

AirGRID: An Innovative Application to Integrate Maps, Documents and Data



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What's the Point?



AirGRID

- Integrated Air Quality Enterprise Data System
 - Identify & efficiently retrieve air quality data
 - Add value & integrated data analysis functionality



Data

Information

Solutions

Decisions

Outline



- AirGRID Background & Objective
- AirGRID Demonstration
 - Overview
 - Database \leftrightarrow Map
 - Documents \leftrightarrow Map
 - AQ Modeling
- Integration Challenges
- Lessons Learned
- Summary & Future Work

AirGRID Background



- Tinker AFB
 - Base covers 5,031 acres
 - 763 Facilities
 - *15.3 million sq. ft. of industrial operations*
- Environmental Management (72ABW/CEV) environmental focal point for base
- Collection, management, analysis & dissemination of data

The objectives of the Air Quality Program are to ensure compliance with all environmental air standards applicable to current operations and to those projected for the future.

Efficiently Retrieve Data



Air Information Management System

AirLog

HMMS
Hazardous Material Management System

XEROX DocuShare®

Emissions Estimator

AIRGRID

3Devs
3D Emissions Visualization System

EMGIS

2D Modeling

AEI
Annual Emission Inventory Tool

Added Value & Integrated Data Analysis



Edit & Add New Data



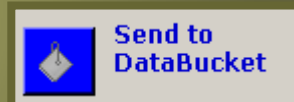
Advanced Spatial Analysis



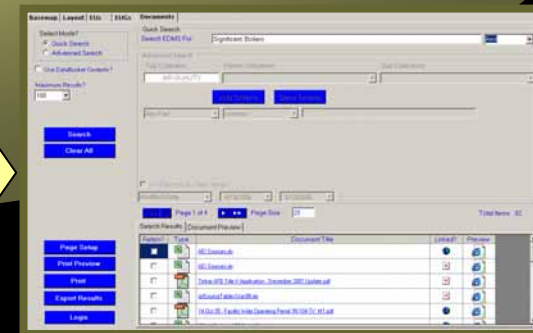
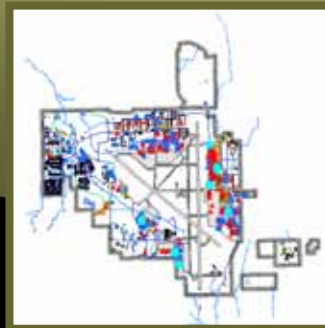
What If? Modeling Scenarios



Material Use Log Access

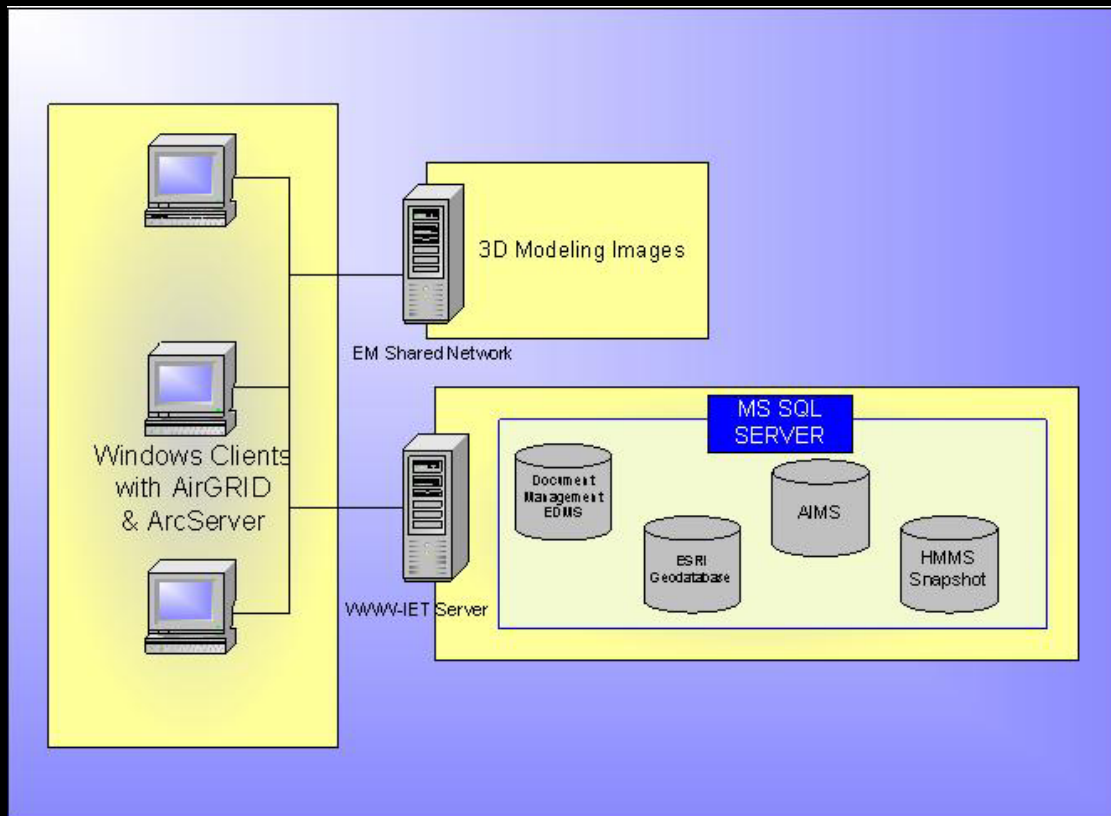


Share Data Among Components



Data ↔ Maps ↔ Documents

AirGRID Under the Hood



- Desktop ArcEngine Application
- VB.Net framework
- SQL/SDE Backend
- Agile programming development

AirGRID Functional Areas



Main

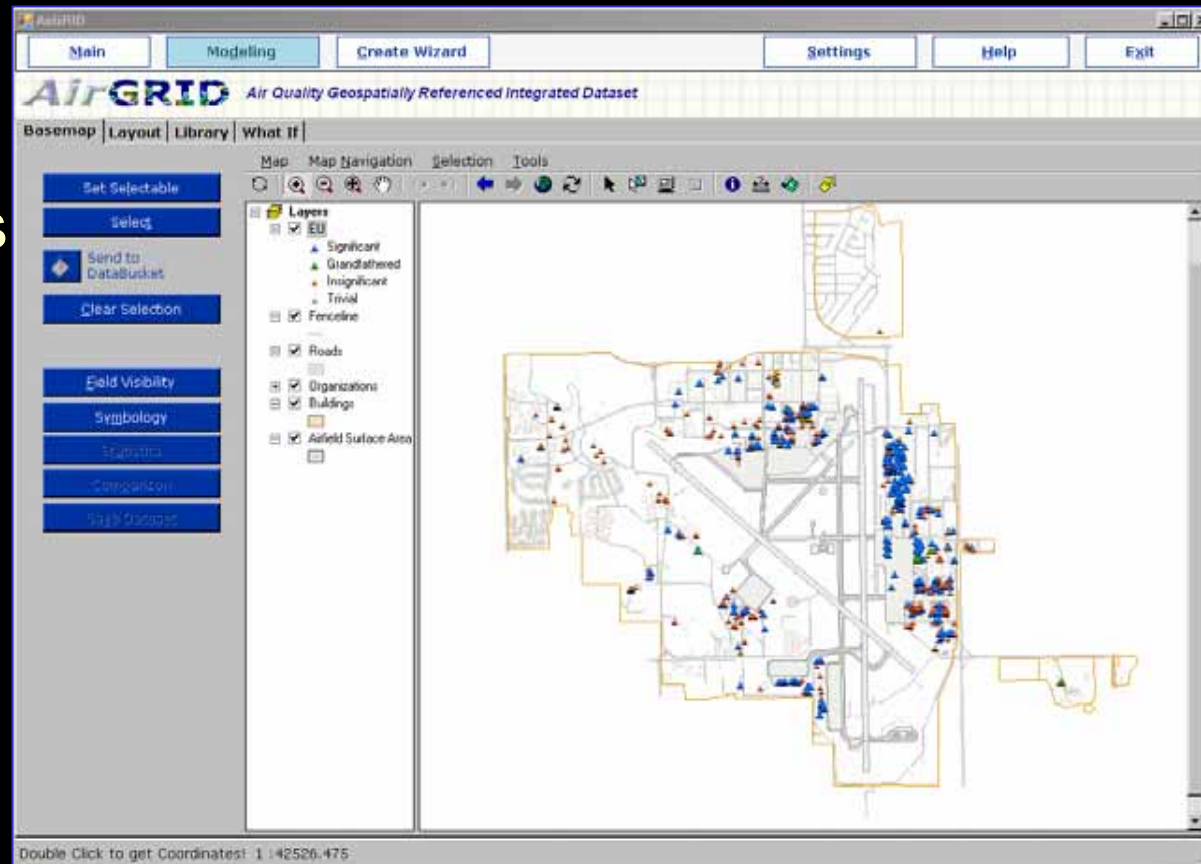
- Spatial Viewing & Analysis
- Electronic Documents
- Database Search

Create Wizard

- Add & Edit Data

Modeling

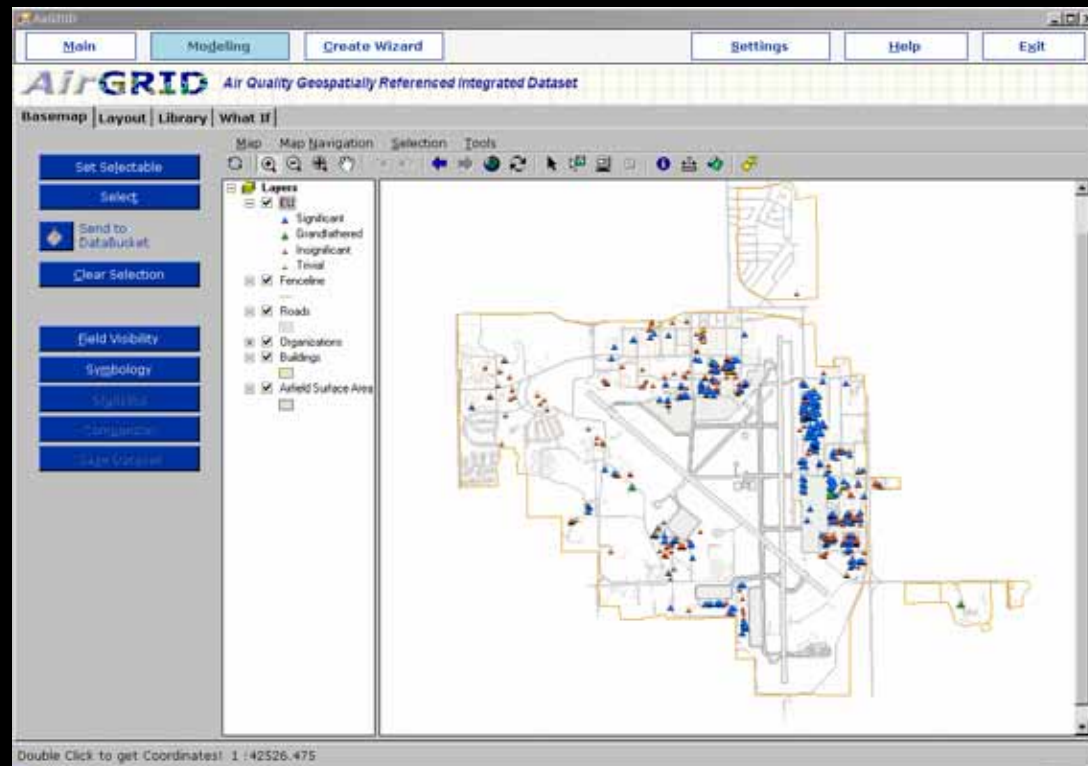
- AQ Modeling & Visualization



Spatial Viewing & Analysis



- Basemap & Layout consistent feature throughout AirGRID
- Similar navigation functionality to ArcView
- Enhanced features
 - Customized tooltips & layout templates



[Main](#)

Electronic Documents



- Quick or advanced search
- Preview or download selected documents
- Build & export customized document lists

