GIS Software 1989: A Survey and Commentary*

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INTRODUCTION

A GIS SOFTWARE SURVEY was conducted during April 1989 using a four-page questionnaire containing over 100 questions about Geographic Information Systems (GIS) firms and products. The survery contained questions on general system characteristics, computing environment, number of users, pricing, data structure, database management, and 68 questions on system functional characteristics. A total of over 100 information fields was completed for each system. Some of the most significant findings are summarized below.

Not all of the 62 systems reported on were true geographic information systems.The survey actually reported on GIS and closely related systems. Many are, however, very useful and sophisticated grapics systems. Although they may lack in-depth analytical functionality, or geographic referencing, or some other aspect of what is generally accepted as characteristic of a true GIS, many such packages are quite sophisticated, and will be useful for geograpically-referenced database management and map production.

It is inevitable that some of the information provided will be misleading in certain respects, simply because of a lack of common definitions of GIS terminology. Another complicating factor is the different backgrounds of the individuals responding. A geographer may see the technology, and therefore the meaning of various technical terms, quite differently than an engineer, for example.

Perhaps the most important trend reflected in the 1989 survey is the increased number and power of systems implemented on microcomputers and workstations. Over half the systems reported on (44) run on microcomputers of some type. Several systems are escaping the limitations of the old DOS operating system by running in the new IBM OS-2 operating environment, while several others have plans to move in that direction soon. The Macintosh is surging in popularity as well, primarily because of its ease of use. Apple clearly hit the target dead-on with its graphic user interface, and other manufacturers are responding with their own versions. User interface design is an aspect of GIS which may ultimately outweigh all the sophisticated computational algorithms in importance. Because GIS technology is destined to be on the desks of its users, instead of being sequestered away behind glass windows in the care of computer intermediaries, the interface must be more than friendly. It must be *loving*.

Approximately 15 systems were reported in the increasingly crowded workstation arena, mostly running under one of the UNIX-based operating systems. A total of 17 systems ran under some form of UNIX. As so-called microcomputers begin to look more and more like workstations, the differences between the two become increasingly artificial. Within a couple of years, there probably will be little meaningful distinction between them.

Because of the growing importance of standards and open system architecture, we asked several questions on these subjects. In addition to the elusive goal of transportable software, standards may also offer competitive advantages to companies marketing systems in the U.S. government sector. The federal government is trying to move toward a variety of systems, windowing, and networking standards. This trend will likely show up as increased support of standards by GIS vendors in coming years, although it is by no means clear now which standards will be in place a decade hence.

Just a few years ago, it was hard to find a vector-based GIS with a modern, topological data structure. Today, the numbers are substantial, with 33 systems reporting a topological vector structure. Also, the number of vendors reporting both raster and vector structures in the same system was up to 27 systems, compared with 12 in the 1988 survey.

One of the growing areas of importance in GIS implementation is database management. Vendors were asked whether their system managed data internally (i.e., without an interface to an external database management system [DBMS], or if external, what DBMS links were supported? Of the 62 systems, 47 interfaced to at least one external DBMS, mostly of the relational type.

The key characteristic that distinguishes a GIS from similar systems is its spatial data analytical power. Table 1 summarizes the percentages of systems that perform some of the more important analytical GIS functions. Each class of function listed may have one or more subfunctions within it. Each subfunction usually translates to a specific system command.

Table 2 presents a brief summary of basic information about each system represented in the survey. Before passing judgement on the merits of any system, it is extremely important to contact vendors directly, because no survey can be completely unbiased and fair in all respects. Due to the current lack of standards and variations in the technical approaches to spatial data handling, GIS technology is a long way from being subject to simple evaluation, as one might compare lawn mowers. Even very complex benchmark tests cannot reveal all the idiosyncrasies, and weak and strong points that might appear under real world use. In addition, any GIS survey can only take a snapshot in time of a very rapidly advancing technology. Truly current data can come only from the system developers.

TABLE 1. PERCENTAGE OF SYSTEMS CAPABLE OF SPECIFIC GIS ANALYTICAL FUNCTIONS.

