

CHAPTER E-2

SPATIAL ENGINEERING

1. Background and Purpose.

a. Spatial Information refers to, by definition, anything that occupies a space and has X-Y coordinates. Spatial Engineering in turn includes engineering applications that manipulate that data for analysis, studies, etc. These engineering application systems include Automated Mapping and Facility Management (AM/FM), Geographical Information Systems (GIS), Project Integrated Database Systems (PIDB), and Facility Management Systems (FMS). These systems rely on and are based on Computed Aided Design and Drafting (CADD) systems.

b. The Spatial Engineering Section (EN-EC) has been established to coordinate spatial engineering applications for the District. By necessity this section must coordinate and set standards for the District CADD System. This will provide for a totally integrated electronic product for customers and will be consistent with the life cycle project management concepts. In addition, Spatial Engineering is responsible for producing the drawing portion of Electronic Bid Sets (EBS).

2. Organization. EN-EC is responsible for the following areas related to automated engineering applications.

- a. Establishing a file set up and naming convention.
- b. Establishing standard cell libraries.
- c. Establishing plotting procedures.
- d. Establishing color conflict plotting procedures.
- e. Establishing scanning and vectorizing standards and procedures.
- f. Archiving and backing up designs and other electronic data.
- g. System Management functions as agreed upon for the file server.
- h. Coordinating all Spatial Systems throughout the District.
- i. Production of drawing portion of EBS.

3. Procedures. The following is a series of standard operating procedures or agreements that enable EN-EC to perform these tasks. The system and standards are primarily based on Bentley Software using Microstation software for CADD. For GIS multiple platforms are used including Intergraph MGE, Intergraph Geomedia, ESRI ArcInfo, ESRI Arcview, and Bentley Geographics.

a. File Set Up and Naming Convention. Chapter A-10 of the A-E Design Standard Procedures Manual discusses in detail proper and acceptable file naming convention for Savannah District. Briefly the requirements are as follows:

(1) Drawings shall comply with latest versions of DP 1110-1-1 Savannah District Drafting Standards and The TriService AEC Standard for CADD.

(2) Each drawing in a design shall have an electronic file copy. One drawing per file.

(3) A key plan should be displayed on each design file that depicts topographic information.

(4) The final design should be saved with the composite drawing in View 8, the title block in View 4, the color overlay in View 5 and the basic in View 2.

(5) All reference files are to be attached with appropriate MicroStation utilities.

(6) The preferred naming convention is as indicated by the AEC Standard adapted for use by Savannah District.

(7) The file name should be displayed below the wide border under the title block. Self-extracting compressed files (filename.exe) may be used on large files to save them to disk. (i.e. PKZIP and ZIP2EXE.)

(8) Each discipline has a CADD drawing level scheme per the AEC. If the standard CADD leveling scheme is not followed, then a Design File Level Scheme sheet must be completed for each file that deviates from the standard.

(9) Abbreviations for Military and Civil projects for file naming purpose are as follows:

A	AIWW	F	Fort McPherson
N	Fort Benning	M	Moody
B	Fort Bragg	P	Pope AFB
V	Brunswick Harbor	U	Richard B. Russell Dam and Lake
D	Dobbins AFB	R	Robins AFB
O	Donaldson AFB	Z	Savannah River
L	Fort Gillem	C	Seymour Johnson AFB
G	Fort Gordon	S	Fort Stewart
H	Hunter AAF	X	Strom Thurmond Dam and Lake
W	Hartwell Dam & Lake	T	Sunny Point Military Ocean Terminal
J	Fort Jackson	E	Turner AFB
K	Kings Bay Naval Sub Base	Y	Tybee Island

b. Standard Cell Libraries. Each section is responsible for establishing and maintaining cell libraries for its specific discipline. Multiple libraries are recommended for each section to avoid excessively large cell files. User group members from each discipline will be responsible for reporting the official cell libraries of each discipline or section to EN-EC (Susan Usher). The cell libraries will be stored on the file server and downloaded to PC's as needed. The sections user group member should also be aware that these same cell libraries will be furnished to A-E firms as required. Therefore, the standards set forth in the AEC Standard should be considered when creating new cells and instructions should be furnished to A-E's to avoid conflict.

c. Plotting and Interference Plotting Procedures. Several methods of plotting are available. Generally drawings are plotted in black and white on either of two plotters – Xerox Plotters. For check

plots half size plots are recommended. Half size plots should also be considered for interim submittal review. Another method of plotting is available via laser jet printers for sizes of 8-1/2 x 11 or 8-1/2 x 14. The proper configuration file is located on the file server and the plotting utility from within Microstation is used for this method.

Full size color plotting is available but should be used sparingly due to expense. The cost associated with color plotting will normally be charged directly to the project. Color charts are available in the CADD room to aide in choosing colors for plotting.

