Optimizing the Speed and Efficiency of Data Collection and Analysis – Techniques Implemented at DOD Facilities

Presented by:

BEM SYSTEMS, INC.

100 Passaic Avenue
Chatham, NJ 07928
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Conference on Accelerating Site Closeout,
Improving Performance, and Reducing
Costs Through Optimization
June 15-17, 2004 – Dallas, Texas
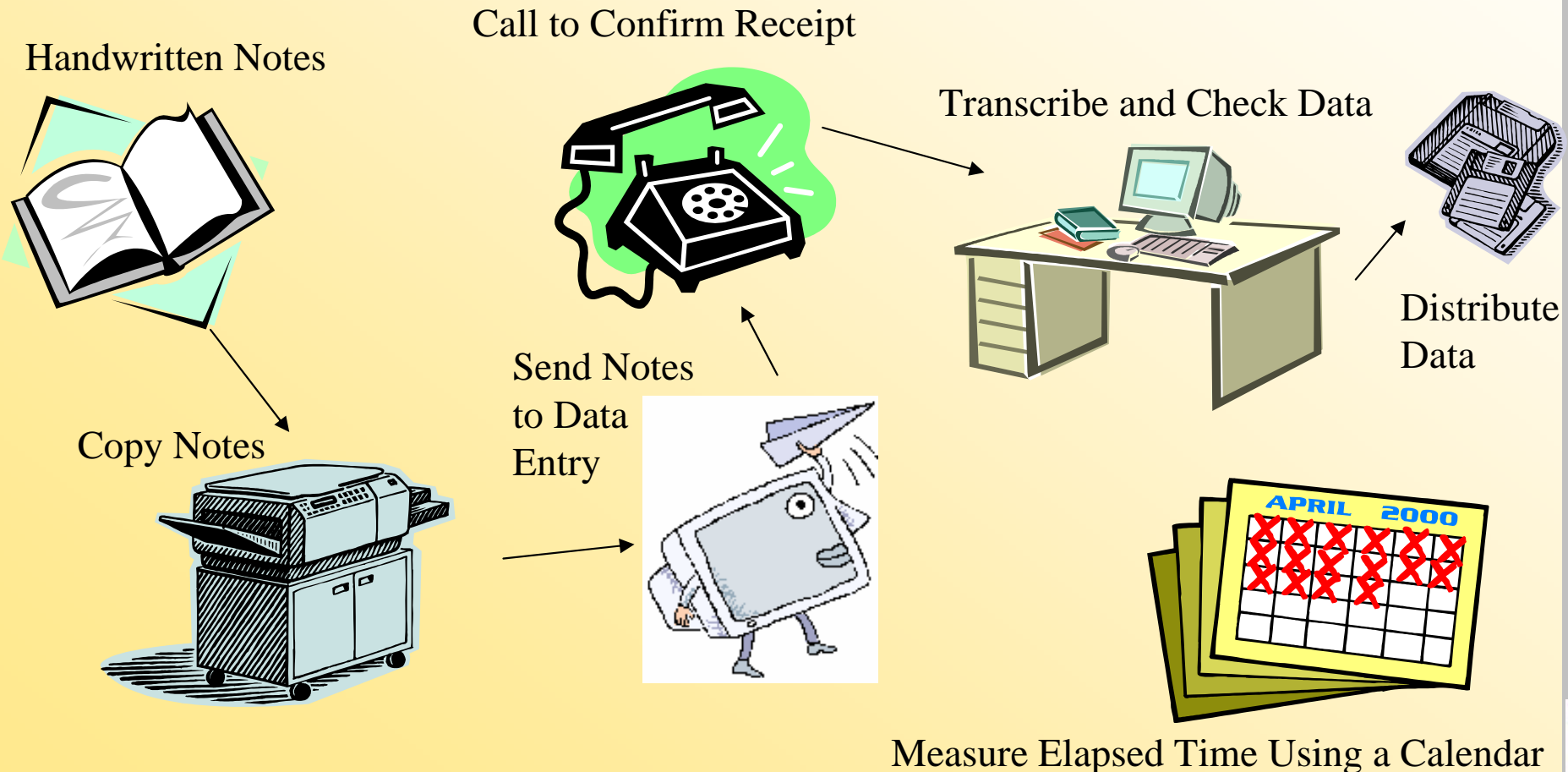
Remediation Optimization

Optimizing the Speed and Efficiency of Data Collection and Analysis – Techniques Implemented at DOD Facilities

