

Rapid Airfield Construction Decision Support Toolset

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Introduction

- One of the greatest challenges to the U.S. Army's Rapid Deployment concept is how to get large amounts of equipment on the ground in a short period of time

Really Quick!



JRAC Mission

- To meet the goal of rapid deployment as well as improve existing Army's airfields, the U.S. Army Corps of Engineers, Engineer Research & Development Center (ERDC) spearheaded the creation of the Joint Rapid Airfield Construction (JRAC) mission to “Deploy anytime, anywhere”



JRAC Research Pillars

Site Selection



Enhanced Construction



Rapid Stabilization



Rapid Airfield Construction Decision Support Toolset

Develop a ArcGIS tool to rapidly assess site potential for contingency airfields using geo-referenced remotely sensed data employed in a DoD common operation environment.



JRAC



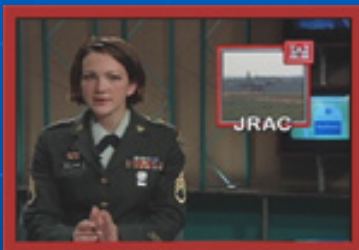
Joint Rapid Airfield Construction Contingency Airfield Engineering Solutions



JRAC News

Project Spotlight

Links & Downloads



The JRAC program was recently featured on the Armed Forces Television Network's *Army Engineer Update* segment. [View video.](#)

"Four Days To Touchdown" is the *Site Prep Magazine* article featuring the JRAC 2004 Demonstration. [View article.](#)

"Technology In Construction" is the name of the article featured in *Construction Magazine*. [View article.](#)

Dr. Gary Anderton Project Manager for JRAC wrote an article for The Society of American Military Engineers (SAME). [View article.](#)

JRAC in the Outback 2007 - The JRAC team is working on plans for the 2007 final demonstration exercise currently scheduled to take place at the Bradshaw Field Training Area in Australia's rugged Northern Territory. [More details coming soon.](#)



The RAVEN or Rapid Assessment Vehicle Engineer is a powerful JRAC product that provides numerous capabilities. [View fact sheet.](#)

2005 Researchers Meeting Presentations have been posted. [Click here for presentations](#)

Download the JRAC Marketing Video The new JRAC work unit plan for FY06 has been posted. [Click here to view the work unit plan](#)

The JRAC Overview presentation gives the overall mission for JRAC. [Click here to view the PDF file](#)

View the JRAC archives for previous year web postings [Click here to view the JRAC archives](#)

View the JRAC products page to see reports and other documents. [Click here to view the JRAC products](#)

Updated JRAC Web Site
<https://jrac.erdc.usace.army.mil>



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RACDST Applications

- **Area Suitability Assessment**

Designed to assist a user during the planning process to determine the best candidate sites for the development of a single airfield template.

- **Airfield Construction Analysis**

Evaluate candidate sites by positioning a airfield template and determining which sites provide the best results that minimize cut-fill requirements.

- **Engineer Operations (ENOPs)**

Designed to provide a first order estimation of operation effort of airfield construction/upgrade/repair.



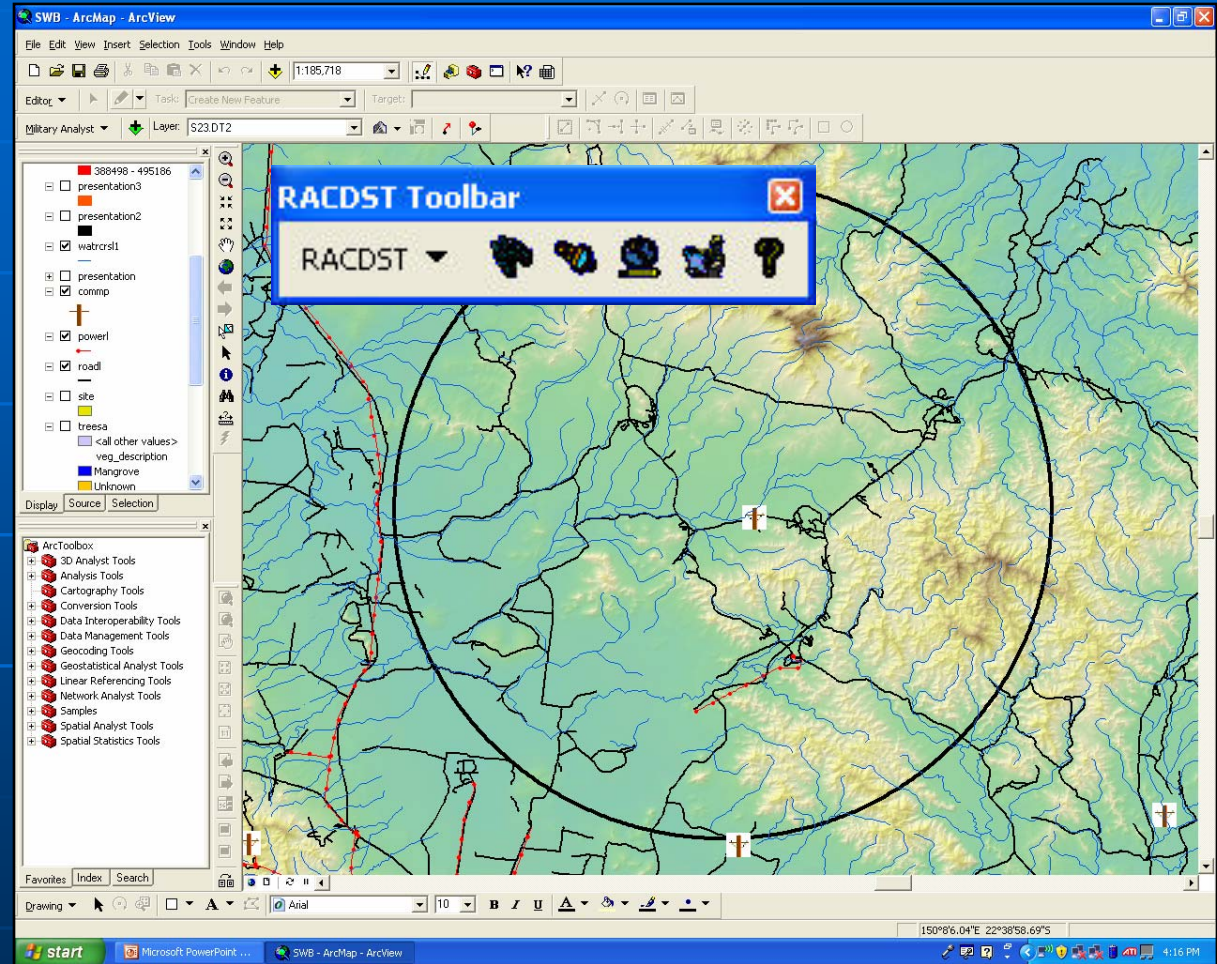
Software Requirements

- ArcGIS 9.2 sp2
- ArcView Level License
- Spatial Analysis
- .Net 1.1 Framework
- Java Runtime Environment Version 5.0



Area Suitability Assessment

RACDST is designed to work as an extension to ArcGIS Version 9.2, Service Pack 2. It is launched from a toolbar within ArcMap.

