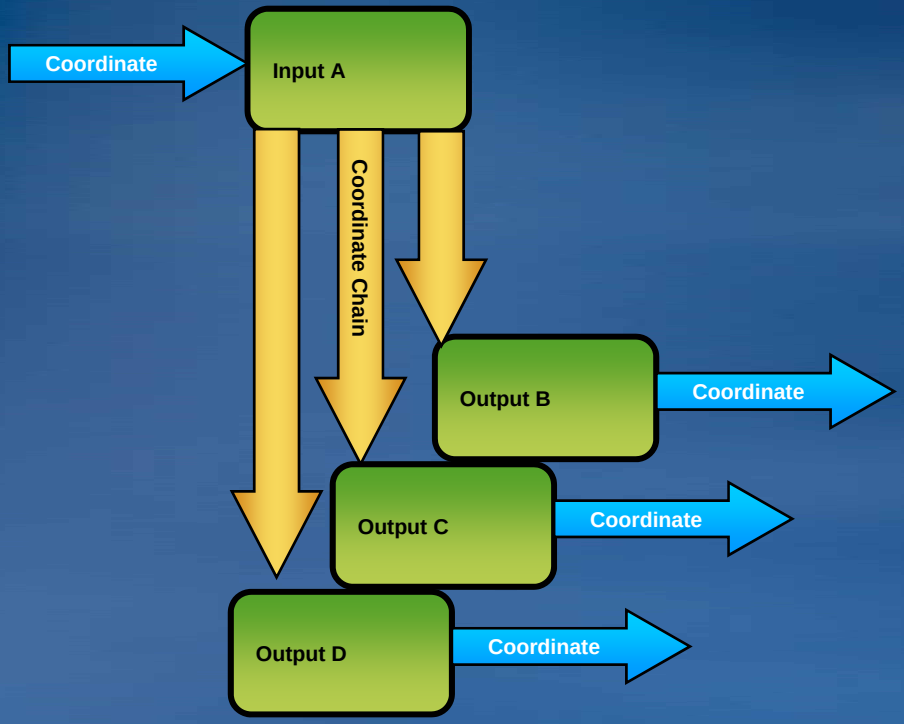
Coordinate Conversion Objects

- Coordinate conversion
  - DMS, DD, UTM, MGRS,USNG
  - Datums and Spatial References from ArcGIS
  - Extensible
  - Parse input and format output
    - Highly configurable
    - Input & Output in Boost regex format (www.boost.org)