Batch Plotting is preferred when a large number of plots must be made for a project such during preparation of submittals. Each section should coordinate with EN-EC for instructions on batch plotting.

Interference plotting is a method of plotting multiple disciplines in different colors to determine if conflicts occur in the design. Time should be allotted in the design schedule for this procedure. A list of the files to be checked should be furnished to the Project Engineers and provided then to EN-EC. The plots will be made and furnished to the Project Engineers for review and correction/coordination. The following are recommended discipline interference plots:

- (1) Electrical Lighting/Mechanical Overlay on Architectural floor plan.
- (2) Electrical Power/Mechanical Equipment Overlay on Architectural floor plan.
- (3) Structural Plan on Architectural Plan

This technology changes rapidly and EN-EC will keep users informed of new methods and procedures via e:mail.

d. Scanning and Vectorizing Standards and Procedures. EN-EC has available full size scanning capabilities. Scanning provides a means of producing electronic raster drawings from hard copy drawings and likewise enables the user to use the electronic image as a reference to vectorized drawings. The files can also be manipulated through the use of various softwares available in EN-EC. Scanned files should be used 1) to produce electronic drawing files from hard copy drawings, 2) as a method of digitizing when a large digitizer is unavailable or impractical, 3) as a preparation for vectorizing non digital drawings, and 4) as a method for preparing electronic drawings for archival. Scanning resolution is available up to 400 dots per inch.

Vectorizing of scanned images can be accomplished by use of CADD Core software or VP Hybrid CADD software. These methods are of most use for scanning and vectorizing of hard copy topographic files or consistent line images. The cost for vectorizing can be as high as two thirds of straight digitizing.

e. Archiving and Back Up Procedures. EN-EC is required to maintain an electronic copy of all Savannah District contract drawings files. The drawing files are copied (archived) to CD-ROM disks with comprehensive indexing in EN-EC and on the file server. To assure that all files associated with that project are captured, it is essential that all the project files be located in the same project directory. The following should accomplish this task.

- (1) Project Directories:

(a) When the Project Manager obtains a directive to begin work on projects, the Project Engineers responsible for tracking the design effort will contact EN-EC to establish a directory on the file server for the CADD work. The Project Engineers will inform all team members of the project's location on the applicable file servers. An Excel spreadsheet called filebook.xls file is maintained on the file server for directory information.

(b) If an individual has information prior to official notification about a potential project and needs a working area on the CADD file server, the individual should coordinate with the Project Manager, the Project Engineers, and EN-EC so that EN-EC can create the project directory as early in the design as possible. As the team grows, all will work in the project directory.

(2) Project Archiving Prior to Advertising.

(a) The Project Engineers will provide instructions to EN-EC via the CADD SECTION REQUEST FORM as to the archiving of projects files. Designs will be archived at scheduled (formal submittals) and unscheduled (directed stoppages). The project files will be removed from the file server in either case if a prolonged work stoppage is anticipated.

(b) When a project is ready to advertise (RTA), the Project Engineers will provide the Invitation for Bid (IFB) number to the Spatial Engineering Section (EN-EC) which will add this number to the project border sheet. The Project Engineers will inform the designers that the final drawings can be plotted. Following the plotting, the Project Engineers will instruct EN-EC to archive the project and remove it from the file server.

(3) Project Amendments.

(a) Changes to drawings during the advertising of a project require the issuance of an amendment. The designers preparing the amendment will notify the Project Engineers as to the drawings which will be required to be reloaded to the project directory. The Project Engineers will consolidate the individual requests for each amendment and provide this information to EN-EC.

(b) Each design office is responsible for making the amendment changes to the design file. Refer to the Design Manual for Military Construction for amendment procedures. The design file will be updated when the amendment is issued. The Project Engineers will inform EN-EC of the issuance of each amendment so that the design files are archived appropriately.

(c) EN-EC will check with the Project Engineers to insure all amendments are posted before issuing successful bidder drawings for a project. After the revisions have been incorporated, the revised plot(s) will be taken to EN-EC, and EN-EC will forward the revised plot(s) after successful bidder reproduction to Construction Division. EN-EC will archive the revised project files and remove project files from the file server.

(4) Project Modifications. When a project under construction requires a modification, the Project Engineers will inform EN-EC which files need to be loaded to modify the drawings. EN-EC will load the

files onto the CADD file server or furnish a CD of the project to the user.. Refer to the Design Manual for Military Construction for modification procedures. After the modifications have been made to the design files, the Project Engineers will inform EN-EC that the design files can be archived. EN-EC will archive the revised project files and remove project files from the file server.

(5) Project As-Built Drawings. Construction Division will insure that the design files include and reflect the As-Built conditions of the project. In the event that the files are not electronic, the manual As-Built drawings will be scanned. EN-EC will archive the projects files for the User and will retain a file copy on CD ROM for the District.