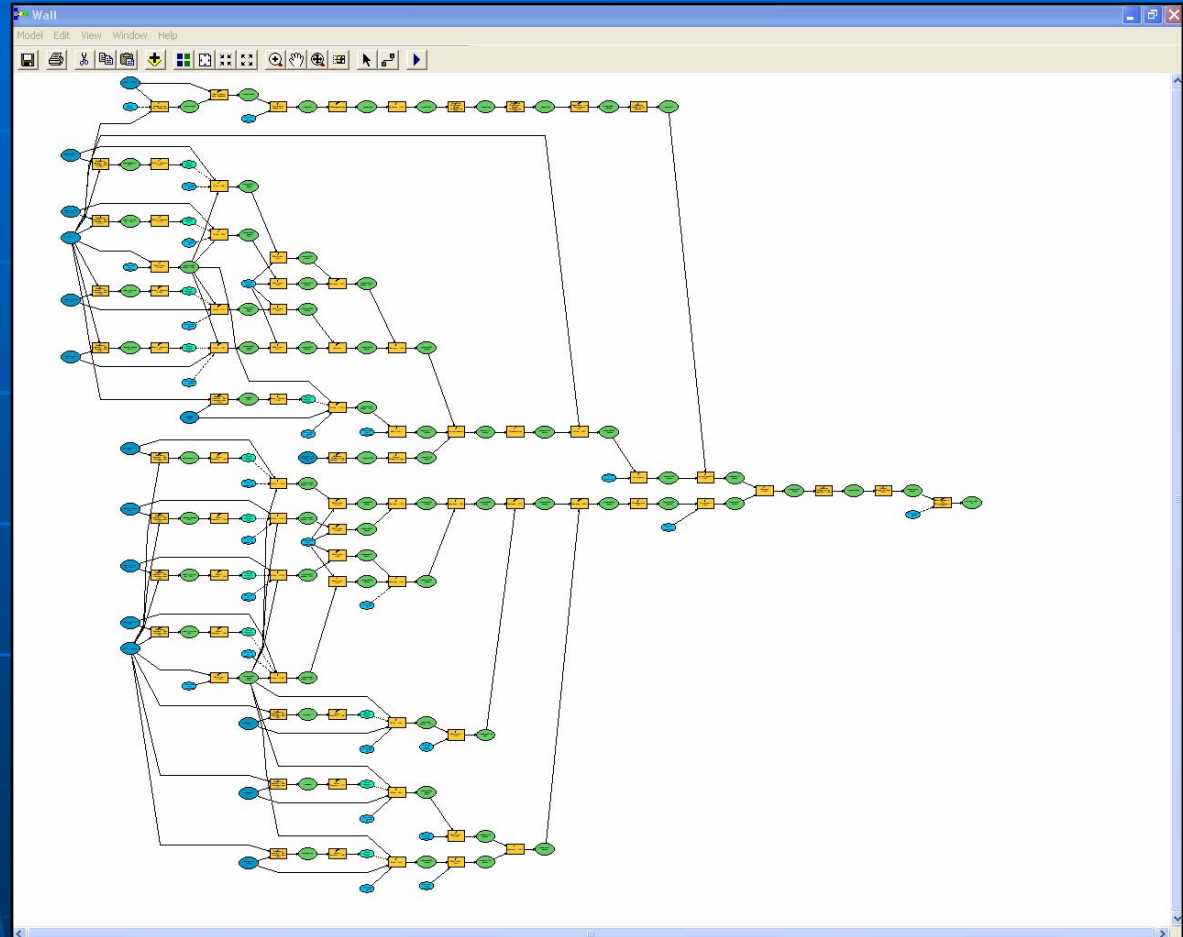


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ArcMap Model Builder

ModelBuilder interface provides a graphical modeling framework for designing and implementing geoprocessing models that can include tools, scripts, and data. Models are data flow diagrams that link together a series of tools and data to create advanced procedures and workflows.

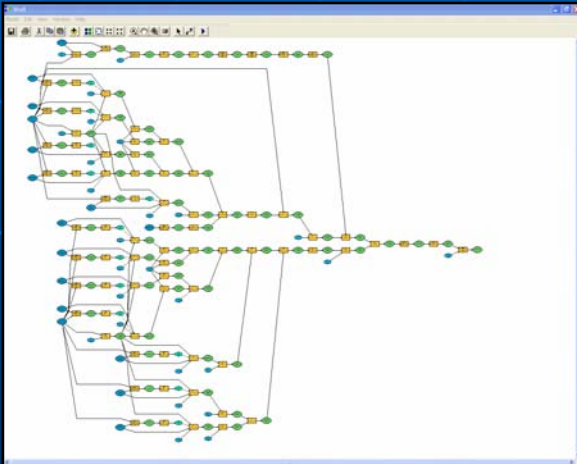


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RACDST Script

■ Completed model exported as a Visual Basic or Python Script.



```
final - Notepad
File Edit Format View Help
gp.outputZFlag = "Disabled"
gp.Clip_analysis watrcrsa_2_, AOI_2_, temp47_shp, ""
gp.outputZFlag = tempEnvironment0

' Process: Buffer (9)...
gp.Buffer_analysis temp47_shp, temp33_shp, Distance_value_or_field_5_, "FULL", "ROUND", "NONE", ""

' Process: Clip (4)...
gp.Clip_analysis watrcrs1_2_, AOI_2_, temp18_shp, ""

' Process: Buffer (3)...
gp.Buffer_analysis temp18_shp, temp29_shp, Distance_value_or_field_5_, "FULL", "ROUND", "NONE", ""

' Process: Union (4)...
tempEnvironment0 = gp.outputZFlag
gp.outputZFlag = "Disabled"
gp.Union_analysis "o:\bourne\JRC\temp33.shp ";o:\bourne\JRC\temp29.shp "", temp35_shp, "ALL", "", ""
gp.outputZFlag = tempEnvironment0

' Process: Clip (6)...
tempEnvironment0 = gp.outputZFlag
gp.outputZFlag = "Disabled"
gp.Clip_analysis lakeresa_2_, AOI_2_, temp48_shp, ""
gp.outputZFlag = tempEnvironment0

' Process: Buffer (10)...
gp.Buffer_analysis temp48_shp, temp25_shp, Distance_value_or_field_5_, "FULL", "ROUND", "NONE", ""

' Process: Clip (7)...
tempEnvironment0 = gp.outputZFlag
gp.outputZFlag = "Disabled"
gp.Clip_analysis aqueduct1_temp_shp, AOI_2_, temp49_shp, ""
gp.outputZFlag = tempEnvironment0

' Process: Buffer (11)...
gp.Buffer_analysis temp49_shp, temp28_shp, Distance_value_or_field_5_, "FULL", "ROUND", "NONE", ""

' Process: Union (5)...
gp.Union_analysis "o:\bourne\JRC\temp25.shp ";o:\bourne\JRC\temp28.shp "", temp34_shp, "ALL", "", ""

' Process: Union (6)...
gp.Union_analysis "o:\bourne\JRC\temp35.shp ";o:\bourne\JRC\temp34.shp "", temp36_shp, "ALL", "", ""

' Process: Clip (2)...
tempEnvironment0 = gp.outputZFlag
gp.outputZFlag = "Disabled"
gp.Clip_analysis Power_Lines, AOI_2_, temp8_shp, ""
gp.outputZFlag = tempEnvironment0

' Process: Buffer (2)...
```



Area Suitability Assessment(GUI)

Exporting the model to a VB script allows for more flexibility to be added to the site selection module. The site selection GUI is launched from the RACDST toolbar.

The screenshot shows a software window titled "Site Selection" with a standard Windows-style title bar. The window is divided into several sections for data input:

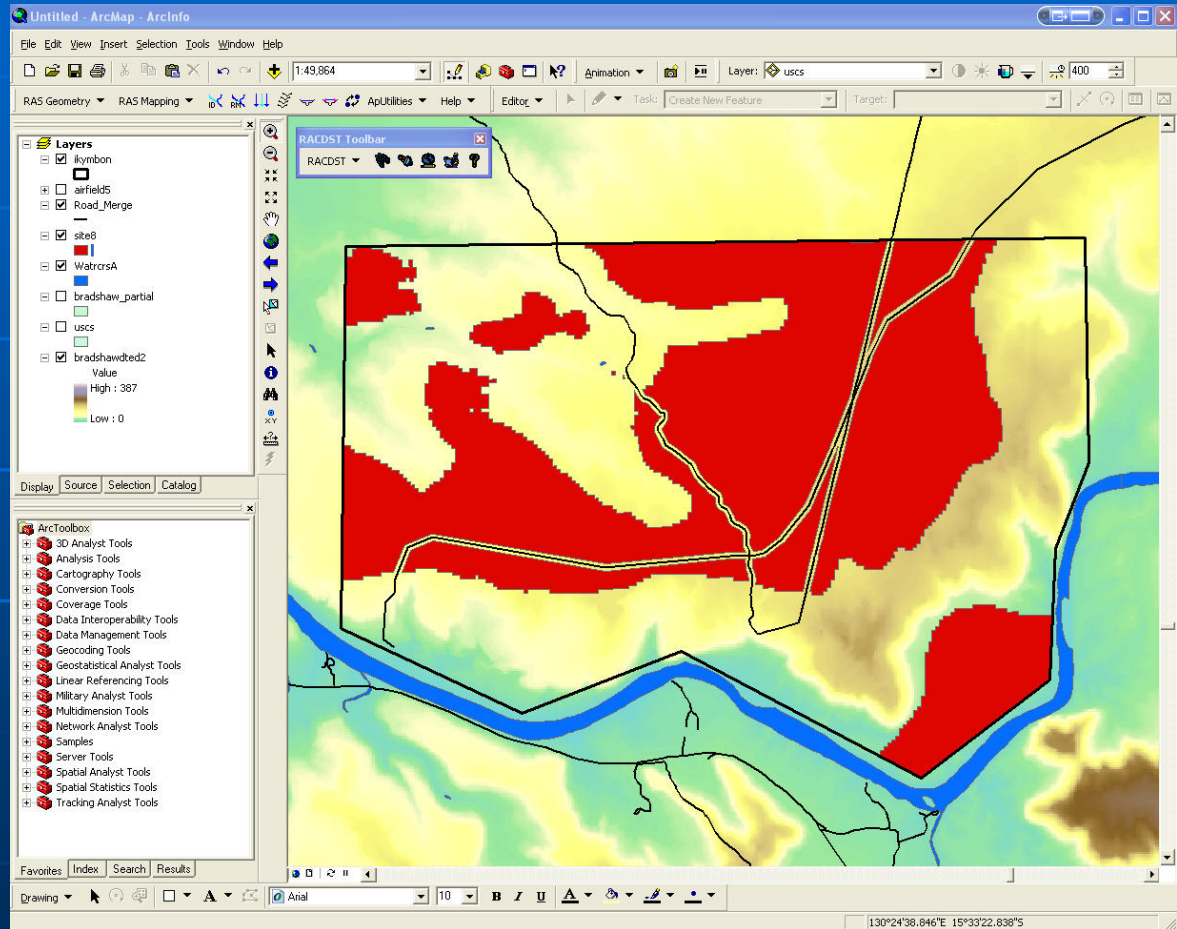
- AOI/Elevation Data (required):** Includes a dropdown menu for "Area of Interest" (set to "ikymbon"), a dropdown for "Digital Elevation Model" (set to "S16.DT2"), a text input for "Maximum Slope (%)" (set to "4"), and a "Mosaic Rasters" button.
- Roads/Power Data:** Includes a dropdown for "Primary, Trail, etc.", a text input for "Minimum Distance to Roads (m)" (set to "50"), and a text input for "Maximum Distance to Roads (m)" (set to "5000").
- Water Linear Feature Data:** Includes a dropdown for "Rivers, Streams, Canals, etc.", a text input for "Minimum Distance to Water (m)" (set to "50"), and a text input for "Maximum Distance to Water (m)" (set to "5000").
- Water Area Feature Data:** Includes a dropdown for "Lakes/Reservoirs", a text input for "Minimum Distance to Water (m)" (set to "50"), and a text input for "Maximum Distance to Water (m)" (set to "1000").
- Power Lines Data:** Includes a dropdown for "High Power, Residential," and a text input for "Minimum Distance to Power Lines (m)" (set to "500").
- Tower Data:** Includes a dropdown for "Power Poles, Comm Towers," and a text input for "Minimum Distance to Power Poles (m)" (set to "2000").
- Exclusion Zone:** Includes a dropdown for "Trees, Urban, Flood, etc.".
- Soil Properties:** Includes a dropdown for "Soil Strength" and a text input for "Minimum CBR" (set to "4").

At the bottom of the window, there is a "Status Window" area, an "Output File name" field with a "Browse" button, and a row of buttons: "Merge Vector Data", "Save Parameters", "Load Parameters", "Cancel", and "Execute".



Area Suitability Assessment Results

- 3% slope
- 4 km proximity to roads
- Void of trees
- 5Km away from power lines and towers



Airfield Laydown

A three dimensional analysis is performed of the cut-fill earth volume and area required to emplace a runway feature.



Airfield Laydown GUI

- Site Selection Data
Output from Site Selection Component or other polygon layer
- Elevation Data
Higher Resolution DEM
- Airfield Spacing
- Airfield Azimuth
- Runway Construction Rating
- Maximum Volume

Airfield Analysis

Airfield Lay-Down

Overlay / Terrain Data	Scenario Data
<input type="text"/> Site Selection	<input type="text" value="C-17"/> Airframe
<input type="text"/> Digital Elevation	<input checked="" type="radio"/> Runway
<input type="text"/> Soil Type (USCS)	<input type="text" value="4"/> RCR
<input type="text" value="FID"/> Field Name	<input type="radio"/> Helipad
	<input type="radio"/> Apron

Lay-Down Criteria

<input type="text" value="1000"/> Evaluation Spacing (m)	<input type="text" value="1"/> Starting Airfield Azimuth (deg)
<input type="text" value="None"/> Maximum Earth Volume (m ³)	<input type="text" value="179"/> Ending Airfield Azimuth (deg)
	<input type="text" value="5"/> Increment (deg)

