

# **SDSFIE & Geodatabase Spatial Data Standards**

**March 20, 2002**

**Marine Corps GIS Working Group (MCGWG) Meeting**

**29 Palms, California**

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*for facilities, infrastructure, and environment*  
**CEERD-ID-C**

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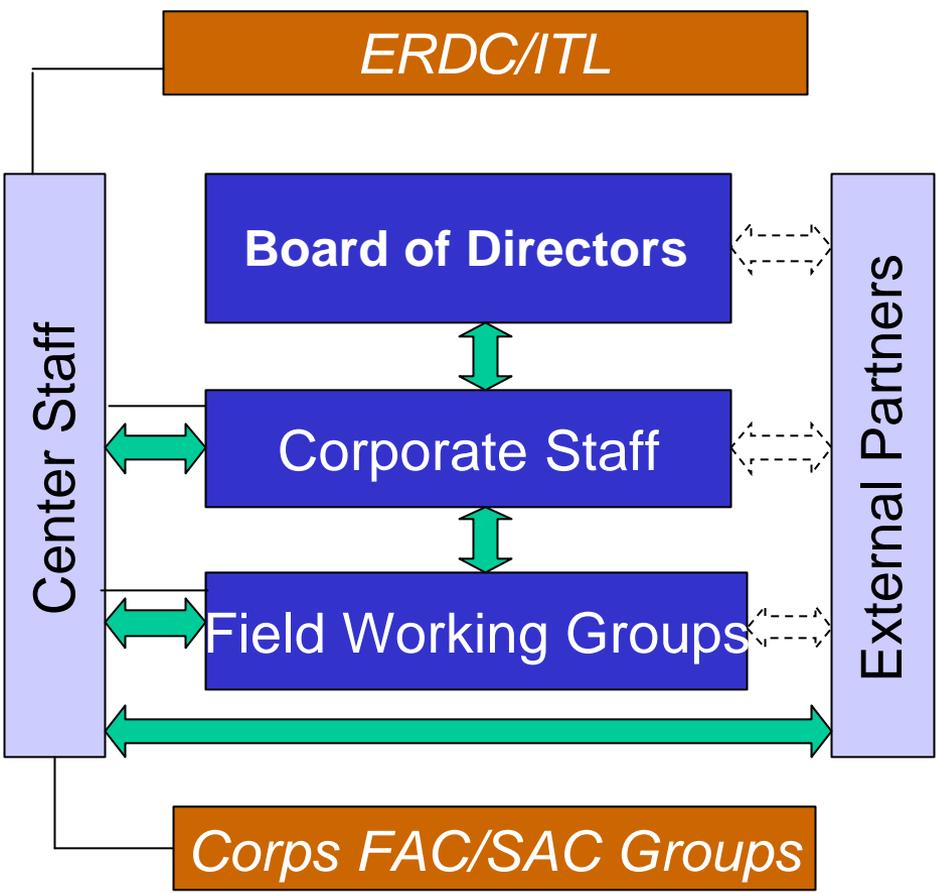
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CADD/GIS Technology Center Internet URL :  
<http://tsc.wes.army.mil>

# The *New* CADD/GIS Technology Center

- Federal Partners:  
 USACE  
 (Military Programs)  
 (Civil Works)  
 (Research and Development)  
 Naval Facilities Command  
 Air Force Civil Engineer  
 Marine Corps  
 General Services Admin.  
 NASA  
 Coast Guard  
 Department of State  
 Defense Logistics Command  
 FAA
- Federal Associates:  
 Architect of the Capitol  
 Army Reserve  
 National Guard  
 Veterans Affairs  
 EPA  
 Department of Interior  
 DOE



- Industry Associates:
- ESRI
  - Autodesk
  - Bentley
  - Intergaph
- Societies/Organizations:
- NIBS
  - CSI
  - AIA
  - IFMA
  - ISO
  - ANSI
  - ASTM
  - ACS
  - Nature Conservancy
  - OGRIP
  - PaMAGIC
  - National Assoc. of Counties

# Symposium 2002

## CADD/GIS Symposium and Exposition 2002

- **When:** August 20 – 22, 2002
- **Where:** San Antonio, Texas
- **Partnering with Air Force Joint Service Pollution Prevention and Hazardous Waste Management Conference and Exposition.**
- **Website:**  
<http://tsc.wes.army.mil/CADDSymposium2002.asp>



- Symposium 2000 had:
- 1129 Attendees
- 115 Presentations
- 19 Workshops
- 89 Exhibitors

# 01.016 – Expand SDSFIE/FMSFIE to Meet CAA and SARA Title III Legal Reporting Requirements

**Scope:** Expand SDSFIE & FMSFIE to include Clean Air Act (CAA) and Superfund Amendments and Reauthorization Act (SARA) Title III legal data collection and reporting requirements.

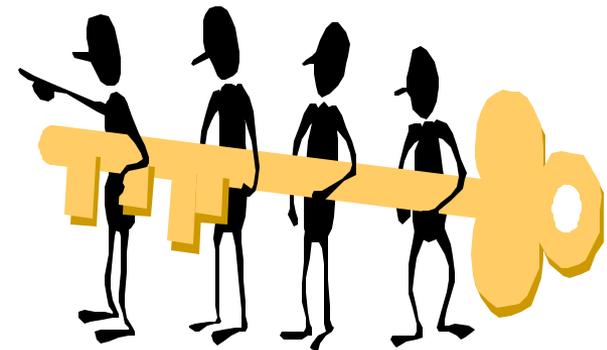
- Project Proposal submitted by Denise Smith, Cherry Point Marine Base, NC.
- Project developed at Cherry Point based upon actual CAA & SARA Title III regulations and data reporting requirements.



# The Center's Approach to Standards

## Current Efforts

- Architect-Engineer (A-E) Deliverables Guidelines
  - A/E/C Guidelines
  - GIS/Spatial Data Guidelines
- Architectural/Engineering/Construction (A/E/C) CADD Standard
- Spatial Data Standard (SDSFIE) (GIS)
- Facility Management Standard (FMSFIE) (GIS & CADD)
- Electronic Bid Solicitations (EBS)
- CADD & GIS Object Standards



## **Spatial Data Standard** for facilities, infrastructure, & environment (**SDSFIE**)

-

- CADD/GIS Technology Center Project No. 96.013.
- Website - <http://tsc.wes.army.mil/products/TSSDS-TSFMS/tssds/html/>
- Called Tri-Service Spatial Data Standards (TSSDS) prior to July 1999. Acronym SDS was used from July 1999 until January 2001. Acronym changed to SDSFIE in January 2001.

## **Facility Management Standard** for facilities, infrastructure, & environment (**FMSFIE**) -

- CADD/GIS Technology Center Project No. 96.015.
- Website - <http://tsc.wes.army.mil/products/tssds-tsfmts/fms/fmsprods.asp>
- Called Tri-Service Facility Management Standards (TSFMS) prior to July 1999. Acronym FMS was used from July 1999 until January 2001. Acronym changed to FMSFIE in January 2001.

# 96.013 – Spatial Data Standard (SDSFIE)

**Scope:** Development, improvement, and testing of Geographic Information System (GIS) Standard, called Spatial Data Standard for facilities, infrastructure, & environment (SDSFIE).

**Objective:** Provide a common non-proprietary data format for GIS development, thereby reducing costs and providing a vehicle for sharing GIS data sets among federal partners, commercial/private concerns, and government installations.

**Products:** (1) GIS data standard, (2) Interactive software tools, (3) Implementation guidance and technical reports, (4) Digital symbol sets, (5) Distribution via CD-ROM and Internet download, (6) Internet web site, (7) Workshops,



# Spatial Data Standard (SDSFIE)

*for facilities, infrastructure, & environment*

Provides a standard graphic and nongraphic (database) format and structure for GIS implementations.

Provides a “nonproprietary” standard designed for use with commercially available “off-the-shelf” GIS and relational database software.

Provides a GIS implementation schema for approved FGDC geospatial related data standards, and appropriate approved DISA data elements.

Provides a grouping of geographically referenced (geospatial) features (i.e., features which can be depicted graphically on a map at their geographic location (coordinate)). Each geospatial feature has an “attached” Attribute Table containing pertinent data about the geospatial feature.

# Benefits of Using a GIS Data Standard

- Standard GIS and FM Data Collection Requirements
- One Training Program
- Common GIS and FM Software Applications
- Standard Implementation Procedures and Requirements
- Common Data Model which Permits the Sharing of Data
- Nonproprietary Data Model (SDSFIE & ANSI NCITS 353)

# Benefits of Using a GIS Data Standard

## Common Data Model which Permits the Sharing of Data

### – Fort Bragg

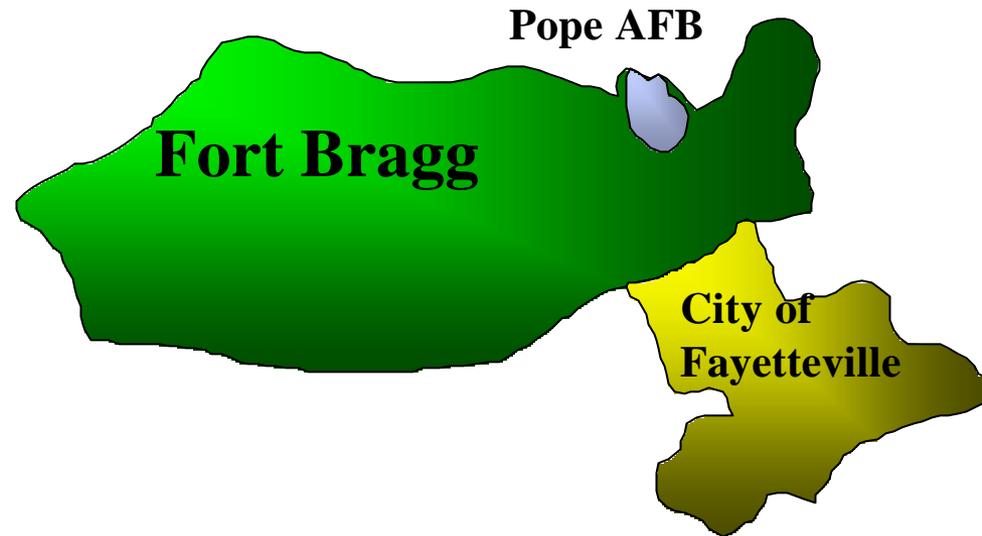
- ◆ Pope AFB Assets
- ◆ BRAC and Mobilization Plans
- ◆ Utilities and Drainage Interface

### – Pope Air Force Base

- ◆ Site Drawings and As-Builts

### – City of Fayetteville

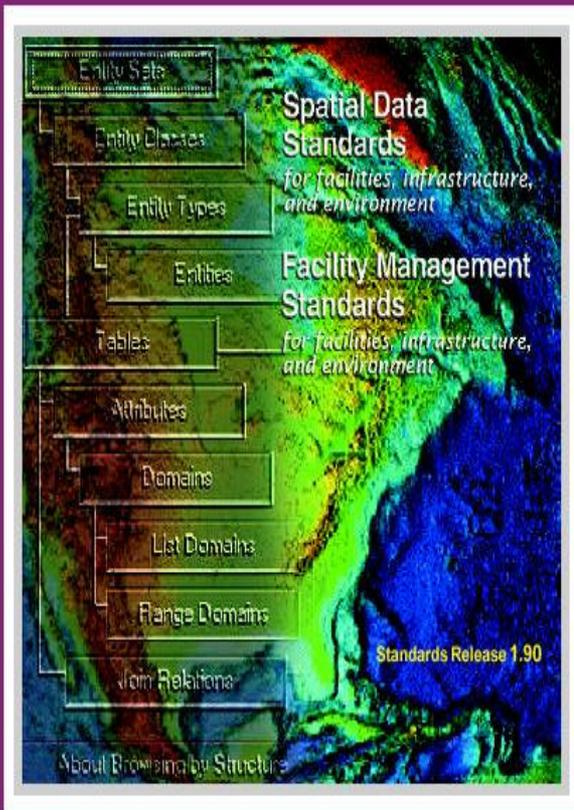
- ◆ Hurricane Evacuation Plan
- ◆ Cadastral Data and Demography
- ◆ Utilities and Drainage Interface



# Benefits of Using a GIS Data Standard

## One Training Program

- Total of 7 SDSFIE Implementation Workshops provided in FY99 – February 2002.
- Total of 256 students.
- Next Advanced SDSFIE Implementation Workshop (Geodatabases) scheduled for April 16 - 17, 2002.



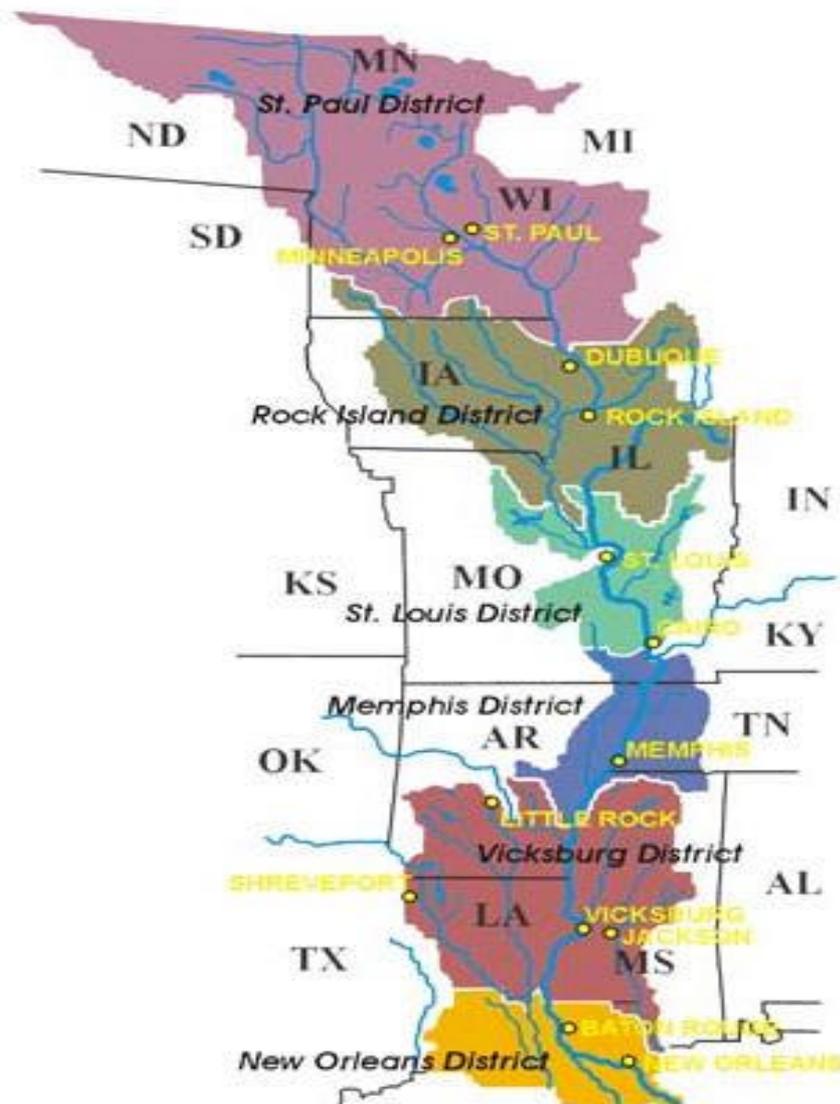
# Benefits of Using a GIS Data Standard

U.S. Army Corps of Engineers  
Mississippi Valley Division (CEMVD)  
adopted SDSFIE as GIS Standard for  
their GIS (called Regional Engineering &  
Environmental GIS (REEGIS)).

REEGIS is used by all Six Districts  
within their Division. Each District  
maintains their part of REEGIS.

Some Districts use Intergraph MGE &  
GeoMedia, whereas other Districts use  
ESRI ArcView, ARCINFO, & ArcGIS.

Geospatial data can be shared between  
Districts & MVD, even though they use  
different GIS software programs.



# Spatial Data Standard (SDSFIE) - Coordination

All DoD Organizations

Other Federal Agencies

- US Coast Guard
- Veteran's Administration
- Indian Affairs
- GSA
- EPA
- FAA
- Census Bureau
- NASA
- CIA
- DOE
- USGS
- U.S. Forest Service
- Housing and Urban Development
- Panama Canal Commission
- Tennessee Valley Authority
- Department of Transportation

- CADD/GIS/Database Software Vendors
  - Intergraph
  - Bentley
  - Autodesk
  - ESRI
  - FIS
  - Maximo
  - Oracle
  - Microsoft
- Numerous State & Local Government Organizations, Universities, etc.
- Numerous Architect-Engineer Firms & Contractors

# 96.013 – Spatial Data Standard (SDSFIE)

## SDSFIE Featured in ESRI Brochure -

- SDSFIE was recommended by ESRI as the preferred standard for GIS implementations, and featured in their brochure entitled “ESRI Military Installation Management GIS”.

### *Spatial Data Standards for Facilities, Infrastructure, and Environment*

The Computer-Aided Design and Drafting (CADD)/GIS Technology Center for Facilities, Infrastructure, and Environment was established at the Information Technology Laboratory (ITL), U.S. Army Engineer Research & Development Center (Waterways Experiment Station (WES)), Vicksburg, Mississippi, in October 1992 to support the Army, Navy, Air Force, and Corps of Engineers. Since its creation it has expanded its role to support other federal, state, and local government organizations.

One of the major initiatives assigned to the CADD/GIS Technology Center is the development of the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE). The SDSFIE is the only nonproprietary GIS data content standard designed for use with predominant commercial GIS and relational database software. The SDSFIE focuses on development of data content standards to facilitate compatibility and interoperability with the enterprise GIS at Air Force, Army, Navy, and Marine Corps installations, U.S. Army Corps of Engineers Civil Works activities, and other federal government organizations.

This nonproprietary design, in conjunction with its universal coverage, has propelled the SDSFIE into a de facto standard throughout the Department of Defense, other federal, state, and local government organizations; public util-

ities; and private industries throughout the United States and the world.

The CADD/GIS Technology Center annually updates and expands the SDSFIE. The SDSFIE (along with the Facility Management Standards for Facilities, Infrastructure, and Environment (FMSFIE)) is distributed via CD-ROM and the Internet (<http://isc.wes.army.mil>). A user-friendly interactive Microsoft® Windows®-based software application installs the SDSFIE/FMSFIE toolbox of software applications that facilitates the use of the standards and the development of an implementation schema.

The Center recently began an effort to develop a consolidated geospatial data model using object-oriented technology. In conjunction with ESRI, the Center is working to define an SDSFIE geospatial implementation. In so doing, the Center will be able to move with and help lead the industry in developing a standard object-oriented data model for GIS.

For additional information, contact Bobby G. Carpenter, P.E., CADD/GIS Technology Center, e-mail: [carpenb@wes.army.mil](mailto:carpenb@wes.army.mil).



## Military Installations

**Taking Command of Your Base with GIS**

Decision Support  
 Facilities Management  
 Pavement Management  
 Utilities Management  
 Work Order Generation and Tracking  
 Safety and Security

Environmental Restoration  
 Hydrology  
 Hazardous Material Tracking  
 Asset Management/Tracking  
 Range Management  
 Range Control Systems  
 Natural Resource Management  
 Hazardous Waste Management  
 Planning  
 Disaster Preparedness and Response



## **Coordination Efforts With DoD & Federal Standards Development Initiatives Include:**

- Federal Geographic Data Committee (FGDC)
  - *Center* Participation
  - Adoption of Subcommittee Products
  - Adoption of Metadata Standards
- Defense Information Systems Agency (DISA)
- Corporate Information Management (CIM) Initiatives
- Defense Environmental Security Corporate Information Management (DESCIM) Initiatives
- National Imagery and Mapping Agency (NIMA) (formerly Defense Mapping Agency (DMA)) Initiatives
- American National Standards Institute (ANSI)

# NCITS 353

## NCITS 353 (Spatial Data Standard for Facilities, Infrastructure, & Environment) –



- **November 1999** - NCITS L1 (GIS Technical Committee) approved concept of pursuing adoption of the SDSFIE as a national GIS standard (to be called NCITS 353).
- **April 26, 2000** - NCITS L1 Committee approved development of draft NCITS 353 for public review and comment.
- **October 19, 2000** – Draft NCITS 353 electronic template completed.
- **July 3, 2001** – Public review and comment period completed.
- **November 15, 2001** – NCITS 353 received final approval from NCITS Executive Committee.

# Incorporation of Approved FGDC Data Standards

- The SDSFIE provides a GIS Implementation Schema for Approved Federal Geographic Data Committee (FGDC) Data Standards.
- Approved FGDC Soils, Vegetation, Wetlands, & Cadastral Classification Standards were incorporated in the SDSFIE.

The screenshot displays the 'SDSFIE/FMSFIE Browser/Viewer/Printer' application window. The 'Source Search' panel on the left shows a search for 'FGDC' with a list of results including 'EPA Form 7550-6', 'ERPIMS', 'FGDC', 'FGDC Soils Classification', 'FGDC Vegetation Classification', 'FGDC Wetlands Classification', 'FIS', and 'ISO'. The 'ISO' option is selected. Below the list are checkboxes for 'List Domain Source/Reference' and 'Range Source/Reference', both of which are checked. Buttons for 'Select All', 'Select None', 'Begin Search', and 'About Browsing by Source' are also visible.

The main window area displays 'Source Search Results For - FGDC --- 28 found'. The results list includes various entity and attribute names, such as 'flora\_general\_land\_vegetation\_area', 'shoreline\_bluff\_crest\_line', 'soil\_unit\_area', 'state\_property\_interest\_site', 'wetland\_area', and 'entries found!'. It also lists numerous attribute names like 'cdfedint + fedsite\_id', 'cdfedint + int\_typ\_d', 'cdcoint + couint\_id', etc.

# NCITS 353

## Incorporation of FGDC Wetlands Classification Standard

Entity Set	Entity Class	Entity Type	Attribute	Domain Value
Theme	Category	Feature Type	Attribute Type	Value
Hydrography	Wetland	Wetland	NWI Classification Code NWI pH Modifier Code NWI Soil Modifier Code NWI Special Modifier Code NWI Subclass Code NWI Subsystem Code NWI System Code NWI Regime Non-Tidal Code NWI Inland Salinity Code NWI Regime Tidal Modifier Code NWI Chemistry Coastal Salinity Modifier Code	

# Spatial Data Standard (SDSFIE) & Facility Management Standard (FMSFIE) - Development History

- TSSDS Release 1.20 - November 1993.
- TSSDS Release 1.40 - August 1995.
- TSSDS Release 1.60 - November 1996.
- TSSDS Release 1.70 - August 1997.
- TSSDS Release 1.75 - January 1998.
- TSSDS/TSFMS Release 1.80 – February 1999.
- SDS/FMS Release 1.90 – December 1999
- SDS/FMS Release 1.95 - April 2000
- SDSFIE/FMSFIE Release 2.00 – January 2001
- SDSFIE/FMSFIE Release 2.10 – January 2002

**Spatial Data Standards / Facility Management Standards**

*Spatial Data Standards for facilities, infrastructure, and environment (SDSFIE) (formerly called Tri-Service Spatial Data Standards (TSSDS) and Spatial Data Standards (SDS) and Facility Management Standards for facilities, infrastructure, and environment (FMSFIE) (formerly called Tri-Service Facility Management Standards (TSFMS) and Facility Management Standards (FMS)).*

**PURPOSE**

- ♦ Provide a standard for GIS and facility management (CADD and GIS) implementations at Department of Defense installations, Army Corps of Engineers Civil Works activities, and other Government organizations.
- ♦ Provide a nonproprietary standard designed for use with commercially available, off-the-shelf CADD, GIS, and relational database software.
- ♦ Provide a GIS implementation schema for approved Federal Geographic Data Committee Data Standards.

**CD-ROM CONTENTS**

- ♦ Windows-based SDSFIE/FMSFIE Applications (95, 98, NT, and 2000) Release 2.00 and Tutorial (Installs with SDS/FMS Release 2.00 Installation Program). Applications include the Browser, SQL Generator, Filter Maker, Filter Eraser, Geomedia Builder, Access Builder, and Access Data Creator.
- ♦ SDSFIE Symbol Sets for MicroStation, AutoCad, ArcInfo, and ArcView. (See ArcInfoSym.200, AutoCadSym.200, ArcViewSym.200, and MicroStaSym.200 directories).
- ♦ SDSFIE/FMSFIE Release 2.00 IDEF Models (.pdf and .ert digital format). (See Models.200 directory).
- ♦ Technical guidance and documentation. See Guidance and Instructions Directories.
- ♦ GPS Tutorial (Compliments of Patuxent River Naval Air Station, Maryland). See GPS Tutorial directory.

**Facilities - Infrastructure - Environment**

Important contributions have been made by many past and present Department of Defense, other Federal government, State government, local government (city/county), and contractor personnel. All deserve our thanks and appreciation for their contributions to the SDSFIE and FMSFIE development effort. Of special note were the dedication and support of all past and present CADD/GIS Technology Center organizers, including Board of Directors (formerly Executive Steering Group), Corporate Staff (formerly Executive Working Group and Field Technical Advisory Group), Field User Groups (formerly Field Working Groups), and contributing subject matter experts. Special appreciation goes to all reviewers and GIS technical experts who provided invaluable comments and recommendations on this and past releases.

U.S. Army Corps of Engineers • U.S. Army • U.S. Air Force • U.S. Navy • U.S. Marines  
U.S. Coast Guard • Defense Logistics Agency • Environmental Protection Agency  
National Aeronautics & Space Administration • General Services Administration  
State Department • National Institute of Building Sciences

**Spatial Data Standards / Facility Management Standards**

Jan 2001

# Spatial Data Standard (SDSFIE) Update Schedule

- **Release 2.10:**
  - Completed Beta - September 2001.
  - Completed Alpha (Data Content & Models) – December 2001.
  - Completed Final (Software) – February 7, 2002.
  - Available for Download – February 20, 2002.
  - CDs Available for Distribution – April 2002.
- **Release 2.20 Schedule:**
  - Complete Alpha – April 2002.
  - Complete Beta – June 2002.
  - Complete Final – July 2002.
  - Available for Download – August 2002.
  - CDs Available for Distribution - August 2002 (at Symposium).

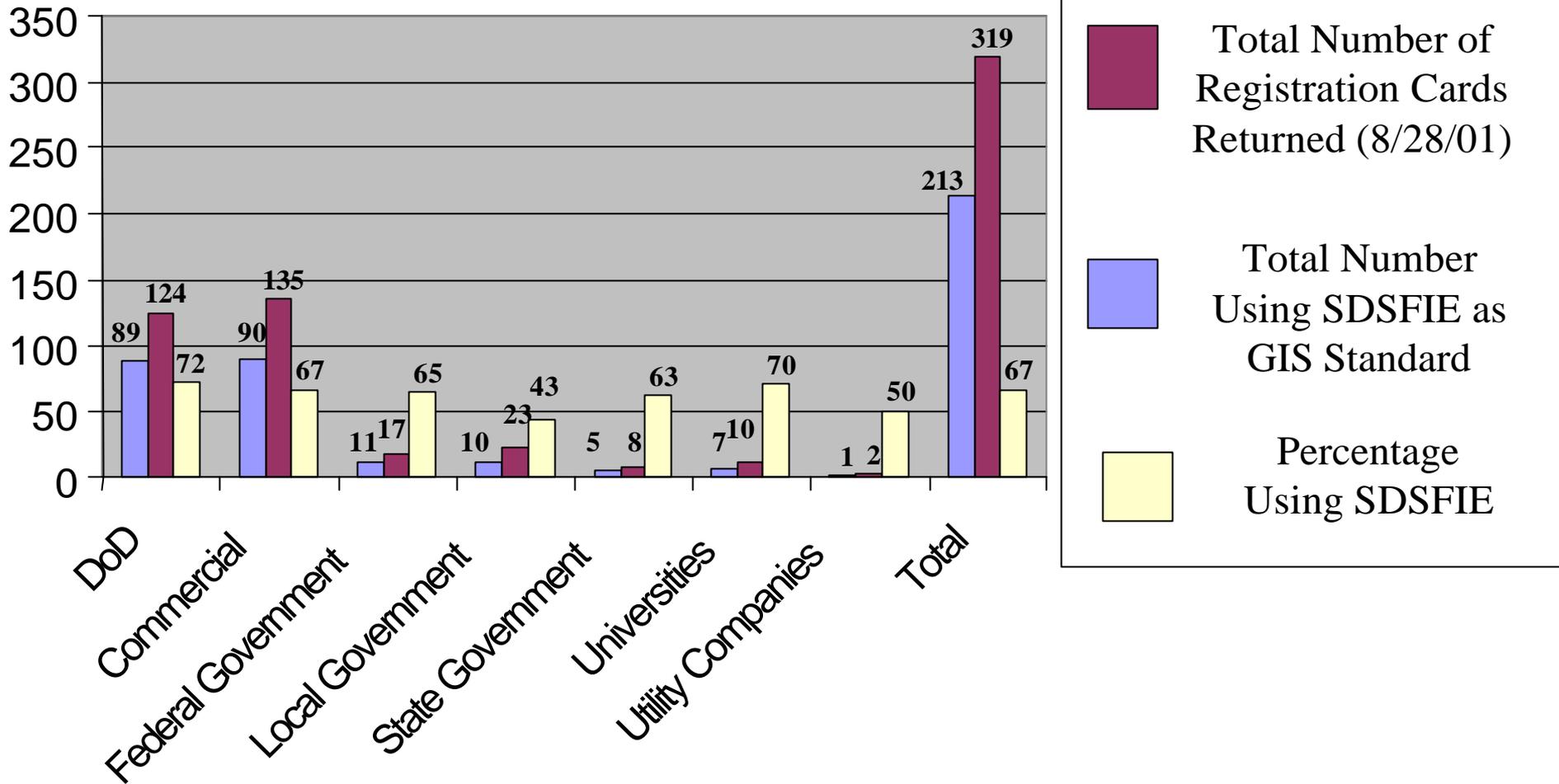


# Spatial Data Standard (SDSFIE) Customer Comments

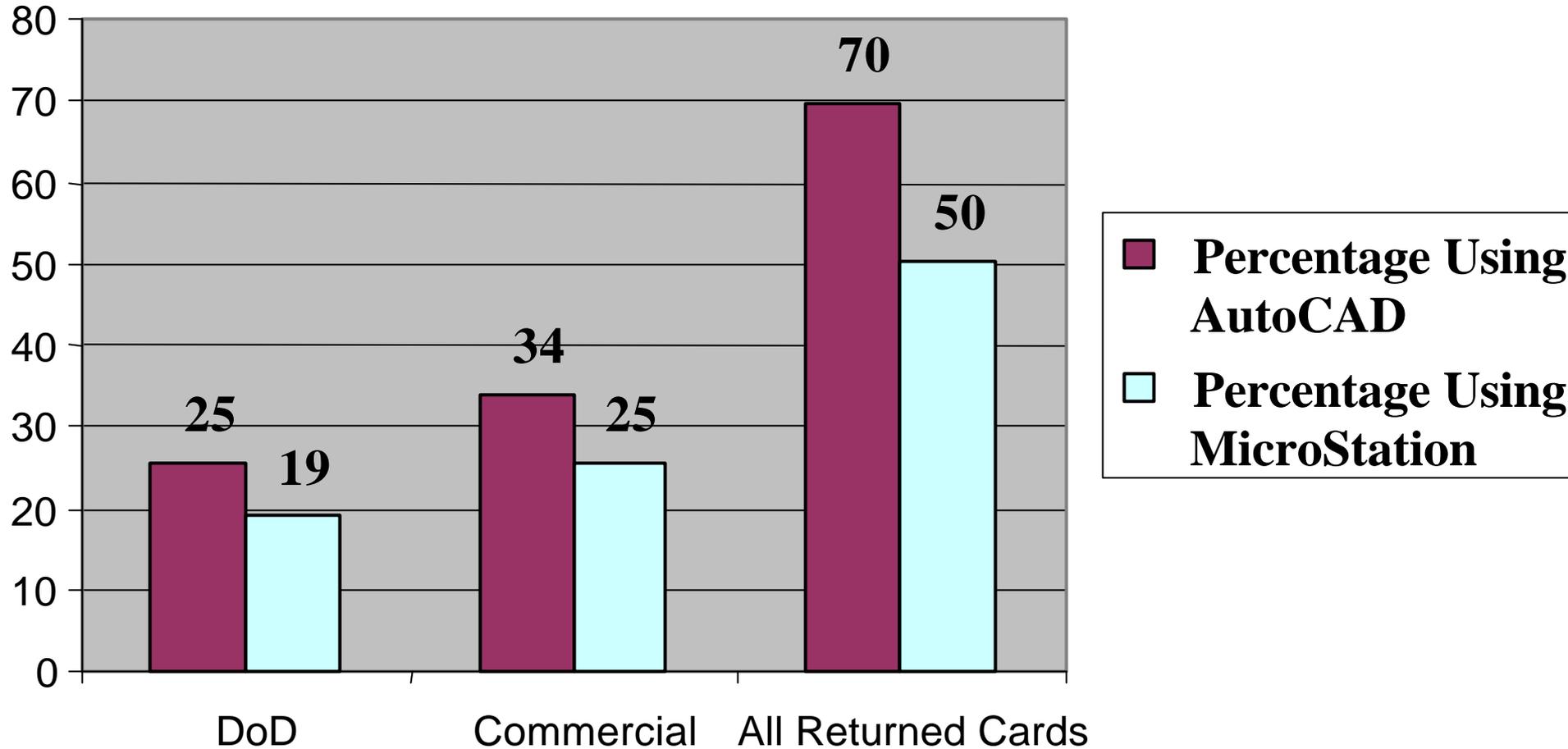
## Center Receives Input from GIS and SDSFIE Users from Various Sources:

- **Registration Cards –**
  - Distributed with CDs.
  - Download from SDSFIE Website.
  - Data from Returned Cards Recorded in Database.
- **Email –**
  - Recorded in Comments Database.
  - Templates for submittal of Comments available for Download from SDSFIE Website.
- **Phone Calls –**
- **Meetings -**

# Release 2.00 Registration Cards – Use SDSFIE

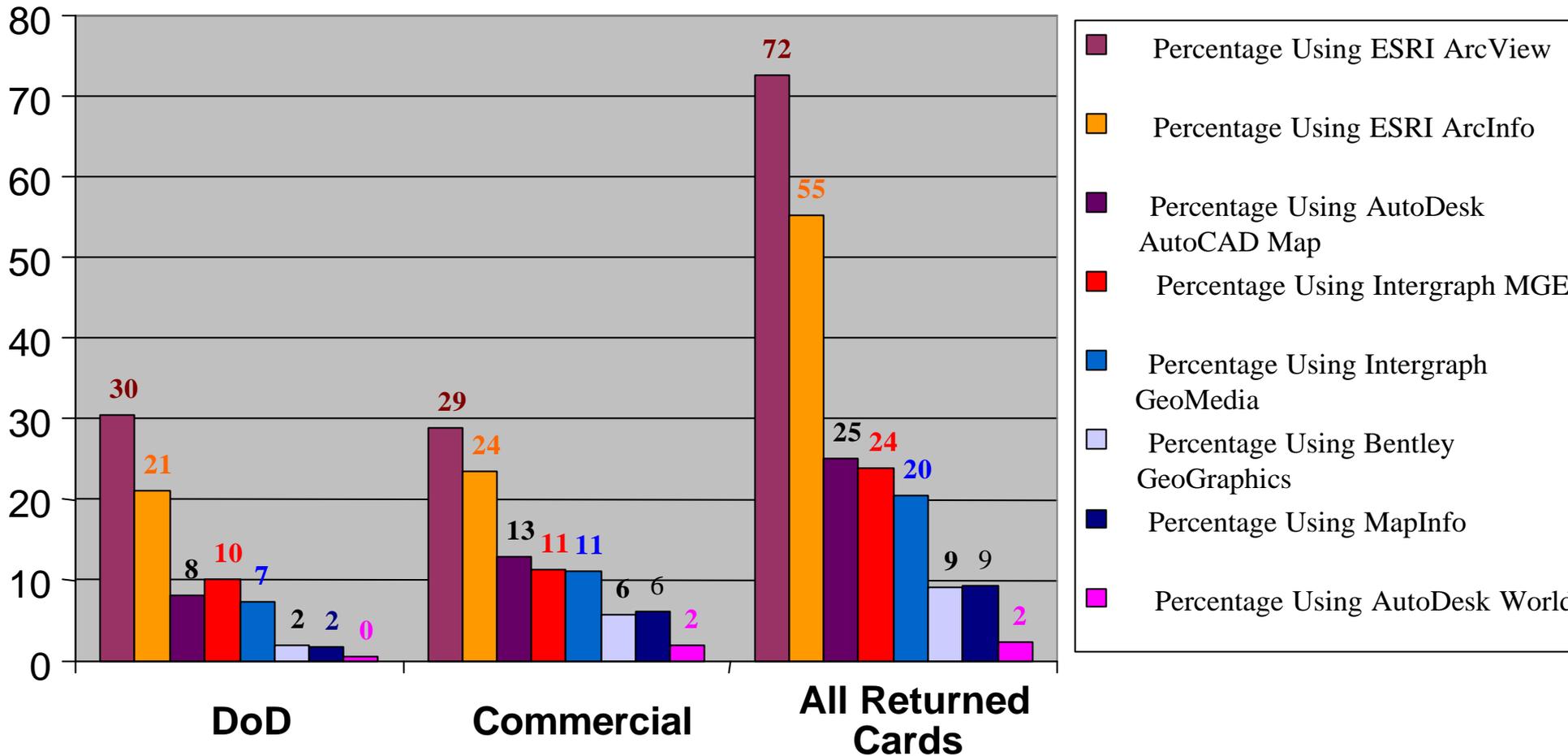


# Release 2.00 Registration Cards – CADD Software Used

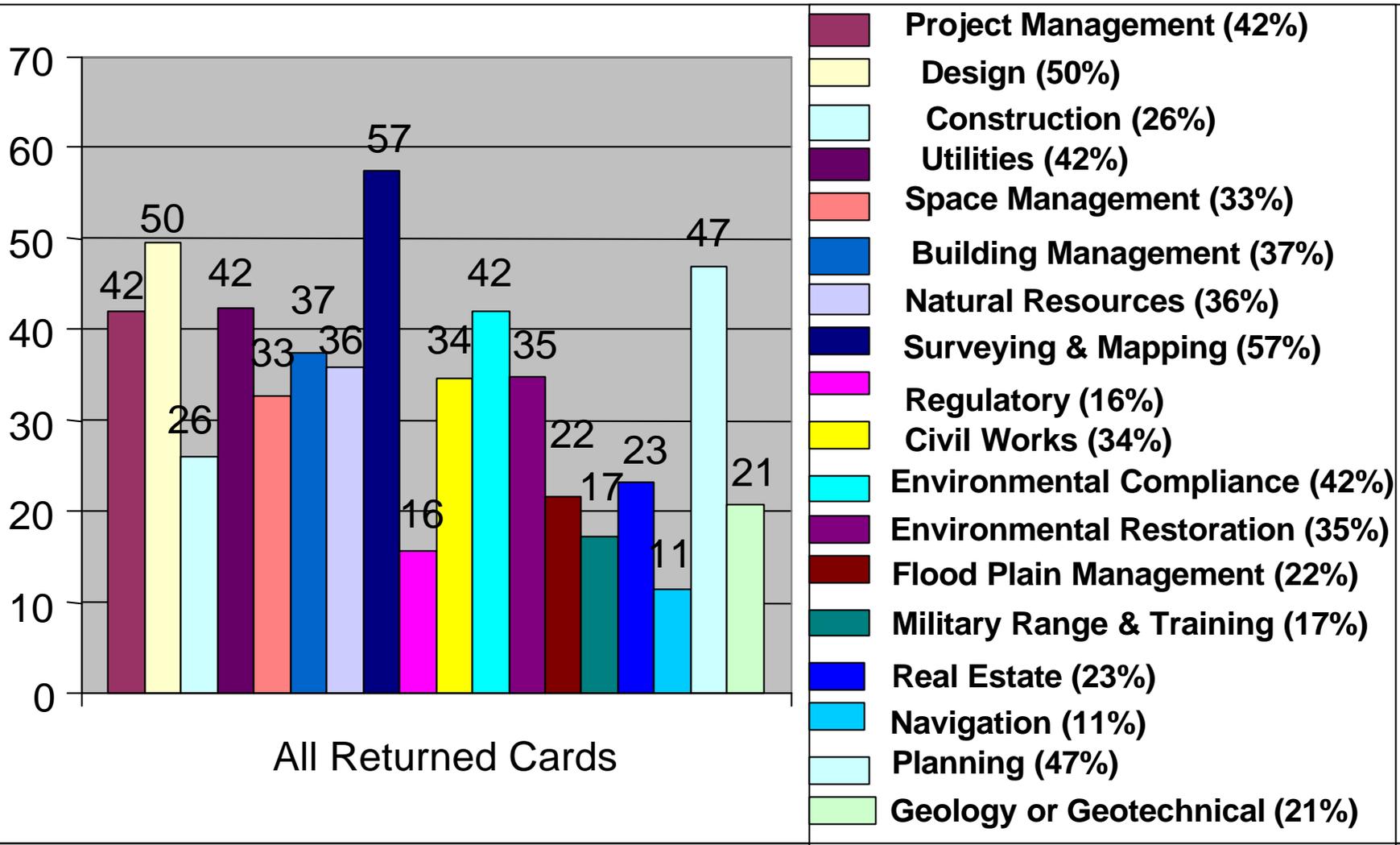


# Release 2.00 Registration Cards

## – GIS Software Used



# Release 2.00 Registration Cards – Use of CADD or GIS



# Comments Database

## Center Maintains Database Containing Customer Comments, Questions, & CD Requests -

- Total of 1,015 Customer Comments, Questions, etc. Recorded from October 1998 – February 2002.
- Total of 180 Customer Comments, Questions, etc. Recorded from October 2001 – February 2002.

Microsoft Access

File Edit View Insert Format Records Tools Window Help

Comments Entry/Viewing Form

RecordNo	Customer ID	Organization Name	
960	BobbyBean	Patuxent River Naval Air Station	
Contact First Name		Contact Last Name	
Mailing Address			
State/Province	Country	Contact Title	Phone Number
MD	USA		
Phone Extension	Fax Number	E-mail Address	
		BeanRA@navair.navy.mil	
Notes			
From Harold - Do service/project specific symbology ( I think he means color symbology) exist?? Does RSIP and other Navy GISs have a symbology?? Is there one for the Corps, Army, Navy, Air Force, etc. How does the color symbology of the CADD surveying and mapping standards fit with the SDS color			
Customer Type			
DoD			
Comment			
John based on a previous email and phone con with you. We are working on the Navair RSIP effort and currently have a version 1 underway. We have been working toward following the Guidance provided out of the manuals and also within the CADD/GIS/FM standards. So a list of information is provided below			
Date Comment Received			
1/13/2002			
Comment Resolution			
REEGIS and MVD don't have set symbology - they use "plot tables" to determine colors, etc for plotting and they use a color table (that we have incorporated into the SDS) for displaying CADD. They have not wrestled with the GIS symbology issues.			
CommentCenterPOC	Reply Date	Comment Classification	Reply Method
nt	1/17/2002	Change Request	Email

# Data Standard Improvements – Release 2.10

## Incorporated Individual Comments Submitted by GIS Users:

- Cherry Point Marine Base
- Army & Army National Guard (ANG)
- USACE Mississippi Valley Division & Districts
- Other USACE Districts
- Fresno, California GIS Users (Local/State Government)
- Patuxent River Naval Air Station
- Several GIS Contractors
  - Higginbotham/Briggs & Associates LLC (Colorado Springs, CO) – from Airfield Obstruction Management System (AOMS) Center Project.
  - G/I/S (Birmingham, AL) - from Navy PWD (Ayman El-Swaify) & ANG projects.
  - Parsons (Austin, TX) – from Air Force Environmental IRP projects.

# Data Standard Improvements – Release 2.10

- **Incorporated FGDC “Utilities Data Content Standard” (FGDC-STD-010-2000).**
- **Incorporated U.S. Department of Transportation (DOT) National Pipeline Mapping System (NPMS) Standard.**
- **Incorporated U.S. Department of Commerce, National Oceanic & Atmospheric Administration (NOAA), National Geodetic Survey (NGS) Monument Data.**
- **Incorporated Additional U.S. Department of Interior Bureau of Land Management (BLM) Data.**

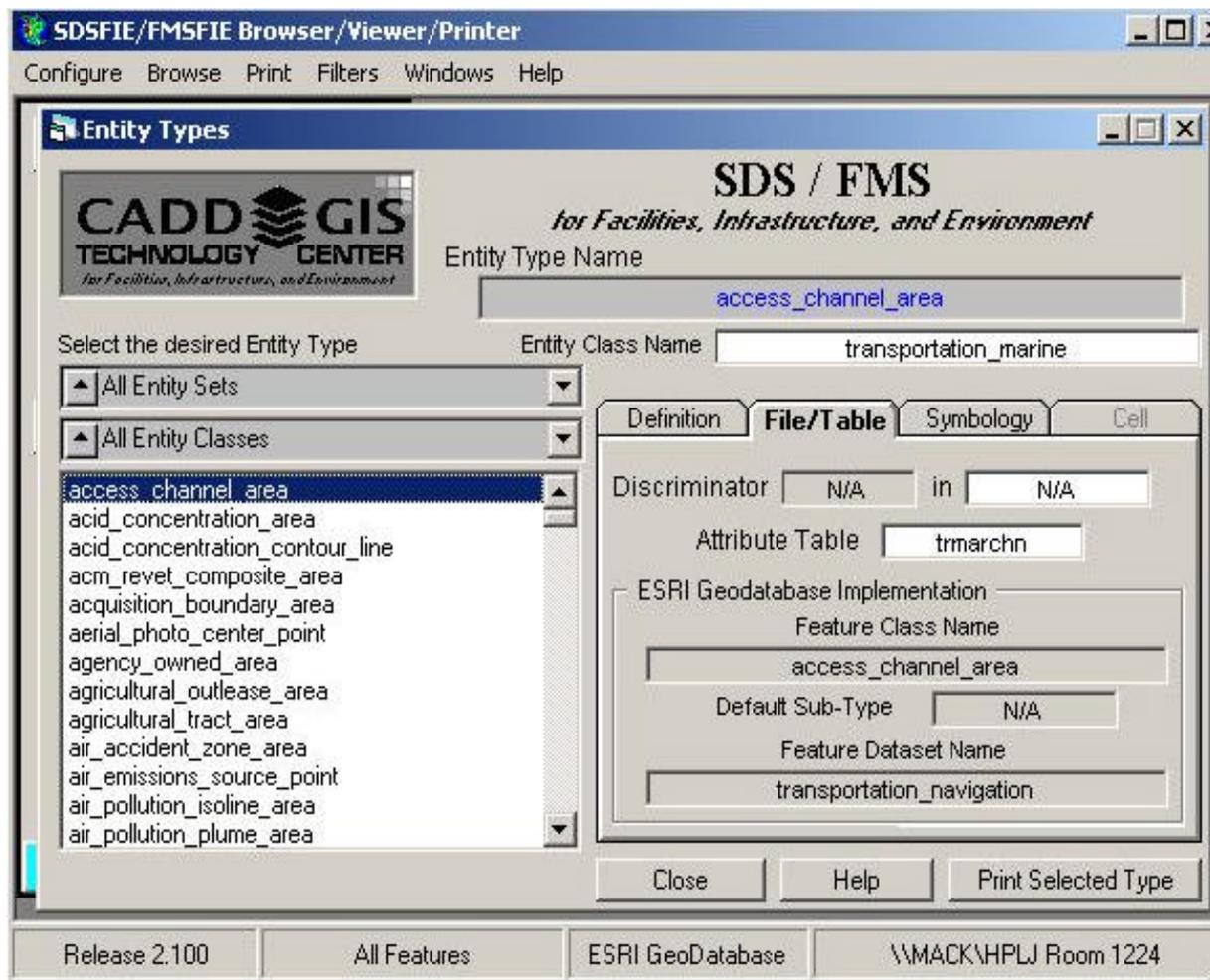
# Data Standard Improvements – Release 2.10

- **Entity Sets** – No Change.
- **Entity Classes** – Added One New Class.
- **Entity Types** – Added 39 New Entity Types.
- **Attribute Tables** – Added 31 New Attribute Tables.
- **Attributes** – Added 950 New Attributes.
- **Domain Tables** – Added 31 New Domain Tables.
- **List Domain Values** – Added 746 New Values.