- Web-Based Applications
- Wireless Internet
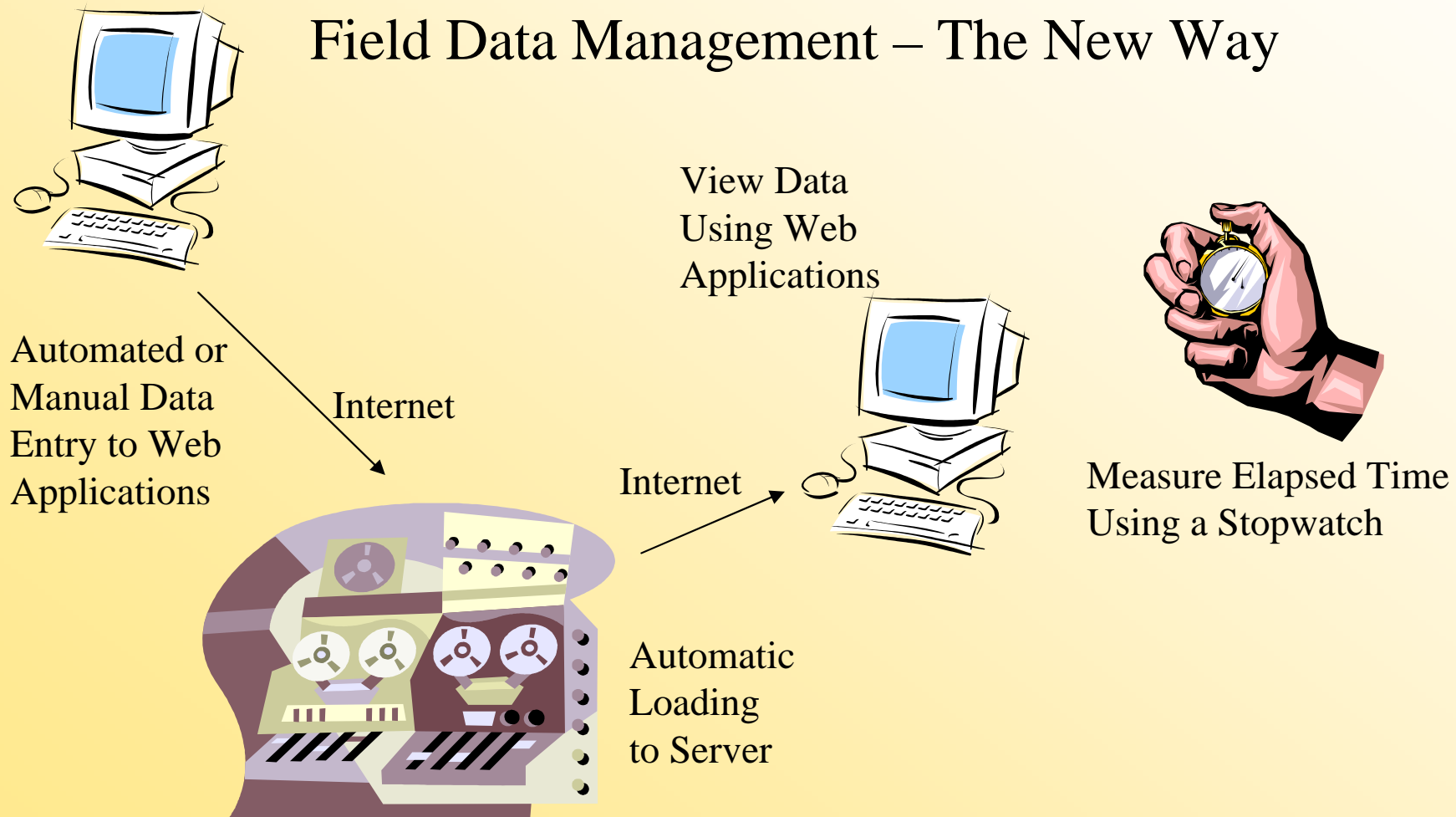- Standardized Data Structures
- An Implemented Example

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Why Use the Internet for Field Data Management

Field Data Management – The Old Way

Handwritten Notes

Call to Confirm Receipt

Transcribe and Check Data

Copy Notes

Send Notes to Data Entry

Distribute Data

Measure Elapsed Time Using a Calendar

APRIL 2000

Why Use the Internet for Field Data Management?

Field Data Management – The New Way

Automated or
Manual Data
Entry to Web
Applications

Internet

View Data
Using Web
Applications

Internet

Automatic
Loading
to Server

Measure Elapsed Time
Using a Stopwatch

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Remediation Optimization

Why Use the Internet for Field Data Management?

Ready Access to Data Anywhere the Internet Can Be Used
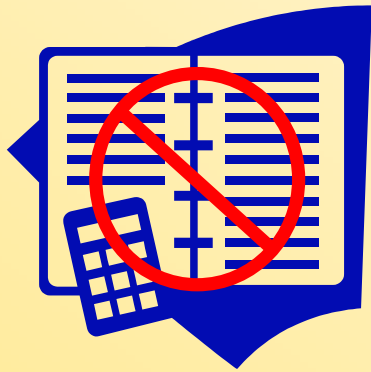
Reduce or Eliminate Manual Data Handling
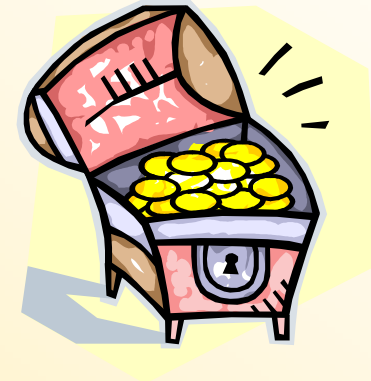
Spend Less Money Making Data Available – Make Decisions Faster

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Remediation Optimization

Wireless Internet Access

"But I don't have a phone line and my site is remote – how do I access the Internet?"