Results

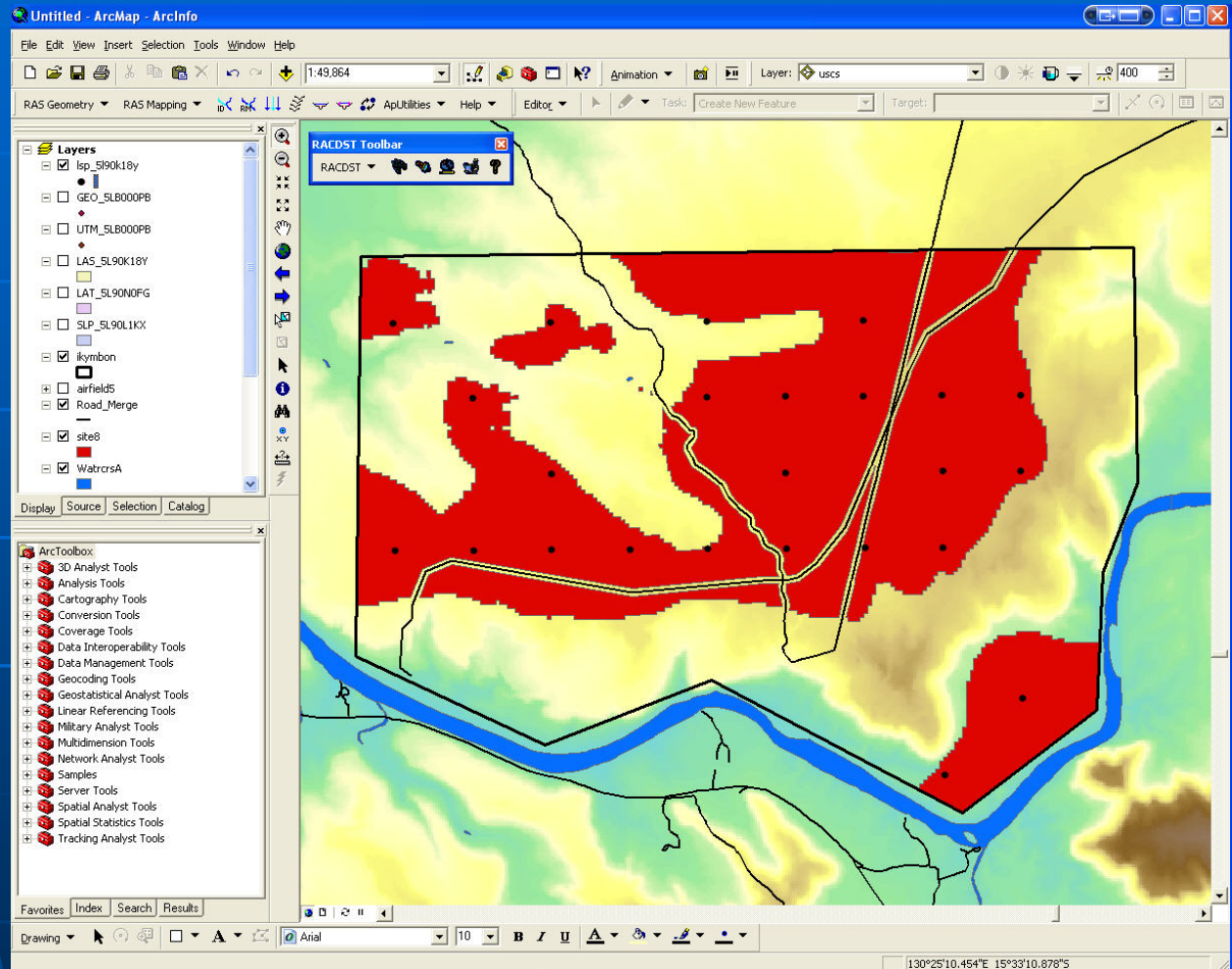
Workspace Name

Layer Name



Locate Airfield Sites

- 1000 meter spacing of potential airfield sites

