

AGI USER EXCHANGE

EAST • WEST 2006

Extended Sensor Pointing Methods

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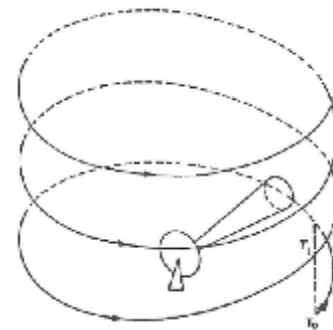
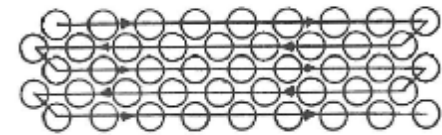
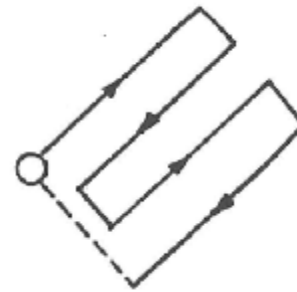


Organization Overview

- SAIC, Scientific and Technical Intelligence, R&D Division
- Huntsville, Alabama
- 125 scientists, engineers, analysts, and programmers
- Developers of
 - STK/Missile Modeling Tools
 - UMPIRE trajectory analysis software
 - Pioneer signature analysis software
 - ModelMan CAD model management software

Challenge

- Mimic complex geometric radar properties
 - Phased array and rasters
 - Rapid shifting of radar beam positions
 - Geometric complexity
- Accurate envelopes for complex beam pointing
 - Easily user-definable
- Targeting a raster beam around a moving vehicle



Solution Criteria

- Method based on
 - Work with common STK components
 - STK/Professional, STK/Connect, STK/Objects
 - Avoid kludges
 - Accessible on any WinPC target platform
 - Visual Basic (VB)
- Relate radar terminology to STK key words
 - Graphical User Interface for radar specialists
 - Reduce requirement to understand STK sensors

Alternative Solutions

- Approaches Considered
 - MATLAB programs for pointing histories
 - VB can be ported
 - STK/Attitude
 - Using a satellite object on the ground
 - End users don't have STK/Attitude
- Approach used
 - STK Vector Geometry Tool
 - STK external files created with VB

Solution

- STK's external file formats worked well for most purposes
 - Attitude files (.a) were used with the Vector Geometry Tool
 - Sensor Pattern (.pattern) files worked well
- Vector Geometry Tool
 - Use an envelope

User Interface

Scanning Sensor

scan name:

Scan Pre-Scan (return file)

Scan Other (custom file)

Grid-based Fixed Envelope

Position Scan (deg)

Position Rotation (deg)

Output Scan?

Start Time (Time - Seconds)

End Time (Time - Seconds)

Time per step (s)

Scan Delay (s)

Envelope Name:

Tracking Sensor Name:

Target Alias Name:

Area select:

Envelope Height Min (usu. negative):

Envelope Height Max (usu. positive):

Envelope width:

Beam(s) or Grid size/Cell (Integer):

Number of Over Bars (Integer):

Positions per Bar (Integer):

Bidirectional

Orientation (deg):

Output Location:

Output Rotation:

Output Height:

Base to file (lower or than manual)

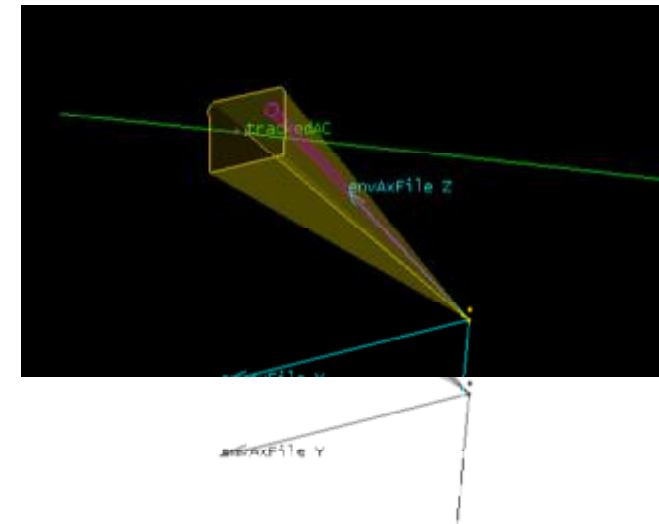
Create Envelope Create Scan Beam

Trick #1 – Use the Vector Tool

- STK 7.1 allows custom axes to be defined with an attitude file
- Strategy
 - Write an attitude file for the *relative* pointing history
 - Use custom coordinate axes
 - Create a guiding “envelope” sensor
 - Pointing, tracking, scanning, etc.
 - Set up custom axes for “From File” for the attitude file
 - Create a “spot” sensor
 - Point it with “Fixed in Axes” method
 - Use the “envelope” sensor’s Custom Axes
 - Scans around the “envelope’s” pointing history

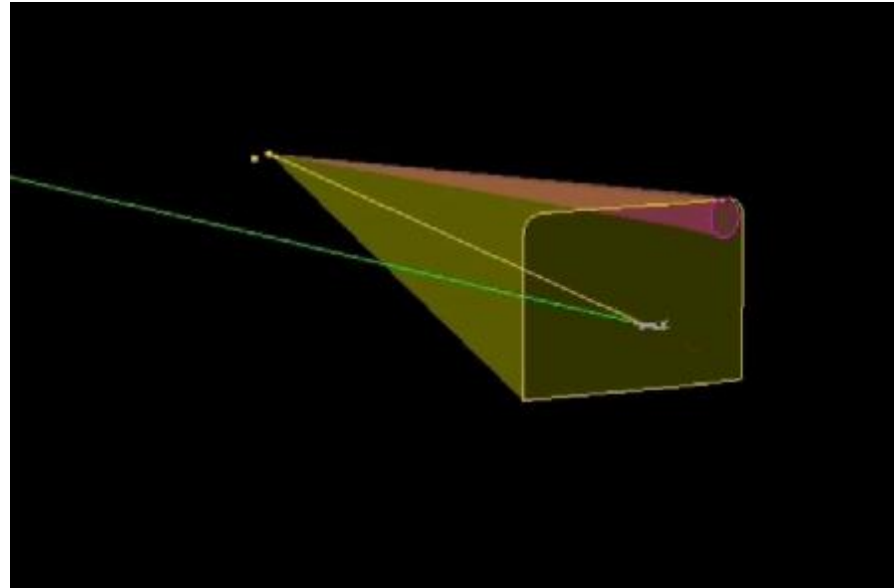
```

stk.v.7.0
Begin Attitude
NumberOfAttitudePoints 20
CoordinateAxes Custom
    (same line) Body GroundVehicle/gv1/Sensor/sen1
Sequence 123
InterpolationOrder 0
AttitudeTimeEulerAngles
0 0 0 0
50 0 -40 0
Etc.
    
```

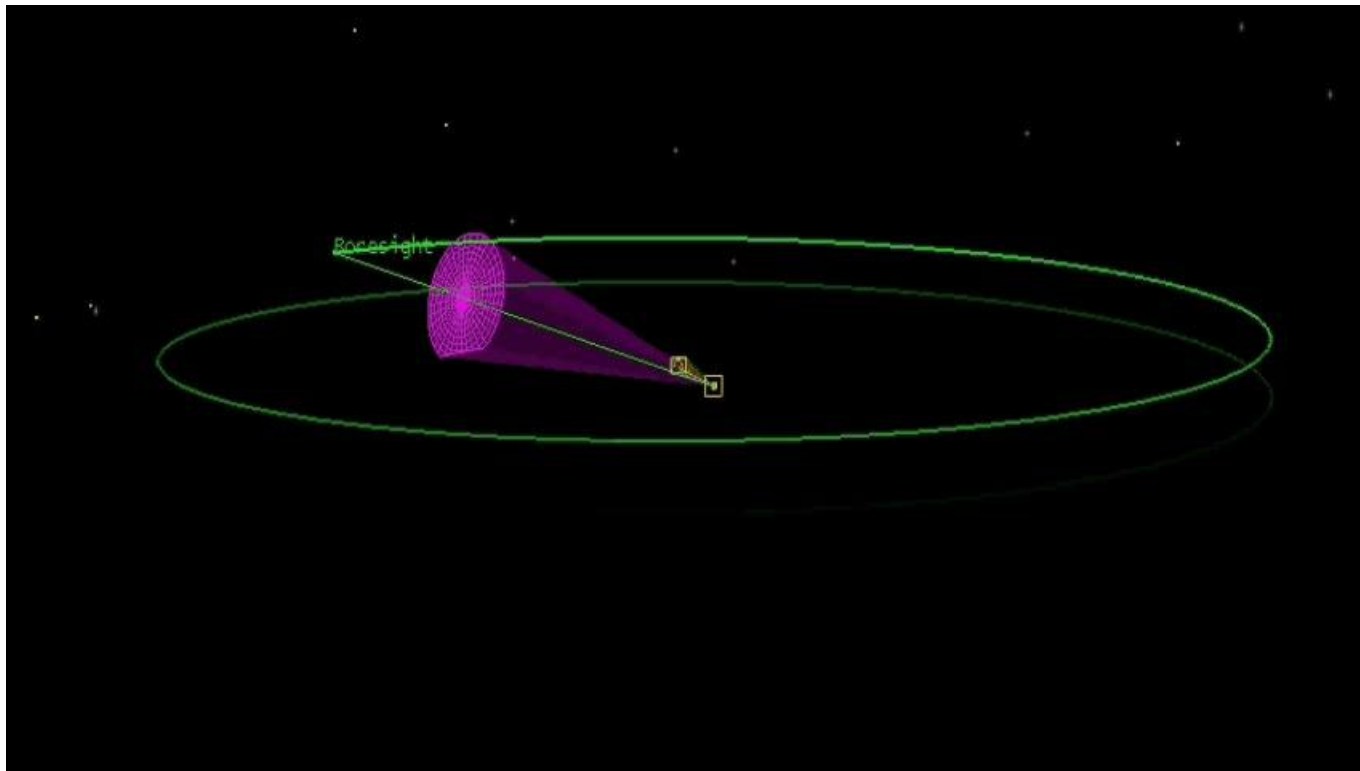


Trick #2 – Stepped Scan

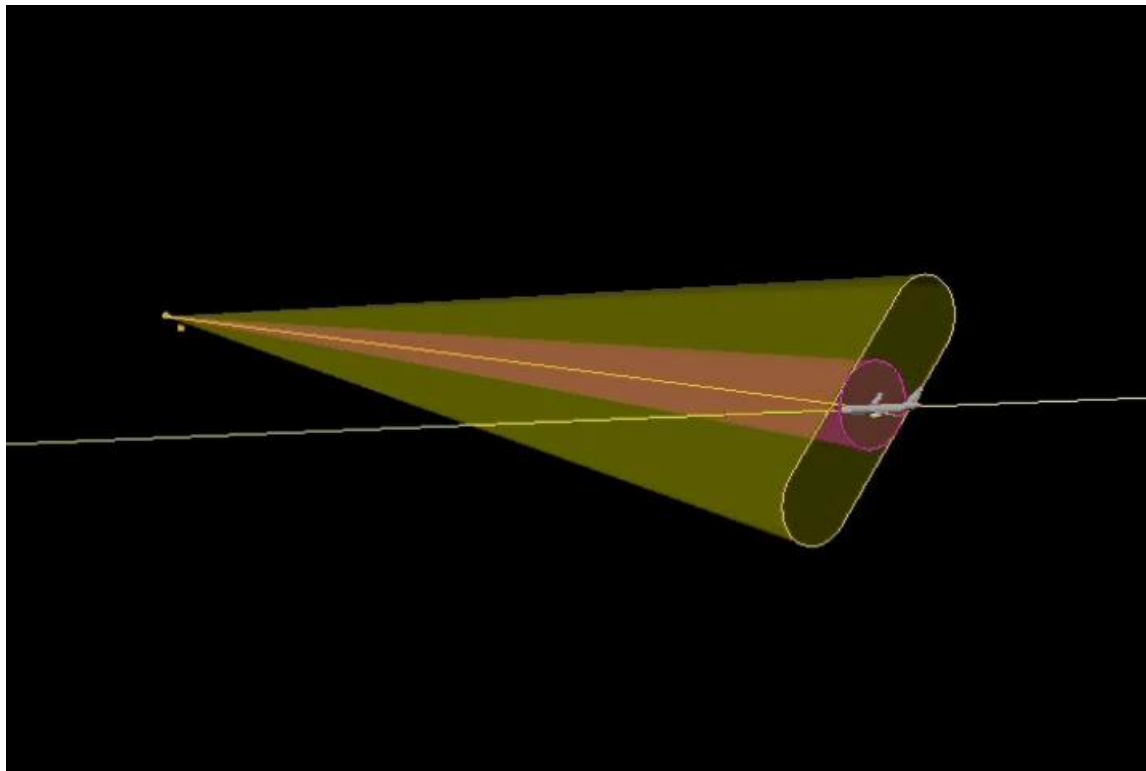
- For a stepped scan
 - Use the VGT as before
 - Use
`InterpolationOrder 0`
in the attitude file
 - Avoids visible “flyback” for stepped rasters



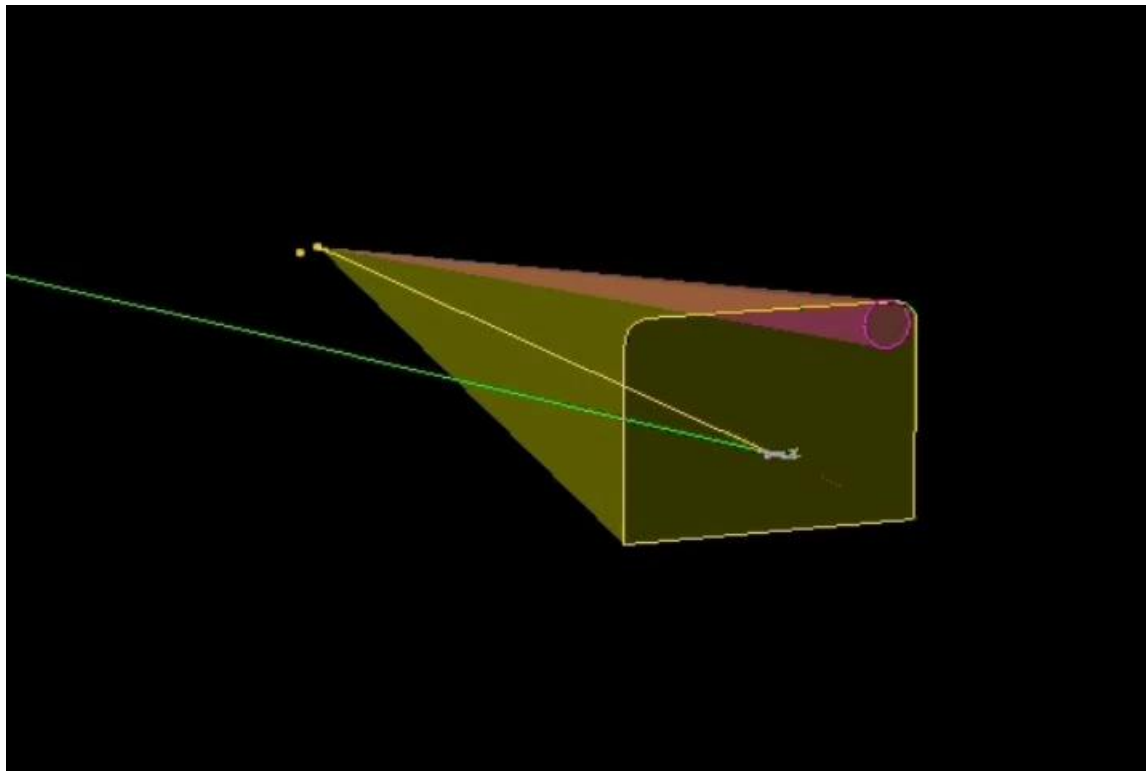
Results – Spiral Scan



Results – Slant Scan



Results – Stepped Raster Scan



Summary

- STK afforded a straightforward way to display complex beam scan patterns
 - External file formats
 - Vector Geometry Tool
 - Connectivity to Visual Basic
- Avoided a need for extensive software development

Contact

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