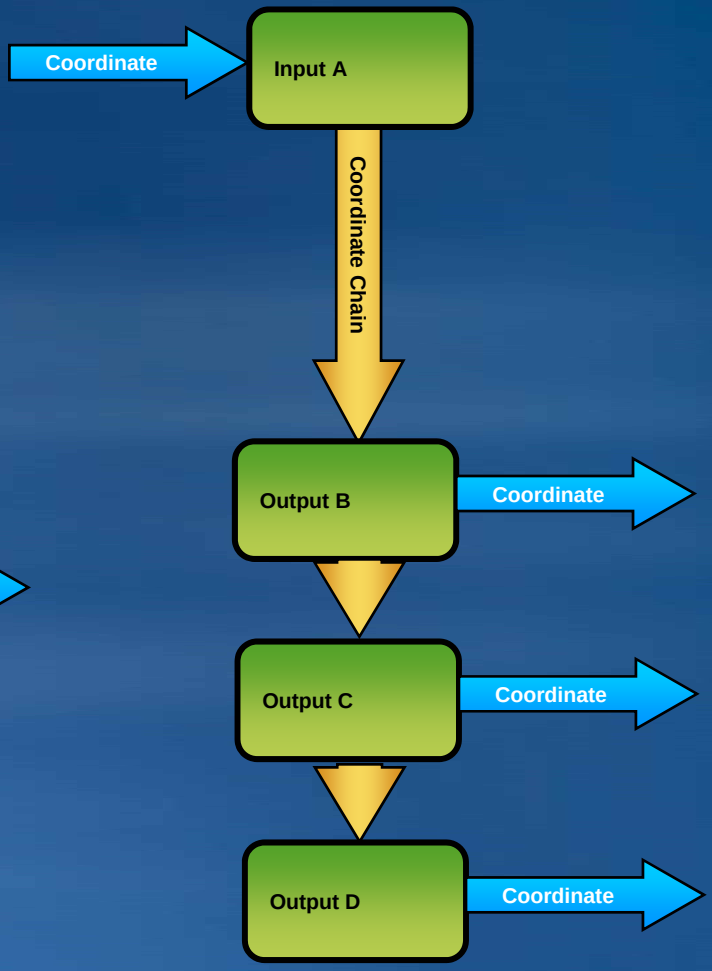


Coordinate Conversion API

Chaining



Parallel Chaining



Series Chaining

Coordinate Conversion API

Coordinate Conversion Objects

- **DD to MGRS Coordinate Conversion**

```
ICoordinate converterDD = new DDCoordinateClass();
ICoordinate converterMGRS = new MGRSCoordinateClass();

// chain the DD converter to the MGRS converter for output formatting
converterDD.AddOutputCoordinate(converterMGRS);

// inject the input coordinates (this is where the conversion occurs)
converterDD.PutCoords(x, y);

return converterMGRS.String;
```

Defense Solutions: Integration Scenarios Demos

Defense Solutions

Integration Scenarios

- Defense Solution ArcObjects are available across the ArcGIS platform suite:
- ArcGIS Desktop
  - Important caveat: UI and Command Objects are only supported here
- ArcGIS Engine
- ArcGIS Server

MOLE Developer Scenarios

The Many Faces of MOLE

- Multiple development scenarios depending on customization and performance requirements
- 9.2 & 9.3
  - Approach 1: Feature Layers / Feature Classes
  - Approach 2: MOLE “Cached Graphics”
  - Approach 3: Export Graphics
- New for 9.3
  - Approach 4: MOLE ISymbols
- Note: only MOLE Feature Classes/Layers will work across Map/Globe/Server

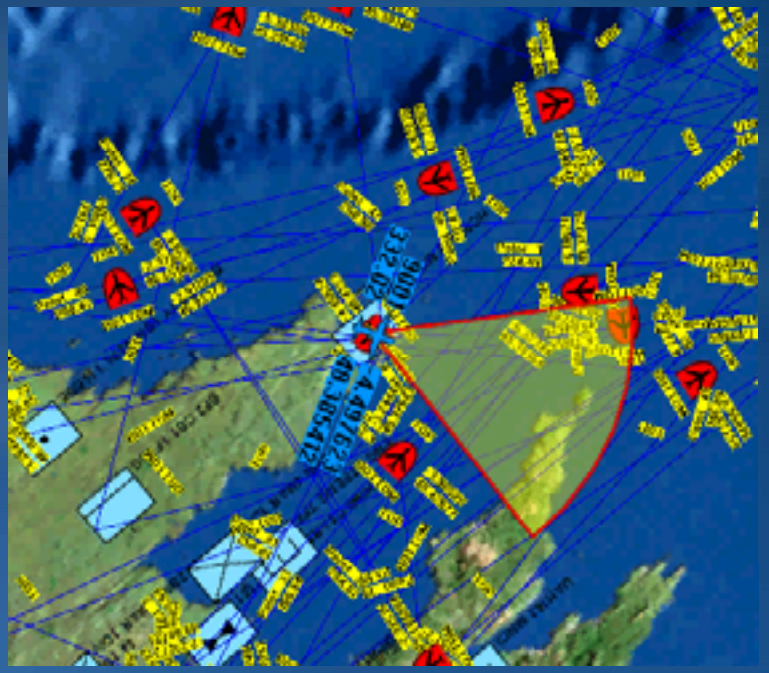
MOLE Approach: MOLE ISymbols

New at 9.3

- **Advantages**
  - Easiest to implement
  - Works well with ArcObjects cartographic/display framework
  - Can generally use anywhere you would use ISymbol
  - Good rendering performance
- **Disadvantages**
  - Less control over symbols
  - Generally only works in 2D