"*Wireless Internet!*"

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Remediation Optimization

Wireless Internet Access

- **Cellular**
  - Speed is OK – Broadband Availability is Expanding
  - Service Widely Available but not Ubiquitous
 - Use Where Speed is not Critical but Mobility Is

- **Satellite**
  - Multiple Field Units can Connect Using Wireless LAN
  - Can Provide Broadband Service
  - Can be Configured for Mobile, but is Expensive and not "Drive-Around"
  - Use Where Speed is Critical, Cellular is Unavailable, and Mobility is not Critical

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Standardized Data Structures

Great – Now I've got Data Coming In!
Where do I put it? I need a Database…
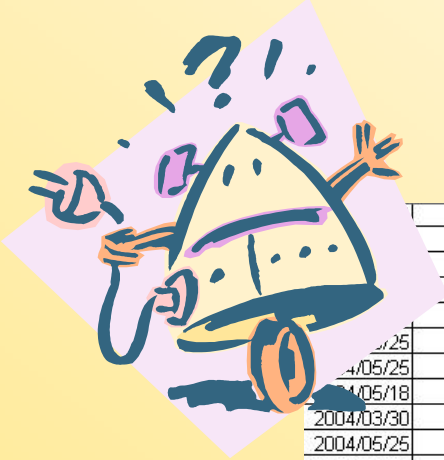
	50.39	Default	N/A	150	20	10.078	20	10.078	5.5	2.772	0	0	54.5	27.4
	25.47	Default	N/A	150	20	5.094	20	5.094	5.5	1.401	0	0	54.5	13.8
	60.31	Default	N/A	150	20	12.062	20	12.062	5.5	3.317	0	0	54.5	32.8
	4.47	Default	N/A	150	20	0.894	20	0.894	5.5	0.246	0	0	54.5	2.4
	67.95	Default	N/A	150	20	13.589	20	13.589	5.5	3.737	0	0	54.5	37
/25	62.87	Default	N/A	150	20	12.575	20	12.575	5.5	3.458	0	0	54.5	34.2
/05/25	3.84	Default	N/A	150	20	0.768	20	0.768	5.5	0.211	0	0	54.5	2.0
/05/18	36.9	Default	N/A	150	20	7.38	20	7.38	5.5	2.03	0	0	54.5	20.1
2004/03/30	6.93	Default	N/A	150	20	1.386	20	1.386	5.5	0.381	0	0	54.5	3.7
2004/05/25	58.07	Default	N/A	150	20	11.614	20	11.614	5.5	3.194	0	0	54.5	31.6
2004/05/26	36.63	Default	N/A	150	20	7.326	20	7.326	5.5	2.015	0	0	54.5	19.9
2004/05/18	50.92	Default	N/A	150	20	10.185	20	10.185	5.5	2.801	0	0	54.5	27.7
2004/03/31	5.99	Default	N/A	150	20	1.198	20	1.198	5.5	0.329	0	0	54.5	3.2
2004/05/25	54.18	Default	N/A	150	20	10.835	20	10.835	5.5	2.98	0	0	54.5	29.5
2004/05/26	47.4	Default	N/A	150	20	9.481	20	9.481	5.5	2.607	0	0	54.5	25.8
2004/05/26	31.16	Default	N/A	150	20	6.232	20	6.232	5.5	1.714	0	0	54.5	16.9
2004/05/18	35.78	Default	N/A	150	20	7.156	20	7.156	5.5	1.968	0	0	54.5	19.4
2004/03/31	5.14	Default	N/A	150	20	1.028	20	1.028	5.5	0.283	0	0	54.5	2.8
2004/05/27	55.35	Default	N/A	150	20	11.069	20	11.069	5.5	3.044	0	0	54.5	30.1
2004/05/26	52.54	Default	N/A	150	20	10.507	20	10.507	5.5	2.889	0	0	54.5	28.6
2004/05/18	29.12	Default	N/A	150	20	5.825	20	5.825	5.5	1.602	0	0	54.5	15.8
2004/04/01	18.62	Default	N/A	150	20	3.724	20	3.724	5.5	1.024	0	0	54.5	10.1
2004/05/26	60.24	Default	N/A	150	20	12.048	20	12.048	5.5	3.313	0	0	54.5	32.8
2004/05/27	101.48	Default	N/A	150	20	20.295	20	20.295	5.5	5.581	0	0	54.5	55.3
2004/05/27	34.6	Default	N/A	150	20	6.92	20	6.92	5.5	1.903	0	0	54.5	18.8
2004/05/18	27.04	Default	N/A	150	20	5.408	20	5.408	5.5	1.487	0	0	54.5	14.7
2004/03/31	16.02	Default	N/A	150	20	3.204	20	3.204	5.5	0.881	0	0	54.5	8.7
2004/06/02	71.89	Default	N/A	150	20	14.377	20	14.377	5.5	3.954	0	0	54.5	39.1
2004/06/02	36.68	Default	N/A	150	20	7.336	20	7.336	5.5	2.017	0	0	54.5	19
2004/05/17	54.56	Default	N/A	150	20	10.911	20	10.911	5.5	3.001	0	0	54.5	29.7
2004/04/01	6.57	Default	N/A	150	20	1.313	20	1.313	5.5	0.361	0	0	54.5	3.5
2004/05/27	104.12	Default	N/A	150	20	20.825	20	20.825	5.5	5.727	0	0	54.5	56.7
2004/06/02	128.75	Default	N/A	150	20	25.749	20	25.749	5.5	7.081	0	0	54.5	70.1