# Data Standard Improvements – Release 2.10

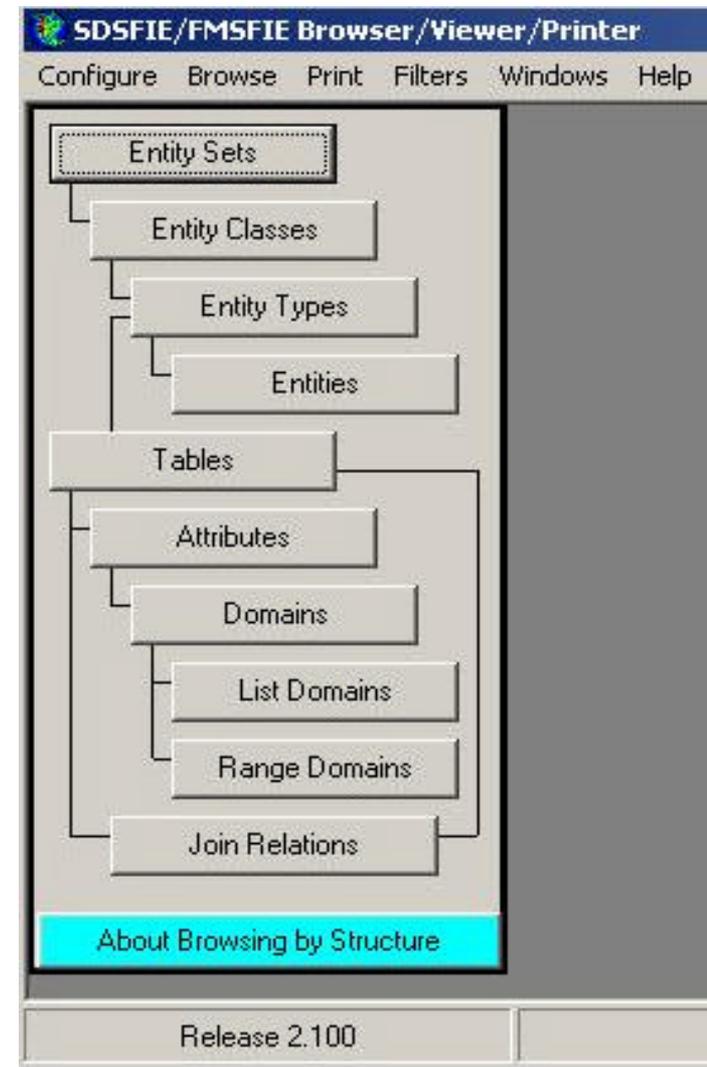
## Incorporation of ESRI ArcGIS Geodatabase Data Structure.

- **Feature Dataset** –
  - Entity Set/Class
- **Feature Class** –
  - Entity Type
- **Default Sub-Type**
  - Discriminator
  - Domain Value



## Release 2.10 Software Toolbox Includes:

- **Browser** – Permits viewing & printing of SDSFIE.
- **Filter Maker** – Permits customer selection of SDSFIE Subset for specific project or organization.
- **Filter Eraser** – Permits deletion of customer developed Filters no longer needed.
- **Access Builder** – Permits construction of SDSFIE compliant Access 97 or 2000 databases.
- **SQL Generator** – Permits construction of script for Oracle, Informix, SQL Server, ANSI SQL.
- **Geomedia Builder** – Permits construction of SDSFIE compliant Intergraph GeoMedia databases.
- **Geodatabase Builder (new)** – Permits construction of SDSFIE compliant ESRI Arc 8.x Personal Geodatabase (Access 2000)
- **Access Data Creator** – Data Entry



# Toolbox Improvements – Release 2.10

- **Upgraded all Software Applications for Multiple Windows Operating Systems –**
  - Upgraded & Tested for Windows 2000 and XP.
  - Tested on Windows 98, ME, & NT.
- **Upgraded Access Builder or Multiple Versions of Access -**
  - Now Permits Construction of SDSFIE Compliant Database Tables for Both Access 97 and 2000.
- **Developed “Geodatabase Builder” Application –**
  - Permits Construction of SDSFIE Compliant ESRI ArcGIS Personal Geodatabases.

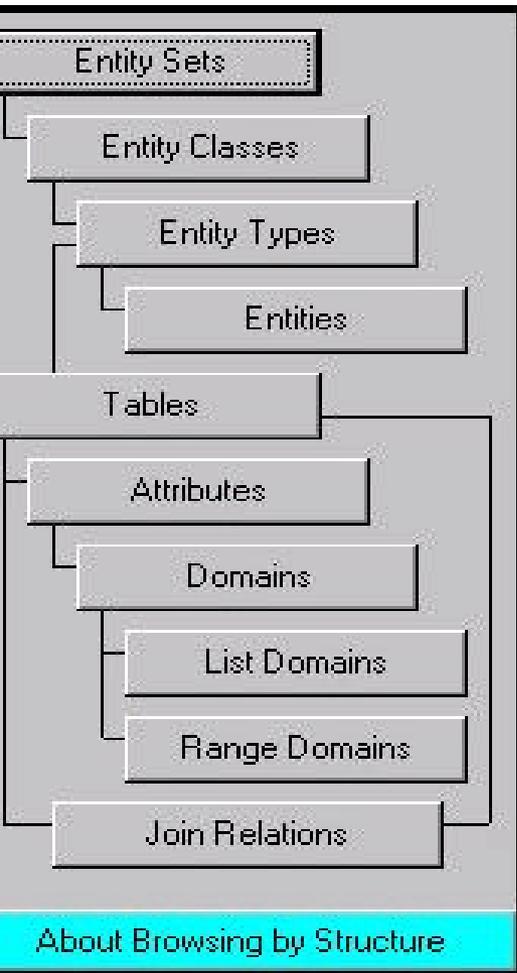
# Design Considerations

- **Must be compatible with the predominant Commercially Available CADD, GIS, & Relational Database Software.**
- **GIS and CADD Software include:**
  - ESRI Arc/Info
  - Bentley MicroStation
  - ESRI ArcView
  - Autodesk Map
  - Intergraph MGE
  - Autodesk AutoCAD
  - Intergraph GeoMedia - Bentley GeoGraphics
  - ESRI ArcGIS
- **Relational Database Management System (RDBMS) Software includes:**
  - ANSI Standard Structured Query Language (SQL)
  - Informix SQL
  - Microsoft Access
  - ESRI SDE
  - Oracle SQL
  - Microsoft SQL Server
- **Operating Systems include:**
  - Windows 98, 2000, NT, & XL

# Data Model Organization

- **Entity Sets** -
  - Broad grouping for data management purposes.
- **Entity Classes** -
  - Grouping of data within each Entity Set for Data Management Purposes.
- **Entity Types** -
  - Grouping of SDS Geospatial Features (i.e., items that appear graphically on a map or drawing). Grouped within each Entity Class.
    - **Entities** -
      - Items that appear graphically on a map or drawing. Grouped within each Entity Type. Each Entity Type may have one or more Entities.
- **Attribute Tables** -
  - Relational database tables containing attribute data. Grouped within each Entity Class.
- **Domain Tables** -
  - Contains lists of “valid” or “permissible” values for specific attributes in an Attribute Table.

# Size and Complexity - SDSFIE/SDSFIE Release 2.100



26	Entity Sets
182	Entity Classes
1,041	Entity Types
5,733	Entities (CADD & CADD Based GIS)
1,044	Attribute Tables (Database Tables)
26,777	Attributes (Fields in Tables)
989	Domain Tables (List & Range)
22,288	List Domain Values
18	Range Domains
8,404	Relational Database Join Relationships

# SDSFIE Entity Sets

- **Entity Sets (26 Themes in Release 2.100)**

Auditory

Boundary

Buildings

Cadastral

Climate

Common

Communications

Cultural

Demographics

Environmental Hazards

Ecology

Fauna

Flora

Future Projects

Geodesy

Geology

Hydrography

Improvements

Landform

Land Status

Military Operations

Olfactory

Soil

Transportation

Utilities

Visual

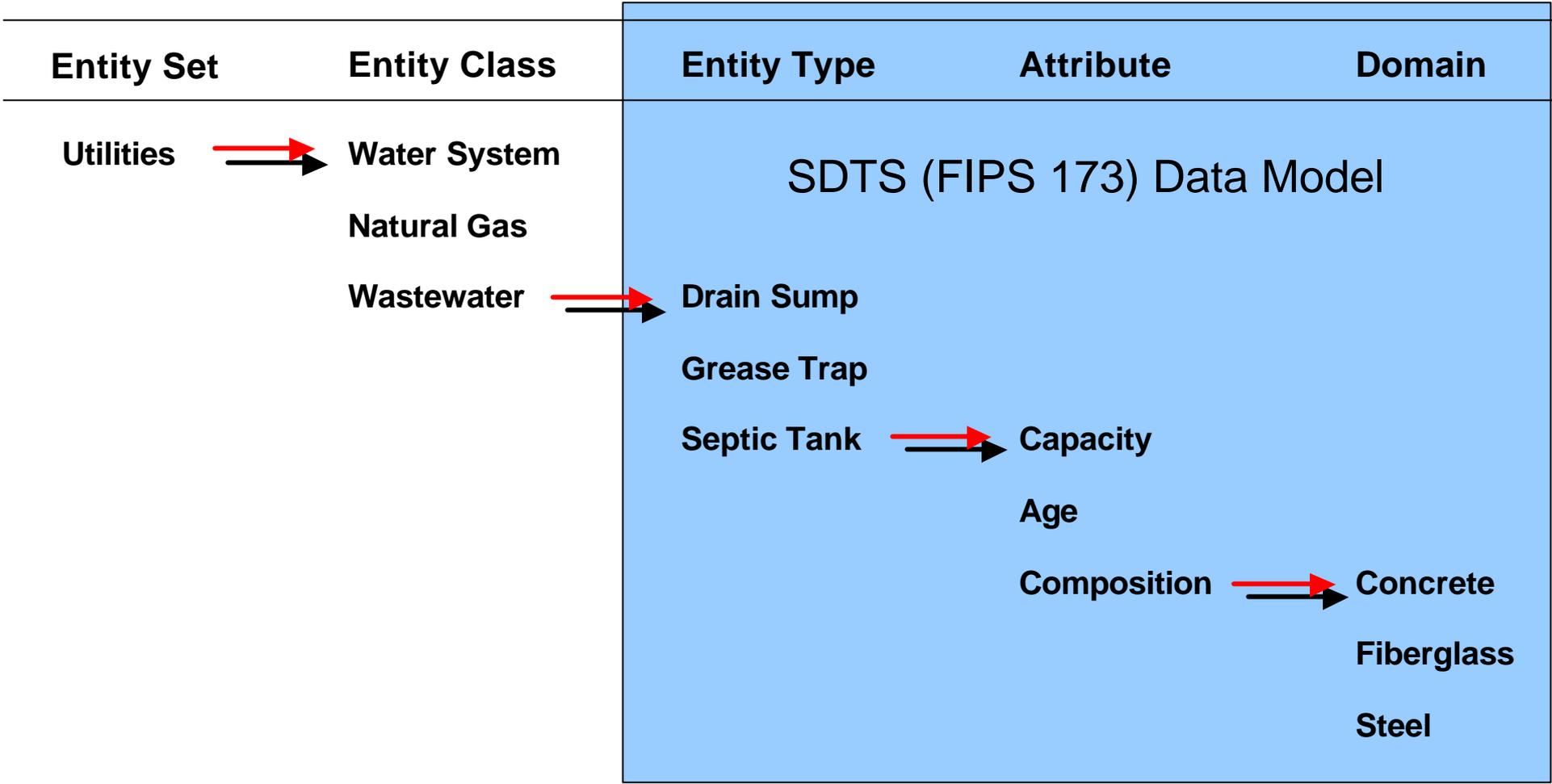
# Data Model – Entity Type, Attribute Table, & Domain Value

The image shows a GIS interface with an aerial map on the left and a data table on the right. A blue oval callout labeled "Entity Type water\_line" points to a highlighted pipe on the map. Another blue oval callout labeled "Attribute mat\_d" points to the "mat\_d" field in the table. A third blue oval callout labeled "Domain Value PVC" points to the "PVC" value in the "mat\_d" dropdown menu.

water_line		
datalink:	100004	
pipe_id:	utwatpip000000536	
map_id:	234	
meta_id:	utwatpip0000000	
media_id:	utwatpip0000000	
coord_id:	97894	
date_acqrd:	19730818	
dispostn_d:	PERMANENT	
use_d:	MAIN	
type_d:	CIRCULAR	
mat_d:	PVC	
size_d:	PVC	polyvinyl chloride
pipe_mat_d:	REINFORCONCR	reinforced concrete
	REINFPLASMOR	reinforced plastic mortar
	SINGLE_CLAY	single clay
	SINGLE_TILE	single tile
inv_elv_1:		
grnd_elv_1:		
inv_elv_2:	254	
grnd_elv_2:	257	
elv_u_d:	FT	

Record: 1 of 1

# Data Model Example



# SDSFIE Entity Classes

- ◆ General logical grouping of features within an Entity Set for data management purposes.
  