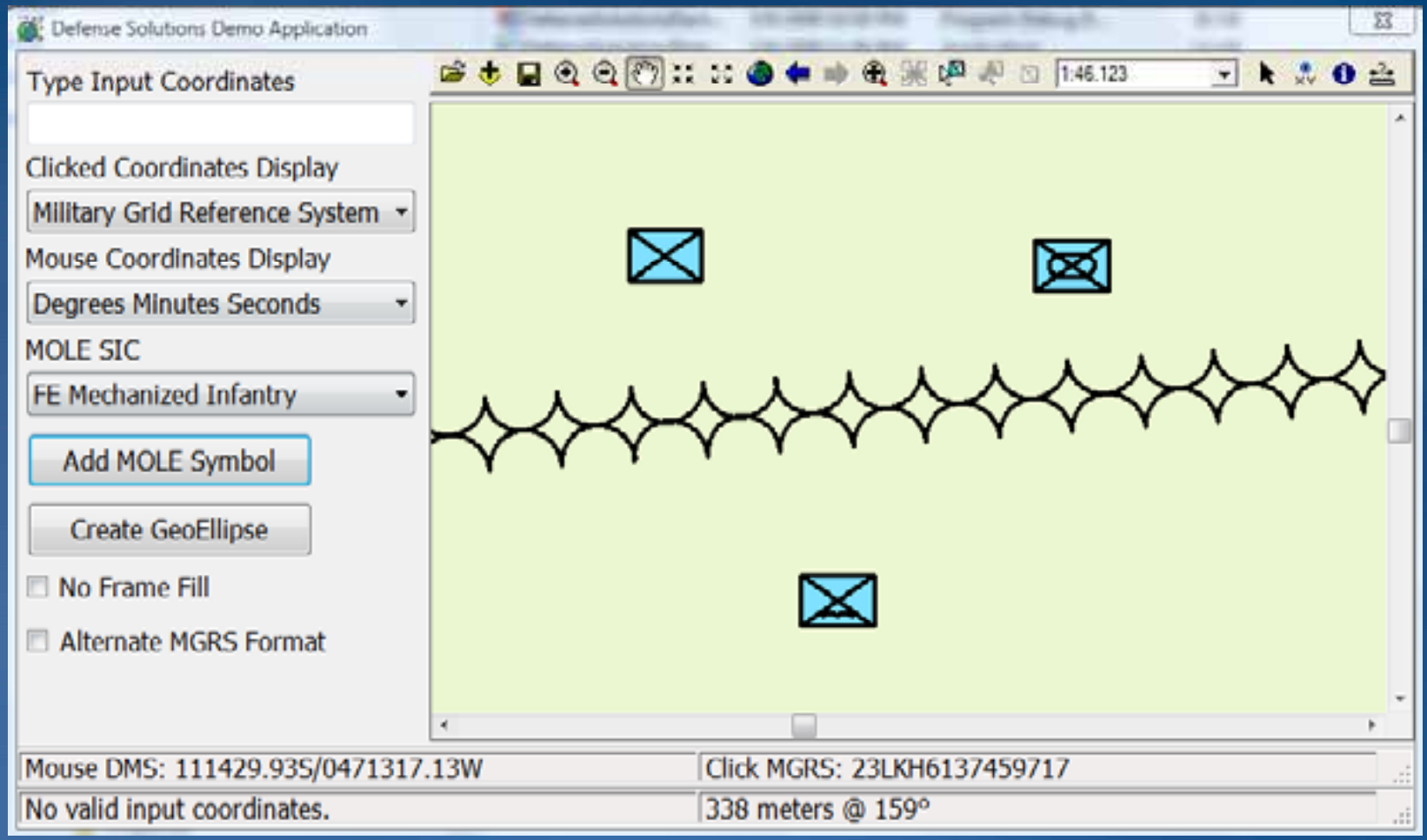
MOLE Approach: Export Graphics

- When to use?
  - Interoperation w/ external frameworks
    - Dynamic Display
    - OpenGL
- Approach
  - MOLE graphics implement ICreateBitmap / IExportGraphic (IMoleSymbolImportExport for MOLE ISymbols)
  - Invoke export methods
  - Use resulting imagery w/ external frameworks