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Standardized Data Structures

The Old Way…Design a Custom Database Schema for Each Project
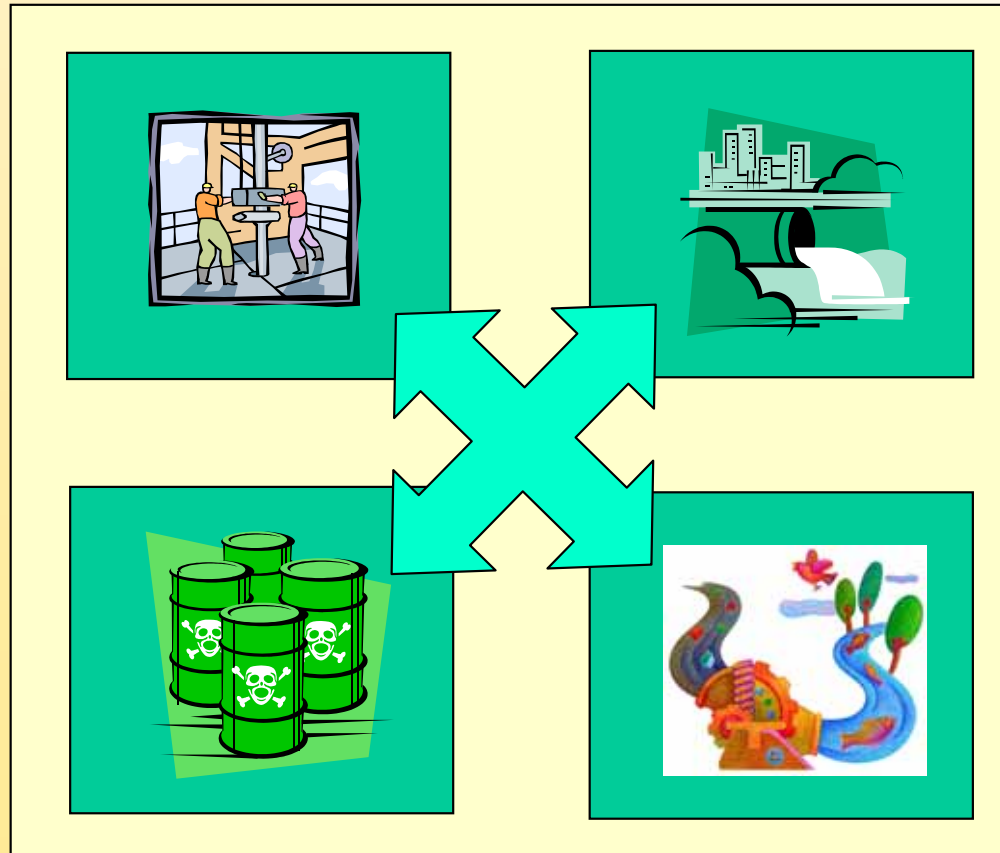
Each database meets needs of specific project types…
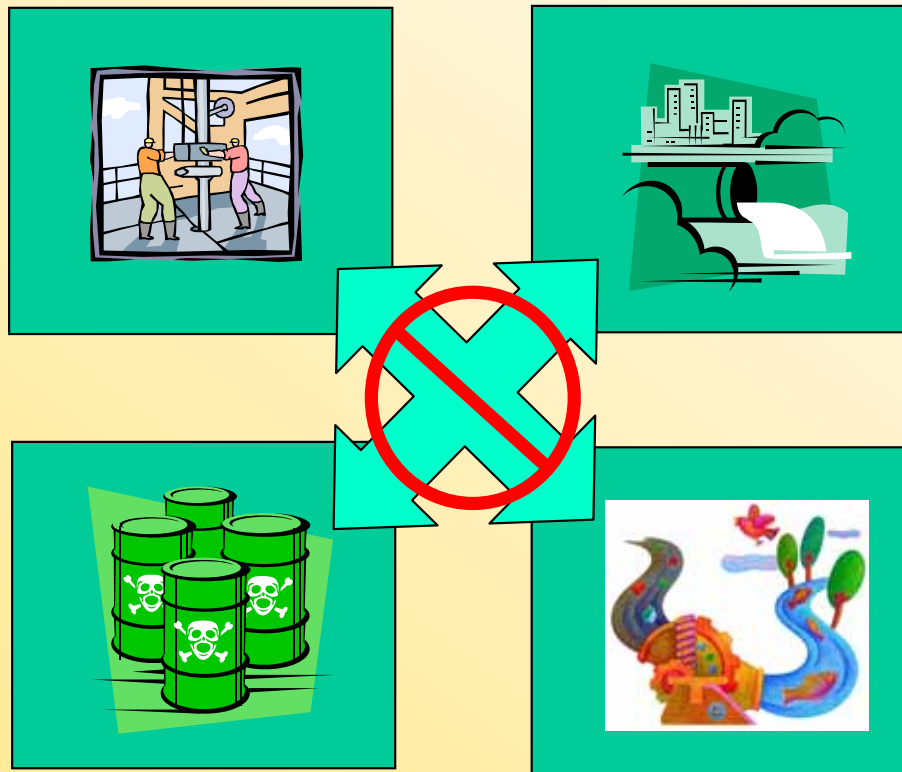
… but they cannot share data with each other!