- ◆ Each entity class will be a separate map or drawing file and corresponds to the following terms:
  - GRASS (CERL): mapset
  - MGE (Intergraph): category or design file
  - ARC/INFO (ESRI): workspace
  - MicroStation (Bentley): design file
  - AutoCAD (Autodesk): drawing file

# SDSFIE Compliance

There are 2 levels of compliance:

- Basic  
(supported by Toolbox)
- Experienced  
(**not** supported by Toolbox)

Each level has 5 elements of compliance:

1. Entity Types and Entities
2. Attribute Tables
3. Attributes
4. Domain Tables
5. Domain Values

# SDSFIE Basic **and** Experienced Compliancy

1. Entity Types and Entities - Use SDSFIE Entity Type and Entity naming conventions
2. Attribute Tables - Use SDSFIE attribute table naming conventions and definitions
3. **Attributes (see following slides)**
4. Domain Tables - Use SDSFIE domain table naming conventions and definitions
5. **Domain Values (see following slides)**

# SDSFIE Basic **vs.** Experienced Compliancy

## Basic

3. Attributes - All SDSFIE defined attributes must be stored in the selected tables. No user-defined attributes may be added to the tables – they may be stored in user-defined local tables and linked to the SDSFIE table.
- 

## Experienced

3. Attributes – User-defined attributes may be added to the SDSFIE tables and SDSFIE attributes not needed may be deleted.

# SDSFIE Basic **vs.** Experienced Compliancy

## Basic

5. Domain Values - All SDSFIE defined list and range domain values must be kept for the selected domain tables. No user-defined values may be added to the tables – they may be stored in user-defined local tables and linked to the SDSFIE table
- 

## Experienced

5. Domain Values - User-defined domain values may be added to the SDSFIE domain tables and SDSFIE domain values not needed may be deleted.

# SDSFIE Geodatabase News Website

<http://tsc.wes.army.mil/News/Geodatabase/Geodatabase.asp>

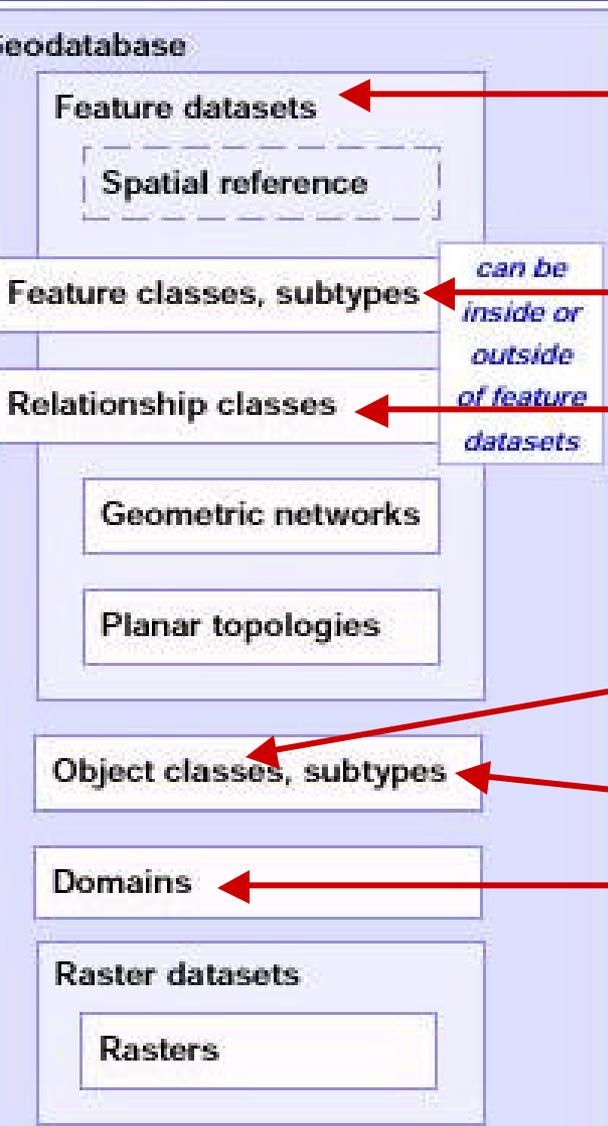
- Provides Information on SDSFIE Geodatabase Development.
- Migration Procedures - Instructions to help guide installation through the migration process
- Center POC – Nancy Towne

The screenshot shows a web browser window titled "Geodatabase News - Microsoft Internet Explorer". The address bar contains the URL <http://tsc.wes.army.mil/News/Geodatabase/Geodatabase.asp>. The website header features the CADD/GIS TECHNOLOGY CENTER logo and the tagline "for facilities, infrastructure, and environment" and "CADD and Geospatial Technologies". A navigation menu includes links for Home, Events/Training, Contacts, The CADD/GIS Technology Center, Links, Products, Projects, and Groups. A sidebar on the left lists "Classes", "Calendars", "Discussion Forums", "CADD/GIS Bulletin", "Visitor Information", and "Geodatabase News". The main content area is titled "SDSFIE Geodatabase" and contains a paragraph of text about ESRI's ArcGIS 8. Below the text is a diagram illustrating the geodatabase model. The diagram shows a flow from "Geodatabase" to "Feature datasets" (Spatial reference, Feature classes, subtypes, Relationship classes, Geometric networks, Planar topologies, Object classes, subtypes, Domains, Raster datasets, Quilts) and "SDSFIE Geodatabase News/Tools" (Entity Data, Entity Types, Entities, Tables, Attributes, Domains, Raster Datasets, and ArcGIS 8.0/9.0). Red arrows indicate the relationships between these components.

## Geodatabase: Installation Relational GIS Database

- Feature Data Set: SDSFIE Entity Set/Class combination
- Feature Class: SDSFIE Entity Type
  - Subtypes: SDSFIE discriminating attributes (type\_d attributes)

# SDSFIE Geodatabase



SDSFIE Entity Set/Entity Classes

SDSFIE Entity Types

SDSFIE Joins/Relationships

SDSFIE non-graphic tables

SDSFIE discriminators +

SDSFIE domain tables

## Geodatabase:

- *ESRI Geodatabase* - Relational database that stores geographic information.
- *Relational database* - Collection of tables logically associated to each other by common key attributes.
- A *geodatabase* can store geographic information because, besides storing a number or a string in an attribute column, tables in a geodatabase can store a geometric object (i.e., polygon, line or point) with defined shape and location.
- A *geodatabase* consists of two files with extensions mdb and ldb (Microsoft Access).

## Feature Classes:

- *ESRI Feature Classes* - Tables in a geodatabase.
- *ESRI Feature Class* - Collection of objects that have the same behavior and the same set of attributes.
- *ESRI Feature Class* – Equivalent to SDSFIE Entity Type.
- *SDSFIE Feature Class Name* – SDSFIE Entity Type Name (or equivalent) constrained to 30 characters (Oracle limitation).

## Feature Dataset:

- *ESRI Feature Dataset* - Collection of feature classes that share the same spatial reference.
  - The *spatial reference* describes both the projection and spatial domain extent for a *feature class* in the geodatabase.
  - Because the *feature classes* in a feature dataset share the same spatial reference, they can participate in topological relationships with each other such as in a geometric network.
  - These topological relationships can also be stored in the feature dataset.
  - Note that feature classes in a geodatabase can exist as stand-alone feature classes, without being part of any feature dataset.

## Feature Dataset:

- Corresponds to either:
  - An SDSFIE Entity Set
  - One or more Entity Classes within a SDSFIE Entity Set.
- For performance reasons a Feature Dataset should contain less than 50 Tables.

# SDSFIE Entity Sets

- **Entity Sets (26 Themes in Release 2.100)**

Auditory

Boundary

Buildings

Cadastral

Climate

Common

Communications

Cultural

Demographics

Environmental Hazards

Ecology

Fauna

Flora

Future Projects

Geodesy

Geology

Hydrography

Improvements

Landform

Land Status

Military Operations

Olfactory

Soil

Transportation

Utilities

Visual

# SDSFIE Geodatabase

**Feature Dataset = SDSFIE Entity Set for following  
SDSFIE Entity Sets:**

Auditory

Cadastral

Communications

Ecology

Future Projects

Hydrography

Military Operations

Visual

Boundary

Climate

Cultural

Fauna

Geodetic

Landform

Olfactory

Buildings

Common

Demographics

Flora

Geology

Land Status

Soil

# SDSFIE Geodatabase

**Feature Dataset = One or more Entity Classes  
within a SDSFIE Entity Set for following SDSFIE  
Entity Sets:**

- Environmental Hazards
- Improvements
- Transportation
- Utilities

## Feature Datasets in Environmental Hazards Entity Set:

- Env\_haz\_pollution\_control
- Env\_haz\_building\_env
- Env\_haz\_characterization
- Env\_haz\_emergencyprep
- Env\_haz\_general
- Env\_haz\_hazmat\_hazwaste
- Env\_haz\_remediation
- Env\_haz\_regulated\_tank
- Env\_haz\_site\_mgmt
- Env\_haz\_solid\_waste

## Feature Datasets in Improvements Entity Set:

- Improvement\_recreation
- Improvement\_channel
- Improvement\_floodcontrol
- Improvement\_general
- Improvement\_machinery
- Improvement\_erosion
- Improvement\_well

## Feature Datasets in Transportation Entity Set:

Transportation\_air  
Transportation\_general  
Transportation\_water  
Transportation\_navigation  
Transportation\_pedestrian  
Transportation\_water  
Transportation\_rroad  
Transportation\_vehicle

