

ACKNOWLEDGEMENTS

The development of this Strategic Plan for the Arizona Geographic Information Council was largely a volunteer effort, involving many people who either served on the Strategic Planning Committee or its subcommittees or offered staff support. AGIC is grateful to the following individuals, who made this Plan possible with their generous contributions of time, energy, and creative ideas:

Dr. Frank Aldrich, Arizona State University; Marian Arnold, Arizona State Land Department; William C. Bayham, City of Phoenix; Howard Billings, Arizona Department of Water Resources; Alan DeLoera, Yavapai County; Thomas C. English, U.S. Bureau of Indian Affairs; Chris Flaccus, City of Flagstaff; Seth Franzman, Arizona Department of Revenue; Diana Barnes Freshwater, The Planning Center; Phil Friesen, Cochise County; Ben A. Froehlich, Arizona Department of Administration; E. Jim Gardner, Maricopa County; Frank Harrison, Maricopa County; Wayne K. Hood, III, Arizona Department of Environmental Quality; Dr. Charles F. Hutchinson, University of Arizona; Scott Hutchinson, Arizona Department of Transportation; Gary Irish, Arizona State Land Department; Merle Johnson, Pima County; Sally Lanier, Arizona Game and Fish Department; Lynn Larson, Arizona State Land Department; Dr. Alan Lew, Northern Arizona University; John Louis, Arizona Department of Transportation; Robert MacArthur, University of Arizona; Brian Miller, US West Communications; Mike Miller, City of Phoenix; Mark Mulligan, City of Phoenix; Peggy O'Sullivan-Kachel, Arizona Department of Administration; Bill O'Sullivan-Kachel, Arizona State Land Department; Curtis Overall, Arizona State Land Department; Jim Price, Arizona Department of Administration; John Regan, Pima County; Frank Secondo, Arizona Department of Water Resources; Jack Shomonta, Maricopa County; Mike Sicurello, Pima County; Howard Stapleton, Arizona Department of Water Resources; J.R. Swinnerton, U.S. Geological Survey; Bill Timmins, Global Systems Modeling; David Totman, Arizona Department of Environmental Quality; Eugene Trobia, Pima County; David Varela, Salt River Project; Steve Whitney, Pima County; and Craig Wissler, University of Arizona.

PREFACE

This strategic plan for geographic information systems (GIS) demonstrates a successful effort by governmental agencies at all levels and the private sector to work cooperatively with the objective of optimizing the use of limited resources. In these difficult fiscal times, the efforts of the Arizona Geographic Information Council should be commended as an excellent example of how government agencies can prioritize, organize, and work together to achieve results with the least impact to taxpayers. The Legislature has given the Land Department a statewide role in GIS, and, as State Land Commissioner, I support this strategic plan and urge others to support it as a means of coordinating efforts to implement GIS in the state of Arizona.

M. Jean Hassell
State Land Commissioner

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EXECUTIVE SUMMARY

The Strategic Plan for the Arizona Geographic Information Council (AGIC) is intended to serve as a guide to help AGIC develop and manage GIS and geographic information resources in Arizona. This Executive Summary provides some background on GIS and AGIC and presents an overview of the Strategic Plan's recommendations.

Definition of GIS

According to a federal committee studying GIS, as much as 90 percent of the work of government agencies relates back to its geography, i.e, where people, places, and things are located. During the last 20 years, a powerful new technology has emerged to create, manage, and analyze land-related data with the aid of computers. This technology, known as geographic information systems or GIS, combines traditional data base management with sophisticated spatial data processing. GIS technology offers the means to communicate and understand information in ways that were never before possible.

Emergence of GIS in Arizona

GIS is a powerful tool, and, since the 1970's, use of this technology in the public and private sectors has grown rapidly across the country and in Arizona. Currently, there are 58 known GIS installations in Arizona, and this trend of increasing utilization of GIS technology is projected to continue. By the end of the decade, virtually all of the federal, state, county, and large municipal governments in Arizona are expected to have a GIS. Usage in the private sector is also anticipated to expand significantly. Both public and private organizations are discovering the value of GIS to enhance decision-making and improve service delivery. GIS has the ability to support a wide range of applications, as the following examples illustrate:

- The **City of Phoenix** uses GIS to evaluate new applications for liquor licenses. Computerized vicinity maps are generated showing proposed site locations together with existing liquor establishments, schools, churches, and crime locations. Workloads associated with processing liquor license applications have been reduced by 50 percent.
- **Salt River Project** uses GIS and related technologies to more effectively plan and manage its extensive network of electrical and water facilities. GIS has enabled them to more accurately forecast demands for electrical load growth and to plan for locating future substations.
- **Pima County** makes extensive use of GIS to assist in such diverse activities as: (1) identifying potential landfill sites, (2) mapping riparian areas, (3) monitoring storm water runoff, (4) managing sewer facilities, (5) analyzing air quality, (6) evaluating alternative land use plans, and (7) defining airport airspace zoning.
- The **Bureau of Land Management** has found that GIS has improved resource management practices and allowed for more efficient allocation of limited staff. They have used GIS to identify unique animal habitats and assess possible land use conflicts, conduct inventories of scenic resources north of the Grand Canyon, and enhance fire suppression tactics.
- **Cochise County** has found GIS to be beneficial in redistricting in response to the 1990 Census. They were able to easily generate alternative plans for new election precincts. GIS has also aided the County in assigning street addresses as part of an extensive rural addressing program.
- The **Bureau of Indian Affairs** used GIS in its defense of a law suit seeking \$185 million in damages. By using GIS to justify its land management practices, they reduced their liability by at least \$180 million.
- The **City of Mesa** has used GIS as part of its pavement management program to more efficiently plan and budget for necessary street repairs. The police department uses GIS to study crime patterns in the city and to develop appropriate response strategies.
- The **Arizona Department of Environmental Quality** has employed GIS to develop complex models to identify vulnerable groundwater aquifers in the state. Prior to GIS, these kinds of sophisticated assessments were impossible,

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due to the number of calculations involving hydrologic and geologic parameters. GIS and related technologies have also increased the efficiency of the Department's environmental monitoring program, improved the positional accuracy of water and soil samples, and automated numerous tasks.

- The **Arizona Department of Water Resources** has used GIS for over seven years, primarily for administering groundwater irrigation rights, well locations, service area population estimates, and groundwater and surface water management planning. The GIS is also used to map all of the water sources, diversions, and claims for the statewide surface water rights adjudications process.

(Note: This is just a small sample of the GIS applications within these organizations and throughout Arizona.)

Need for Coordination

GIS differs from traditional data processing because of the common need across organizations for the same land-based data. For example, several public and private organizations could all use parcel, road, land use, drainage, and population data to support their operations. However, creating digital GIS data is expensive. Without coordination, there is a potential for tremendous duplication of effort at taxpayers' expense. By its very nature, GIS is an integrating technology, and organizations need to share data if they are to be cost effective. The fact that, out of over 600 spatial data sets that have been identified in Arizona, 55 percent were acquired from other organizations vividly illustrates the importance of data sharing in GIS. However, impediments to data exchange persist, such as lack of awareness about data availability, incompatible software and hardware systems, and absence of uniform standards and guidelines. Thus, in order to be efficient and maximize limited resources, coordination of GIS data development efforts is essential.

Purpose of AGIC

It was for the purpose of coordinating the cooperative development and management of GIS and geographic information resources that the Arizona Geographic Information Council (AGIC) was created by Governor's Executive Order, in 1988. AGIC's 29-member Executive Management Board is composed of representatives from federal, state, and local governments as well as regional GIS consortia, the universities, and the private sector. While AGIC has begun efforts to develop cooperative multi-participant projects, it recognized that, in order to meet the needs of the state as a whole, a comprehensive strategic plan of action would need to be developed.

Strategic Planning Process

In the fall of 1991, AGIC began to develop its first Strategic Plan to identify key directions for future action to help guide the development of GIS in Arizona. Over forty individuals, representing federal, state, municipal, county, regional, and indian agencies as well as the universities, utilities, and the private sector throughout the state, served on committees to contribute ideas to the plan. In addition, the plan incorporates the results of a survey of existing digital spatial data and future needs. A total of 120 organizations responded to the survey. Thus, the AGIC Strategic Plan truly represents a comprehensive perspective of GIS-related issues in Arizona.

A Strategic Planning Committee was formed to coordinate the overall planning effort. This committee identified five critical strategic issues, which would become the focal points for the plan. These include Administrative and Legal, Data Resources, Technology, Information Exchange, and Education issues. Five subcommittees were organized to study and recommend a course of action for each of the issue areas. These subcommittees began by conducting a situation assessment to clarify current problems and opportunities associated with each issue. Next, they identified objectives and strategies

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that AGIC could pursue over the next three to five years to respond to current problems and take advantage of opportunities. The subcommittees also went one step further; they developed a detailed first-year plan of action for each issue, targeting high-priority activities and specifying time frames, responsibilities, and resource requirements. As a result of the process, participants have reached consensus on a focused plan of action regarding what needs to be done in 1993 to address Arizona's most important GIS-related concerns.

Five Strategic Issues

Following is a synopsis of the general goals and the most important strategic actions proposed for each of the five issues, beginning with the two most critical: Administration and Legal issues and Data Resources issues.

1. Administrative and Legal Recommendations

AGIC is a relatively recent organization attempting to guide the development of a new technology. Because many existing laws and institutional arrangements were established prior to the advent of computerized information, these mechanisms do not always facilitate the sharing of data and other resources. The primary focus of the Administrative and Legal Subcommittee was to examine AGIC's existing organizational structure and duties, review existing statutes, and address administrative policies and procedures that would promote data sharing.

Although the subcommittee recommended many actions to improve existing laws and procedures, none is deemed more important than to obtain funding for the State Cartographer's Office. This office was established under the Arizona State Land Department by statute in 1988, but the funding to implement this office has never been appropriated. The State Cartographer would serve the state GIS community by providing essential administrative support for AGIC, developing GIS policies and standards, maintaining a clearinghouse of information about data resources, and coordinating the development of common projects. AGIC proposes submitting a bill to the legislature to request initial funding for the State Cartographer as well as to establish AGIC as an organization in statute.

The plan also clarifies the relationship of AGIC as a policy and oversight board with respect to the State Cartographer and the Arizona Land Resource Information System (ALRIS), in the Land Department, and establishes operating procedures for AGIC as an organization. In addition, the plan calls for actions designed to facilitate data sharing, including resolution of problems associated with data ownership, quality, and security. Due to the challenges of budget shortages facing all levels of government, AGIC will also be exploring alternative sources of funding for the development and maintenance of GIS data as well as examining legal issues related to cost recovery and data resale.

2. Data Resources Recommendations

The Data Resources Subcommittee was responsible for identifying the requirements and priorities for geographic data in Arizona. To gain a better understanding of statewide needs for specific kinds of data and clarify requirements for data accuracy, they conducted a detailed survey of all levels of government and many private sector organizations. The subcommittee analyzed the survey results in order to help address its primary goal: to plan for and initiate the development and maintenance of statewide geographic data resources that have multiple-purpose value and can be used by all levels of government, utilities, and the private sector. Based upon the survey results, the following high-priority data themes for Arizona have been established:

- geodetic survey control grid

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- land ownership/land parcels
- transportation network
- water resources
- administrative boundaries

Formal interagency task forces will be established to prepare and implement plans for the cooperative development and maintenance of these important data bases. Other major goals of the Data Resources Subcommittee are to publish the detailed results of the survey, to recommend GIS data standards to enable cooperative project development, and to facilitate data exchange between disparate software and hardware environments.

3. Technology Recommendations

The overall goal of the Technology Subcommittee is to develop efficient and effective methods for the physical exchange of GIS data via hardware, software, and telecommunications, since many agencies have a need for the same data. As GIS applications become more sophisticated and as maintenance of data becomes more transactional in nature, agencies will need to develop the physical infrastructure necessary to support high-speed data transfers and data sharing, such as with fiber optic lines.

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The subcommittee decided that an important way to facilitate GIS data exchange in Arizona would be to improve information about technological solutions. They propose clarifying technical options available for data transfer, assessing the present and potential demand for data within the GIS community, and monitoring important technological advancements. In addition, this subcommittee will recommend standards and guidelines for GIS technology to make data exchange easier. Much of this information is to be summarized in a GIS Technology Guide, which will be distributed throughout the state. Another important objective is to improve communication between GIS users and organizations responsible for planning telecommunications infrastructure.

4. Education Recommendations

Because GIS is a new technology, agencies have difficulty finding and hiring qualified personnel, and the situation is expected to worsen as more organizations install geographic information systems. While the universities and ALRIS offer educational and training programs, there is a need to develop a more coordinated and comprehensive approach to human resources for GIS in the state as a whole. Some of the specific strategies recommended include adoption of a GIS job series for state government, identification of unmet needs for additional GIS training, exploration of approaches to fill those gaps, and development of an electronic clearinghouse for information about GIS job opportunities in the public and private sectors. In addition, this subcommittee identified a number of strategies, designed to forge a stronger partnership between the academic and GIS communities in Arizona.

5. Information Exchange Recommendations

Because GIS is a new technology and sites tend to be dispersed across the state, there is a particular need to improve the exchange of information about GIS in general and about AGIC and Arizona activities in particular. This subcommittee determined that information about existing GIS data bases and applications, employment and training opportunities, and industry trends were especially important. Subcommittee members identified specific strategies to either establish new mechanisms or improve existing methods of exchanging information about GIS. The recommendations include organizing a statewide GIS conference, producing an annual calendar to showcase GIS development projects and applications in the state, creating an editorial board to improve AGIC's newsletter, expanding notification of meetings and workshops, and developing an annual report of AGIC activities.

Conclusion

As a result of the strategic planning effort, which involved participants from the public and private sectors, AGIC has achieved consensus on a comprehensive course of action to address Arizona's most important GIS-related concerns. ***Of all the ideas generated in the planning process, there was widespread agreement on the two highest priorities: securing the necessary funds to implement the State Cartographer's Office and beginning to develop GIS data bases of statewide importance.***

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The intent of the Strategic Plan is to guide AGIC and its volunteer committees in its efforts to coordinate and manage the development of GIS and geographic information resources in Arizona. The plan serves to answer some important questions for AGIC and the Arizona GIS community: Where have we been? Where are we now? Where do we want to go? How are we going to get there? The Strategic Plan is not intended to set a rigid course of action but to provide a flexible road map for the future. In this way, the plan will help AGIC fulfill its mission and vision for GIS in Arizona while remaining responsive to the challenges of this rapidly growing and evolving technology.

I. INTRODUCTION

INTRODUCTION

A primary function of many public agencies is to collect, process, and analyze data relating to geography, i.e., where people, places, and things are located. It has been estimated that as much as 90 percent of the work of city and county governments relates back to its local geography.

During the last 20 years, a powerful new technology has emerged to create, manage, and analyze computerized spatial data. This technology, known as Geographic Information Systems (GIS), combines traditional data base management with sophisticated spatial data processing. GIS technology offers the means to communicate and evaluate information in ways that were never before possible. Use of GIS in the public and private sector across the country and in Arizona has grown dramatically since the 1970's, as organizations discovered its value in enhancing decision-making and improving service delivery. Currently, there are 58 known GIS installations in Arizona (source: AGIC Survey, 1992).

GIS can be used to support a tremendous range of different applications. By way of illustration, GIS is currently being used in Arizona for such projects as these:

- The **City of Phoenix** uses GIS to evaluate new applications for liquor licenses. Computerized vicinity maps are generated showing proposed site locations together with existing liquor establishments, schools, churches, and crime locations. Workloads associated with processing liquor license applications have been reduced by 50 percent.
- **Salt River Project** uses GIS and related technologies to more effectively plan and manage its extensive network of electrical and water facilities. GIS has enabled them to more accurately forecast demands for electrical load growth and to plan for locating future substations.
- **Pima County** makes extensive use of GIS to assist in such diverse activities as: (1) identifying potential landfill sites, (2) mapping riparian areas, (3) monitoring storm water runoff, (4) managing sewer facilities, (5) analyzing air quality, (6) evaluating alternative land use plans, and (7) defining airport airspace zoning.
- The **Bureau of Land Management** has found that GIS has improved resource management practices and allowed for more efficient allocation of limited staff. They have used GIS to identify unique animal habitats and assess possible land use conflicts, conduct inventories of scenic resources north of the Grand Canyon, and enhance fire suppression tactics.
- **Cochise County** has found GIS to be beneficial in redistricting in response to the 1990 Census. They were able to easily generate alternative plans for new election precincts. GIS has also aided the County in assigning street addresses as part of an extensive rural addressing program.
- The **Bureau of Indian Affairs** used GIS in its defense of a lawsuit seeking \$185 million in damages. By using GIS to justify its land management practices, they reduced their liability by at least \$180 million.
- The **City of Mesa** has used GIS as part of its pavement management program to more efficiently plan and budget for necessary street repairs. The police department uses GIS to study crime patterns in the city and to develop appropriate response strategies.
- The **Arizona Department of Environmental Quality** has employed GIS to develop complex models to identify vulnerable groundwater aquifers in the state. Prior to GIS, these kinds of sophisticated assessments were impossible, due to the number of calculations involving hydrologic and geologic parameters. GIS and related technologies have also increased the efficiency of the Department's environmental monitoring program, improved the positional accuracy of water and soil samples, and automated numerous tasks.

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- The **Arizona Department of Water Resources** has used GIS for over seven years, primarily for administering groundwater irrigation rights, well locations, service area population estimates, and groundwater and surface water management planning. The GIS is also used to map all of the water sources, diversions, and claims for the statewide surface water rights adjudications process.

(Note: This list represents only a small sample of the GIS applications in use by these agencies and across Arizona.)

Over the years, government agencies have designed and built information data banks and computerized information systems to manage their land records. For the most part, agencies independently created these data bases to fulfill their particular missions, and there was little coordination with other organizations. However, with the advent of GIS, organizations are finding a common need for the same land-based information. For example, several agencies may have use for road, parcel, land use, drainage, and population data to support their operations. In fact, of over 600 documented spatial data sets held by agencies in Arizona, 55 percent were acquired from other organizations. By its very nature, GIS is an integrating technology, and organizations will need to share data if they are to be cost effective. Thus, GIS offers new opportunities for public and private organizations to work together to share and cooperatively develop geographic information resources.

Unfortunately, traditional data development practices that have been applied to GIS have created problems. Development of data can, and often is, duplicated at taxpayers' expense because agencies are unaware of data development efforts elsewhere. Often they use incompatible data classification schemes, data standards, quality control measures, and updating procedures that, in effect, render their data unusable by another agency. Institutional or economic barriers also inhibit data sharing. Because creation of digital spatial data is extremely expensive, if uncoordinated geographic data resource development is allowed to continue, millions of dollars of public and private funds could be at stake.

The lack of coordination can also inhibit the ability of public agencies to analyze data and respond to public problems in a timely manner. While increasingly sophisticated telecommunications systems and computer hardware and software provide the technical capability to rapidly process and analyze a diversity of data, institutional problems can often impede the full utilization of these advances. For example, if data users are not able to agree on such matters as data transfer standards, it may be technically possible to get data from one part of the state to another in fractions of a second, but it may take days for the receiving agency to convert the data to a usable format.

Efforts to accomplish more cooperation are complicated by the reality that nearly everyone could be considered a potential stakeholder when it comes to geographic information. Federal, state, regional, county, and municipal governments as well as the universities, utilities, private firms, non-profit organizations, and the general public all have an interest in gaining access to accurate spatial data about Arizona.

In order to coordinate the cooperative development and management of GIS and geographic information resources for Arizona, the Arizona Geographic Information Council (AGIC) was created by Governor's Executive Order, in 1988. AGIC's 29-member Executive Management Board is composed of representatives from federal, state, and local government agencies as well as regional GIS consortia, universities and the private sector. The current Executive Management Board members are listed in Exhibit 1.

EXHIBIT 1 AGIC Executive Management Board

AGENCY	REPRESENTATIVE	POSITION IN AGENCY
<u>State Government</u>		
Department of Administration	Ben A. Froehlich	Assistant Director
Department of Commerce	A. Mobin Qaheri	Senior Economic Specialist, Research Division
Department of Economic Security	Dan R. Anderson	Research Administrator
Department of Education	Edward F. Sloat	State Director/Administrator, Research and Development Unit
Department of Environmental Quality	Wayne K. Hood, III	Supervisory Hydrologist, Groundwater Hydrology Section
Department of Health Services	Robert L. Cooper	Manager, Office of Management Information Systems
Department of Revenue	Seth L. Franzman	Manager, Property Valuation and Equalization Division
Department of Transportation	Harry A. Reed	Director, Transportation Planning Division
Department of Water Resources	Frank J. Secondo	Assistant Director, Administration
Game and Fish Department	Robert K. Weaver	Supervisor, Habitat Branch
Geological Survey	Larry D. Fellows	Director and State Geologist
State Land Department	Lynn M. Larson	Director, Administration and Resource Analysis Division
State Parks	Gerald W. Dillehay	Chief, Statewide Recreation Planning
Arizona State University	Frank T. Aldrich	Associate Professor, Geography Department
Northern Arizona University	Alan A. Lew	Associate Professor, Department of Geography and Public Planning
University of Arizona	Charles F. Hutchinson	Dir, AZ Remote Sensing Ctr, College of Ag, Office of Arid Lands
Studies		
<u>Federal Government</u>		
Bureau of Indian Affairs	Thomas C. English	Geographic Information Systems Coordinator
Bureau of Land Management	Steven A. Wing	RS/GIS, Natural Resource Specialist
Bureau of Reclamation	Garry Buck	Regional Officer, Lower Colorado Region
Forest Service	Laura L. Bostwick	Assistant Director, Information Systems and Telecommunications
Geological Survey	J.R. (Dick) Swinerton	Chief, Western Mapping Center
Soil Conservation Service	Davie L. Richmond	State Soil Scientist
<u>County Government</u>		
Arizona Association of Counties	Edward Abrigo, Jr.	Drafting Supervisor, Assessor's Office, Pima County
<u>Municipal Government</u>		
League of Arizona Cities and Towns	William C. Bayham	GIS Project Manager, MIS Department, City of Phoenix
<u>Private Sector</u>		
The Planning Center	Diana Barnes Freshwater	Manager, GIS Division
<u>Regional GIS Consortia</u>		
Central Arizona Geographic Information System Consortium	Jon Chase	Administrator, Development Services
Northern Arizona Geographic Information Forum	Alan DeLoera	Coordinator, Geographic Information Services
Southern Arizona Geographic Information System	Gene Trobia	Director, Engineering and Geographic Info Services Dept, Pima
County		
Yuma Regional Geographic Information System	Robert A. Vaughan	Executive Director, Yuma Metropolitan Planning Organization

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AGIC began meeting in 1989 and initially established committees to develop particular statewide data bases. However, AGIC recognized that, in order to truly be effective in carrying out its mission, it needed to develop a comprehensive strategic plan for Arizona.

In the fall of 1991, AGIC held a special two-day workshop on strategic planning and thereafter appointed a Strategic Planning Committee to guide the process. This committee defined five key issues of strategic importance, and subcommittees were formed to study and recommend a specific plan of action for each issue. These five strategic issue areas and the broad general goals established for each are as follows:

DATA RESOURCES: To efficiently develop and effectively manage the geographic information resources of Arizona.

TECHNOLOGY: To develop efficient and effective methods for the physical exchange of geographic information via hardware, software, and communications.

ADMINISTRATIVE AND LEGAL: To establish state-level laws and administrative policies that create an effective structure for developing and managing geographic information resources.

INFORMATION EXCHANGE: To foster the sharing of information and ideas and to disseminate information about GIS-related activities throughout the state.

EDUCATION: To ensure that qualified personnel are available to meet the GIS needs of the public and private sectors and to strengthen GIS-related education programs in Arizona.

Because AGIC is an appointed board with no staff or resources, development of this Strategic Plan has been largely a volunteer effort. Over 40 individuals, representing public and private organizations from across the state, with support from a part-time graduate student, participated in the planning process during 1992. To gain more information about the status of GIS in the state, AGIC conducted an inventory of over 170 organizations to survey existing data and to assess future needs. In this way, AGIC sought to ensure that the plan truly represents a comprehensive perspective of GIS and GIS-related issues in Arizona. A list of the members of the Strategic Planning Committee and the five subcommittees is provided in the Appendices.

Each subcommittee completed a detailed situation assessment for their issue to clarify current problems and opportunities related to GIS in Arizona. The subcommittees then identified objectives and strategies that AGIC could pursue over the next three to five years to effectively address current problems and to take advantage of opportunities. The subcommittees also went one step further; they developed a first-year plan of action for each issue, targeting high-priority activities and specifying time frames, responsibilities, and resource requirements. In this way, AGIC and its committees have a clear focus on what needs to be done to address Arizona's most important GIS-related concerns.

On September 3, 1992, AGIC held a special all-day workshop to review the draft plan. Approximately 80 people from organizations across the state attended this session to hear the recommendations of the five subcommittees and to offer comments on the draft document. The AGIC Executive Management Board unanimously adopted the Strategic Plan on October 1, 1992.

This Strategic Plan document is organized as follows: Chapter II provides a historical perspective on GIS in Arizona and includes an overview of the results of AGIC's 1992 survey. As part of the planning process, AGIC needed to clarify its mission and organizational structure and create a vision

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for the future. This material is covered in Chapter III. The rest of the report reflects the work of the five subcommittees. Chapter IV introduces each of the five strategic issues and identifies problems and opportunities. Chapter V builds upon the previous section and identifies possible objectives and strategies that AGIC could pursue over the next 3 to 5 years. Finally, Chapter VI includes the first year action plans for each of the five strategic issues.

The intent of this Strategic Plan is to guide AGIC and its committees in its efforts to coordinate and manage the development of GIS and geographic information resources in Arizona. It provides the basis for development of more detailed annual operating plans and budgets to ensure implementation of these strategies. The Strategic Plan is not intended to set a rigid course of action but to provide a flexible road map for the future. In order to remain responsive to the rapidly growing and evolving nature of GIS technology, AGIC must review and reevaluate this Strategic Plan on an annual basis to keep pace with changing conditions. For this reason, it is recommended that the Strategic Plan be completely updated every three to five years.

**II. BACKGROUND:
THE DEVELOPMENT OF
GIS IN ARIZONA**

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

HISTORICAL CONTEXT

The development of modern geographic information systems in public agencies in Arizona began in the 1970's. At that time, the federal government's Landsat satellite program was spurring interest in GIS and remote sensing throughout the country. The U.S. Geological Survey (USGS) began to work with state governments across the country through technology transfer programs to adapt GIS software for state agency applications. Interest in the new technology began to grow across the country and within Arizona.

The Arizona Department of Transportation initiated development of geoprocessing capabilities as early as 1972 and is credited with creating Arizona's first statewide digital spatial data base for road centerlines and accident records. During the late 1970's, the Arizona State Land Department began spatial data processing with some early GIS software.

1979 also marks the beginning of the first coordination efforts. In that year, the multi-agency Arizona Mapping and Advisory Committee (AZMAC) was formed to assist the USGS in setting mapping priorities for Arizona and to address state mapping issues and needs. Although AZMAC's main objective was to establish traditional paper map priorities, a digital mapping subcommittee was formed in 1981. Formation of this subcommittee marked the beginning of organized interagency concern for digital geographic data.

The subcommittee's first activity was to assemble a listing of digital geographic data available in the state, for which they developed the state's first questionnaire to identify existing data and future needs. In 1981, AZMAC also created a subcommittee to describe the duties of a potential state cartographer. On November 1982, Governor Babbitt officially established AZMAC as a state committee by Executive Order 82-10.

In 1980, the State Legislature commissioned a study to determine whether Arizona state government needed an automated "information system" for processing natural resources and other land-related information. This study eventually led the way to funding and establishing the Arizona Land Resource Information System (ALRIS) within the State Land Department as the state's first complete GIS system. At the start, the high cost of computer hardware (typically mainframe or mini computers) and software associated with GIS, coupled with the limited experience and knowledge of public agency personnel, necessitated such a centralized system. The most significant project in these early days of ALRIS was a cooperative project with the State Land Department's Forestry Division and the U.S. Forest Service.

Since establishment of the ALRIS system, GIS use has grown tremendously in Arizona's public sector. By 1985, in response to the requirements of the State Groundwater Management Act, the Department of Water Resources had implemented an independent GIS for processing and analysis of data pertaining to water resources and water rights. Other Arizona organizations that initiated geoprocessing by 1985 (according to the results of AGIC's survey) include Dames and Moore (1976), the U.S. Bureau of Land Management (1983), the Cities of Mesa (1983) and Kingman (1984), the U.S. Bureau of Indian Affairs (1985), the Salt River Project (1985), and the Navajo Nation (early 1980's).

Between 1986 and 1987, eight additional sites were added: the USGS, the Arizona Game and Fish Department, Northern Arizona University, Maricopa Association of Governments, the City of Tempe, Southwest Gas, Cochise County, and Design Workshop. Thereafter, approximately ten new sites were added each year, particularly in local government, as more agencies discovered GIS to be an affordable solution. The price and performance of both software and hardware improved dramatically during this period, and personal computer-based systems became more popular. The late 1980's and early 1990's also saw the advent of GIS operations designed to meet the needs of several departments within the organization. Some of the larger multi-participant GIS projects included Pima County, the

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

City of Phoenix, and the City of Mesa. By the end of the 1980's, the number of organizations in Arizona involved with GIS (or some geoprocessing functions) had grown to 38 and continues to increase.

Although tremendous progress was made in utilizing GIS technology by the late 1980's, two significant problems began to emerge. The first problem was the lack of sufficient statewide spatial data bases. In response to this need, AZMAC initiated a multi-agency project to develop a statewide hydrography data base, which was perceived to be of critical importance. This project, initiated in 1987, represented a first coordinated attempt to cooperatively develop a GIS data base on a statewide basis. AZMAC's experience with this project forced the committee to recognize another major problem: the lack of attention to, and coordination of, GIS activities at higher levels of management. Traditionally, GIS activities had been conducted and managed by technical personnel. Due to the high cost, overlapping requirements, and the need for integration, the support of top management was deemed to be essential if cooperative data development was to succeed.

AZMAC began two initiatives designed to increase coordination of the development of statewide geographic information bases and to ensure management support. These initiatives were (1) development of the State Cartographer's Office and (2) reformation of AZMAC into a geographic information council, composed of administrators.

The notion of a State Cartographer's Office had been under consideration by AZMAC since the early 1980's, and, although the committee was not able to find the necessary financial support for this coordinator position, interest in the concept had endured. In 1988, AZMAC presented the proposal to the Arizona Legislature, introduced as Senate Bill 1186, and the legislation creating the Office of the State Cartographer under the duties of the Resource Analysis Division of the State Land Department was passed. Unfortunately, funding for the office was not allocated by the legislature in conjunction with the bill. Nevertheless, the bill marked the first legislation in Arizona dealing specifically with issues concerning GIS standards and coordination.

In response to the need for upper-level management support, AZMAC began to consider modifying its institutional structure. They decided that the best approach was to ask the Governor to rescind the 1982 executive order and issue a new one that would create an executive management board. As a result of their efforts, Governor Mofford signed Executive Order 89-24 in October of 1989 which disbanded AZMAC and established the multi-agency Arizona Geographic Information Council (AGIC) in its place. The Council's primary purpose is to coordinate the management of statewide geographic information and "to provide guidance and direction in the management of a State Geographic Information System."

AGIC held its first meeting on October 1990 and began to organize subcommittees to coordinate the development of specific GIS data bases. However, it soon became clear to the AGIC Executive Management Board that it needed to develop a comprehensive strategic plan to focus its efforts. A strategic plan would enable the Council, composed of federal, state, university, local government, and private sector representatives, to develop consensus on a plan of action to address the GIS needs of Arizona.

CURRENT STATUS OF GIS IN ARIZONA

AGIC recognized that, in order to develop a meaningful Strategic Plan for Arizona, it was important to gain a current understanding of the status of GIS across the state, particularly with the rapid growth of this technology. Thus, in early 1992, AGIC developed the Survey of Existing Digital Spatial Data and Future Needs. This extensive survey sought to discover three things: (1) which organizations in Arizona currently have or plan to develop a GIS, (2) what digital spatial data already exist in the state,

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

and (3) what types of geographic data organizations will need in the future. This information was deemed vital to the strategic planning effort to enable AGIC to truly respond to the GIS needs of the state as a whole.

The AGIC survey was widely distributed throughout the state, to all levels of government and to the private sector, in the spring of 1992. The 171 organizations who received the survey included major federal and state agencies as well as all regional, county, and city governments. The universities, several utilities, and other private sector organizations, primarily consulting firms, were also invited to participate in the survey. The number of public sector agencies responding to the survey was exceptionally high--120 out of 141 (85 percent of the government agencies). Exhibit 2 provides a summary of the response rate for the different categories of respondents.

EXHIBIT 2

Organizations Responding to AGIC's
Survey of Existing Digital Spatial Data and Future Needs
(Spring 1992)

Organization Type	Number Sent	Number Returned	% Response
Federal	13	11	85
State	16	13	81
Universities	3	2	67
County	16	13	81
Regional Councils of Governments	6	5	83
Cities and Towns	<u>87</u>	<u>76</u>	<u>87</u>
TOTAL Public Agencies	141	120	85
Utilities	5	3	60
Private Firms	<u>25</u>	<u>10</u>	<u>40</u>
GRAND TOTAL	171	133	78

There are some limitations with the AGIC survey that need to be acknowledged. First, this survey was not sent to all organizations in Arizona. For example, some of the smaller state and federal agencies were not included. However, the survey was given to every city and county government in the state; so the results for local governments should be most representative. Particularly limited are the conclusions for the utilities and the private sector, due to the smaller sample and lower response rate. Only those private organizations that were known to have an interest in GIS, generally consulting firms, were included. Another aspect of the survey is that participation was self-selecting. Articles in the AGIC and Arizona AM/FM newsletters as well as announcements at other meetings were used as techniques to invite participation. Any organization requesting a copy of the survey received one.

A further limitation is that one copy of the survey was sent to each organization with the request that responses be coordinated for the entire agency. For example, the survey was sent to the city manager, who theoretically was to route it to someone who could represent the GIS needs of the entire city. As a practical matter, the person responding to the survey may not have circulated it to every department for input but may have attempted to answer the questions based on his or her perception of the organization's needs.

Respondents were instructed to identify their anticipated future data needs even if they did not presently

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

have a GIS. In practice, it is difficult to have a realistic needs assessment until one begins seriously planning for a GIS; so some of the needs reported may be incomplete or subject to considerable future revisions. In addition, there is the potential problem that people misunderstood some of the technical terms and responded incorrectly. Another issue is that the survey requested information on personnel and budgeting, which is particularly difficult to assess. In many organizations, GIS is implemented on a multi-departmental basis, and staff and other resources may be contributed by departments that are not reflected in a consolidated GIS budget. Finally, some agencies were reluctant to reveal financial information and declined to respond to these questions.

In summary, the AGIC survey has limitations. Consequently, the results must be interpreted with some caution. In hindsight, there are many areas that could have been improved to enhance the validity of the results. Nevertheless, the information is the most comprehensive ever assembled about GIS in Arizona and provides valuable insight into the levels of activity and future GIS needs in the state.

Survey Results

The first part of the survey sought information about the organization and its plans for GIS. Of the 133 organizations who responded to the survey, 44 percent or 58 already have a GIS. In addition, 28 organizations plan to develop a GIS within the next five years while 47 stated that they had no plans to start up a system within the foreseeable future. A total of at least 86 different organizations in Arizona are expected to have GIS by 1997.

Nearly all (94 percent) of the federal, state, and county governments and the larger cities indicated that they either currently have, or plan to develop, a GIS in five years. Of those who indicated that they had no plans to develop a system (35 percent of all respondents), a full 91 percent were the state's smallest cities and towns. One could, however, speculate that, as the price of GIS software and hardware continues to decline, even these smaller jurisdictions will find GIS to be an affordable management tool in the years to come.

For those 58 agencies that currently have a GIS, a somewhat surprising 47 percent indicated that they were employing a coordinated agency-wide approach to GIS implementation to serve several departments or divisions within their organization. Meanwhile, 31 percent had a system for one department or division, and 22 percent had two or more individual systems that functioned independently (i.e., there was no agency-wide coordination).

From a historical perspective, three trends emerge from the data. Prior to 1980, there were only three sites in Arizona. From 1980 to 1985, GIS development began to steadily increase with about two new sites added each year. By 1986, GIS began to take off dramatically with about 10 new sites coming on line annually. At least six new sites are expected to be established each year from 1992 to 1997, according to the survey responses.

Existing sites reported usage of a surprising variety of GIS software and computer-aided mapping and drafting (CADD) software packages. Altogether, a total of 41 different GIS or CADD packages were reported to be in use in Arizona for the development and maintenance of digital spatial data or for performing spatial display and analysis functions. The most frequently reported commercially available GIS software is the Environmental Systems Research Institute's ARC/INFO. The most common CADD software in use is Autodesk's AutoCAD. Many agencies reportedly use both packages. DOS and UNIX were the most commonly identified operating systems.

It is estimated that at least \$17.1 million was spent on GIS in Arizona during 1991. In looking at expenditure breakdowns, personnel emerges as the most significant cost, amounting to 55 percent of all

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

reported expenses, at \$9.4 million. Other expenses include \$3.7 million for hardware (22 percent); \$1.6 million (9 percent) for service contracts related to consulting, software development, or data conversion; \$1.5 million for software (7 percent); \$600,000 (3 percent) for data purchases such as satellite imagery; and \$400,000 (2 percent) for other expenses.

Human resources are, thus, clearly the most significant part of a GIS, and, as might be expected, most of the people working in GIS in Arizona at the present time are involved in creating data. The survey results indicate that 46 percent of the hours employees work each week are associated with data input and editing (e.g., digitizing). Approximately 23 percent of employees are involved in software development, 12 percent in management, 9 percent in hardware support, and 12 percent in other activities.

The existing GIS installations in Arizona differ considerably in size of personnel and generally fall within two categories with respect to size. Nine of the responding agencies had at least 10 full-time equivalent (FTE) employees, while the average was a remarkable 23 FTE's. Most of the other organizations in Arizona, however, have small operations with an average of only two full-time staff.

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

Totalling all the reported results for both personnel and budget expenditures dramatically illustrates the importance of GIS in Arizona. Three hundred thirteen (313) full-time equivalent personnel are reported to be currently employed in GIS-related activities in organizations across the state. Given that several known sites failed to respond, the actual number is undoubtedly higher. From the survey data, it is estimated that \$53 million has been spent on GIS to date, but many respondents who omitted budget information did provide personnel information, making it possible to extrapolate that the total amount spent to date is actually over \$100 million.

Nearly 650 individual digital spatial data sets reportedly exist in Arizona, and, surprisingly, over 55 percent of them were derived from other organizations. This latter figure illustrates how GIS information differs from traditional data bases, which are typically generated in-house, and vividly depicts the importance of data exchange and sharing of geographic information.

The survey also revealed that most agencies have a need for a wide range of GIS data but at different scales. Federal and state agencies tend to be able to utilize data derived from a scale of 1:24,000 or 1:100,000. As expected, cities indicated that they required greater accuracy and larger-scale data, ranging from 1:100 to 1:4,800. Counties and utilities have needs that straddle both the federal/state and city perspectives on scale and accuracy.

Geodetic control was identified as the most important data needed to support GIS in Arizona, undoubtedly because this provides the underlying framework upon which all other data sets are built. Other general categories of data needs, in descending order of priority, are land ownership/parcels, transportation, water, administrative boundaries, biological distribution, environmental quality, land use, and socio-cultural data.

AGIC will be publishing a more detailed listing of all the survey results and the inventory of existing digital spatial data in the fall of 1992.

Summary

In summary, the results of the AGIC survey helped to greatly increase understanding about the extent of GIS development in Arizona and needs for the future. The results reveal that GIS is more widespread than had previously been known. Nearly all federal, state, regional, county, and larger municipalities in Arizona will have a GIS by 1997. The universities, utilities, and an ever-growing private sector will also be important players. To be successful, these organizations will need adequate funding, competent personnel, and a variety of digital spatial data. The survey results have provided valuable input for the AGIC Strategic Plan and serve as the basis for many of the recommended actions in this document.

BACKGROUND: THE DEVELOPMENT OF GIS IN ARIZONA

LEGAL AUTHORITY FOR AGIC, ALRIS, AND THE STATE CARTOGRAPHER

AGIC was established through Executive Order 89-24 by Governor Mofford in October 1989 to coordinate the management of statewide geographic information and to guide development of a state geographic information system. Originally, membership on the 25-member AGIC Executive Management Board included 13 representatives from state agencies, 6 from federal agencies, 3 from the state universities, 1 from the League of Arizona Cities and Towns, 1 from the Arizona Association of Counties, and 1 from the private sector. Members are appointed by the Governor.

During the course of this planning effort, the AGIC Board recognized the emergence of several regional GIS consortia in Arizona. These groups provide an important forum to promote cooperation between public and private organizations on a regional basis. Thus, in the summer of 1992, the AGIC Board requested that Governor Symington revise the original executive order to include the four existing regional GIS consortia as members of AGIC. On July 14, 1992, Governor Symington signed Executive Order 92-17 to accomplish this change. A copy of this executive order, which supersedes the original Executive Order 89-24, is included in the Appendices.

In contrast to the AGIC Executive Management Board, both the Arizona Land Resource Information System (ALRIS), and the State Cartographer are established by state statute. The purpose of these programs is to provide coordination and technical support for GIS in Arizona. ALRIS is not mentioned specifically in the law, but its duties are prescribed under the statutes authorizing the Resource Analysis Division of the Arizona State Land Department, where ALRIS is housed. These statutes, A.R.S. 37-172 and 173 were amended in 1988 to add the office of the State Cartographer to the Resource Analysis Division. As noted previously, funds to implement this office have never been appropriated.

As part of the AGIC Strategic Plan effort, the roles and responsibilities of AGIC, ALRIS, and the State Cartographer were evaluated and clarified to define an efficient division of labor among the three. A more detailed discussion of the existing and proposed roles and responsibilities for AGIC, ALRIS, and the State Cartographer is examined in the Administrative and Legal Situation Assessment and Objectives and Strategies Sections.

**III. ROLE OF THE ARIZONA
GEOGRAPHIC INFORMATION
COUNCIL**

ROLE OF THE ARIZONA GEOGRAPHIC INFORMATION COUNCIL

As part of the strategic planning process, AGIC clarified its organizational mission statement and defined an idealized vision of the future for AGIC and GIS in Arizona.

This chapter contains the revised mission statement and two exhibits to illustrate the membership composition and organization of AGIC and AGIC's vision for the future.

AGIC'S MISSION STATEMENT

The mission of AGIC is to coordinate the development and management of geographic information systems (GIS) and geographic data in Arizona. We seek to ensure that Arizona's public decision-makers and other users have access to geographic information that is complete, timely, accurate, and reliable. We promote the use of GIS and related technologies to more effectively and efficiently address problems, develop plans, and manage the natural, cultural, economic, and infrastructural resources of the state.

We will strive to accomplish this mission by:

- fostering a spirit of cooperation among local, state, and federal agencies and the private sector in addressing geographic information needs and services in the state.
- assigning priorities for statewide geographic information needs and developing implementation plans.
- facilitating cost-sharing and collaborative arrangements to develop and maintain high-priority GIS data bases and applications programs.
- developing policies and procedures to facilitate the distribution and exchange of geographic information within the state.
- providing policy and program recommendations to the Arizona Land Resource Information System and the Arizona State Cartographer pertaining to GIS in the state.
- providing recommendations and proposing strategies to local governments, regional GIS consortia, and state and federal agencies regarding priorities, standards, and guidelines to meet Arizona's geographic information needs.
- providing recommendations to the governor and the legislature, when appropriate, concerning issues related to geographic information in Arizona.
- promoting education, training, and technical support regarding the application of geographic information systems and related technologies.

EXHIBIT 3

EXHIBIT 4

ROLE OF THE ARIZONA GEOGRAPHIC INFORMATION COUNCIL

A VISION OF THE FUTURE FOR AGIC AND ARIZONA

The Arizona Geographic Information Council will serve as the **CHAMPION** for the development and management of geographic information resources in Arizona.

As a result of AGIC's efforts:

- Geographic information systems will assist government in **CONTROLLING COSTS** of services.
- Accurate information about Arizona will be **MORE ACCESSIBLE** to government, business, and citizens.
- The **QUALITY** of **SERVICES** provided to the public by government will be enhanced.
- Information resources and systems will be well **INTEGRATED** to provide **SUPPORT** for **EFFECTIVE DECISION-MAKING** throughout the public sector.
- **SHARING** of **INFORMATION** and resources among various levels of government will be increased.
- The public and private sector will find new and **CREATIVE WAYS** of **COOPERATING TOGETHER** to develop geographic information resources.

IV. STRATEGIC ISSUES AND SITUATION ASSESSMENTS

STRATEGIC ISSUES AND SITUATION ASSESSMENTS

AGIC identified five key issues of strategic importance for GIS in Arizona and formed a subcommittee to study each one. These five strategic issues and the broad, general goals established for each are as follows:

DATA RESOURCES: To efficiently develop and effectively manage the geographic information resources of Arizona.

TECHNOLOGY: To develop efficient and effective methods for the physical exchange of geographic information via hardware, software, and communications.

ADMINISTRATIVE AND LEGAL: To establish state-level laws and administrative policies that create an effective structure for developing and managing geographic information resources.

INFORMATION EXCHANGE: To foster the sharing of information and ideas and to disseminate information about GIS-related activities throughout the state.

EDUCATION: To ensure that qualified personnel are available to meet the GIS needs of the public and private sectors and to strengthen GIS-related education programs in Arizona.

Each subcommittee conducted a situation assessment to provide background on the issues and to identify and better define the problems and opportunities associated with each issue. The results of these situation assessments are contained in this chapter.

DATA RESOURCES SITUATION ASSESSMENT

GENERAL GOAL:

To efficiently develop and effectively manage the geographic information resources of Arizona.

CURRENT SITUATION ASSESSMENT:

Following is a summary of current issues related to data resources that need to be considered if the general goal stated above is to be realized. Some of the statements are included as background information while others identify particular problems and opportunities associated with this issue. This situation assessment becomes the basis for developing the more specific objectives and strategies for data resources contained in Chapter V.

PLANNING

Background:

- ALRIS has been involved in coordinating the development of several statewide GIS data bases for land ownership, municipal boundaries, public land survey, socio-economic data, and hydrography. These have evolved as cooperative ventures, primarily between federal and state agencies.

Problems and Opportunities:

- Comprehensive planning for GIS data resources on a statewide basis does not exist. Future needs for digital spatial data have not been identified. Priorities have not been defined, and no arrangements for cooperative design, development, and maintenance of critical data layers have been established that would minimize costs and avoid duplication.
- Most GIS data sets are originally created for a particular application and, as a result, are project-driven. Other agencies may later acquire the data and use them for purposes for which they were never intended and, thus, unknowingly introduce significant errors into their spatial data analyses.
- Developing plans for cooperative data base development will be complicated because, theoretically, all levels of government and the private sector have a stake in the outcome.

STANDARDS

Background:

- Digital spatial data are being created at all levels of government as well as in the private sector. Organizations tend to develop their data in response to their own needs and resources. They utilize a variety of software and conversion procedures to create their data.

DATA RESOURCES SITUATION ASSESSMENT

Problems and Opportunities:

- There are no standards or consistent procedures related to GIS data in Arizona. More particularly, there is no uniformity in:
 1. GIS software
 2. Data exchange formats
 3. Data base architecture
 4. Spatial feature and attribute classification schemes
 5. Data conversion methods and procedures
 6. Data integrity/quality control
 7. Spatial accuracy
 8. Documentation
 9. Map design and symbolization (e.g., line symbols, annotation, etc.)
- The State Cartographer is authorized in state statutes to establish GIS standards, but this office has never been funded.
- The absence of standards or guidelines for GIS data resources renders much existing data unusable by other organizations. The lack of uniformity often makes it impractical to share data, to integrate data from other sources, or to develop data in cooperation with other organizations.
- Neither a uniform map base nor adequate statewide geodetic control have been established for Arizona.
- Federal, state, regional, county, and municipal governments all create GIS data. However, these different governments have widely divergent needs and applications as well as scale and accuracy requirements. They also have vastly different resources. As a consequence, establishing GIS standards that will be practical and appropriate for all levels of government will be a difficult task.

FUNDING

Background:

- The costs associated with data conversion and maintenance in terms of time, effort, and money can be considerable.

Problems and Opportunities:

- Adequate sources of funding to create and maintain digital spatial data do not exist.
- Government budgets are developed on an annual basis, making it difficult to ensure multi-year funding commitments for GIS data resources.

DATA RESOURCES SITUATION ASSESSMENT

- Conversion of paper tax assessor maps to digital parcel data is essential to the success of GIS in local government. However, these data are particularly expensive to develop and manage due to the large numbers of parcels and the frequency of ownership transactions.

INFORMATION

Background:

- Hundreds of GIS data sets have been created in Arizona by government agencies and the private sector and would be potentially useful to other organizations.

Problems and Opportunities:

- Agencies are unaware of digital spatial data that already exist. As a result, there is tremendous duplication and redundancy in data conversion and maintenance throughout the state.
- Existing inventories of digital spatial data have not been updated frequently enough to be useful and are not readily accessible.

TECHNOLOGY SITUATION ASSESSMENT

GENERAL GOAL:

To develop efficient and effective methods for the physical exchange of geographic information via hardware, software, and communications.

CURRENT SITUATION ASSESSMENT:

Following is a summary of the important issues associated with the technological aspects of geographic information resources that need to be considered in addressing the general goal stated above. Some of the statements represent background information while others identify particular problems and opportunities. This situation assessment becomes the basis for developing the more specific objectives and strategies for technology contained in Chapter V.

DATA EXCHANGE

Background:

- Studies indicate that the long-term costs of GIS technology are 60 to 80 percent data related. Due to the expense associated with digital data conversion, there is a tremendous potential for cost savings if agencies can cooperate in data development and maintenance.
- Most agencies need a wide variety of common geographic data themes (e.g., land ownership, transportation network, elevation, administrative boundaries, census tracts, etc.). The common need for geographic data cuts across all levels of government, whether federal, state, or local. Thus, there is a high potential for sharing and cooperative development of digital spatial data. Considerable potential for cooperative development with the private sector also exists. (Refer to the Data Resources Situation Assessment for a more thorough discussion of data sharing.)

Problems and Opportunities:

- Although technological solutions are rapidly becoming available, effective and efficient data exchange methods, which would facilitate cooperative data development, have not been established. Thus, it appears that impediments to sharing data and establishing standards may be more legal, political, and economic than technical.
- A wide range of data exchange options are available, ranging from the physical exchange of tapes to a variety of high-speed electronic data transfer services. Many users are unfamiliar with the various alternatives and need assistance in determining the most appropriate approach.
- The lack of established standards and guidelines for GIS software, hardware, and network communications hinders cooperative data exchange.
- Information about GIS software, hardware, and data exchange formats currently in use by public sector agencies in Arizona has not been well documented.
- To gain the full potential of GIS, spatial data processing systems need to be connected, not only to

TECHNOLOGY SITUATION ASSESSMENT

each other, but to systems that house tabular, non-spatial data bases. Simple and commonly available data access and retrieval methods do not exist in the state.

TELECOMMUNICATIONS

Background:

- The telecommunications industry is growing rapidly, and these emerging networks offer the potential for high-speed access to digital data bases.

Problems and Opportunities:

- In general, the Arizona GIS community is not familiar with the telecommunications industry. They are unaware of, not only the types of transmission systems available, but the physical location of existing infrastructure and which organizations are developing plans for Arizona's public and private telecommunication system network. A tremendous potential exists to forge a cooperative relationship with these organizations to ensure that future plans reflect the special needs of GIS users.
- The potential for GIS as a large client application for wide-area networks (WAN's) has not been well documented. WAN's have potential, not only for GIS data exchange but for cooperative data and application sharing.
- The GIS user requirements for telecommunication interconnections vary by application but are not generally known. Specifications related to demand, transfer rates, volumes, frequencies, and performance expectations for various GIS applications have not been identified. Other requirements, such as the need for connections with non-GIS systems, have not been assessed yet either.
- Telecommunications technology is improving at an extremely rapid rate. For this reason, any plans, standards, or guidelines that are developed to facilitate data exchange must be reevaluated on a regular basis in order to take advantage of technological advances.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

GENERAL GOAL:

To establish state-level laws and administrative policies that create an effective structure for developing and managing geographic information resources.

CURRENT SITUATION ASSESSMENT:

Following is a summary of the important administrative and legal issues that need to be considered if the general goal stated above is to be realized. Some of the statements are included as background information while others identify particular problems and opportunities associated with this issue. This Situation Assessment becomes the basis for developing the more specific objectives and strategies for the administrative and legal issues contained in Chapter V.

AGIC ORGANIZATION

Background:

- AGIC was created by Governor's Executive Order in 1989.
- Membership consists of 13 representatives from state agencies, 6 from federal agencies, 3 from the state Universities, 1 from the League of Arizona Cities and Towns, 1 from the Arizona Association of Counties, and 1 from the private sector. Members are appointed by the Governor.

Problems and Opportunities:

- The creation of AGIC by Executive Order is effective for coordinating GIS development in state agencies, but, without statutory authority, AGIC's relationship with other levels of government is unclear.
- Several regional GIS Consortia are emerging across Arizona to promote cooperation between the public and private sector on a regional basis. Including representatives from these groups on the AGIC Executive Management Board would bring a valuable perspective and minimize duplication of GIS effort.

AGIC DUTIES AND RESPONSIBILITIES

Background:

Executive Order 89-24 authorizes AGIC to:

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- Collect user requirements for maps, imagery products, and geographic information systems.
- Set priorities for requirements to providers of geographic information.
- Define categories of spatial data appropriate for standardization and establish standards for content, format, and accuracy.
- Coordinate interagency map production or acquisition and geographic data base development.
- Study cartographic and geographic information systems issues and make recommendations to responsible entities.

Problems and Opportunities:

- AGIC is a relatively new organization involved with guiding the development of a rapidly changing technology. In order to be most responsive to the needs of the state GIS community, AGIC should examine and redefine its role and relationships with other jurisdictions. AGIC's new mission statement (Chapter III) proposes that AGIC assume a more proactive role in promoting GIS in Arizona.
- Although ALRIS has provided limited staff support to the Council, AGIC has no assigned personnel to assist the organization in completing its mission. Relationships between AGIC and ALRIS and the State Cartographer are unclear.
- AGIC receives some funding from member agencies but has never clarified its resource requirements or identified revenue sources.

STATE CARTOGRAPHER/ALRIS ORGANIZATION

Background:

- The State Cartographer and the Resource Analysis Division of the State Land Department are authorized by A.R.S. 37-172 and 173.
- ALRIS is not specifically referenced in statute, but it exists as part of the Resource Analysis Division.
- The ALRIS GIS program has been in operation since 1982 and is supported with general fund appropriations.

Problems and Opportunities:

- The roles and responsibilities of the State Cartographer, compared to ALRIS, need to be clarified. The relationship of the State Cartographer and ALRIS to AGIC is not clearly defined.
- Funding has never been appropriated for the State Cartographer. Consequently, many of the important coordination and administrative functions specified in statute have never been undertaken.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

STATE CARTOGRAPHER/ALRIS DUTIES AND RESPONSIBILITIES

Background:

The duties of the Resource Analysis Division that include the State Cartographer and the ALRIS Program are defined in A.R.S. 37-173 as follows:

- Establish a clearinghouse of information and central repository for map and imagery products and digital cartographic data.
- Provide a geographic information system for the State Land Department and other public agencies in this state.
- Provide current land resources information and monitor changes over time by remote sensing techniques.
- Prepare standards and specifications for developing and producing cartographic and aerial photographic products and geographic information systems.
- Produce maps and inventories at standard scales for various areas, to include combinations of data elements.
- Provide maps, aerial photographic, and other remote sensing data to help analyze natural resources.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- Function as the Arizona affiliate office for the National Cartographic Information Center with support from the U.S. Geological Survey and the Department of Library, Archives, and Public Records.
- Establish a liaison relationship with the Arizona Geological Survey and the U.S. Geological Survey as well as with regional federal mapping and other state and local government organizations in order to coordinate activities in this state relating to collecting, compiling, producing, and processing cartographic materials, satellite imagery, and land resource information.
- Identify local digital cartographic data to include in the national digital cartographic data base.
- Coordinate development of a public land survey system monument data base.

Problems and Opportunities:

- Although the services offered by ALRIS have been well utilized by state agencies and some federal agencies, many city and county governments are not generally aware of this resource.
- Staffing resources at ALRIS are limited and may not be available to meet increased demand for services.
- Some of the specific duties prescribed in the enabling statute for ALRIS were specified prior to the significant growth of GIS and are no longer relevant.

DATA DEVELOPMENT AND SHARING

Background:

- Entities that can benefit from a data sharing policy include state and federal agencies, cities, counties, utilities, and the private sector.
- Several state agencies have responsibilities that will have an important influence on GIS development in the state. Key agencies include the Departments of Land, Water Resources, Transportation, Environmental Quality, and Game and Fish.
- The Federal Geographic Data Committee was established in 1990 to provide leadership in coordinated spatial data development and resource sharing between the public and private sectors on a national level.

Problems and Opportunities:

- There is no established planning process for defining statewide data needs and developing geographic data resources on a cooperative basis.
- The roles and relationships of the state agencies in shaping a comprehensive GIS strategy for Arizona need to be clarified to establish leadership in developing key data bases of statewide importance and to minimize duplication of effort.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- There are a few examples of multi-participant data development projects in Arizona. Of note is the hydrography data base under development by ALRIS, which involved cooperation with several federal and state agencies. These types of successful projects can serve as a model for other collaborative ventures.
- The state has neither a central index or inventory of existing GIS data bases in the state nor provisions for maintaining and updating such an inventory, once created. Without a current index of existing digital spatial data, agencies are unaware of available GIS resources. Consequently, considerable duplication and redundancy in GIS data base development exist.
- Procedures for development and maintenance of GIS data have not been established in Arizona. The absence of procedures limits opportunities for sharing data in the state.
- An objective of the Federal Geographic Data Committee is to form a partnership among federal, state, and local governments and the private sector to develop a national spatial data infrastructure. This presents an opportunity for Arizona to work more closely with federal agencies in multi-participant data development projects.
- The federal government has recently established the Spatial Data Transfer Standard. This standard specifies an exchange format to facilitate data transfer between dissimilar spatial data base systems. Arizona should explore the potential use of this and other mechanisms to promote data sharing.
- If high-quality, multi-purpose data bases can be created that are reasonably accessible, organizations would not be stimulated to duplicate efforts.

DATA MAINTENANCE

Background:

- Some data bases, such as soils data, do not require frequent updates. In contrast, many data bases are transactional in nature and require constant updating to remain current. Property ownership is an example. Ongoing data base maintenance programs can be expensive.
- Many GIS data sets are created for a one-time project with a particular focus.

Problems and Opportunities:

- The short-term focus of many projects results in the creation of data bases that are never maintained and updated. This minimizes their usefulness for other applications and organizations. Certain data bases should be viewed as long-term, multi-project resources that constitute important public investments. Currently, there is no planning on a statewide level to identify these critical data bases.
- In many situations, it is difficult to ascertain the age of a particular data set because there is often no documentation and no way to "date stamp" the data. Similarly, if a data base has had the benefit of frequent updates, it may be impossible to establish whether a particular copy is the most current version.
- Lack of adequate money, time, and personnel are also cited as reasons that data base maintenance is not done more frequently. More coordinated planning and resource sharing is needed to ensure that essential data maintenance occurs. This would help to protect the substantial initial investment involved in creating the data.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- Many agencies do not keep records of who has acquired their data in the past and which version of the data they presently have. In most cases, agencies have no formal procedures or resources for notifying interested persons of data updates.

DATA OWNERSHIP

Background:

- GIS data is typically acquired from a variety of different sources and then recombined in new ways to address particular concerns. For example, someone may obtain soils data from the U.S. Soil Conservation Service, hydrology from the Arizona Department of Water Resources, and land ownership from ALRIS. Using GIS software, they can combine this different data for a particular project, such as to identify the types of soils within 300 feet of streams on public lands.
- ALRIS and many other public agencies share their GIS data bases with other public sector organizations, upon request, for reimbursement of the reproduction costs. Other agencies have financial and legal restrictions on the use of their data.

Problems and Opportunities:

- If an agency creates a digital spatial data set from its own source material, that originating agency can be thought to be the "custodian" of the data. However, if another organization subsequently acquires that same data but enhances it by adding new information, questions about ownership can arise. Arrangements and agreements need to be developed and specified in advance of data sharing to avoid potential legal problems.
- The sharing of information resources is much more difficult to manage than sharing of material goods. It is practically impossible to control what people do with a digital data base once they obtain it. Agencies can acquire data from secondary and tertiary sources without the knowledge or permission of the original creator. Data can also be utilized for purposes for which they were never intended, and they frequently are.
- It is difficult to copyright GIS data bases because of their transactional nature; i.e., they need to be updated regularly and, thus, can change considerably over time.
- Information about the creator and original source material is often not documented and does not reside in the data base. Thus, the origin and ownership tend to become obscure over time, especially as data are recombined.
- Many organizations have different policies regarding the use of their data. There is a need for a uniform approach among public agencies. Standardized written agreements that clarify ownership and any terms or conditions associated with access and data reuse or resale for public agencies have not been established.
- Some organizations that have legal and/or financial restrictions on accessing their data are reluctant to give the data to some public agencies, such as ALRIS. They fear that, under public records law, the recipient agency may allow unlimited third-party access to the proprietary data, and the originating

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

agency could lose ownership control. The lack of standardized legal agreements stipulating ownership rights effectively limits data sharing in these cases.

QUALITY ASSURANCE

Background:

- Most GIS data bases are typically created by public agencies to address a particular project.

Problems and Opportunities:

- The narrow project-driven approach that characterizes GIS data base development mitigates against data sharing. In designing a project, little consideration is given to the needs for quality and accuracy beyond the immediate project, resulting in the creation of data bases that are often unusable by others.
- Accuracy becomes a particular problem for GIS because data is derived from multiple sources and is then recombined in new ways. It is technically difficult and time-consuming to determine the relative and absolute accuracy of a particular data set.
- The absence of standards for GIS also results in variable quality and accuracy in GIS data bases. There are no standardized procedures for quality assurance and quality control. Similarly, there is no uniformity in data conversion approaches or data documentation.
- Because of limited funds and personnel, many agencies do not develop documentation or attempt to assess the accuracy and quality of their data. The quality of most data bases is completely unknown, and a potential user must employ considerable discretion in deciding whether data can reliably be used for a particular application.
- People who become involved in GIS typically come from a variety of backgrounds and may lack knowledge of disciplines such as traditional MIS, surveying, photogrammetry, and cartography. Increased exposure to the techniques employed by these disciplines would improve project design quality and aid the process of accuracy assessment.

LIABILITY CONCERNS

Background:

- Because GIS technology is relatively new, there have been few court cases litigated regarding liability for accuracy; so the law remains largely untested. In general, courts tend to hold government agencies more liable if they charge fees for services. The prevailing view seems to be: the higher the fee charged, the greater the potential liability. This suggests that, when data is given away, there may be a stronger presumption of sovereign governmental immunity or, at least, that user clients are less likely to litigate over data problems.

Problems and Opportunities:

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- Because GIS software allows the user to "stretch" or compress the digital data to fit any map scale, projection, or coordinate system, accuracy becomes muddled and obscure when data layers that were created at differing scales are combined.
- If data is found to be inaccurate, it is unclear whether the agency who created that data is liable, especially when it is used for applications for which it was never intended.
- Many agencies do not have written agreements that inform a person who is acquiring data about its limitations at the time of the transaction. For example, if the data is not to be used for engineering purposes, this should be explicitly stated to protect the agency. Standardizing the language of disclaimer statements for public agencies would help to aid understanding and minimize the potential misuse of data.
- Additional legal research on the liability issues associated with GIS data is necessary and will need to be coordinated with attorneys at all levels of government. At present, public sector attorneys in Arizona may not recognize the importance of this issue.

DATA SECURITY

Background:

- There is steadily increasing pressure from government agencies, private sector organizations, and the general public to access public data bases, including those containing geographic information.
- Arizona statutes provide that the public be allowed to access agency records.

Problems and Opportunities:

- Allowing increased access to spatial data bases introduces inherent risks. There is a potential that data can become "polluted" or inadvertently damaged. Exposure to computer viruses is also a threat. Additional security measures may be required to preserve data integrity.
- Some government agencies are required to maintain records that must remain confidential to protect the privacy of individuals. Increasing access to government data bases presents special challenges for preserving the confidentiality of certain records.

PUBLIC ACCESS VERSUS COST RECOVERY

Background:

- The Federal Freedom of Information Act and Arizona Open Records statutes ensure that the public has the right to have access to information about the government and its activities. Information should

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

not necessarily be exempt from the public record provisions of the law just because it becomes electronic data.

- While it is clear that the public has the right to access data, there is no uniform approach that agencies use in response to requests. Some agencies allow people to sort through boxes of records while others provide computer terminals for ease of querying and display of the data.
- A.R.S. 39-121 authorizes a reasonable fee to be charged for the copying of public records. An increased fee is allowed if the public records are to be used for commercial purposes.
- Developing GIS data is very expensive, and public sector budgets are limited. Many agencies, although prohibited from making a profit, are seeking to recover the significant costs of data development.
- The federal government has drafted a policy for data sharing that encourages agencies to recover only the costs of reproduction and distribution.

Problems and Opportunities:

- Current Arizona statutes related to open records were established prior to the advent of large and complicated electronic data bases, such as those created for GIS. Consequently, current statutes are ambiguous and, in some cases, contradictory regarding the ability of public agencies to sell digital data.
- Requests for electronic data are expected to increase dramatically as GIS data bases grow, although the magnitude of future demand is unknown. Agencies could, potentially, become inundated with requests for data, deterring them from fulfilling their primary missions. Some states have developed a central clearinghouse to more efficiently respond to requests for their spatial data.
- No standard approach or methodology has been established to provide a uniform basis for pricing GIS data resources developed with public funds. In Arizona, many agencies have different pricing policies. Defining the market value of GIS data used for commercial purposes, as allowed under statute, is particularly problematic. Without a defensible basis for pricing GIS data resources, agencies could be vulnerable to legal challenges.
- Agencies are obliged to allow public access to certain government records and usually provide them in the format in which they are maintained. However, if someone wanted the data to be organized in a more meaningful way, an agency may choose to charge a fee to recover the cost of this special customer service. Other examples of value-added products and services could include exporting files into a particular software format, providing special user-friendly support documents, creating customized maps and printouts, or providing subscription update services or direct dial-up access. The legal aspects of cost recovery programs for such value-added products and services need to be more fully explored.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- Legal agreements and/or contractual arrangements are needed to equitably share the costs of data development between organizations. For example, if three agencies share the costs of data creation and other non-contributing organizations subsequently desire to use this data, they could be expected to pay the original partners some reasonable fee for cost recovery. However, there currently is no mechanism to establish a fair and acceptable basis for such a cost recovery arrangement. Without it, there may be reduced incentive for an agency or a private organization to commit its limited resources to joint GIS projects.
- Extensive legal research and, ultimately, revision of existing statutes will be needed to adequately resolve questions of public access and cost recovery involved with GIS data.
- The increased use of CD-ROM technology provides new opportunities for sharing large spatial data bases, perhaps through the public library system.
- Expensive prices for data resources tend to discourage usage and promote duplication, as organizations attempt to recreate the data more cheaply. Many organizations formerly made extensive use of Landsat satellite imagery, but usage has declined dramatically since the price of these products increased, a few years ago.
- There is increasing potential that important spatial data for government may be created and marketed for retail sale by the private sector.

FUNDING

Background:

- Development and maintenance of GIS data bases require significant financial investments over the long term.

Problems and Opportunities:

- Adequate and stable sources of funds for GIS development do not presently exist.
- Cooperative projects have a tremendous potential to reduce overall data base development costs. Different agencies have different resource levels and operational advantages. For example, one agency may have fewer restrictions on the use of funds while another may have access to federal grants, and still another may have staff with particular expertise. If they all need the same digital data, it may be cost effective to cooperate in data development to maximize their collective resources. However, public agencies do not currently have standardized agreements to readily undertake these kinds of joint projects.
- The recently passed legislation removing the limitations on the State Land Department's Revolving Fund provides a new vehicle for cooperatively funded GIS projects.
- Opportunities exist for cooperative cost-sharing arrangements with federal agencies, such as the U.S. Geological Survey, if the data is developed in accordance with federal standards. Other federal grant programs may be available for Arizona.

ADMINISTRATIVE AND LEGAL ISSUES SITUATION ASSESSMENT

- More innovative funding approaches have been utilized in other states, but the feasibility of these methods has not been explored for Arizona.

INFORMATION EXCHANGE SITUATION ASSESSMENT

GENERAL GOAL:

To foster the sharing of information and ideas and to disseminate information about GIS-related activities throughout the state.

CURRENT SITUATION ASSESSMENT:

Following is a summary of current issues related to information exchange that need to be considered if the general goal stated above is to be realized. Some of the statements are included as background information while others identify particular problems and opportunities associated with this issue. This situation assessment becomes the basis for developing the more specific objectives and strategies for information exchange contained in Chapter V.

GIS INFORMATION

Background:

- GIS is a growth industry, and the technology is rapidly changing. Significant numbers of government agencies at all levels and the private sector organizations have established, or are planning, GIS operations.
- ALRIS provides limited technical assistance about geographic information systems to public sector agencies in Arizona.

Problems and Opportunities:

- Due to the rapid growth and changing nature of GIS, there is a particular need for current and timely information about GIS and related activities. Information should be provided in the following areas:
 1. Existing data bases that might be shared
 2. Current GIS applications being developed in the state
 3. GIS employment opportunities
 4. Technical GIS training
 5. Important trends in the GIS industry
 6. Directory of available expertise
- There is a general lack of knowledge about GIS among top managers in the public and private sectors. These managers need information about GIS concepts as well as system design and implementation guidelines. Some managers require assistance in evaluating candidates for GIS positions.
- ALRIS performs a valuable service in providing information about GIS to public sector agencies, but they do not have sufficient staff to respond to current and projected demands.
- The State Cartographer's Office was established in statute to provide a clearinghouse for GIS

INFORMATION EXCHANGE SITUATION ASSESSMENT

information in Arizona, but this important function has never been funded.

AGIC ACTIVITIES

Background:

- The AGIC Executive Management Board meetings and newsletter currently provide a forum for sharing information about GIS issues and activities in the state.

Problems and Opportunities:

- The goals and accomplishments of AGIC are not well known or generally understood in the GIS community.
- The existing newsletter of AGIC is excellent, but its distribution has not been widespread, consistent, or frequent enough to be as effective as it could be.
- Communication channels between AGIC, regional GIS consortia, local governments, and other professional associations in the state are not well developed.
- GIS development requires planning and coordination and needs an agency to serve as a "GIS Champion" to assure the successful development of GIS in Arizona. AGIC is well-suited to assume this role.

EDUCATION SITUATION ASSESSMENT

GENERAL GOAL:

To ensure that qualified personnel are available to meet the GIS needs of the public and private sector and to strengthen GIS-related education programs in Arizona.

CURRENT SITUATION ASSESSMENT:

Following is a summary of current issues related to education that need to be considered if the general goal stated above is to be realized. Some of the statements are included as background information while others identify particular problems and opportunities associated with this issue. This situation assessment becomes the basis for developing the more specific objectives and strategies for education contained in Chapter V.

HUMAN RESOURCES

Background:

- GIS is a new and rapidly growing industry, requiring personnel with a wide range of specialized skills. Recruiting and retaining qualified professional and technical personnel are crucial to the success of a GIS project. GIS employment in the public and private sectors is expected to grow dramatically in the next five years.

Problems and Opportunities:

- GIS is a new field. Consequently, the GIS employment market is not mature. There are no standardized job descriptions, uniform salary ranges, or agreement on needed skill levels. Many personnel departments do not recognize the need for a GIS job classification series that is separate and distinct from MIS positions.
- There is a general lack of knowledge about the particular GIS personnel needs in Arizona. For example, information is lacking on required staffing levels, necessary professional and technical skills, and needed expertise in GIS software and applications development. The current and future requirements for GIS employment in the public and private sector need to be documented.
- It is difficult to identify GIS employment opportunities in Arizona because job titles are not standardized, and there is no central clearinghouse where a prospective employer can advertize current openings. Most information is spread through informal networks. As a result, organizations may not have the opportunity to consider all of the qualified candidates who might be interested in a particular position.
- Because GIS is such a new field, there is a shortage of qualified people with several years of experience. As a result, agencies tend to "steal" personnel from other agencies. This situation may worsen as more GIS sites are established and the demand for this expertise increases.
- There is no organized strategy on a statewide level to attract entry-level GIS personnel, such as

EDUCATION SITUATION ASSESSMENT

through high school outreach programs. Although ALRIS and a few agencies have initiated student internship programs (ALRIS currently provides internship opportunities to about 12 students each year), there is a potential to expand these efforts to help students gain practical experience in GIS applications.

- GIS is expected to grow significantly in local government. Managers will need assistance in identifying the type of technical and professional personnel needed to ensure the success of their GIS operations. Some managers will require assistance in evaluating candidates for GIS positions.

EDUCATION AND TRAINING

Background:

- The University of Arizona has extensive GIS-related graduate-level course offerings with a focus on natural resource management. Northern Arizona University has developed a strong GIS undergraduate program associated with geography and forestry. Both universities have experienced increasing demands for these courses and have waiting lists for many of their classes.
- ALRIS has provided GIS training in ARC/INFO software for public sector personnel for several years. Currently, about 100 persons receive this training annually, and approximately 50 people are on the waiting list.
- Many of the community colleges in Arizona have begun to offer computer-aided drafting courses.

Problems and Opportunities:

- There is a need for strong GIS educational programs at all three state universities to serve the different regions of the state.
- Current GIS-related course offerings and available training in the state are not generally known. There has not been an attempt to compile and organize this information into one source.
- The GIS industry is rapidly changing, making ongoing personnel training a vital part of a successful GIS program. However, particular training needs for Arizona GIS installations have not been documented.
- ALRIS has not extensively advertised its course offerings, and people find out about this valuable training by word of mouth. There is a potential for much greater demand for this service in the future, especially from local governments, if this training program can be more widely publicized.
- The expanded revolving fund account, recently approved by the Arizona Legislature for the State Land Department, creates an opportunity to expand the ALRIS training program. ALRIS is now able to contract with the universities or other organizations in order to offer additional special topics and advanced GIS courses.
- Communication between the GIS users and the academic community is not well developed. It would be mutually beneficial to strengthen these relationships. The GIS users in the public and private sectors need to identify and communicate their requirements and support the academic institutions.

EDUCATION SITUATION ASSESSMENT

For their part, the universities should design their GIS curriculum in response to needs within the state. There are also opportunities for collaborative research projects.

- Students in academic programs need to receive the education and training necessary to prepare them for successful GIS careers in Arizona. They should be exposed to commonly used GIS software packages and applications as well as have the opportunity to gain experience through internship programs and obtain assistance in securing professional employment in the public and private sectors.
- ALRIS has offered to make its computer lab available for evening ASU classes in GIS; similar opportunities to share facilities with other agencies may exist in Tucson and Flagstaff to enhance the GIS programs at the U of A and NAU.
- Some agencies conduct their own in-house training or contract with a private vendor to offer special GIS training on site. When space is available, there is the potential to open these sessions to others outside the organization and, perhaps, share in the costs of training.
- Many agencies in Arizona utilize computer-aided drafting software for data input and then use a GIS software package for manipulation and analysis. Thus, there is a potential that community colleges could be training prospective GIS technicians. However, to date, there has been little communication between the GIS community and the colleges.
- Due to the projected growth of GIS in the public sector, top managers and agency technical staff will need assistance in learning what GIS is, how it can help their organizations, and how to design and implement successful programs.

**V. PROPOSED OBJECTIVES
AND STRATEGIES**

PROPOSED OBJECTIVES AND STRATEGIES

The situation assessments presented in the previous chapter led to a greater understanding of the problems and opportunities associated with the five strategic issues. The subcommittees then identified possible strategies that AGIC can undertake over the next three to five years to respond to these problems and take advantage of the opportunities. High-priority strategies that need to be implemented within the first year are also identified. The objectives and strategies for each of the five issues are included in this chapter.

DATA RESOURCES OBJECTIVES AND STRATEGIES

GENERAL GOAL:

To efficiently develop and effectively manage the geographic information resources of Arizona.

KEY OBJECTIVES AND POSSIBLE STRATEGIES:

Following is a summary of key objectives and possible strategies to achieve the general goal and address the problems and opportunities identified in the Data Resources Situation Assessment in Chapter IV.

Those strategies which are recommended to be implemented in the coming year are denoted by an "*". Specific action steps to accomplish these objectives and strategies in the next year are further detailed in Chapter VI.

PLANNING

Objective:

To identify the requirements and priorities for geographic data in Arizona.

Strategies:

- Utilize survey methods to determine the requirements of all levels of government, utilities, and the private sector for geo-based data.
- Analyze and compile the results of the data survey and document the priority rankings and accuracy requirements by jurisdiction for all major geographic data themes.

Note: The above tasks have been accomplished by the Data Resources Planning Subcommittee. The results are summarized in Exhibit 5.

Expected Benefits:

A statewide GIS plan should consider the relative importance of data resources that support vital business functions of all levels of government, utilities, and the private sector. Understanding the data priorities and accuracy requirements among jurisdictions will help to identify opportunities for sharing data and will enable executive decision makers to understand where to best direct resources for data development activities and in ways that will optimize information resource benefits throughout the state.

EXHIBIT 5

DATA RESOURCES OBJECTIVES AND STRATEGIES

Objective:

To plan and initiate the development and maintenance of statewide geographic data resources that have multiple-purpose value and can be used by all levels of government, utilities, and the private sector.

Strategies:

- Establish formal interagency task forces to prepare cooperative data base development and maintenance plans for each of the top five geographic data themes that were identified in the data survey sponsored by AGIC. (Refer to Exhibit 6 for the data priority rankings.)*

Guidelines:

- A. Establish an interagency task force with representation from all jurisdictions to plan and initiate the development and maintenance of a single, statewide geodetic control network that will facilitate the integration of digital data themes derived from multiple sources on a statewide basis.
 - B. A two-tiered approach for data base development should be established for the Land ownership/parcel, transportation, water, and administrative data themes because of the different trends among jurisdictions in accuracy requirements.
 - C. Federal and state agencies and the private sector should take the lead in planning, developing, and maintaining high-priority data coverages from source maps produced at scales ranging from 1:24,000 to 1:100,000.
 - D. County and municipal governments and the utilities should cooperate through established regional GIS consortia and take the lead in planning, developing, and maintaining regional data coverages from source maps produced at scales ranging from 1:100 to 1:4,800.
 - E. Because there is overlap in the accuracy requirements between individual entities within these two source map groups, jurisdictions should be encouraged to work with either one or both groups, depending upon the specific requirements and circumstances of their organizations.
- Designate responsibility to the Arizona Land Resource Information System (ALRIS) to coordinate and administer the activities of each data resource development task force to ensure that data standards are developed for each data theme and geographic area in order to facilitate statewide integration between coverages and to maximize data exchange capabilities.*

EXHIBIT 6
ARIZONA GIS DATA THEME PRIORITIES

Priority	Data Theme	Primary Elements	Key Agencies	Status/Comments
1	Geodetic Control/Land Description System	Horizontal/vertical control points and monuments Public Land Survey, township and ranges, and 1/4 sections	All public agencies, utilities, and private sector	ADOT, the USGS, and the BLM maintain some data.
2	Land Ownership/Parcels	Federal (e.g., Forest Service and BLM), State Trust, Indian, county, municipal, and private lands Subdivisions, lot lines, easements, and rights of way	All public agencies, utilities, and private sector	Statewide land ownership data exists at 1:100,000. Many local governments are creating parcel data.
3	Transportation	Roads, streets, centerlines, address ranges	ADOT, Indian agencies, counties, and cities	Statewide coverage exists at 1:100,000.
4	Water	Surface water, drainage networks, and lakes	Arizona Department of Water Resources and Arizona Department of Environmental Quality	Statewide coverage is under development at 1:100,000.
5	Administrative Boundaries	Indian reservations; federal, state, county, and city administrative boundaries; and election districts	All public sector agencies	Some statewide coverage exists at 1:100,000.

EXHIBIT 6
ARIZONA GIS DATA THEME PRIORITIES

Priority	Data Theme	Primary Elements	Key Agencies	Status/Comments
6	Biological Distribution	Vegetation communities (e.g., riparian areas), animal habitats and ranges, and endangered species	Arizona Game and Fish Department and Arizona State Land Department	
7	Environmental Quality	Solid waste disposal, underground storage tanks, surface and ground water quality, and air quality	Arizona Department of Environmental Quality and local government environmental departments	
8	Land Use	Cropland, forests, and industrial, residential, commercial, and vacant lands	All public sector agencies	Some large data bases exist for a portion of the state.
9	Socio-cultural	U.S. Census tracts/blocks, population characteristics, and labor and economic information	Arizona Department of Economic Security and Arizona Land Resources Information System	U.S. Census TIGER at 1:100,000 exists for the state.
10	Utilities	Pipelines, water treatment systems, and wells	Utilities	

EXHIBIT 6
ARIZONA GIS DATA THEME PRIORITIES

Priority	Data Theme	Primary Elements	Key Agencies	Status/Comments
11	Land	Elevation, geology, and soils	U.S. Geological Survey, Arizona Geological Survey, and U.S. Soil Conservation Service	DEM data exists for the entire state at 1:250,000 and as a partial coverage at 1:24,000. Scattered soil coverages exist.
12	Sports and Recreation	Fishing, hunting, boating, and outdoor recreation areas and hiking trails	State Parks and local government park and recreation agencies	
13	Atmosphere	Precipitation (i.e., rain and snowfalls), temperature, and air pressure	Weather Service	
14	Communication	Telephone, telegraph, and microwave	Telephone companies and communications industry	

DATA RESOURCES OBJECTIVES AND STRATEGIES

Expected Benefits:

Cooperative interagency initiatives to plan, develop, and maintain standard GIS data bases will: (1) eliminate or reduce redundant activities among all levels of government, the utilities, and the private sector; (2) reduce costs to tax and utility rate payers for data resource management; and (3) expedite the development of high-priority data on a statewide or regional basis.

STANDARDS

Objective:

To develop and recommend data standards that will enable cooperative GIS projects and facilitate data exchange.

Strategies:

- Develop and recommend to the State Cartographer data standards for each of the top five priority data themes (as identified in Exhibit 6) in the following critical areas:*

GEODETTIC CONTROL GRID (PUBLIC LAND SURVEY SYSTEM)

Horizontal Accuracy
North American Datum
Map Projection
Data Documentation

LAND OWNERSHIP/PARCELS

Horizontal Accuracy
Ownership Classification System
Ownership Features/Entities
Feature/Entity Attributes
Spatial Data Base Models
Data Element Definitions
Data Documentation
Access Keys

TRANSPORTATION

Horizontal Accuracy
Transportation Classification/Coding System
Transportation Features/Entities
Feature/Entity Attributes

DATA RESOURCES OBJECTIVES AND STRATEGIES

Spatial Data Base Models
Data Element Definitions
Data Documentation
Access Keys

WATER

Horizontal Accuracy
Water Classification/Coding System
Water Features/Entities
Feature/Entity Attributes
Spatial Data Base Models
Data Element Definitions
Data Documentation
Access Keys

ADMINISTRATIVE BOUNDARIES

Horizontal Accuracy
Administrative Features/Entities
Feature/Entity Attributes
Data Element Definitions
Data Documentation
Access Keys

- Establish an interagency task force to design and develop a standard data exchange architecture and process for transferring digital GIS data between disparate hardware/software environments or platforms.
- Development a statewide data administration function in the State Cartographer's Office to maintain a State GIS data dictionary and to disseminate information on GIS data standards.*
- Review existing federal standards related to data development and data exchange (e.g., national map accuracy standards, federal data transfer standards, etc.) and evaluate their applicability for Arizona.

Expected Benefits:

Data standards will facilitate the access, exchange, and usability of geographic information by multiple jurisdictions for planning, analysis, and decision support. In addition, data standards will help to increase the value of geo-based data for supporting multiple business applications. By reducing the need for redundant activities associated with data development and maintenance, agencies will save time, money, and staff.

DATA RESOURCES
OBJECTIVES AND STRATEGIES

FUNDING

Objective:

To identify potential sources of revenue and establish funding mechanisms for cooperative GIS data development and maintenance programs.

Strategies:

- Conduct a cost/benefit analysis for developing and maintaining the top five priority GIS data themes. (Refer to Exhibit 6).*

Guidelines:

- A. Identify and estimate resource/cost requirements for the following:
 1. Hardware/software
 2. Data base design
 3. Conversion of data and maps
 4. "Orgware" - costs associated with internal or external personnel expenses, from planning through implementation
 - B. Identify and estimate benefits in the following areas:
 1. Improved processing efficiency
 2. Improved asset utilization
 3. Improved resource control
 4. Increased accuracy
 5. Availability of new, better, and more timely information
 6. More informed, more timely decision-making
 7. Cost savings from new way of doing business versus present business operations
 - C. Analyze costs/benefits and publish the results.
- Identify and formalize funding mechanisms to support the costs for developing and maintaining the top five priority GIS data themes. (Refer to Exhibit 6).*

Guidelines:

- A. Each data development task force should survey all potential funding strategies and evaluate the advantages and disadvantages of each one. Examples of potential funding sources include:
 1. Cooperative agreements for cost sharing
 2. Grants
 3. Operating budgets
 4. Privatization

DATA RESOURCES OBJECTIVES AND STRATEGIES

5. General obligation or revenue bonds
 6. Legislation that provides funding for government land records modernization
- B. Each task force should identify the combination of funding strategies that will best support development and maintenance of the data themes and should present its recommendations to the AGIC Board.
- C. The AGIC Board formally adopts and initiates actions to implement and administer the appropriate funding mechanisms.

Expected Benefits:

Funds or resources are required in order to initiate statewide cooperatives to improve the management of GIS data resources. Funding mechanisms must be established before GIS data base development and maintenance activities can take place. The development of cost/benefit justifications will significantly improve the chances of obtaining approval from legislators and executive decision makers for funding of data resource management programs.

INFORMATION

Objective:

To improve information about existing data resources and geographic information systems in Arizona.

Strategies:

- Compile, organize, and publish the results of the 1992 statewide Survey of Existing Digital Spatial Data and Future Needs, which was sponsored by AGIC.*
- Develop a data base management system and on-line capabilities for remote access to information about GIS data resources and geographic information system activities throughout the state. Information collected during the 1992 data survey should be entered into the data base system to support information query, analysis, and reporting of the data survey results.
- Designate the State Cartographer as the administrative authority for managing a long-term program for collecting, updating, and disseminating statewide information about geographic information systems and data resources. Responsibilities should include developing and refining data survey methodologies, conducting annual data surveys, publishing survey results, and developing and managing automated systems for storing, maintaining, and accessing GIS metadata. (See also the duties of the State Cartographer in the Administrative and Legal sections.)*

Expected Benefits:

Effective access to a central repository of information about GIS data resources and implementation activities will help to reduce duplication of data development and maintenance activities throughout all levels of government and will facilitate searches for geographic information to support specific land,

**DATA RESOURCES
OBJECTIVES AND STRATEGIES**

infrastructure, transportation, and environmental resource planning and management applications.

TECHNOLOGY OBJECTIVES AND STRATEGIES

GENERAL GOAL:

To develop efficient and effective methods for the physical exchange of geographic information via hardware, software, and communications.

KEY OBJECTIVES AND POSSIBLE STRATEGIES:

Following is a summary of key objectives and possible strategies to achieve the general goal and address the problems and opportunities identified in the Technology Situation Assessment in Chapter IV.

Those strategies which are recommended to be implemented in the coming year are denoted by an "*". Specific action steps to accomplish these objectives and strategies in the next year are further detailed in Chapter VI.

DATA EXCHANGE

Objective:

To increase understanding about data exchange options.

Strategies:

- Develop a taxonomy of physical data exchange options (e.g., tape exchange and the variety of possible electronic exchanges). Include in the taxonomy the frequency and volume of information exchange. Report options in a Technology Guide.*
- Create recommendations for physical exchange methods, based on exchange needs. Report recommendations in the Technology Guide.*
- List data base management systems (DBMS) that can be linked to commonly used GIS systems and briefly describe the links. Monitor changes and update the DBMS and link methodologies.*

Expected Benefits:

Many users in the GIS community are unfamiliar with the various technological options available to exchange data. By developing and distributing materials that are easy to understand and that clearly explain these alternatives, transferring and exchanging data between organizations in the GIS community will become more effective and efficient.

Objective:

To increase understanding of the present and potential future demand for data exchange by Arizona's GIS sites.

TECHNOLOGY OBJECTIVES AND STRATEGIES

Strategies:

- Review and summarize data exchange-related information from AGIC's Survey of Existing Digital Spatial Data and Future Needs. Work with the Data Resources Committee to determine how information should be published. Publish and distribute the information.*
- Utilizing results from the AGIC survey, develop a supplemental survey (or work with the Data Resources Committee on a supplemental survey) to determine potential short-term and long-term data exchange pathways. Include types of exchanges.*
- Develop a report on data exchange pathways and needs. Present the report to the AGIC Executive Management Board.

Expected Benefits:

Increasing understanding of both telecommunications infrastructure and needs for data exchange pathways between sites will be mutually beneficial to both GIS users and telecommunication system planners.

Objective:

To establish standards and guidelines for GIS technology.

Strategies:

- Review results from AGIC's survey on software, hardware, and network communications. Summarize the results and develop hardware, software, and network communications recommendations that would maximize an organization's ability to exchange data with other organizations.*
- Report recommendations to AGIC and to the State Cartographer.*
- Publish the summary and recommendations in the Technology Guide.*
- Review existing federal standards related to data development and data exchange (e.g., national map accuracy standards, federal data transfer standards, etc.) and evaluate their applicability for Arizona.*

Expected Benefits:

Developing GIS guidelines and standards, as appropriate, will make it more possible for organizations to efficiently share and exchange digital spatial data. Such standards and guidelines will also aid new GIS installations in selecting the software and hardware systems that will maximize their ability to exchange data with other agencies.

TECHNOLOGY OBJECTIVES AND STRATEGIES

TELECOMMUNICATIONS

Objective:

To increase awareness of the relationship between GIS and telecommunications.

Strategies:

- Identify other groups or organizations in Arizona that have an interest in the development of Arizona's telecommunications infrastructure. Add to the following draft list, as they are identified, any other organizations that should be contacted: Arizona Strategic Planning for Economic Development (ASPED) Information and Communications Group, Arizona State Public Information Network (ASPIN), Arizona Department of Administration (ADOA) Telecommunications Center, and U.S. West Communications Inc.*
- Contact identified potential cooperative groups or organizations and brief them on potential GIS service demands.*
- Determine ways in which AGIC can cooperate with these groups or organizations to further develop the necessary physical infrastructure or standards.*
- Monitor technological advances related to GIS and inform AGIC and other interested groups of important trends. Make recommendations in response to changes, as appropriate.

Expected Benefits:

By developing a more cooperative relationship with the groups involved in planning for telecommunications systems, the GIS community will not only become more aware of proposed system improvements, but will have the opportunity to ensure that the needs of the GIS users will be considered in plans for future infrastructure development.

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

GENERAL GOAL:

To establish state-level laws and administrative policies that create an effective structure for developing and managing geographic information resources.

KEY OBJECTIVES AND POSSIBLE STRATEGIES:

Following is a summary of key objectives and possible strategies to achieve the general goal and address the problems and opportunities identified in the Administrative and Legal Situation Assessment in Chapter IV.

Those strategies which are recommended to be implemented in the coming year are denoted by an "*". Specific action steps to accomplish these objectives and strategies in the next year are further detailed in Chapter VI.

AGIC ORGANIZATION

Objective:

To strengthen AGIC as an organization.

Strategies:

- Revise the composition of AGIC's Executive Management Board and organizational structure as necessary to balance operational efficiency with broad representation.*
- Establish AGIC in statute to provide greater authority for the establishment of GIS policies, standards, and priorities; to clarify relationships with public agencies, utilities, and the private sector; and to provide the ability to request funding for the establishment of cooperative GIS projects.*
- Establish the following standing committees: Administrative and Legal, Data Resources, Technology, Human Resources and Education, and Conference/Newsletter. Establish ad hoc committees and subcommittees as needed to implement the recommended actions in the AGIC Strategic Plan.*
- Revise AGIC's Bylaws to conform with the AGIC Strategic Plan.*

Expected Benefits:

These recommended strategies will address the problems that AGIC currently faces, including ambiguous authority, uneven representation, and lack of adequate staff support. These proposed actions will greatly enhance AGIC's ability to perform its mission, to implement its Strategic Plan, and to help it to run more efficiently as an organization.

ADMINISTRATIVE AND LEGAL ISSUES
OBJECTIVES AND STRATEGIES

AGIC DUTIES AND RESPONSIBILITIES

Objective:

To redefine and clarify AGIC's role and relationships.

Strategies:

- Explore opportunities to clarify and strengthen the relationship between AGIC and the regional GIS consortia.*
- Develop an annual operations plan to clarify which of the recommended strategies and actions in the AGIC Strategic Plan are to be undertaken in a given year, to provide more detailed work tasks, and to assign responsibilities.*
- Develop an annual budget for AGIC, to include administrative and staffing costs as well as operational expenditures required to implement the Strategic Plan. Identify revenue sources.*
- Adopt policies and procedures as necessary to develop and manage the geographic information resources of Arizona. Organize the policies and procedures into a manual. Establish an adoption process that allows for review and comment by interested public and private sector agencies.

Philosophy: Compliance with AGIC's policies and procedures will not be "forced" upon any agency, but will be voluntary. They will, however, be applicable to all cooperative data development projects undertaken by AGIC. In addition, AGIC member agencies and other public sector organizations will be encouraged to adopt AGIC's policies for their own agencies through formal memoranda of understanding/agreement.

- Provide regular reports to the AGIC Executive Management Board on the progress of implementing the AGIC Strategic Plan.*
- Amend the AGIC Strategic Plan in three to five years.
- Establish the following additional specific duties for AGIC:*

 - A. Foster cooperative development of GIS projects.
 - B. Provide a forum for promoting the exchange of GIS information.
 - C. Promote the use of GIS through education and training programs.
 - E. Establish priorities for statewide GIS projects.

- Review and comment on the proposed annual work programs of ALRIS and the State Cartographer's Office, and monitor work program progress to ensure adherence to established plans and policies.*

Expected Benefits:

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

These strategies clarify AGIC's most important duties as a policy-setting body and establish an effective working relationship with the State Cartographer and ALRIS. This clarification of responsibilities will help ensure that AGIC can efficiently carry out its mission.

STATE CARTOGRAPHER/ALRIS ORGANIZATION

Objective:

To implement the Office of the State Cartographer.

Strategies:

- Prepare background material and request permanent funding from the Arizona State Legislature for the State Cartographer in conjunction with the legislation to establish AGIC in statute.*
- In the event that the Resource Analysis Division statutes (A.R.S. 37-173) are ever amended, revise the list of specific duties assigned to ALRIS to more accurately reflect the current focus.
- Assist the State Land Commissioner in hiring a State Cartographer.*

Expected Benefits:

The State Cartographer will play a vitally important administrative role in implementing the AGIC Strategic Plan and in developing GIS policies and standards. Without this critical staff position, AGIC will be severely limited in its ability to respond to the needs of the state GIS community.

STATE CARTOGRAPHER DUTIES AND RESPONSIBILITIES

Objective:

To clarify the relationships and responsibilities of the State Cartographer's Office.

Strategies:

- Establish the following specific duties and responsibilities of the State Cartographer's Office:*
- A. Provide staff for AGIC activities.
- B. Facilitate all technical committees of AGIC (Technical, Data Resources, Administrative and Legal, etc.).
- C. Develop requirements for an annual operational plan in conjunction with regional GIS consortia and with federal and state agencies.

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

- D. Submit an annual GIS plan for review and approval by AGIC.
- E. Monitor the GIS plan and report progress to AGIC.
- F. Draft policies and standards for review by AGIC.
- G. Promulgate rules and procedures to support AGIC-approved policies and standards.
- H. Distribute AGIC policies and standards and provide training to the GIS community in the use of them.
- I. Monitor adherence to policies and standards for commonly funded projects and projects funded through the State Cartographer's Office.
- J. Maintain a clearinghouse for information, referral, and data resources.
- K. Serve as a primary contact for the public regarding requests for information about GIS.
- L. Represent the State of Arizona on national committees addressing GIS-related issues.

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

- M. