Chapter 5
Implementation Plan

5-1. Introduction

a. It is a requirement that all USACE Commands develop and maintain an individual multi-year GD&S Implementation Plan (IP) for purchases of dedicated GD&S hardware and software systems. Some USACE Commands have developed and maintain implementation plans. One example is available on the Internet at Universal Resource Locator (URL) http://corps_geo1.usace.army.mil. Some of the considerations used by the Commands in developing their IP's includes: resolution, format and use of presently encoded data; anticipated needs for future data and a GD&S model; compatibility of systems division-wide; Information Management support needed; coordination of GD&S needs and uses across disciplines (e.g., Real Estate, Engineering, Planning and Construction, Operations); and costs.

b. Development and execution of a GD&S Implementation Plan is necessary in order to guarantee the successful and effective installation of a GD&S. In order to reduce risks and minimize excessive costs and redundancy, a comprehensive design and timeline must be created in order to reduce the likelihood of failure. A three to five year timeline driven by specific performance milestones and pilot projects assures progress and manageability. Even if the IP is not acted upon, the document will serve as an informative report on user needs and may benefit other agencies interested in implementing a GD&S.

c. Figure 5-1, taken from an Environmental Protection Agency (EPA) system design (EPA 1993), illustrates the time and resource savings that can be achieved if a system has been properly engineered, such as with an implementation plan. Long-term maintenance costs will be reduced and system implementation will require fewer resources and cost less. The development of an IP will increase costs in the short run, but during a three to five year life cycle, the cost savings during implementation and maintenance will be significant.

5-2. GD&S Implementation Plan Contents

The following sections describe the required content and recommended format of a GD&S Implementation Plan (IP). USACE commands may reformat the IP at their discretion but must include the required information.

a. Background. The background section of the IP summarizes the objectives of the GD&S Implementation Plan and explicitly states the need to execute this IP consistently and comprehensively. This section should also provide examples of the positive impacts of implementing this IP.

b. Scope.

(1) General.

This section of the IP provides some general information of GD&S technology and its application. The following is adapted from existing USACE GIS Implementation Plans:

GD&S is a powerful tool for combining a variety of data types into a common format. The system will speed any analyses that use spatially referenced data by automating processes that were often done by hand. Due to improved technology more information can be managed and manipulated. The sophistication of the analyses that now can be performed is enhanced over what can be achieved using only printed maps. Immediate updating of map files, viewing of multiple classes of information, and iterative "what if" analyses are a small sampling of the available capabilities.

All disciplines in the District must work cooperatively to share geospatial data whenever possible. Increased awareness of data availability and greater sharing of data between disciplines reduces the potential for loss of valuable data (e.g., "old" aerial photos or maps) and reduces costly replication of data collection. The most cost- effective approach to the development and use of a District-wide geospatial data inventory involves consideration of uses for each geospatial data set by the community of potential users, avoiding a limited purview engendered by looking at single applications. Data created by one corporate entity should be available for sharing with all spatial data users within the District or by District customers. Use should not be restricted or precluded by file format, operating system, object description incompatibilities, and so forth.

(2) Existing uses.

This section of the IP will list and describe current GD&S systems implemented and will discuss their individual strengths and weaknesses. Each GD&S description will include whether the data is raster or vector based, what the data sources are, what analyses are exercised, and what modeling is done. In addition, report on the current status of the GD&S in regard to its implementation plan and whether the GD&S has been effective.

(3) Future uses.

This section of the IP provides examples of current projects that could profit from the technologies of a GD&S. Include projects that handle large amounts of data that could be

analyzed more effectively in a geographical environment. Describe the needs or potential needs of the project and then show how GD&S technology could simplify and enhance the capabilities of the project.

(4) Needs assessment.

The needs assessment section of the IP lists and prioritizes the requirements presented in Sections 5-2.b (2) and (3) and describes what GD&S solutions would meet the requirements. Assess the requirements and describe the potential benefits of implementing a GD&S in these environments. Multiple sites can find great benefit in sharing data across networks and therefore reducing overall cost.

(5) Communication.

This section of the IP discusses how the GD&S technology and capabilities will be brought to the field through communication. Modes of communication will be compared based on availability and ease of use and may include newsletters, electronic mail, etc.

(6) Awareness of technology.

This section of the IP discusses the importance of the awareness and education of decision-makers of the technology and benefits of GD&S. Awareness may be spread through the use of video tapes, demonstrations and seminars.

c. Design guidance.

(1) Hardware.