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Standardized Data Structures

The New Way…Use a Single, Comprehensive Schema

More complex to design, but meets more needs.

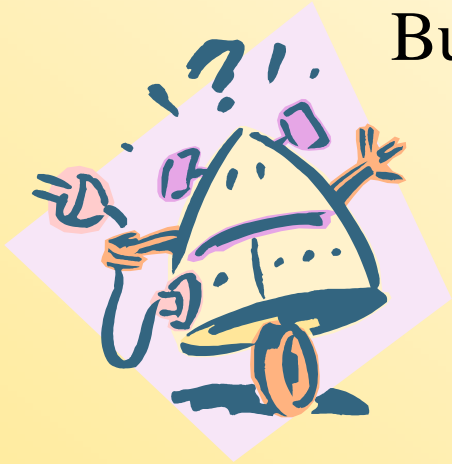Relationships are easier to determine.

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Standardized Data Structures

But what schema should I use?

Database Designs are often Proprietary

But open schema are available!

Remediation Optimization

Standardized Data Structures

Users Don't Want to be Hostage to Proprietary Designs

Spatial Data Standards (SDS) for Facilities, Infrastructure & Environment

- Provides Database Schema for Environmental and Other Data
- Proper Use Ensures Wide Accessibility of Data
- Data Structures are Optimized for Spatial Relationships
- Works with Multiple Database Platforms (Oracle, Access, SQL Server, etc.)
- Developed/Used by Department of Defense
- Free and Open Standard
- http://tsc.wes.army.mil/products/TSSDS-TSFMS/tssds/html/

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Show Me!

How does all this get put together?

Cape Canaveral Air Force Station

Launch Complex 15

- Major Remediation Program to Treat DNAPL
- Selected Technology: Large Diameter Auger
  - Over 500 Treatment "Cells"
  - Auger Moves Through Contamination Zones Based on Real-Time Instrumentation Readings
  - Typical Daily Data Load is ~3,000 records each with 30 Fields

Launch Complex 15

Remediation Program Generates Large Quantities of Data

- Challenges:
  - Project is on East Coast, but a key Project Engineer is on West Coast
  - Data Collected Real-Time, but Delivered Daily in Bulk
  - Advanced Interpretation of Data is Time Consuming
  - Data Handling/Processing Tasks Onerous due to Quantity of Data
  - No Remote Monitoring of Real-Time Data
  - Different Stakeholders Need to See Different Things

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Launch Complex 15

Remediation Program Generates Large Quantities of Data

- Solution:
    - Send Real-Time Data to Wireless Internet Equipped PC at Site
    - PC Passes Data Directly to Web Service
    - Web Service Application Immediately and Automatically Formats and Passes Data to SDS Database
    - Users with Proper Access Use Web Application to View Performance Charts and GIS Updated Every Minute
    - Project Team has Easy Access to All Data from One Source
    - Project Engineers Direct Remediation Activities from Anywhere with Internet Access