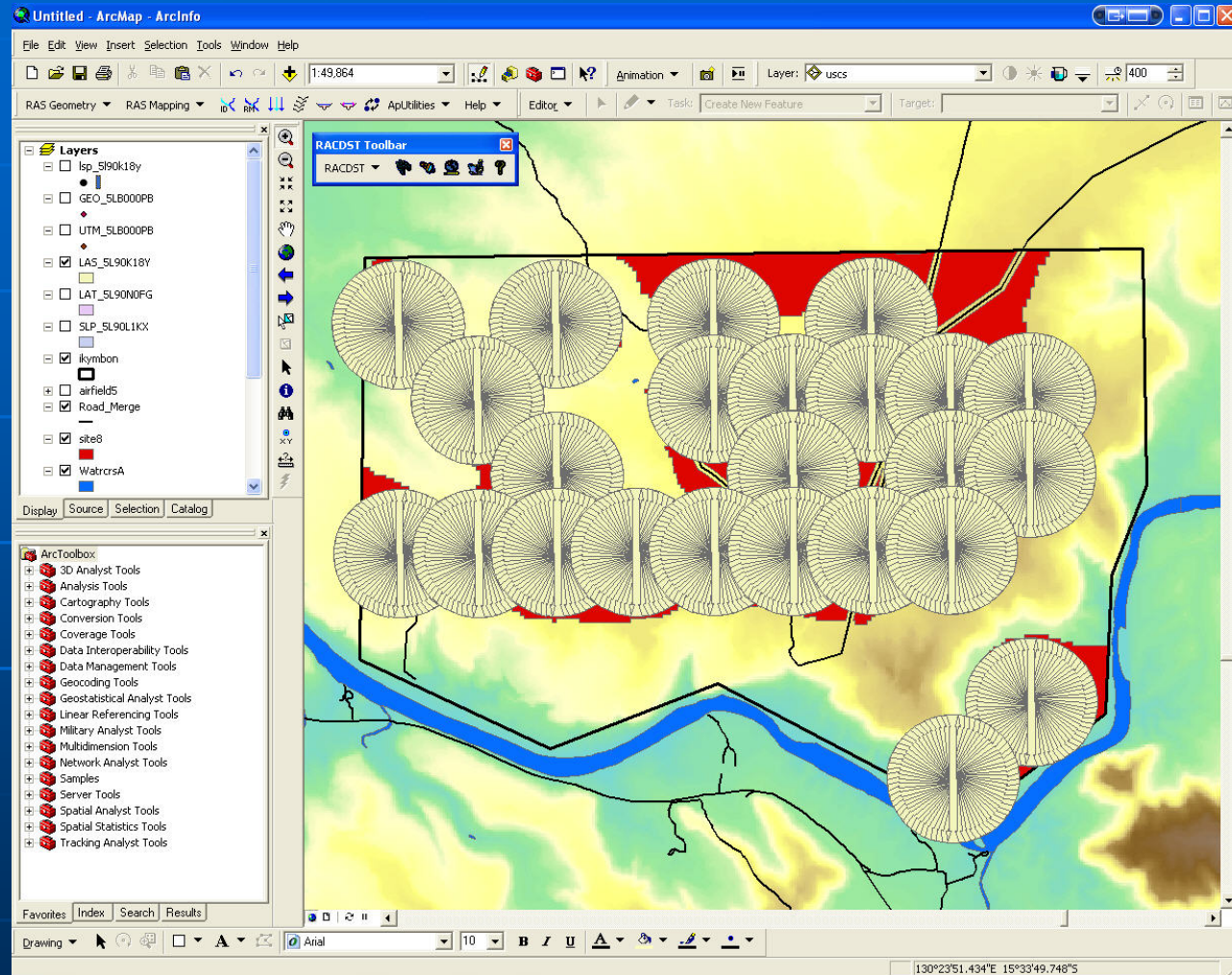


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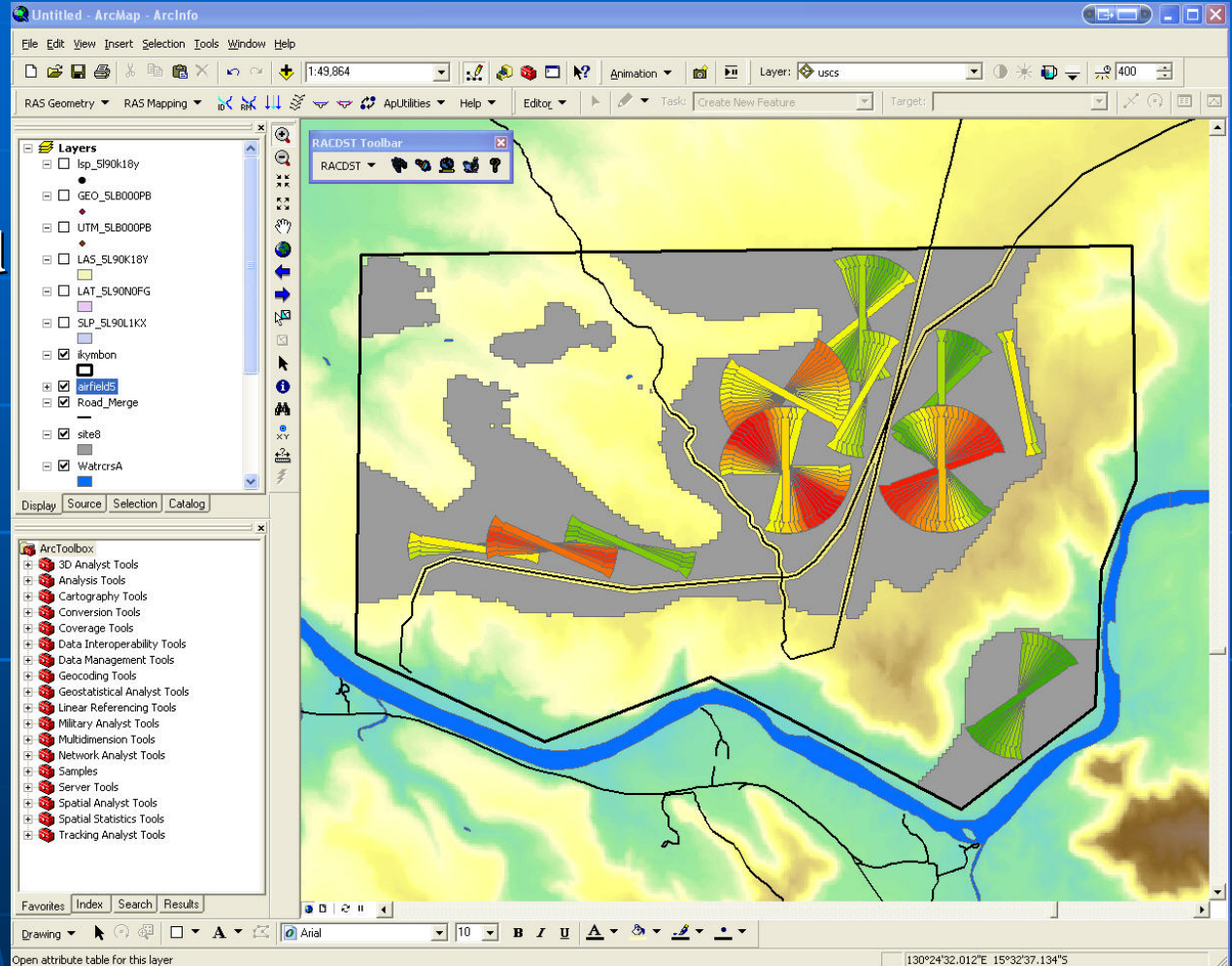
Build Airfields