The hardware section of the IP presents standards and requirements that restrict the selection of GD&S hardware. Describe the federal and industry-wide standards (GOSIP, POSIX, etc.) that may be relevant. Make sure the standards that are imposed on the GD&S hardware are necessary and appropriate in the light of standards being modified regularly. The major aspect of a GD&S system that must be standardized is the protocols and transports it uses to communicate with other systems or networks. Attention should be given to how well the hardware will fit with existing systems and how well the hardware can be maintained and upgraded. HQUSACE can provide numerous examples of GDS that became dependent on hardware platforms that were obsolete before the system was fully operational.

The decision to implement a multiple system (networked, redundant CPUs) solution or a single (stand-alone) system solution will be made based on the system's user load, throughput, and the requirements for reliability. Multiple system implementations allow more users to be online simultaneously and still perform complex spatial analyses. If a single CPU fails, the multiple system solution will allow continued operation with low to medium effect on processing times. Multiple systems can also effectively share hard disks for storing large databases. However, successfully maintaining multiple systems require additional labor for administration, which can be costly and will demand more strict system resource procedures.

The single system is a simple and cost-effective solution, but it has many drawbacks. On the plus side, the single system features lower maintenance requirements. However, the dependence on a single machine can be disastrous if a system failure corrupts data or delays time-critical projects. The single system limits the number of users that may use the GD&S drastically; in many cases only one user may effectively use the system at one time.

The specific hardware platform that is chosen will depend on the system requirements. A single-user single machine system should use a low-cost solution, such as a 586-based PC configured with at least 16MB RAM and a 500MB hard drive. This system may run using either DOS/Windows or OS/2 and will provide impressive performance for the price. However, if user requirements specify the need to access information from other Districts or from other sources on the Internet and require multiple users, then a UNIX based hardware platform is the best solution. A minimum configuration would be a Sparcstation 20 with 32MB RAM and a 1 GB hard drive. Additional peripherals should be added to each system, such as backup drives, CD-ROM drives, digitizers, scanners and printers.

(2) Software.

The software section of the IP presents standards and requirements that restrict the selection of GD&S software. Describe important capabilities that are required for the proposed GD&S. Issues involving raster and vector compatibility, interoperability with CADD systems, data exchange with cooperating agencies, and importing important nationwide databases should be addressed.

(3) Data formats.

The data format section presents standards and requirements that restrict the selection of GD&S data formats. Discuss data format conversion for importing and exporting data with cooperating agencies and potential users. Describe the different formats that the GD&S will be able to input and output.

(4) Connectivity.

This section of the IP presents standards and requirements that restrict the selection of GD&S networking protocols and transports. This may be done by standardizing on a particular operating system and networking protocol, such as Unix/NFS/Ethernet. This section will also mention the importance to be able to share data with important data sources or other systems that may not be GD&S. An important example would be the capability to connect a raster-based GIS to a vector-based CADD system.

d. Data management.

(1) Data access and exchange.

This section of the IP discusses how data will be accessed and exchanged within the GD&S and with outside organizations.

(2) Data exchange formats.

This section of the IP discusses what formats will be used for data exchange with an emphasis on compatibility and minimizing data loss. The implementation of the Spatial Data Transfer Standard (SDTS) will be addressed also.

(3) Data stewardship.

The data stewardship section of the IP discusses the importance of the centralized database stewardship and how that improves security and minimizes data misuse.

(4) Data maintenance.

This section of the IP discusses who will be responsible for data security, data backups and data updates for each database. Specific procedures and equipment for data backup shall be addressed.

(5) Data archiving.

In this section the IP will discuss the standard operating procedure for performing routine daily and weekly data and system backups.

(6) Data quality.

This section of the IP discusses how quality assurance and quality control will be maintained for each database. Data acquisition standards and procedures will be addressed. Data sources may provide data in non-standard formats which will require that a standard format will be defined along with a procedure to convert all incoming data to the standard format. The standard format for data exchange is the SDTS. It specifies exchange constructs, addressing formats, structure, and content for spatially-referenced vector and raster (including gridded) data.[1]

e. Scope of existing and proposed systems.

(1) Existing systems.

This section of the IP will give detailed system configurations of each currently existing GD&S or related system. The list of system hardware should include workstation name and type, memory installed (RAM), secondary storage devices, tape backup devices, input devices (mouse, tablet, digitizer, scanner), and printers. Describe the operating environment and the networking protocols be used. List all the GD&S related software installed on the computer, including databases.

(2) Pilot projects.