## Feature Datasets in Utilities Entity Set:

Utilities\_air

Utilities\_emcs

Utilities\_electrical

Utilities\_fuel

Utilities\_general

Utilities\_hcs

Utilities\_industrial

Utilities\_gas

Utilities\_saltwater

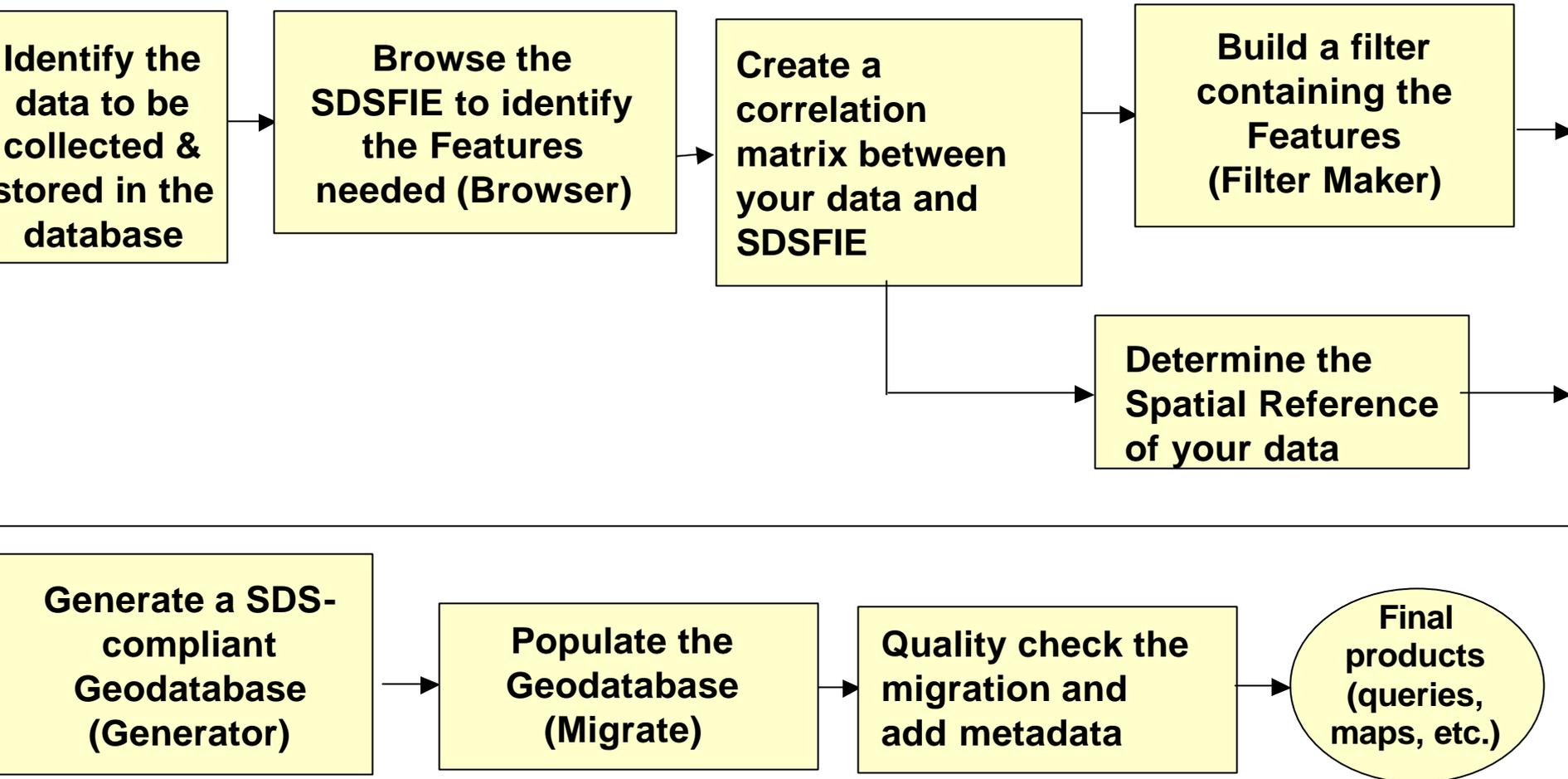
Utilities\_storm

Utilities\_transmission

Utilities\_wastewater

utilities\_water

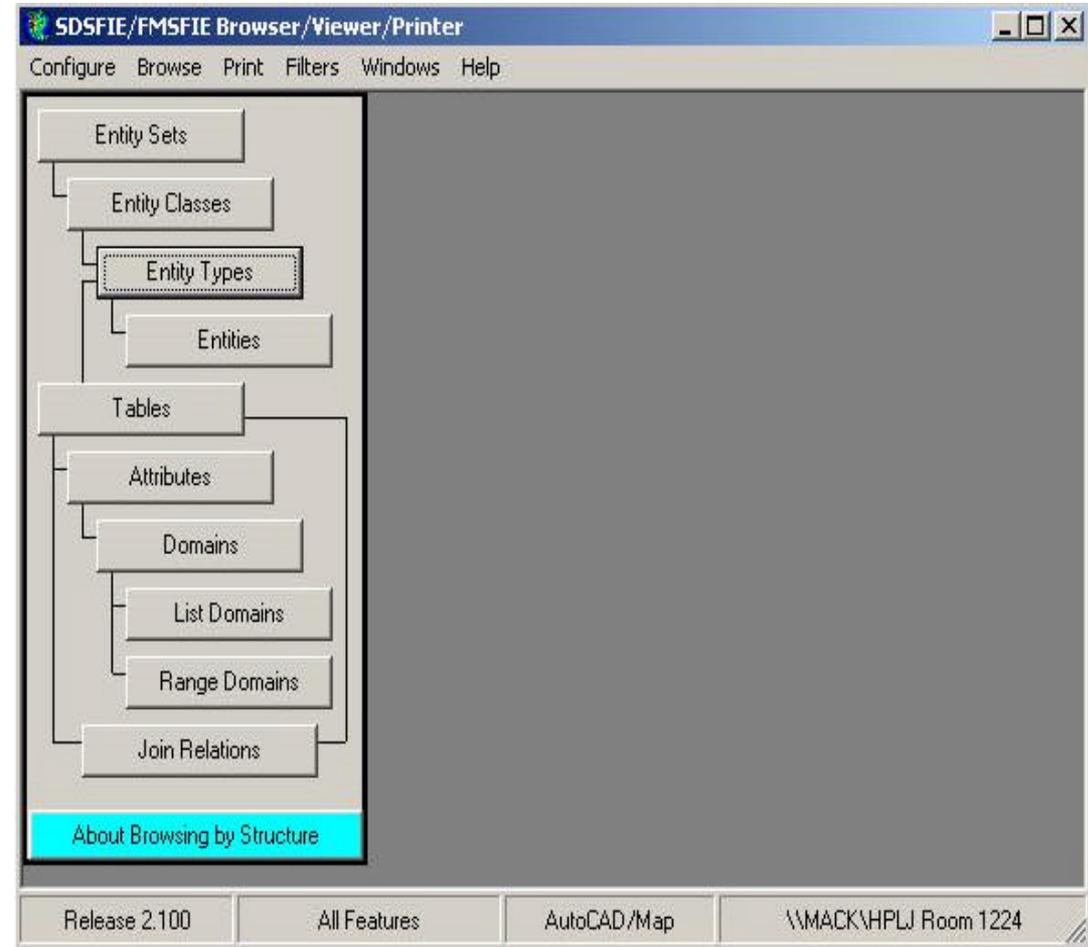
# Steps for Implementing the SDSFIE



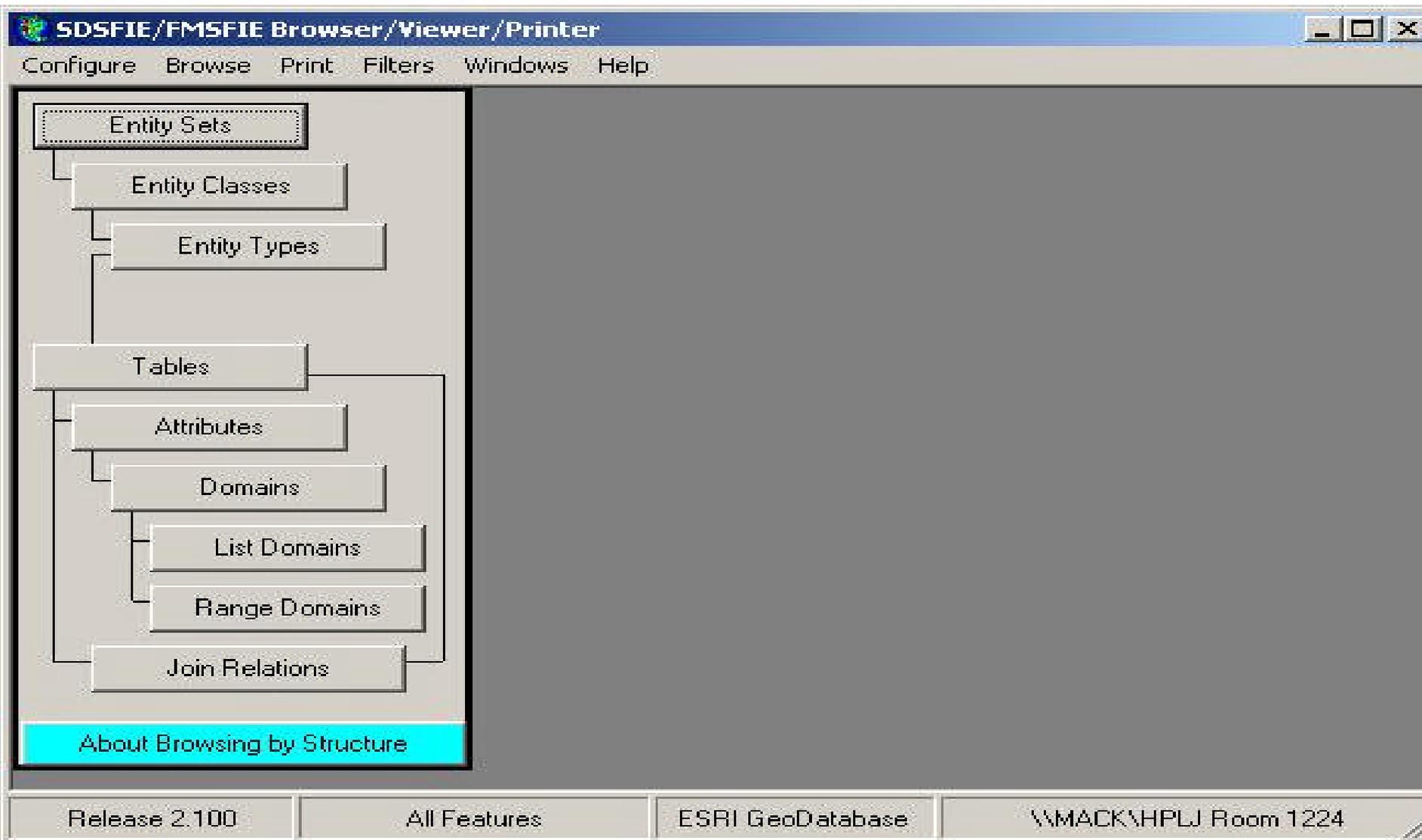
# SDSFIE/FMSFIE Toolbox - Browser

## SDSFIE/FMSFIE Browser Software Application:

- Provides a tool for viewing & printing the various components of the Standards.
- Permits the User to view/print Standard based upon their specific CADD/GIS software.
- Permits the User to view/print either: (1) entire Standard, (2) pre-defined “filter”, or (3) User’s custom filter.



# SDSFIE Toolbox - Browser



SDSFIE/FMSFIE Browser/Viewer/Printer

Configure Browse Print Filters Windows Help

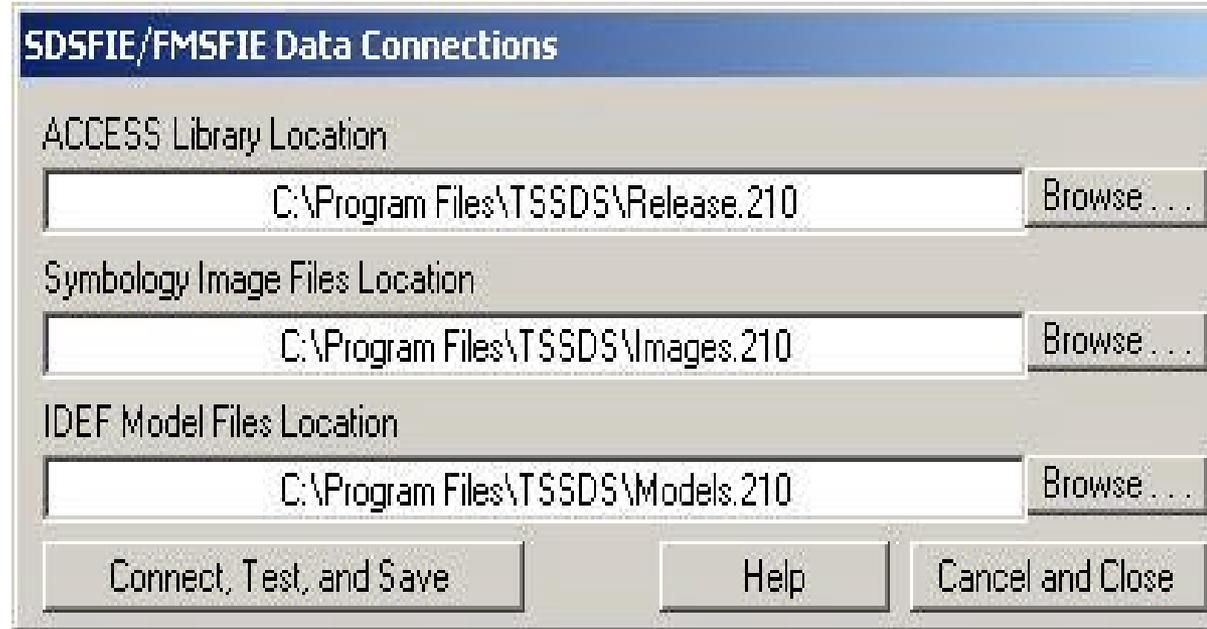
- Entity Sets
- Entity Classes
  - Entity Types
- Tables
  - Attributes
    - Domains
      - List Domains
      - Range Domains
    - Join Relations

About Browsing by Structure

Release 2.100 All Features ESRI GeoDatabase \\MACK\HPLJ Room 1224

# SDSFIE Toolbox – Browser Setup

- **Step 1 –**
  - Go to Browser Menu entitled “Configure”.
  - Select “Connect”.
  - Make sure you are connected to the most current SDSFIE/FMSFIE Release.



SDSFIE/FMSFIE Data Connections

ACCESS Library Location  
C:\Program Files\TSSDS\Release.210 Browse ...

Symbology Image Files Location  
C:\Program Files\TSSDS\Images.210 Browse ...

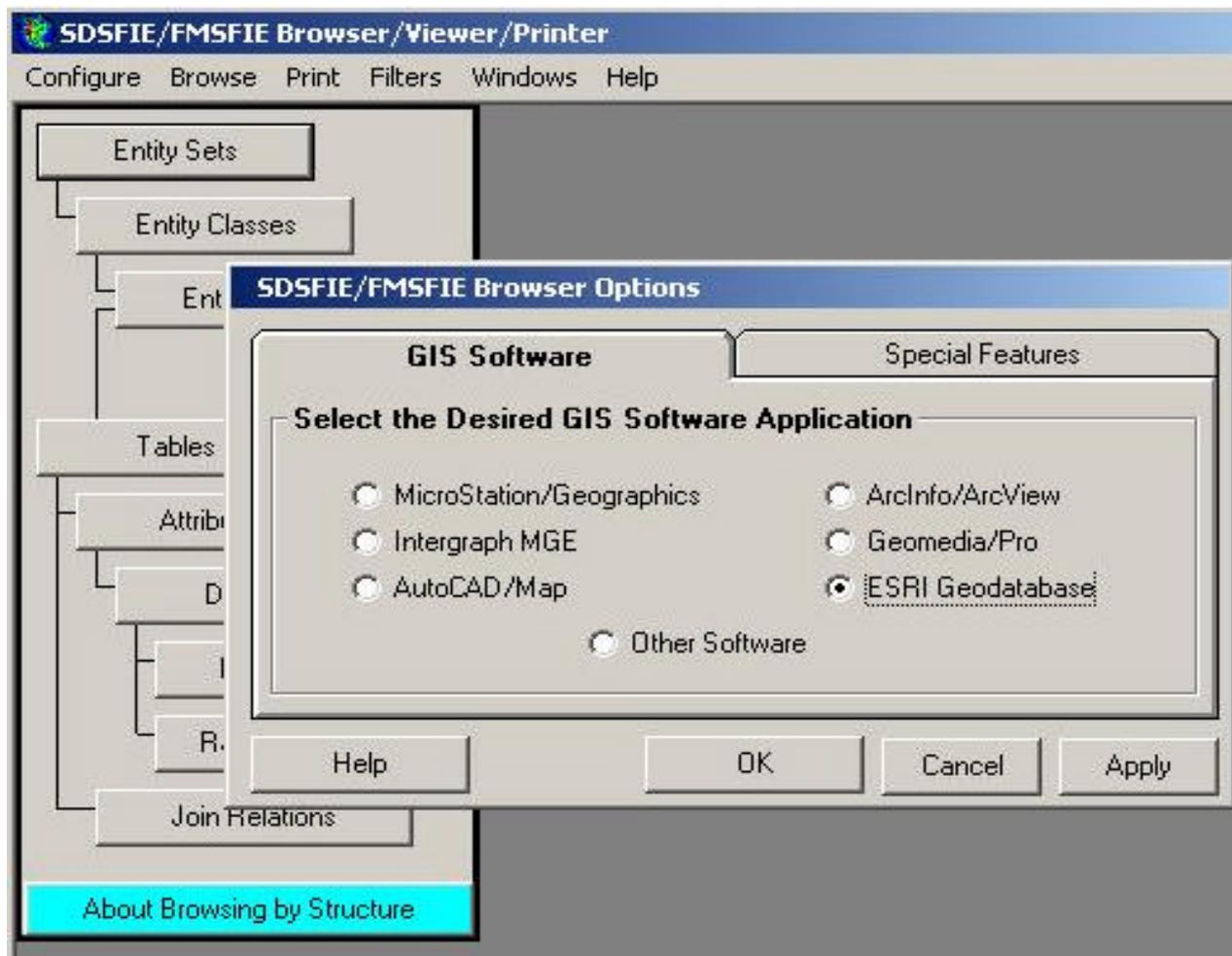
IDEF Model Files Location  
C:\Program Files\TSSDS\Models.210 Browse ...

Connect, Test, and Save Help Cancel and Close

# SDSFIE Toolbox – Browser Setup

- Step 2 –

- Go to Browser Menu entitled “Configure”.
- Select “Options”.
- Select “ESRI Geodatabase”, then press “Apply” button.

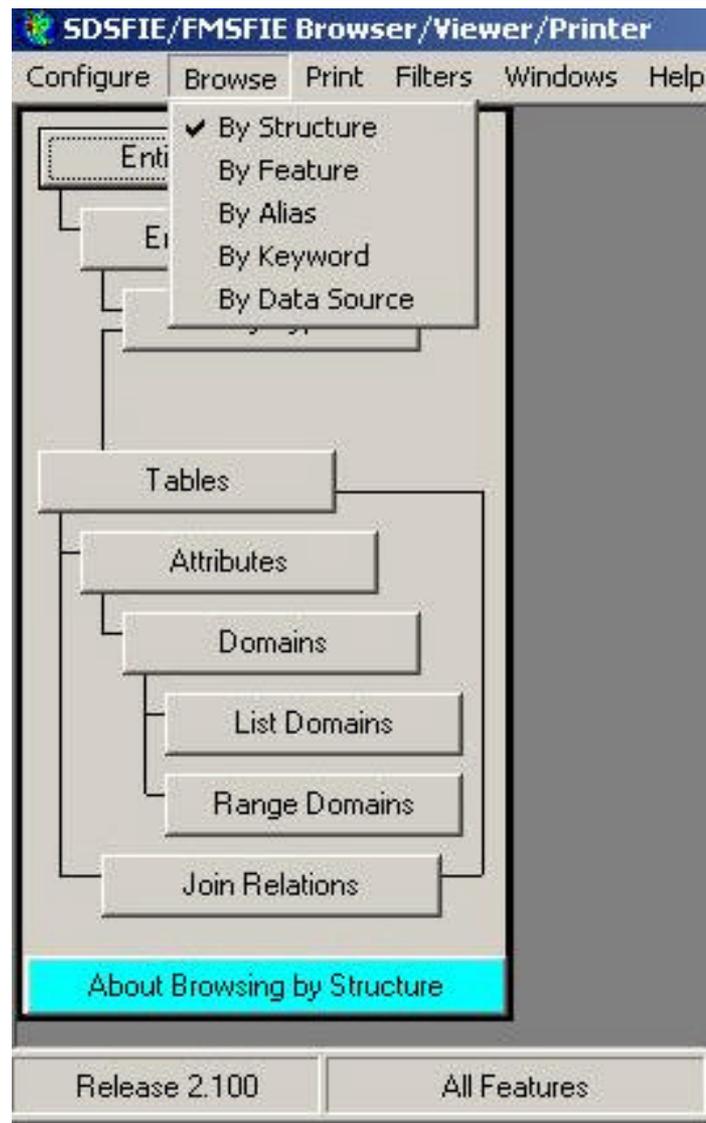


# SDSFIE/FMSFIE Toolbox - Browser

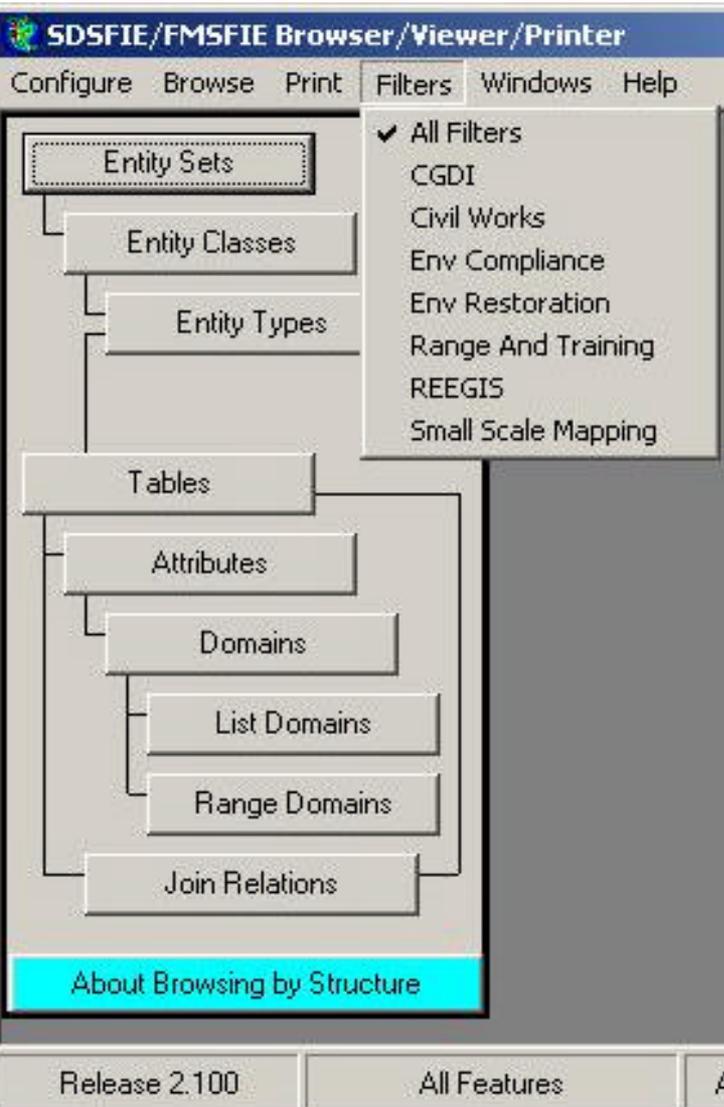
## SDSFIE/FMSFIE Browser Software Application:

Provides Several Options for Viewing the Standard:

- Structure – View Standard by selecting Entity Set, Entity Class, Entity Type, Tables, Attributes, Domain Tables, & Domain Values.
- Feature – View standard by selecting Features of Interest.
- Alias – View standard by selecting Alias Feature Names.
- Keyword – View standard by a Keyword (e.g., tree).
- Data Source – View standard by Source (e.g., EGDC, EPA)



# SDSFIE/FMSFIE Toolbox - Filters



- “Filters” are a subset of the SDSFIE/FMSFIE.
- “Filters” can be “Pre-Defined” (i.e., defined by a User Group and provided by the Center with the SDSFIE/FMSFIE Release) or “User-Defined” (i.e., defined by a User through use of the “Filter Maker” Software Application).
- SDSFIE/FMSFIE contains an enormous amount of detail and information. Most GIS implementations use a subset of the SDSFIE/FMSFIE. “Filters” simplify development of a SDSFIE/FMSFIE compliant GIS through the identification and use of a defined SDSFIE/FMSFIE subset.

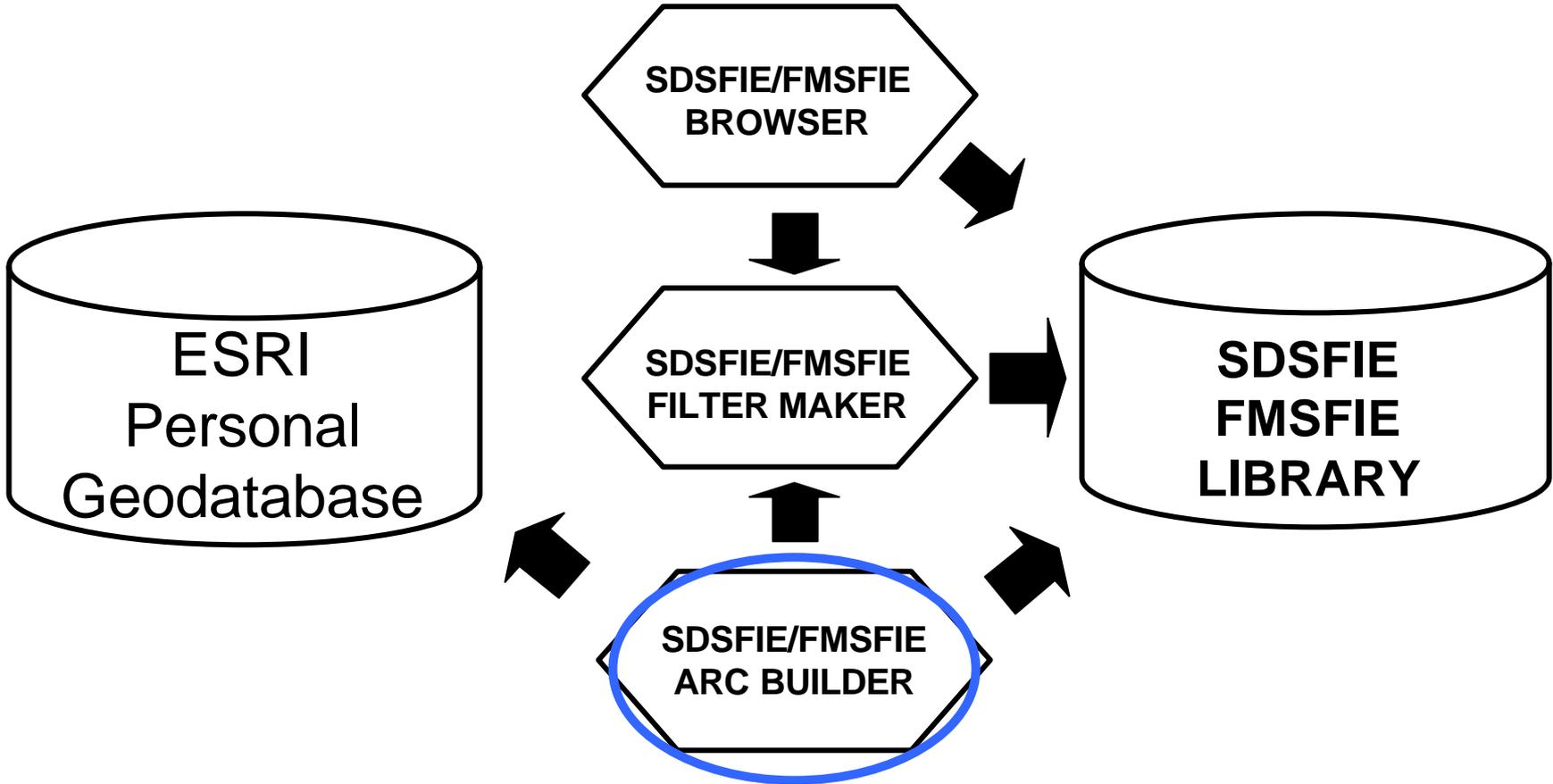
# SDSFIE/FMSFIE Toolbox – Filter Maker

## SDSFIE/FMSFIE Filter Maker Software Application:

- Provides a tool which permits the User to define their own subset of the SDSFIE/FMSFIE for use in GIS development.



# SDSFIE Toolbox



# SDSFIE/FMSFIE ARC Builder Summary

**THE SDSFIE/FMSFIE ARC Builder** is a tool to:

- **Provide assistance in the creation, modification, and maintenance of the user geodatabase**
- **Provide a simple, easy to use, means to reduce the complexity associated with the SDSFIE/FMSFIE when dealing with a user geodatabase**

**NOTHING IS MORE IMPORTANT THAN DATA INTEGRITY**

# Summary

- **The SDSFIE/FMSFIE ARC Builder can either Create a new geodatabase or Modify an existing geodatabase**
- **The SDSFIE/FMSFIE ARC Builder will build:**
  - **SDSFIE/FMSFIE Feature Datasets**
  - **SDSFIE/FMSFIE Feature Classes**

# SDSFIE/FMSFIE ARC Builder Screen Layout

**CAPTION BAR** - The standard Windows Caption Bar containing the Application Title, Minimize/Maximize/Close Buttons, Control Menu, and Application Menu.

**Application Title**

**Application Master Menu**

**Datasets Window**

Existing Feature Datasets

**Classes Window**

Existing Feature Classes

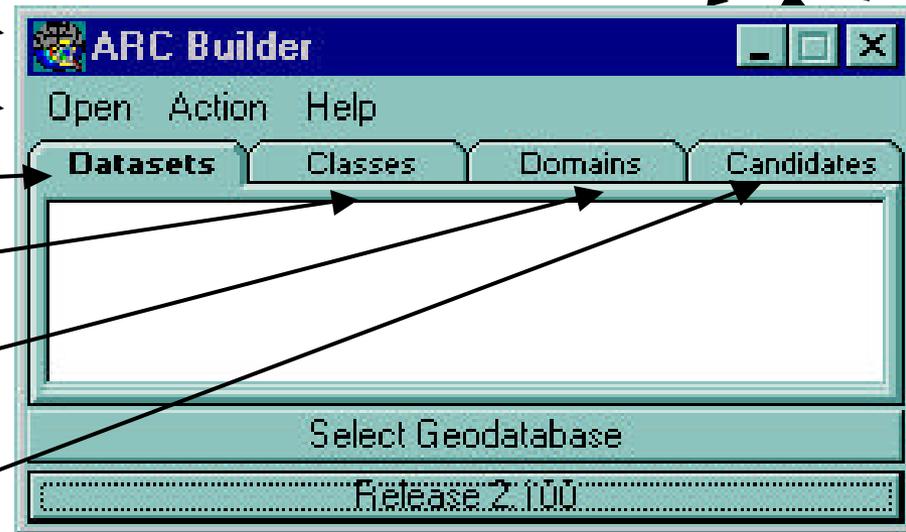
**Domains Window**

Existing Database Domains

**Candidates Window**

Feature Classes to be included in the Database

Maximize Button  
 Minimize Button  
 Close Button



# SDSFIE/FMSFIE ARC Builder Menu Operations

**MENU HIERARCHY** - the complete SDSFIE/FMSFIE ARC Builder Menu Hierarchy appears as follows:



- ARC Builder
- Contents/Index
- About the Arc Builder

- List Feature Classes
- Candidate Table List
- Add Candidates to Geodatabase
- Build All Domains

- Create Geodatabase
- Open Geodatabase
- Library Connection
- Compact Database
- Exit

# SDSFIE/FMSFIE ARC Builder Screen Layout

**MASTER WINDOW** – Automatically sizes to the right hand side of the desktop and the full height from the top of the screen to the “Start” Menu.

**“Select Geodatabase” Button** – Allows for opening an existing Geodatabase (duplicates menu item “Open” -> “Open Geodatabase”)

## **Library Connection Button –**

Displays the Connection SDSFIE Release if properly connected to a SDSFIE/FMSFIE Library

(duplicate menu item “Open” -> “Library Connection”)



# SDSFIE/FMSFIE ARC Builder Library Connection

**CONNECTING** to the **SDSFIE/FMSFIE Library** is nearly identical to the connection process in the SDSFIE/FMSFIE Browser. Use the Button or the Menu item to display the connection dialog.



**BROWSE** - opens a Directory Selection window to permit browsing for the SDSFIE/FMSFIE Library Directory

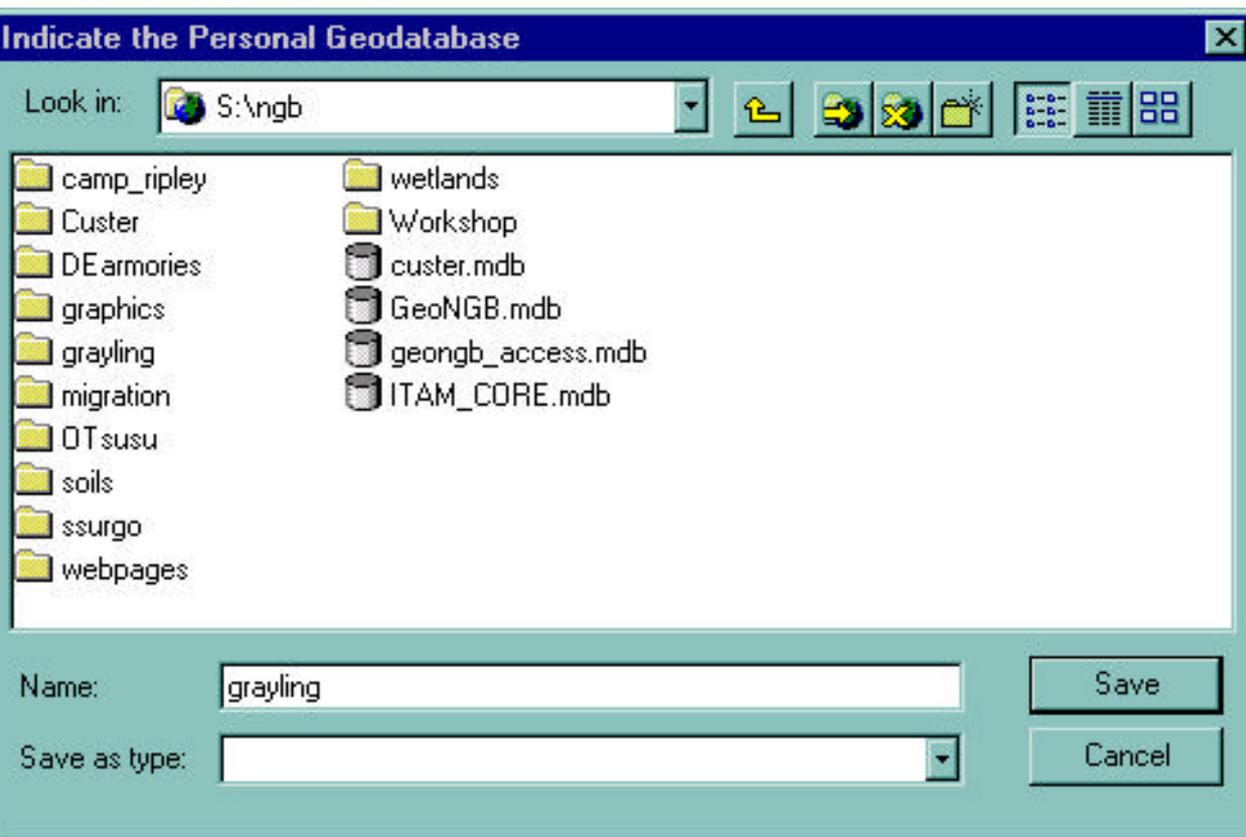
**CONNECT, TEST, AND SAVE** - uses the directory indicated in the Location Text Box to connect to the Library, read the Release, and begin reading data

**HELP** - opens a Help File for the Library Connection Screen

**CANCEL AND CLOSE** - closes the Connection Screen without attempting to connect

# SDSFIE/FMSFIE ARC Builder Database Creation

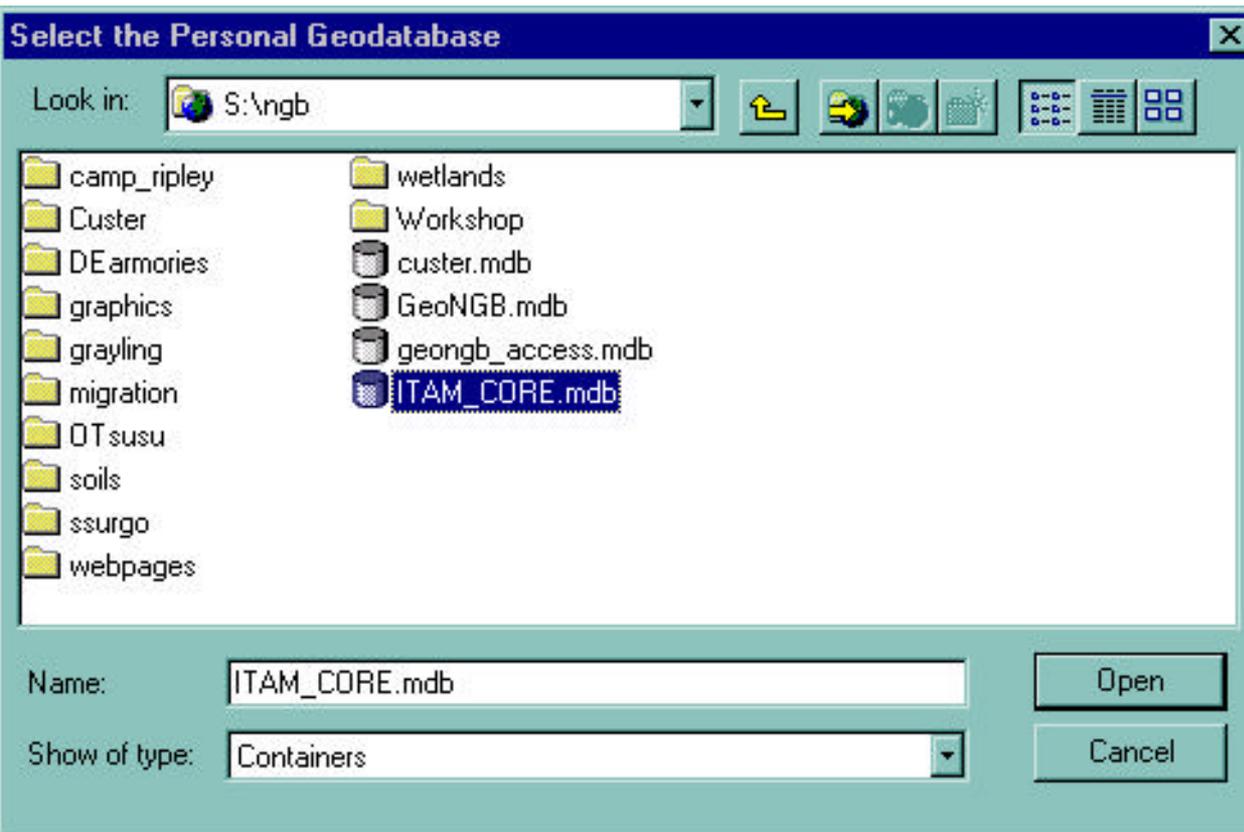
**CREATE GEODATABASE** - this menu item is used to create a new Geodatabase which can then be populated with SDSFIE data attributes and domains.