Class of Function	No. of Subfunctions	Percent of Systems*
Distance Measurement	3	74-94%
Buffering	5	78-90%
Map algebra	5	36-78%
Boolean operations	2	80-82%
COGO computations	1	40%
Network tracing	1	44%
Remote sensing image analysis	1	26%
Terrain analysis	8	26-60%
Polygon operations	6	18-82%

* A range is shown in cases where the number of subfunctions within a function class exceeded one, because not all systems perform the same combination of subfunctions.

*The complete 1989 GIS Survey Report is available in the 1989 *GIS Sourcebook*, published by GIS World, Inc., P.O. Box 8090, Fort Collins, Colorado, USA 80526.

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TABLE 2. BASIC SYSTEM CHARACTERISTICS

System Name	Computing Environment	System Type	First Installed	Number of Users	Pricing	Data Structure(s)	DMBS Interfaces
AGIS	PCs/DOS	GIS	1986	12	$15,000+	Vector, raster	na
ARC/INFO	DEC, PRIME, DG, IBM, etc.	GIS	1981	nr	nr	Vector	Info, Oracle, Ingres
Aries	DEC VAX/VMS	IP	1978	2,004	$65,000	Raster	na
ATLAS* Graphics	PCs/DOS	DM	1984	1000's	$450-1,200	Vector	DIF, Dbase, Lotus, etc.
Axis Mapping Info.	PCs/DOS, Sun Apollo, VAX IBM/UNIX	GIS	1978	25+	£7500-15000	Vector, Raster	na
CRIES-GIS	PCs/DOS	GIS	1978	60	$1,500	Raster	Dbase III
Deltamap	HP9000, SUN, APOLLO, SGI/UNIX	GIS	1986	100+	$8000-80,000	Vector, raster, TIN	Oracle, Ingres, Informix
Earth One	PCs/DOS	GIS	1986	40	$12,000-28,000	Vector & raster	na
EPPL7	PCs, PS-2/DOS	GIS	1987	335	$500-1,000	Raster	Rbase, Dbase III
ERDAS	PCs/DOS; SUN/UNIX; VAX/VMS	GIS, IP	1979	900+	$2,000	Raster	Infor
Filevision IV	Macintosh	FM, DM	1984	40,000	$495	Raster	na
FMS/AC	PCs/DOS; SUN/UNIX; Macintosh	GIS, FM	1987	500	$2,500-7,500	Vector	Dbase, etc.
Gas, Electric, Water & Municipal FM	IBM 370/MVS, VM	GIS, AM, FM	1984-89	22	nr	Vector	IMS, DB-2
Geo Sight	PCs/DOS	GIS, AM	1987	65+	$4,450	Vector, quadtree	Dbase
Geo-Graphics	PCs/DOS	FM	1985	nr	$2,400	Vector	na
GeoSpread-Sheet	PCs/DOS	GIS	1989	18	$595-2,490	Vector	na
Geo/SQL, MumMap	PCs/DOS; Sun/UNIX	GIS	1987	240	$9,500+	Vector	Rbase, Oracle, Ingres
GeoVision	VAX/VMS, ULTRIX; SUN, IBM-RT/AIX	GIS, FM	1976	47	nr	Raster, vector quadtree	Oracle
Geovision "GeoPro"	PCs/DOS Macintosh	AM	1988	2	$1,995-4,995	Vector	SQL & DBF supported
Geovision WOW	PCs/DOS	GIS	1985	1,200+	$595	Vector	nr
GFIS	IBM S/370 architecture systems	GIS	1977	180+	var.	Vector	IMS/DLI, SQL/DB2
Gimms	Mainframes, Minis (inclu. UNIX); PCs/DOS, Macintosh	DM,GIS	1970	300	$1500-$3000	Vector, raster	Oracle, SAS, SPSS
GISIN	PCs, PS-2/DOS	FM	1986	5	nr	Vector	Condor
GDS	VAX/VMS, DEC station/Ultrix	GIS, AM	1980	800+	$10,000+	Object (vector)	Oracle, etc.
GRASS	Sun, MASSCOMP, etc./UNIX	GIS	1985	500-100	$1,000	Vector, raster	nr
IDRISI	PCs/DOS	GIS	1987	700	$50-300	Raster	Lotus, Quattro, etc.
IGDS/DMRS	DEC VAX/VMS	CAD-CAE FM-GIS	1973	1371	$7,500-110,000	Vector, raster	Informix
IMAGE	PCs/DOS	GIS, IP	1989	100+	$995+	Vector	Lotus, Dbase, etc.
Infocam	VAX/VMS	GIS	nr	23	$40,000-65,000	Raster, quadtree	Oracle
Informap	VAX/VMS	GIS	1975	nr	nr	Vector	SQL-based
Land Trak	PCs/DOS	GIS	1983	230	$3,000-$20,000	Vector	na
Laser-Scan	DEC VAX/VMS	GIS	1985	150	£10,000-100,000	Vector, raster	RDB
Mac GIS (Cornell U.)	Macintosh	GIS, AM, FM	1988	nr	150	Vector, raster	na
MacAtlas, PCAtlas	Macintosh, PCs/DOS	GIS	1985	5000+	$79-199	Vector, raster	na
MacGIS (U. Oregon)	Macintosh	GIS	1987	30	$100-300	Raster	Hypercard, etc.