The screenshot displays the AirGRID web application interface. At the top, there are navigation tabs for 'Home', 'Modeling', and 'Create Wizard'. Below this is the 'AirGRID - Air Quality Geospatially Referenced Integrated Dataset' header. The main navigation bar includes 'Basemap', 'Layout', 'Documents', 'EUs', 'EUGs', 'BLDGS', 'EU/NSN/ZONE', 'ZONES', 'NSNs', 'Actual Emissions', 'GRGR', 'Estimated Emissions', and 'Summary AirLog'. A search section on the left allows for 'Use DataBucket Contents?' and 'Maximum Results?' (set to 100). The search area includes 'Quick Search' and 'Advanced Search' options. The 'Advanced Search' section has fields for 'Top Collection' (AIR QUALITY), 'Parent Collections' (SEARCH ALL), and 'Sub Collections' (SEARCH ALL). There are also fields for 'Any Part' and 'Document Keywords', both set to 'contains'. A 'Limit Search By Date Range?' section is visible below. The search results are displayed in a table with columns for 'Retain?', 'Type', 'Document Title', 'Linked?', and 'Preview'. The table lists several documents, including 'Tinker AFB Title V Application - December 2001 Update.pdf', 'ipSourceTables1Jur98.xls', '99104v9a.doc', '99104v4c.DOC', 'Detailed Permit Cond Change Req Listing.xls', 'Appendix B Update.msp', '99104Va - DEQ Revision4 (04-05-04) docsheetd', '99104Va - DEQ Revision3 - rev 11-11.doc', and '14 Oct 05 - Facility Wide Operating Permit 99-104-TV_M1.pdf'. The interface also shows 'Page 1 of 5', 'Page Size 20', and 'Total Items: 100'. At the bottom left, there are buttons for 'Page Setup', 'Print Preview', 'Print', and 'Export Results'. The status bar at the bottom left says 'Ready!'.

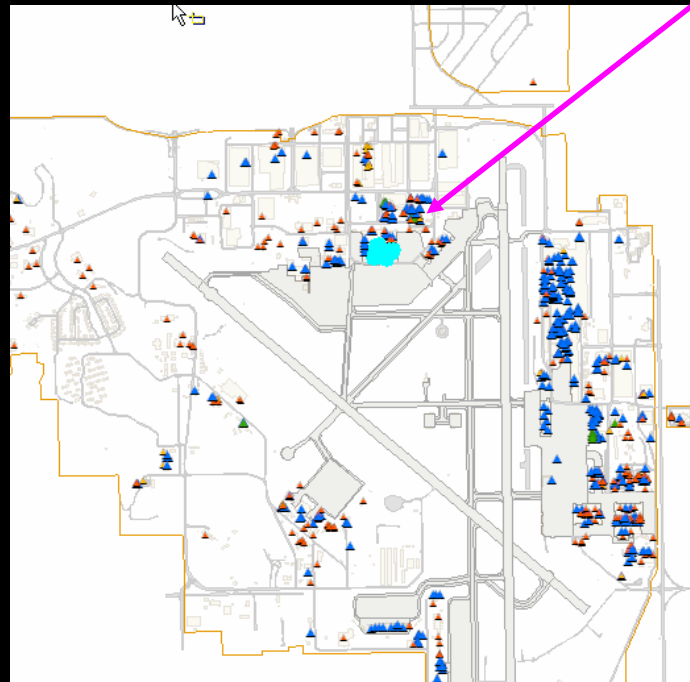
[Main](#)

Documents ↔ Map



- Georeferencing engine (GRE) developed to link documents to map feature
- Linked documents display as selected features on map

Retain?	Type	Document Title	Linked?	Preview
<input type="checkbox"/>		Minor Source Temp AC Units 9-27.doc		
<input type="checkbox"/>		Minor Source Cal Fluid Op App 2-201.doc		
<input type="checkbox"/>		Detailed Listing of Needed Permit Modifications, August 31, 2000.pdf		
<input type="checkbox"/>		Existing Permit Condition Change Request Aug 00.xls		
<input type="checkbox"/>		Detailed Permit Cond Change Req Listing-unprotected.xls		
<input type="checkbox"/>		Detailed Permit Cond Change Req Listing.xls		
<input type="checkbox"/>		ImatonPermit.doc		
<input type="checkbox"/>		99104v6a.doc		



Database Search



- Access multiple data sources from multiple points of entry
- Extensive search capabilities
- “Data Bucket” allows for transfer between data tabs
- Manual modification & export

114 rows retrieved.

Main

Database Search ↔ Map

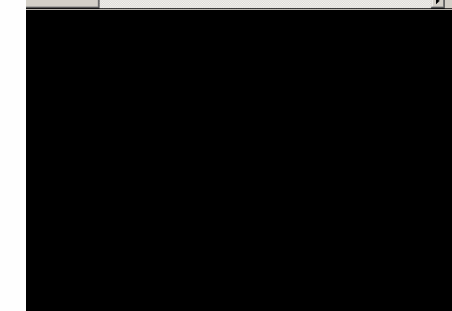
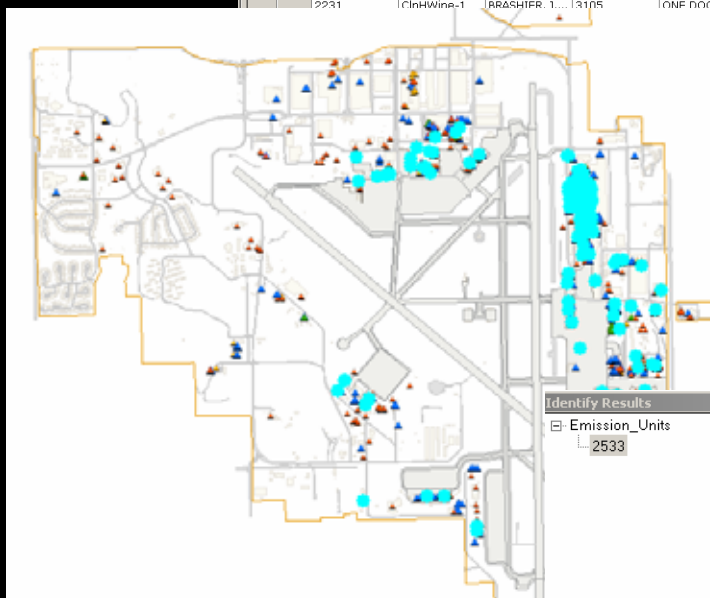


- Search results select corresponding features on the basemap
- Database search fields added to identify results

Search all fields for

<input checked="" type="checkbox"/> EU/PU	<input type="text"/>	<input checked="" type="checkbox"/> Full Description	<input type="text"/>	<input checked="" type="checkbox"/> OC Number(s)	<input type="text"/>
<input checked="" type="checkbox"/> EUG/LUG/PUG	ClnHWipe-1	<input checked="" type="checkbox"/> Concise Description	<input type="text"/>	<input checked="" type="checkbox"/> Org. ID	<input type="text"/>
<input checked="" type="checkbox"/> Contacts	<input type="text"/>	<input checked="" type="checkbox"/> Organization	<input type="text"/>		
<input checked="" type="checkbox"/> Building	<input type="text"/>	<input checked="" type="checkbox"/> Shop Name	<input type="text"/>		
<input checked="" type="checkbox"/> Location	<input type="text"/>	<input checked="" type="checkbox"/> Effective Date	<input type="text"/>		
<input checked="" type="checkbox"/> Regulatory Status	Significant	<input checked="" type="checkbox"/> Date Removed	<input type="text"/>		
<input checked="" type="checkbox"/> Comments	<input type="text"/>	<input checked="" type="checkbox"/> Site Phone	<input type="text"/>		

	EU/PU	EUG/LUG/PUG	Contacts	Building	Location	Regulatory Status	Comments	Full Description	Concise Description	Organization
Included	2001	ClnHWipe-1	BRASHIER, J...	2121	EAST SIDE O...	Significant	MATERIAL U...	[9B] GENER...	GENERAL SO...	MXABF
	2100	ClnHWipe-1	BRASHIER, J...	2121	NORTH AND ...	Significant	MATERIAL U...	[6C] GENER...	GENERAL SO...	MXABF
	2112	ClnHWipe-1	BRASHIER, J...	2122	B-1 MAINT...	Significant	Process is n...	[7C] GENER...	GENERAL SO...	MXABB
	2123	ClnHWipe-1	BRASHIER, J...	2136	E-3 MAINT...	Significant	MATERIAL U...	[5C] GENER...	GENERAL SO...	MXACE
	2127	ClnHWipe-1	BRASHIER, J...	240	BOTH DOCKS	Significant	MATERIAL U...	[8E] GENER...	GENERAL SO...	MABATB
	2140	ClnHWipe-1	BRASHIER, J...	3102	KC-135 POS...	Significant	MATERIAL U...	[12B] GENER...	GENERAL SO...	MABAT
	2150	ClnHWipe-1	BRASHIER, J...	3225	NEW PAINT ...	Significant	77.6% OF T...	[16A] GENER...	GENERAL SO...	MXACCB
	2231	ClnHWipe-1	BRASHIER, J...	3105	ONE DOCK	Significant	MATERIAL U...	[15C] GENER...	GENERAL SO...	MABAT
						Significant	MATERIAL U...	[17A] GENER...	GENERAL SO...	MABCCA
						Significant	77.6% OF T...	[11B] GENER...	GENERAL SO...	MXACCA



Identify Results

Emission_Units	2533
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Field	Value
Building (BLDG)	FLIGHTLINE
Location (LOCATION)	<NULL>
Regulatory Status (STATUS)	Significant
Comments (COMMENT)	JAN06 UPDATE: JC BRASHIE...
Full Description (DESCRIPTION)	[18B] GENERAL SOLVENT U...
Concise Description (TITLE_V...	GENERAL SOLVENT USE
Organization (ORGANIZATION)	MAB
Shop Name (SHOP)	AIRCRAFT DIVISION
Site Phone (SITE_PHONE)	736-5986
Effective Date (DATE_EFFEC...	<NULL>
Date Removed (DATE_REMO...	<NULL>
OC Number(s) (OC_NUMBER)	<NULL>
Org. ID (TWDLTR)	AIRCRAFT

Add & Edit Data



- Browse, edit & create new data
- Filtering capability
- Automatic creation of new record IDs and parameters based on category selection

The screenshot shows the 'Air-GRID' software interface, specifically the 'Create Wizard' window for editing an existing EU/PU record. The window has a menu bar with 'Main', 'Modeling', 'Create Wizard', 'Settings', 'Help', and 'Exit'. Below the menu bar is a toolbar with 'Basemap', 'Layout', and 'EU Wizard' buttons. The main area is divided into a left sidebar and a main form area. The sidebar contains 'Select Mode' with options for 'Browse Data', 'Edit EU/PU', and 'Create New EU/PU', and a 'Select EU/PU Category' dropdown. The main form area contains fields for 'EU Type' (Temp EU), 'EU ID' (711), 'Building' (208), 'Regulatory Status' (Grandfathered), 'EUG ID' (CulCamp-8), and 'Location' (BOILER PLANT). It also includes a text area for 'EU/PU Description' (BOILER, NATURAL GAS#2 FUEL OIL, 116 MMBtu/hr), 'Organization' (72 ABW/OEC), 'ORG ID' (CE), 'Phone' (734-3070), 'Shop Name' (BOILER PLANT), and 'Comment' (JANIS UPDATE, DAVE DOWNEY ON 28 JULY 2005, PEGGY). There are also sections for 'Title V Description' (BOILER, NATURAL GAS#2 FUEL OIL, 116 MMBtu/hr), 'Important Dates' (Title V Effective Date: 1942, Date Removed:), and 'Equipment (if applicable)' (Make/Model, OC Number(s), Serial No.: 60311-2). At the bottom left, there are 'Save EU/PU' and 'Cancel' buttons. The status bar at the bottom indicates 'Editing an existing EU/PU'.

Create Wizard

Air Quality Modeling Library



- GIS Integration
 - results displayed on basemap
 - investigate & compare results using spatial analysis