*A Standard Windows file save dialog to locate the path and name where the Geodatabase is to be created.*

# SDSFIE/FMSFIE ARC Builder Database Open

**OPEN GEODATABASE** - this menu item is used to open an existing SDSFIE Geodatabase and read its contents.



*A Standard Windows file save dialog to locate the path and name where the Geodatabase is located.*

# SDSFIE/FMSFIE ARC Builder Database Compact

**COMPACT Database** - this menu item is used to perform a file size reduction on the Geodatabase by removing space allocated to deleted or otherwise unused items.

**This operation is exactly the same as the COMPACT command in Microsoft Access.**

*This operation will not work properly if the database is in use by some other application. COMPACTING a database requires that the database be opened exclusively by the ARC Builder.*

# SDSFIE/FMSFIE ARC Builder Menu Operations

**CANDIDATE TABLE LIST** – two submenu items are available.

**BUILD** – activates the SDSFIE Selection Dialog

**CLEAR** – clears the CANDIDATE window

Use the **BUILD** menu item to add to the Candidates List in the CANDIDATE Window and the **CLEAR** menu item to completely empty the CANDIDATE Window. Individual Tables may be deleted by selecting the table and right-clicking.



# SDSFIE/FMSFIE ARC Builder

## Concept – Developing a Candidate List

A **CANDIDATE** is a SDSFIE feature class which is proposed to be added to the user Geodatabase. Candidates may be added one at a time or based on combinations of either Entity Sets, Entity Classes, Filters, or Single Features.

They are considered **CANDIDATES** because the Builder looks to determine whether the Candidate feature class already exists before attempting to build the feature class, its attributes, its domains, and its joins.

*The Candidate Window is available to display the Candidate List where it can be maintained and or modified.*

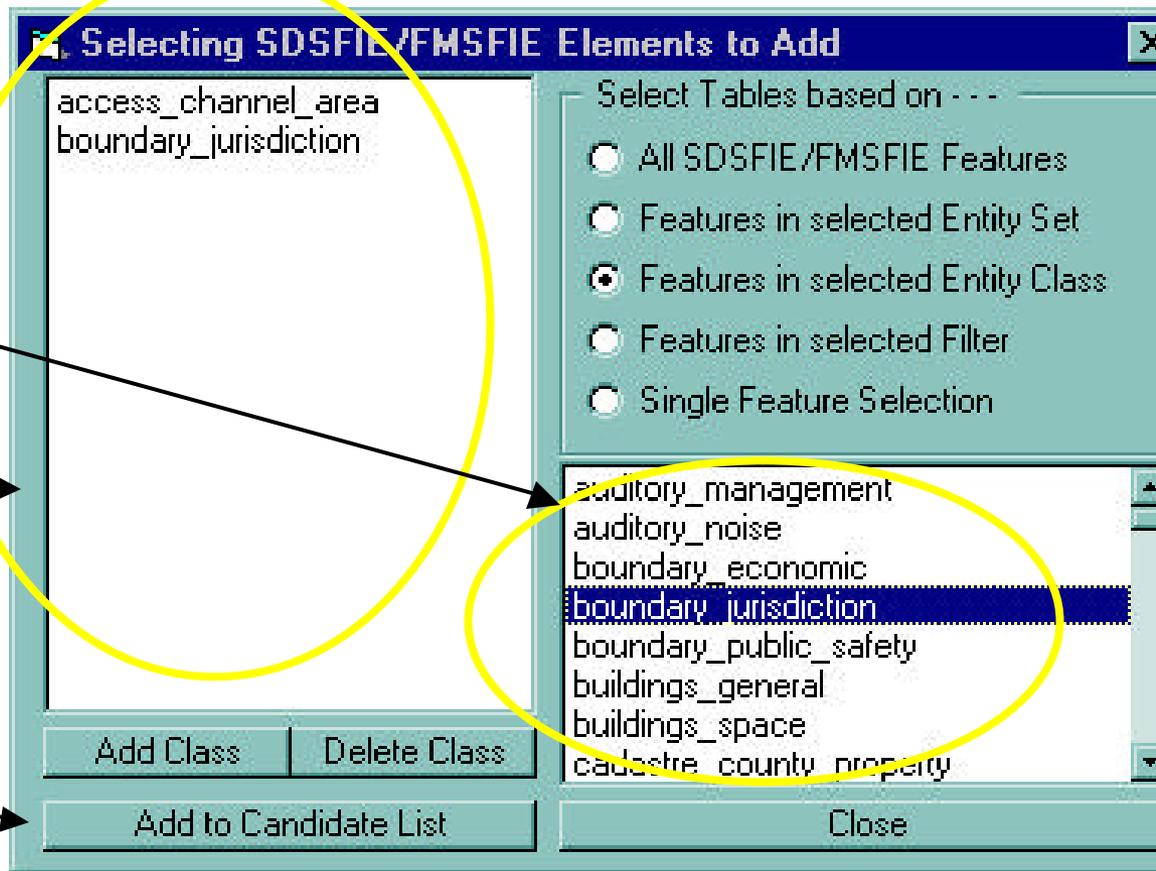
# SDSFIE/FMSFIE ARC Builder Menu Operations

**BUILD CANDIDATE LIST** – displays the SDSFIE/FMSFIE Selection Dialog

**SOURCE LIST** – a list of Entity Sets, Entity Classes, Filters, or Individual Tables included in the SDSFIE/FMSFIE.

**DESTINATION LIST** – a list of the selected items which will become the basis for the Candidate Classes.

**Add to Candidates Button**  
Converts the Destination List to the Candidate List



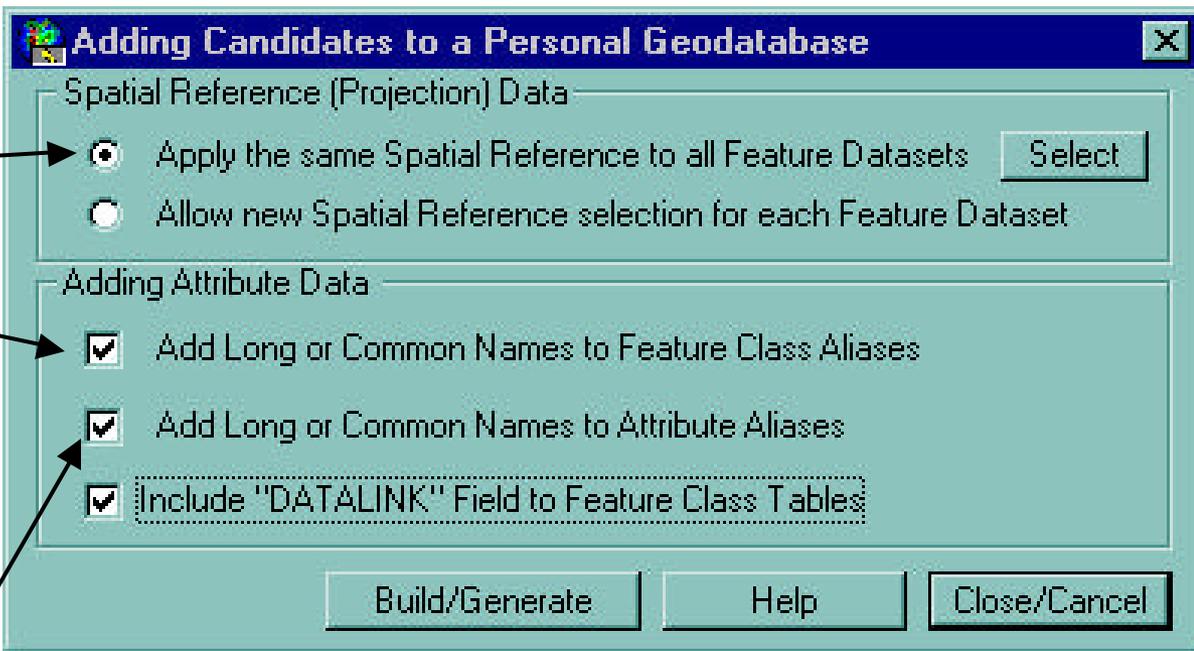
# SDSFIE/FMSFIE ARC Builder Menu Operations

**ADD CANDIDATES TO GEODATABASE** – adds the defined candidate classes to the Geodatabase

**SPATIAL REFERENCE** –  
set it once or for each  
Feature Dataset

**ADDING FEATURE  
CLASSES ALIASES** –  
includes Long/Common  
Names and definitions.

**ADDING ATTRIBUTE  
ALIASES** – includes  
Long/Common Names



# SDSFIE/FMSFIE ARC Builder Menu Operations

**ADD CANDIDATES TO GEODATABASE** – During the process, a “Progress Bar” is displayed at the bottom of the screen. In addition, the classes being included and configured are highlighted in the Candidates Window.

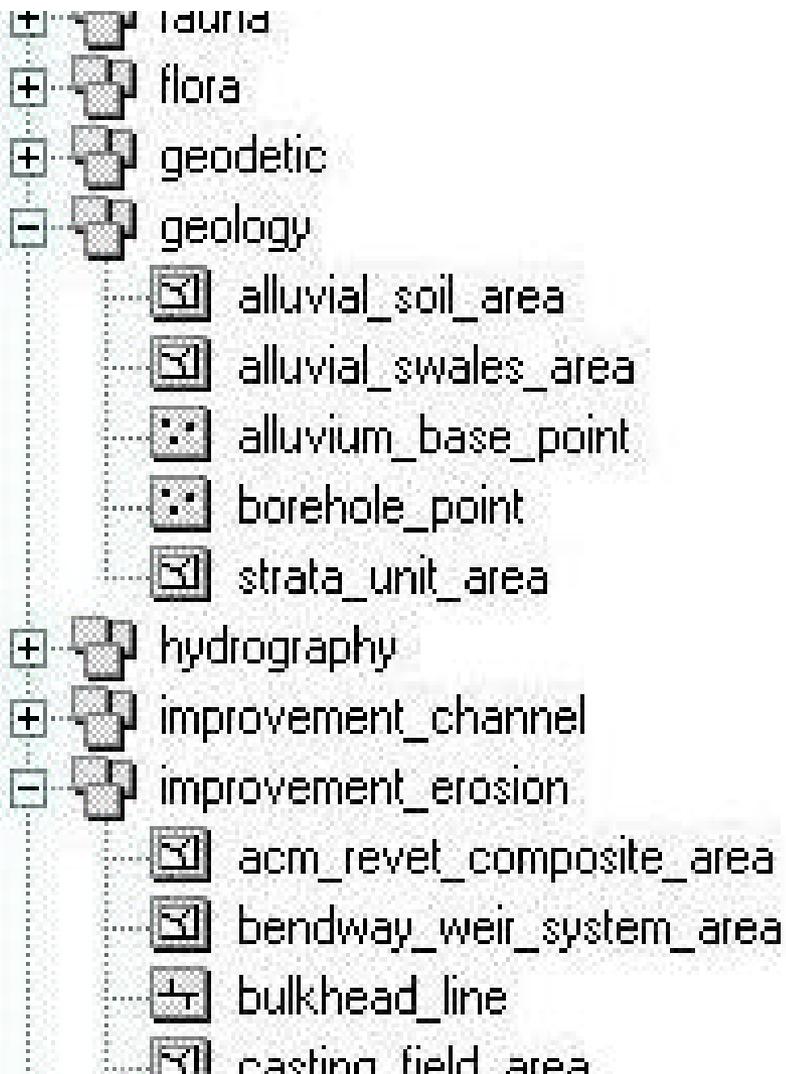
**PROGRESS BAR** – displays the status of the configuration

**CANCEL BUTTON** – permits termination of the process but DOES NOT reconfigure those tables already included



**COMPACTING REQUIRED  
FOLLOWING PROCESS**

# SDSFIE Arc Builder

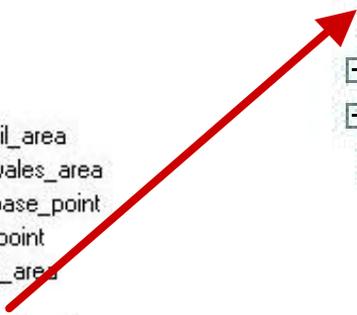


- X,Y Coordinate Values are provided by the user
- Subtypes and Domain Values are Automatically populated.

# SDSFIE Geodatabase

- + boundary
- buildings
  - ☑ structure\_existing\_area
  - ☐ structure\_existing\_point
  - ☑ structure\_future\_area
  - ☐ structure\_future\_point
- + cadastre
- + common
- + communications
- + cultural
- + demographics
- + ecology
- + environmental\_hazards\_characterization
- + environmental\_hazards\_pollution
- + environmental\_hazards\_sites
- + environmental\_hazards\_waste
- + fauna
- + flora
- + geodetic
- geology
  - ☑ alluvial\_soil\_area
  - ☑ alluvial\_swales\_area
  - ☐ alluvium\_base\_point
  - ☐ borehole\_point
  - ☑ strata\_unit\_area
- + hydrography
- + improvement\_channel
- improvement\_erosion
  - ☑ acm\_revet\_composite\_area
  - ☑ bendway\_weir\_system\_area
  - ☐ bulkhead\_line
  - ☑ casting\_field\_area
  - ☐ dike\_centerline

- Buildings
  - ☐ structure\_existing\_site
- + Cadastre
- + Cultural
- Hydrography
  - ☑ Hydrography\_wetland
- + Military\_operations
- Soil
  - ☑ Soil\_General



## QUESTIONS?

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CADD GIS Technology Center Internet URL :

<http://tsc.wes.army.mil>