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Launch Complex 15

Data Can be Presented in Charts or Exported to a Spreadsheet for Additional Manipulation.
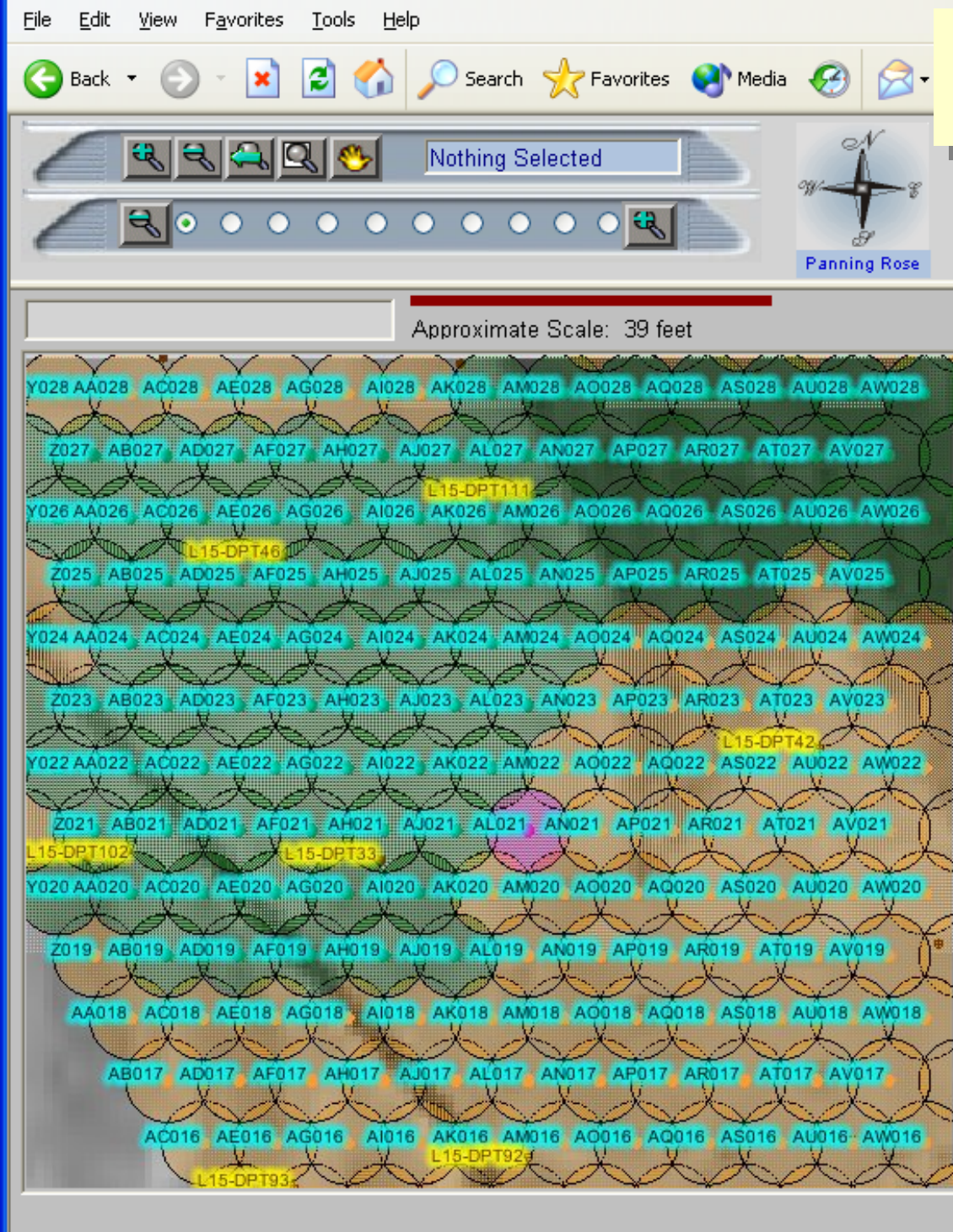
Data Chart & Cell Treatment Status in GIS Module
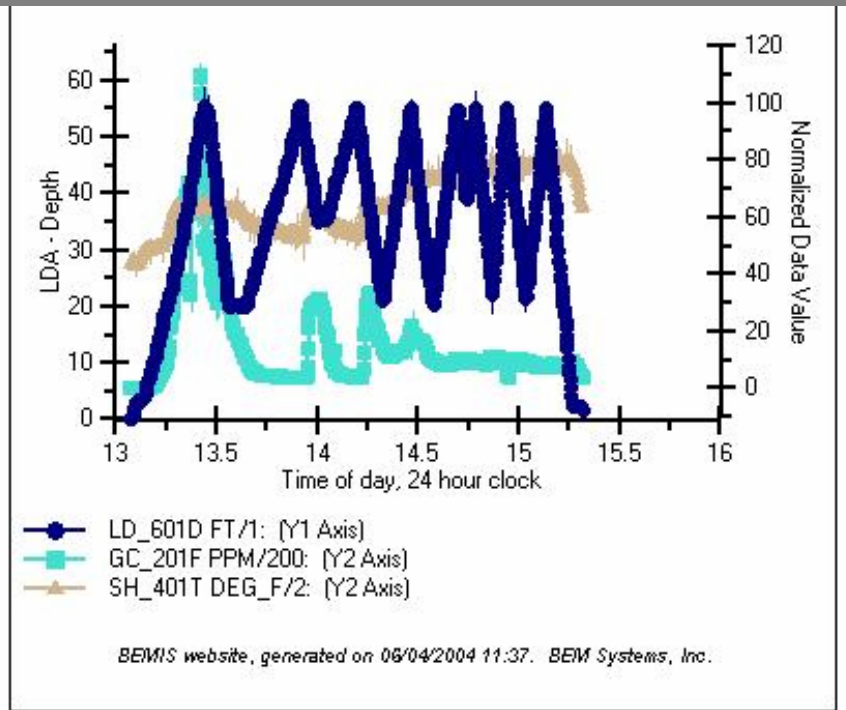
Single database approach allows many related layers to be managed