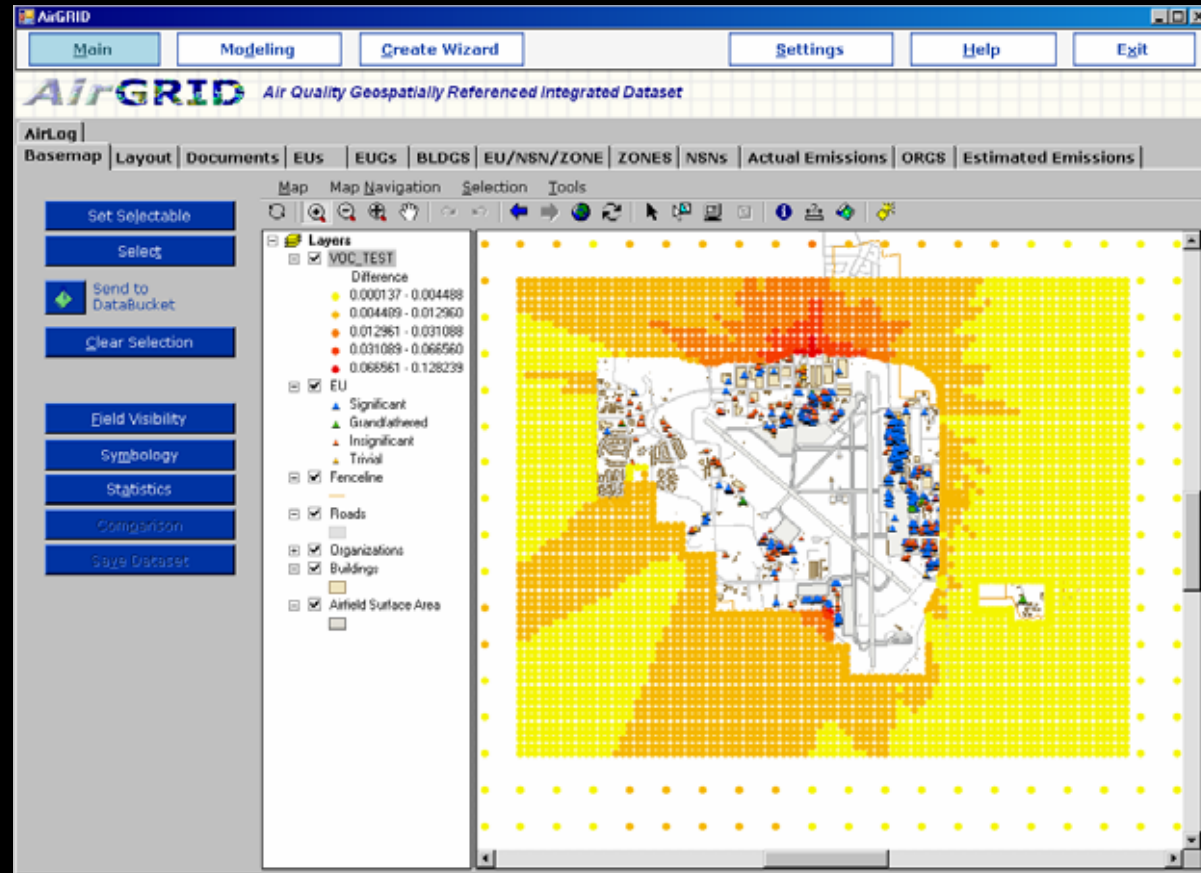
The screenshot shows the AirGRID software interface. The title bar reads "AirGRID: Air Quality Geospatially Referenced Integrated Dataset". The main window is titled "Modeling Library" and contains a table of modeling results. The table has columns for ID, 3D, File Name, Chemical, CAS_NO, Emission Year, Averaging, and Scenario. The first row is selected, showing NOxAN05 for Nitrogen Oxides.

ID	3D	File Name	Chemical	CAS_NO	Emission Year	Averaging	Scenario
NOxAN05			Nitrogen Oxides	0000-101	2005	Annual	Basewide
SO2AN05			Sulfur Dioxide	0000-102	2005	Annual	Basewide
SO224H05			Sulfur Dioxide	0000-102	2005	24 Hour	Basewide
SO23H05			Sulfur Dioxide	0000-102	2005	3 Hour	Basewide
CO1H05			Carbon Monoxide	630-09-0	2005	1 Hour	Basewide
CO8H05			Carbon Monoxide	630-09-0	2005	8 Hour	Basewide
PM10AN05			Particulate Matter (10 microns)	0000-010	2005	Annual	Basewide
PM1024H05			Particulate Matter (10 microns)	0000-010	2005	24 Hour	Basewide
PM2.5AN05			Particulate Matter (2.5 microns)	0000-025	2005	Annual	Basewide
PM2.524H05			Particulate Matter (2.5 microns)	0000-025	2005	24 Hour	Basewide
PERC24H05			Tetrachloroethylene	127-18-4	2005	24 Hour	Basewide
MELC24H05			Methylene Chloride	75-09-2	2005	24 Hour	Basewide
CR624H05			Hexavalent Chromium	7739-94-5	2005	24 Hour	Basewide
FORB24H05			Formaldehyde	50-00-0	2005	24 Hour	Basewide
ACE24H05			Acetaldehyde	75-07-0	2005	24 Hour	Basewide
AS24H05			Arsenic	7440-39-2	2005	24 Hour	Basewide
BZ24H05			Benzene	71-43-2	2005	24 Hour	Basewide
BE24H05			Beryllium	7440-41-7	2005	24 Hour	Basewide
BUT24H05			1,3-Butadiene	106-99-0	2005	24 Hour	Basewide
CD24H05			Cadmium	7440-41-7	2005	24 Hour	Basewide
NI24H05			Nickel	7440-02-0	2005	24 Hour	Basewide
AMNH24H05			Ammonia	7804-41-7	2005	24 Hour	Basewide
EB24H05			Ethylbenzene	100-41-4	2005	24 Hour	Basewide
MN24H05			Manganese	7439-96-5	2005	24 Hour	Basewide
HG24H05			Mercury	7439-97-6	2005	24 Hour	Basewide
TOL24H05			Toluene	100-66-3	2005	24 Hour	Basewide

Air Quality Model- What if?



- Test change in emission scenarios on-the-fly
- Change results (what if vs. now) displayed on basemap



Integration Challenges



- Poorly documented API's
 - e.g., DocuShare
- COM interoperability with .Net objects issues
 - ESRI objects, e.g. cursors
- Inherited data structures
 - Legacy databases



Lessons Learned



- Value of Agile programming methodology
 - Daily “scrum” meetings
 - Monthly “sprint” meetings
 - Flexible & adaptable
- Utility of Cruise Control for continuous integration
 - Central repository for code (Subversion)
 - Easily updated builds and executables

Future Development



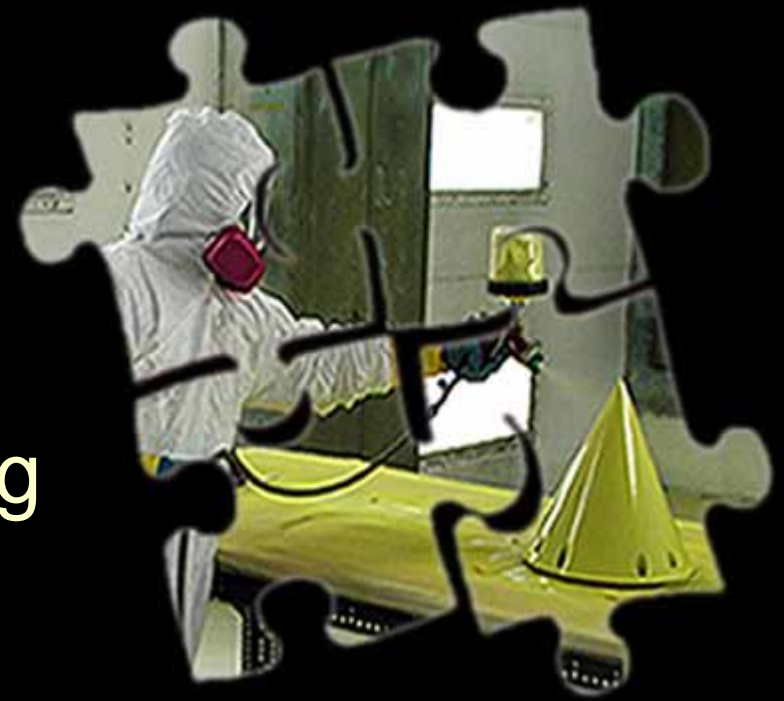
- Enhanced spatial analysis functionality
 - Statistics
 - Comparisons
- Map to database link
- Map to documents link
- Convert to web-based application

Summary

- AirGRID is a “one-stop” data portal
 - Identify & efficiently retrieve data
 - Add value & integrated data analysis functionality
- Agile “sprint” programming allows for flexible development



AirGRID



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Thank You

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