MA / MOLE Demo

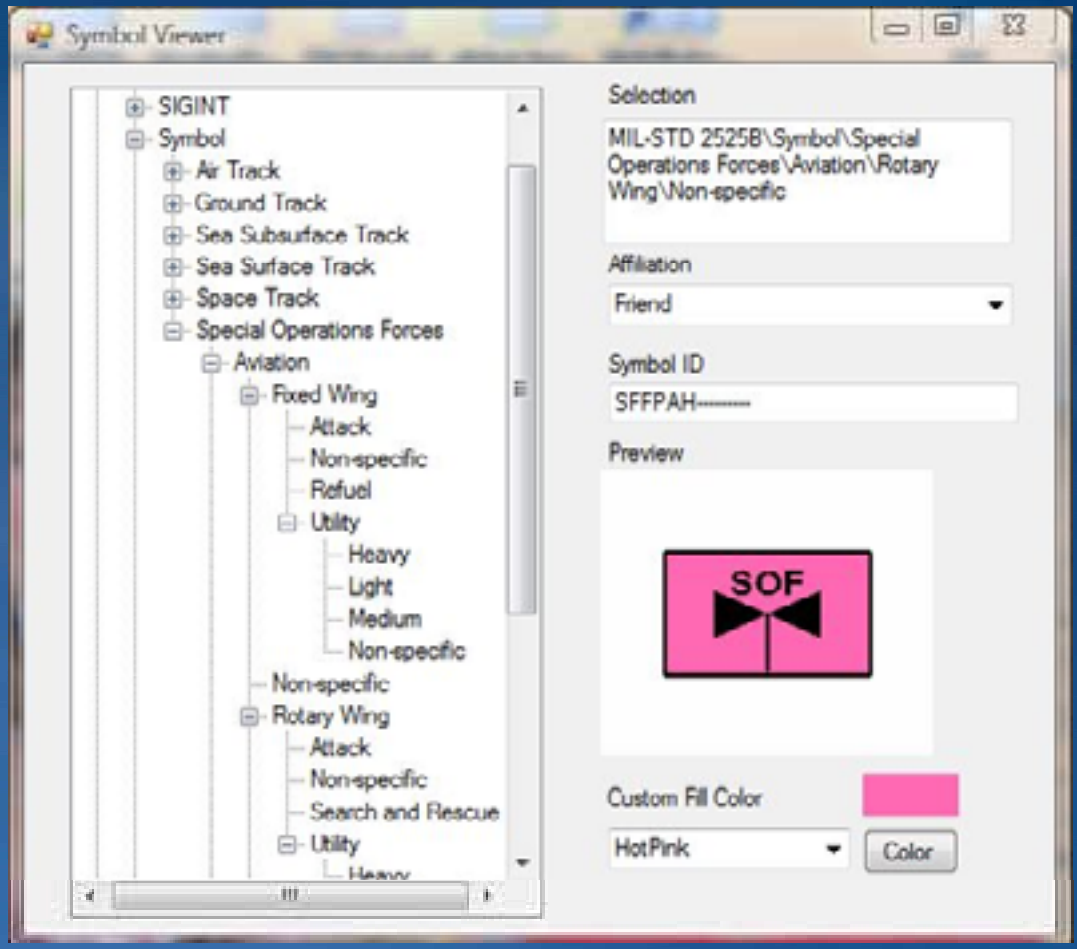
Sample Map Control Application



MOLE Symbol Viewer Demo

Sample Symbol Selector

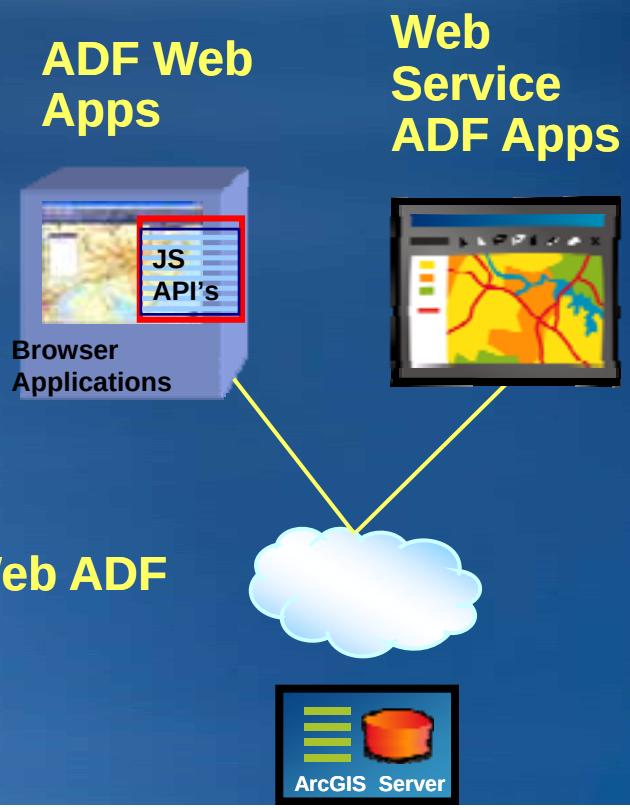
- MOLE ISymbol
- MOLE Export to HBitmap
- Query MOLECore GDB for list of symbols
- Custom Fill Colors