Project Team Easily Uses Data to Optimize Process Example: Compressed Depth Range to Maximize Treatment Effectiveness
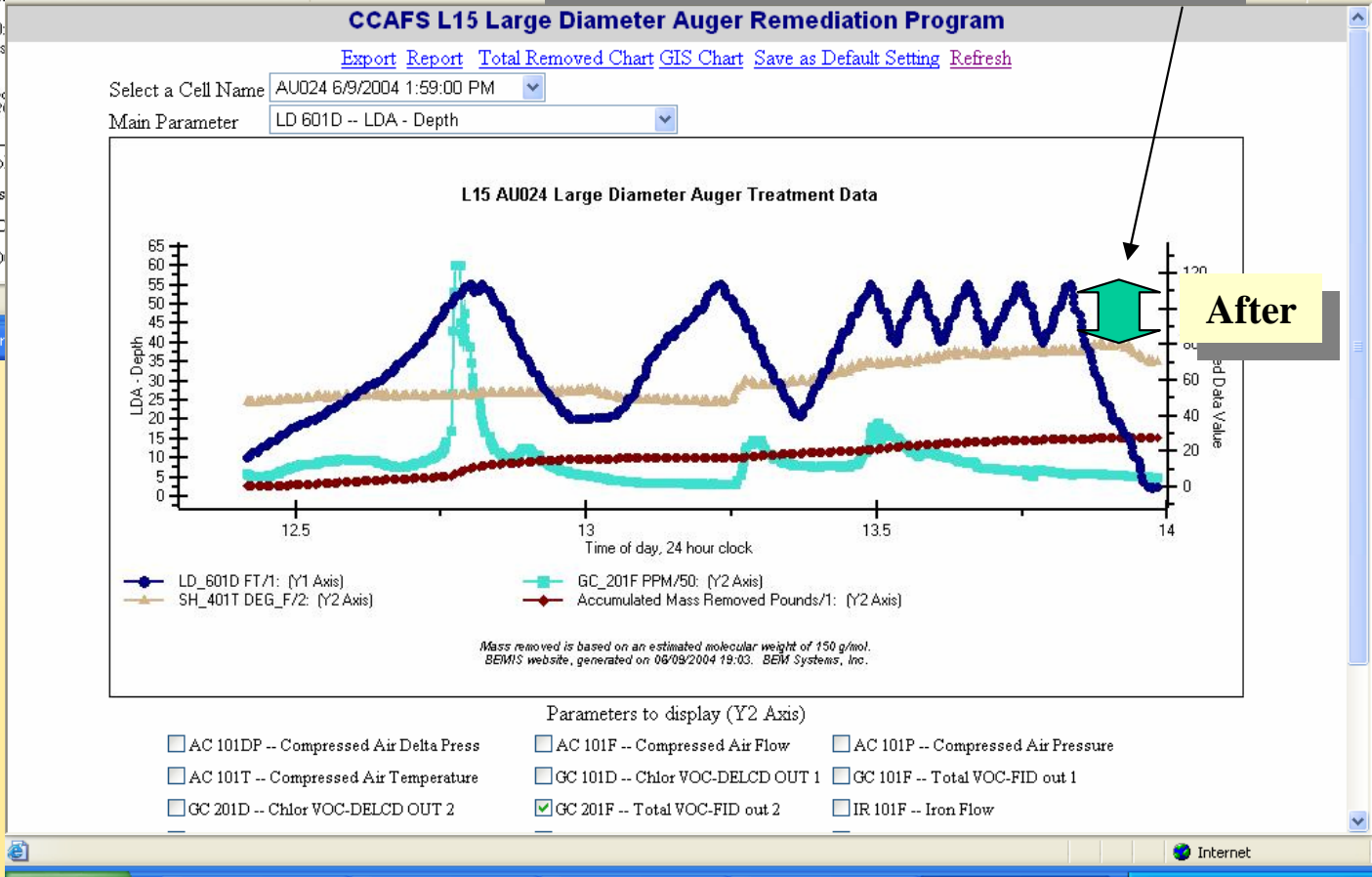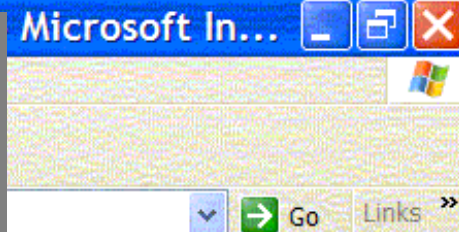
Cape Canaveral Air Force Station
L15 Large Diameter Auger Remediation Program
Treatment Program Status Report
June 01, 2004 08:00 PM