(6) Electronic Bid Sets. See Section for information on Electronic Bid Sets.

f. System Management Functions. System management functions have been delegated to EN-EC as shown by the following chart:

Spatial Engineering Server Responsibility

TASKS	RESPONSIBLE ORGANIZATION	
	EN	IM
SYSTEM CONFIGURATION PLANNING	X	A
PARTICIPATION IN CADD CONFERENCES, USER GROUP MEETINGS, ETC."	X	
APPLICATION PROBLEM LOGGING	X	
POLICY FOR CADD FUNCTIONAL MANAGEMENT AND OPERATION	X	
WORKSTATION SOFTWARE DELIVERY	X	A
WORKSTATION SECURITY	X	A
PROJECT ACCOUNTING	X	
PROJECT COORDINATION AMONG VARIOUS DISCIPLINES	X	
PROJECT DIRECTORY AND FILE MAINTENANCE	X	
APPLICATION-ORIENTED USER COMMAND, MDL, & MICRO CSL PROGRAMMING"	X	A
APPLICATION -ORIENTED MENU DEVELOPMENT	X	
APPLICATION DOCUMENTATION MAINTENANCE	X	
DISK SPACE USE	X	
SYSTEM-RELATED PROBLEM LOGGING	X	A
HARDWARE PROBLEM LOGGING	X	A
GENERAL PURPOSE USER COMMAND, MDL, & MICRO CSL PROGRAMMING"	X	A
GENERAL PURPOSE MENU DEVELOPMENT	X	A
NETWORK SECURITY	A	X
SERVER SECURITY	X	X
SERVER SOFTWARE DELIVERY	X	A
USER SECURITY ACCESS	X	
ROUTINE BACKUPS	X	
COMPUTER UTILIZATION ACCOUNTING	X	
CADD CONTRACT ADMINISTRATION	X	X
HARDWARE AND SYSTEM SOFTWARE TROUBLESHOOTING	A	X
APPLICATION TROUBLESHOOTING	X	A
ACCREDITATION AND DOCUMENTATION	A	X
SYSTEM DOCUMENTATION	X	
PLOTTING SUPPLY INVENTORY	X	
ROUTINE PLOTTER MAINTENANCE	X	
DISK SPACE ALLOCATION	X	
POLICY FOR CADD SYSTEM MANAGEMENT AND OPERATION	X	
PC CONFIGURATION	X	
TROUBLE SHOOTING, SETTING UP, INSTALLING, AND RELOCATING PC's"	A	X
TROUBLE SHOOTING NETWORK PROBLEMS	A	X
REPAIRING CORRUPT FILES	X	A
RELOADING FILES FROM BACKUPS AND ARCHIVES	X	A
EVALUATE NEED FOR UNIX PROGRAMMING CONTRACTOR IN EXTREME CASES	A	X
SUPPORT FOR REMOTE LOC. AS DIRECTED BY EN-EC CHIEF (SYS. MTN. AND MGMT.)	X	X
DIRECT CADD USE TO ACCOMPLISH MISSION	A	
APPROVAL AUTHORITY FOR CADD POLICY	X	
COORDINATION OF CADD USE WITHIN THE DISTRICT	X	

X - DENOTES PRIMARY

A - DENOTES SECONDARY OR ASSISTANCE

ALL TASKS ASSIGNED AT THE DISCRETION OF ENGINEERING

All procedures are documented in the Spatial Engineering Section Procedures Reference Manual.

g. Coordination of District Spatial Systems. EN-EC is responsible for coordinating all Spatial Engineering activities or projects within Savannah District. This includes but is not limited to automated mapping and facility management (AM/FM), facility management systems (FMS), project integrated database (PIDB), and geographical information systems (GIS). EN-EC will maintain a close relationship with the Tri-Services CADD/GIS Center and assure that Savannah District designs, mapping, etc. are compatible with or based on the appropriate standards set forth by the Center. The needs of each division will be assessed and every effort will be made to establish District Spatial Engineering Systems. While meeting the needs of each division, it will be equally important to meet the requirements of various "stove pipes" or higher authority.

The intent of EN-EC coordination is to produce designs in line with life cycle management assuring compatibility and integration from planning through design and construction and ultimately the facility management of designed projects.

EN-EC is also responsible for maintaining close working relationships with the Military Installations in order to support the Spatial Systems in place at each. EN-EC will also actively pursue development of Spatial Systems at those installations which are not as yet working in this environment.

EN-EC will represent the District and keep management informed of activities with the Federal Geographic Data Committee and the Savannah Area Geographical Information System Consortium. EN-EC will also maintain contact and coordinate with other districts and federal agencies in the area of Spatial Engineering.