TABLE 2. BASIC SYSTEM CHARACTERISTICS *(cont.)*

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Manatron GIS	Unisys/DOS, UNIX	GIS	1983	60+	nr	Vector, raster	Oracle, Fasport, Adept, Request, etc.
Map Grafix	Macintosh	GIS, AM	1987	nr	$8,500	Vector	4th Dimension, Oracle, Double Helix, Omnis, etc.
Map II	Macintosh	GIS	1989	nr	<$100	Raster	no
MapInfo	PCs/DOS	GIS	1986	nr	$750	Vector	Dbase
MatchMaker/GDT	PCs/DOS	DM	1987	10	$5,995-9,995	Vector	na
Micropips	PCs, PS-2/DOS	AM	1981	250	$745-1,490	Raster	
MicroStation GIS	Intergraph/UNIX	GIS	1989	11	$8,300	Vector, raster	Oracle, Ingres, Informix
MIPS	PCs/DOS	GIS	1987	nr	$2-5,000	Vector, raster	Dbase
MOSS	DG, Prime	GIS, IP	1977	>100	(public)	Vector, raster	DG/SQL, Oracle
Nucor GIS	PCs/DOS	GIS	1988	10	$500-4,500	Vector, raster	ZIM
Pamap GIS	Var./VMS, DOS, UNIX, ACS, CS/2	GIS	1983	200	$7,500-$60,000	Vector, raster	RDB, Oracle, Dbase
Panacea	PCs/DOS	GIS	1986	500	$500-2,000	Raster	na
PC ARC/INFO	PCs, PS-2/DOS	GIS	1987	nr	nr	Vector	Info
PMAP	PCs/DOS	GIS	1987	180	$895-1,600	Raster	Dbase
SICAD	Siemens/UNIX	GIS	1978	250	£20,000+	Raster, vector, quadtree	DB2, Informix, etc.
SPANS	PCs/DOS, OS2	GIS	1985	400	$8,000+	Raster, vector, quadtree	nr
StrataGIS	Tektronix/UNIX; IBM PCs/DOS	GIS	1988	20	$7-25,000	Vector	Unify
STRINGS	PCs/DOS	GIS/FM	1979	150	$3,500-5,000	Vector	Ingres, Sybase Britton Lee
System 600	VAX/VMS,Sun/UNIX	GIS	1984	200	$10,000-50,000	Vector, raster	Ingres
System 9	SUN/UNIX	GIS/IP	1987	25	$40,000	Vector	Empress
Territory Mgt. Sys.	PCs/DOS	GIS	1988	25	$2,950-3,950	Vector, quadtree	Dbase
Tigertools	PCs/DOS	GIS	1989	2	nr	Vector	nr
TIGRIS	Intergraph/UNIX workstations	GIS	1988	16	$10,000	Vector, raster	na
Topologic	PCs/DOS; OS-2; VAX/VMS	GIS	1987	18	$2-7,000	Raster, vector, quadtree	Dbase, RDB
UltiMap	Apollo, AEGIS Operating System	GIS, AM	1974	40	$19,000-50,000	Vector, raster	Oracle, Informix, Ingress, IMS, etc.
USEMAP	PCs/DOS	GIS, AM, FM, CADD	1973	3	$1,500-5,000	Vector, raster	Dbase III
VANGO	VAX/VMS	GIS	1981	96	$12,000-17,000	Vector	UserBase
Zone Ranger/GDT	PCs/DOS	AM	1987	3	$5,995-9,995	Vector	na