- Starting Azimuth 0
- Ending Azimuth 179
- Increment 5 Degrees
- RCR 4

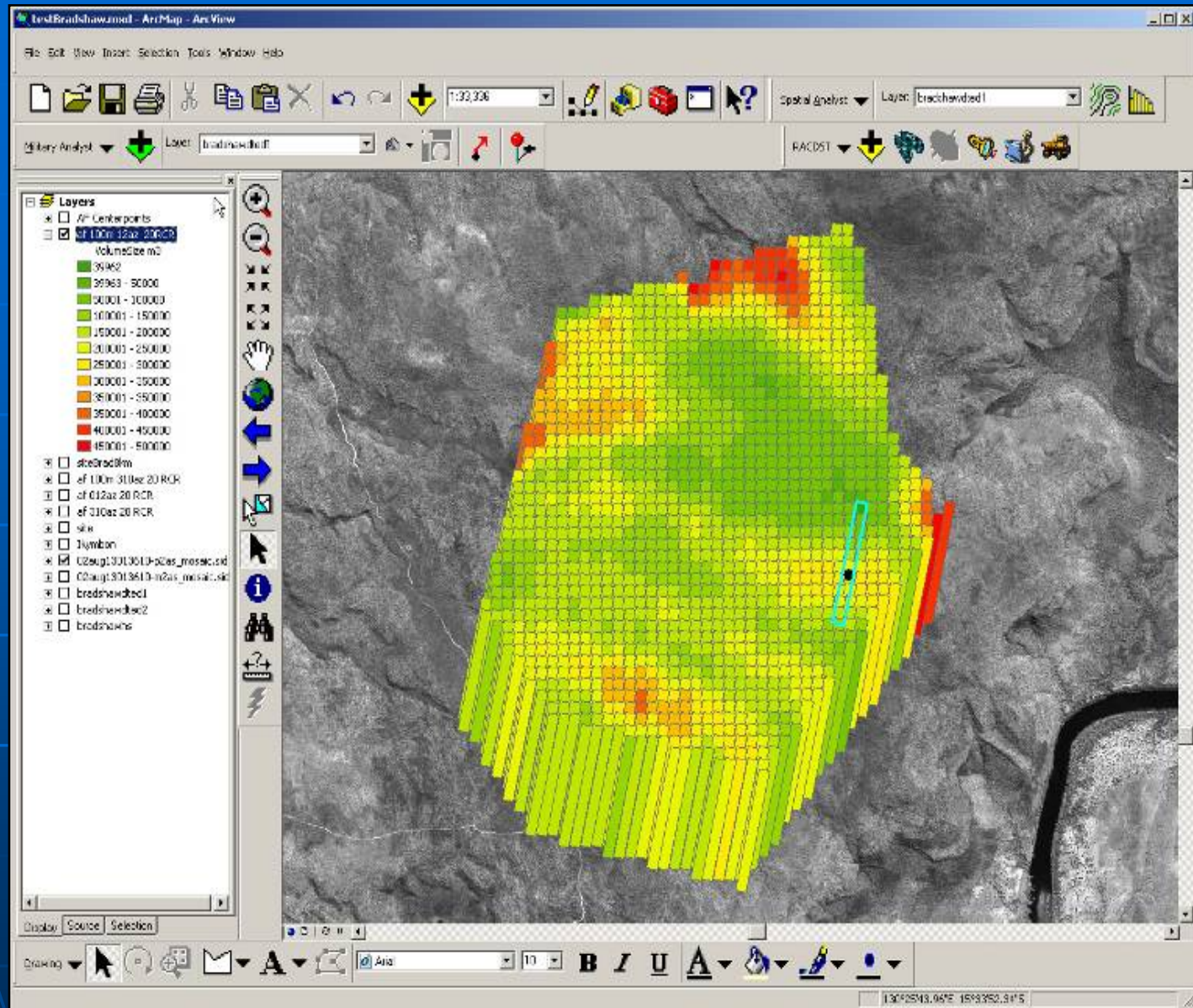


Airfield Sites

- 127 sites
- Airfield contained within site layer
- Cut/Fill requirements less than 500,000 cubic yards



1. 100 Meter Separation
2. 12 Degree Azimuth
3. RCR = 8
4. Maximum Volume 1,000,000



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Engineer Operations (ENOPs)

- Uses outputs from Construction Analysis Application to determine the estimation of operation effort to build the airfield.



ENOPs GUI

Engineer Operations Asset Allocation Calculator

Engineer Operations GUI

Constrained Results Unconstrained Results

Select Operation: build_ALZ_MOG1_heavy

Scenario Inputs:

Earliest Start Time (hrs): 0.0

Latest Finish Time (hrs): 1000.0

Air Temperature (Celsius): 26.0

Percent Humidity: 100.0

Terrain Inputs:

USCS Soil Type: SM

Linear Size (ft): 8000

Areal Size (sq ft): 80000

Volumetric Size (cu yds): 100000

Armored: TRUE FALSE

Degraded Sensor: TRUE FALSE

- Or Enter Scenario and Terrain Files Below (Optional) -

Select Scenario File

Select Terrain File

Select Output File

(Note: Output will be displayed on console if no output file selected.)

Select Operations XML File Select Assets XML File

Compute Exit Export ARC File



ENOPs Report

Interactive Output Console

Operation: build_ALZ_MOG1_heavy
Optimization Criteria: totalTime
Early Start Criteria: 0.0 (hrs)
Late Finish Criteria: 1000.0 (hrs)
Armored Condition: false
Best Technique: Technique 1
Early Start Duration: 0.0 (hrs)
Late Finish Duration: 437.04 (hrs)

Valid Techniques For Operation:

Technique ID	Technique Duration(hrs)	Early Start Duration(hrs)	Late Finish Duration(hrs)	Segment Number	Segment Duration(hrs)	Equipment Group Serial#
1	437.04	0.0	437.04	1	11.1	666
				2	1.0	666
				3	2.49	893
				4	1.36	889
				5	92.08	889
				6	74.22	393
				7	92.08	889
				8	0.32	442
				9	296.86	577
				10	149.33	756



Benefits

- **Easy to use.**
- **Track your geoprocessing tasks.**
- **Not tied to a specific data set.**
- **Reduces the number of potential sites.**



Questions?

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