This section of the IP will discuss all pilot projects that have been done or are being planned. The projects will be used to generate a list of lessons learned and a list of additional requirements for the proposed GD&S. Describe what GD&S was used and evaluate the system for its effectiveness.

(3) Proposed systems.

This section of the IP will describe what the proposed system hardware and software configurations will be for the GD&S and how these decisions were made. Pilot Project evaluation is an important step in formulating a wise system configuration.

f. Life cycle costs and justification.

(1) Hardware costs.

This section of the IP will discuss the costs involved in acquiring the hardware for the proposed systems. Hardware costs include the cost of the central processing units, monitors, keyboards, input devices, digitizers, modems, network connections, secondary storage devices, tape backup systems, printers, scanners and other non-standard hardware peripherals.

(2) Software costs.

This section of the IP will discuss the costs involved in acquiring the software for the proposed systems. Software

[1] Paraphrased from the Spatial Data Transfer Standard (FIPS 173) Fact Sheet, July 1994.

costs include operating system support, GD&S software (i.e., Microstation, ERDAS, ARC/INFO, GRASS), database server software (i.e., ORACLE, Informix) and software maintenance packages.

(3) Data acquisition.

This section of the IP will discuss the acquisition of data for the proposed system. Sources and costs for each database will be listed as well as sources for optional data sets.

(4) Database development costs.

This section of the IP will describe how the GD&S database will be designed. Efforts should conclude with the identification of the data dictionary used.

(5) System benefits.

(a) Tangible benefits.

This section of the IP will discuss the benefits of using a GD&S over a manual method which may include the following issues: easier data entry, efficient data manipulation, credible data analysis, faster data output, improved access to current data, ability to perform complex analyses not possible with manual methods, and manpower savings.

(b) Intangible benefits.

This section of the IP will discuss the intangible benefits of using a GD&S which may include the following issues: extended use/reuse of mapping data, ability to analyze more alternatives, common framework for analysis and data sharing, credibility and repeatability of analysis, interdependence of organizations, modeling, and morale and prestige.

g. System implementation.

(1) Personnel requirements and costs.

This section of the IP describes the staffing requirements of the GD&S with emphasis on the source of staffing and the day-to-day activities. GD&S is a shared resource that should be manned and funded as a cooperative basis through all interested parties. Staffing can best be analyzed by reviewing the day-to-day activities that will be required (paragraph 3-10 provides some example position descriptions that may be needed).

(2) Training requirements and costs.

This section of the IP discusses the issues involved with acquiring or developing skilled personnel for the operation and maintenance of the GD&S. The GD&S industry is growing both in number and in technology, so there will be a continuing need for advanced training. GD&S education can be pursued through contractor seminars/classes or through college course work. Having highly-skilled staff must be a high priority in order to maintain a complicated system such as a GD&S.

This section will discuss the training program that will be used to maintain a highly skilled and educated staff. Multiple disciplines must be supported to ensure that a properly prepared staff is available. This may include scheduling contractor based or college course base GD&S training since there is a lack of GD&S dedicated seminars.

(3) Acquisition strategy.

This section of the IP details the sources of funding and contract vehicles for the acquisition of the proposed systems. System acquisition may be fragmented over many years, so be sure to provide a complete timeline for all procurements. This section will discuss the issues involved in hardware and software acquisition after the systems arrive. Describe the ramp-up time required for staff to learn how to use the systems appropriately. An orderly ramp-up can be achieved through an active system administrator who maintains standard operating procedures for the system. In addition, describe who will be in charge of allocating GD&S resources to competing projects.

This section will also include tabular timelines detailing the time and cost of system acquisition, training, user group activities, database development and pilot projects. Milestones shall be established so that the timeline may be followed accurately and with performance evaluations. Provide sources of funding for all acquisitions. Create system configuration schematics. Describe the procedure by which ongoing evaluation of the implementation can be made with meetings at least annually.

(4) Time frame.

(a) Mission assignments.

This section of the IP can establish mission assignments with specific staffing requirements and goal-oriented projects.

(b) Milestones.

This section of the IP will establish short- and long- term milestones so that evaluations can be performed and progress can be reviewed regularly.

(c) Document lessons learned.

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This section of the IP may describe how a separate "Lessons Learned" document will be created and updated throughout the term of the Implementation Plan. This document will provide useful insight into the implementation of a GD&S and offer advice for future revisions of the IP.

h. Evaluation plan.

(1) Geospatial data and systems technical committee.

This section of the IP assigns the responsibility of performing IP evaluations to the Geospatial Data Technical Committee.

(2) Time table.