ArcGIS Server ADF SDK Samples

Defense Object in ArcGIS Server

- SDK Samples using Defense Solution Objects in ADF Web Client Map Application
- Show how to consume defense objects in custom ADF Tasks
- Creating DefSol objects in
  - Local Context (“CreateAO”)
  - Server Context (Remote Objects)
- Demo



Common Questions and Developer Resources

Defense Solutions SDK

- **Software Developer Kit**
  - **Military Analyst API**
  - **Samples & snippets**
  - **Fully integrated documentation**
  - **Online at http://resources.esri.com/help/9.3/ArcGISEngine/ArcObjects/ao_start.htm**

SDK Samples

- Engine
  - Geodesy
    - MAGeodesyMapControl
    - MALocateCoordinates
  - Symbology
    - MOLE Symbols
      - Grouping, etc.
    - Military Symbology in 3D (MOLE)
- Server
  - Geodesy
  - MOLE Symbols

Common User Feedback / Questions

How do I do X – Why can't I do Y?

- **Should be in Documentation and KB Docs**
  - If not we need to add them
- **Label visibility**
  - IEnumAttributeLabel – only for ForceElements and ForceElementLayer
    - http://support.esri.com/index.cfm?fa=knowledgebase.techarticles.articleShow&d=34981
  - Must blank out data field for Tactical Graphics
- **MOLE Crash on Exit in .NET**

```
// Workaround for crash on exit bug.
// This:
IMoleCoreHelper mch = new MoleCoreHelperClass();
mch.ReleaseForceElementRenderer();
mch.ReleaseTacticalGraphicRenderers();

// Before This:
ESRI.ArcGIS.ADF.COMSupport.AOUninitialize.Shutdown();
```

Common User Feedback / Questions

More Common Questions

- **2 Controls for MOLE Tactical Graphic Layer *Text* and *Graphic* Size**

```
// Setting 2 different Layer Size Properties
TacticalGraphicLayerClass tacticalGraphicsLayerClass = new TacticalGraphicLayerClass();
tacticalGraphicsLayerClass.FeatureLayer = featureLayer;
// Text Size:
tacticalGraphicsLayerClass.TextSize = 0.01;
// Pattern Size:
(tacticalGraphicsLayerClass as ICachedGraphicLayer2).Size = 0.05;
```

- **Required Geometry and Point Counts for Tactical Graphics**
  - **IGeometryLimits - GeometryType, MinimumPointCount to determine if a graphic requires a specific geometry/point count**
  - **http://support.esri.com/index.cfm?fa=knowledgebase.techarticles.articleShow&d=35636**

Additional Resources

Questions, answers and information…

- ***Meet the Team***
  - ***Outside this room right now!***
- ***Other sessions***
  - ***ArcGIS 9.4—The Road Ahead for Developers***

    Thurs., 10:15am Primrose B
  - ***ArcGIS Server Performance and Scalability - Testing Methodologies***

    Thurs., 1:30pm-2:45pm
- ***ESRI Resource Centers***
  - **PPTs, code and video**

  resources.esri.com
- ***Social Networking***

  www.twitter.com/ESRIDevSummit

  tinyurl.com/ESRIDevSummitFB

Want to Learn More?

ESRI Training and Education Resources

- **Instructor-Led Training**
  - **Introduction to ArcGIS for Geospatial Intelligence and Law Enforcement**
  - **Introduction to PLTS Defense Solution**
  - **Working with ArcGIS Spatial Analyst for Geospatial Intelligence**
- **Free Web Training Seminar**
  - **Introduction to ArcGIS Military Analyst 9.2**
- **Free Advice**
  - **Know and be comfortable with ArcEngine/ArcObjects before moving to Defense Solutions objects**

http://www.esri.com/training

The Road Ahead

- SDK
  - More samples more frequently updated to SDK on web
- Symbology
  - Current Symbology Standard Releases
    - MIL-STD-2525C released 17 November 2008
    - APP-6(B) released June 2008
  - Future Releases
    - MIL-STD-2525D
    - APP-6(C)

Summary

- Military Analyst
  - NGA data, geodesy & terrain analysis tools
    - Geodetic geometries
    - Measurement tools
    - New Geoprocessing tools & Python scripts
  - Coordinate Tool & Coordinate Conversion API
- MOLE
  - MIL-STD 2525B & NATO APP-6A symbology
  - MOLE Basic Symbols API
- Where to get Samples & Answers

Questions

Still have questions?

Please Turn In Your Session Survey!

- Please complete the session survey – we take your feedback very seriously!

- Continue to enjoy the conference!

Thank You