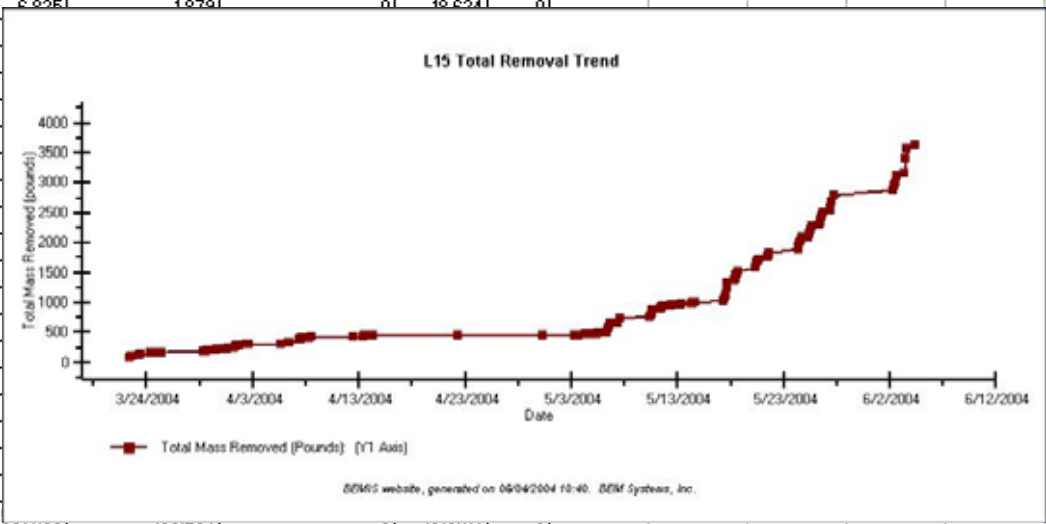| Cell Name	Date Treated	Total Mass Removed (Pounds)	Ratio Default or Corrected	Individual Component Mass Removed (Pounds)					
				Vinyl Chloride	1,2-Dichloroethene	Trichloroethene	Tetrachloroethene	Freon	Other
AD025	2004/05/18	36.9	Default	7.38	7.38	2.03	0	20.111	0
AG024	2004/05/18	29.12	Default	5.825	5.825	1.602	0	15.872	0
AA024	2004/05/20	80.78	Default	16.156	16.156	4.443	0	44.026	0
AB025	2004/05/20	38.77	Default	7.753	7.753	2.132	0	21.127	0
Z025	2004/05/20	21.66	Default	4.332	4.332	1.191	0	11.805	0
AC024	2004/05/20	60.31	Default	12.062	12.062	3.317	0	32.868	0
Z023	2004/05/21	48.43	Default	9.686	9.686	2.664	0	26.395	0
AA022	2004/05/21	22.66	Default	4.532	4.532	1.246	0	12.351	0
AB021	2004/05/21	34.17	Default	6.835					
AB023	2004/05/24	50.45	Default	10.091					
AD019	2004/05/24	67.95	Default	13.589					
AC022	2004/05/24	25.47	Default	5.094					
AC020	2004/05/24	50.39	Default	10.078					
AB019	2004/05/24	65	Default	13					
AF019	2004/05/25	54.18	Default	10.835					
AD021	2004/05/25	62.87	Default	12.575					
AE020	2004/05/25	58.07	Default	11.614					
AD023	2004/05/25	3.84	Default	0.768					
AF023	2004/05/26	31.16	Default	6.232					
AF021	2004/05/26	47.4	Default	9.481					
AH019	2004/05/26	60.24	Default	12.048					
AG022	2004/05/26	52.54	Default	10.507					
AE022	2004/05/26	36.63	Default	7.326					
AH023	2004/05/27	34.6	Default	6.92					
AI022	2004/05/27	101.48	Default	20.295					
AJ019	2004/05/27	104.12	Default	20.825					
AG020	2004/05/27	55.35	Default	11.069					
Project Totals		2785.53		557.106					

Ratio Default: Default values have been used for compound ratios to determine the molecular weight.
Ratio Corrected: Default values have been replaced with values based on field GC measurements to provide a corrected molecular weight.
Ratio Estimated: An estimated value has been substituted for the calculated mass removed.

L15 Total Removal Trend
Total Mass Removed (Pounds) [Y1 Axis]
BEMIS website, generated on 06/04/2004 10:40. BEM Systems, Inc.

Launch Complex 15

So How Did All This Technology Help Me?

The Basics
- Speed of Access to Data is Greater
- Less Labor to Retrieve and Analyze Data
- Minimized Data Handling
  - Data Move Automatically
  - No Transcription or Synchronization
  - Improved Data Quality
- Centralized Data Storage
  - Everyone Sees the Same Data

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Launch Complex 15

So How Did All This Technology Help Me?

Beyond the Basics…

Project Team Concentrated on Optimization

•Used Initial Cell Data to Modify the Process to Optimize the Speed and Effectiveness of Treatment

•Evaluated Effect of Modifying Inputs

•Identify Depth Where Most Material is Found

•Evaluate Possibility of Treating Remaining Cells Cheaper While Still Meeting Objectives

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Remediation Optimization

Summary

- Web-Based Tools Facilitated Field Data Entry
- Wireless Data Submission Allowed Real-Time Monitoring for Remote Sites
- Standardized Data Structure Facilitated Interaction with Related Data

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Remediation Optimization

Summary

Spend Less Time and Money
Collecting and Managing Data

Spend More Time Using Data
to Optimize Remediation and
Reduce Remediation Costs

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