This section of the IP describes when, where and how often specific evaluations will occur. The time table for these evaluations will conform to Paragraph 7 of Engineer Regulation 1110-1-8156.

i. Conclusions and recommendations.

This section of the IP discusses the reasons why a GD&S is needed. It should state that the IP presents the justifications, the means and a plan of action for the implementation of a GD&S. It should also state that as technology and the GD&S industry continues to advance, the plan must be reviewed annually and updated as necessary. This section will provide a list of recommendations that summarizes the solutions to the requirements elicited during the requirements analysis.

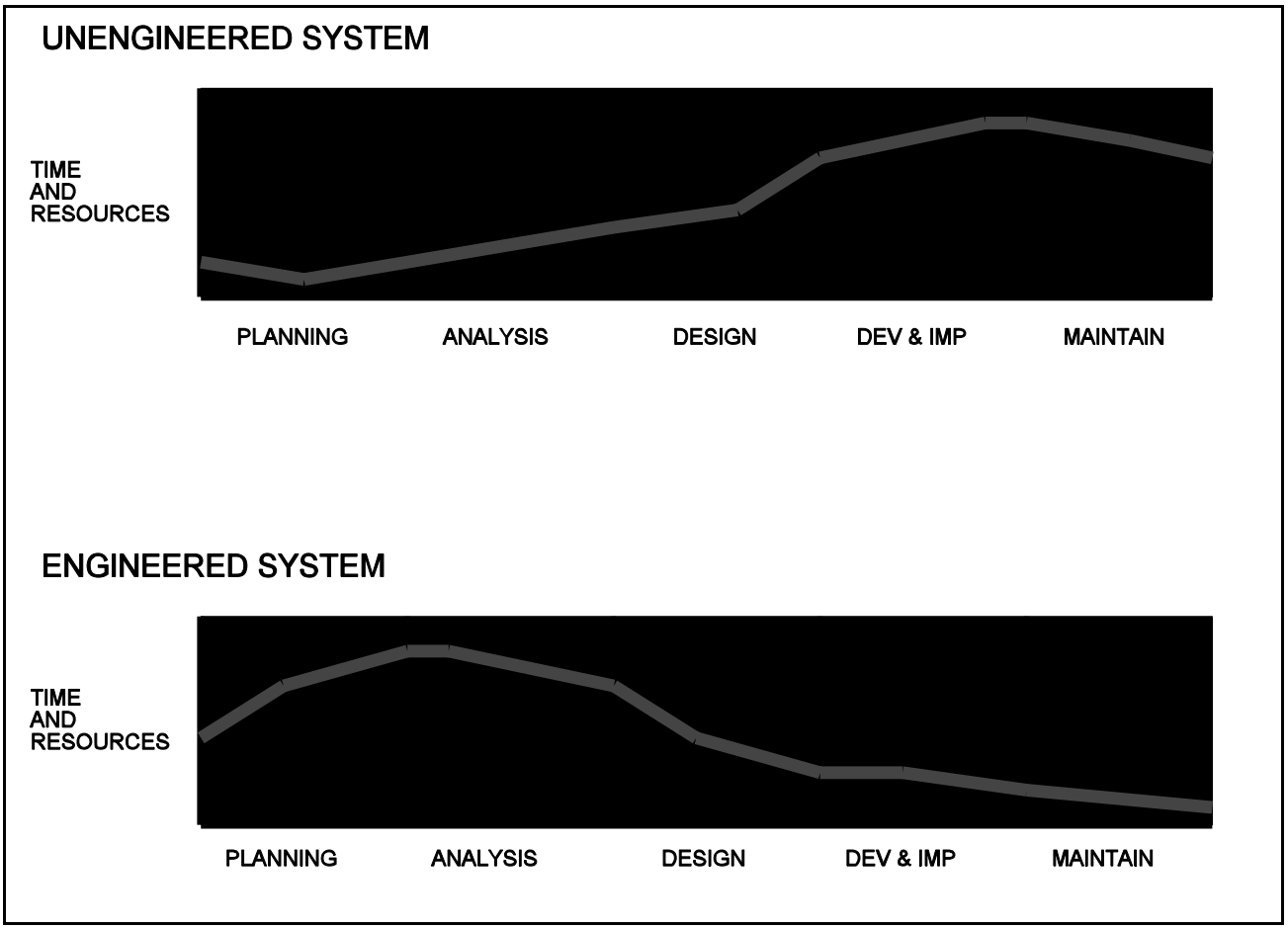

Figure 5-1. System development life cycle comparison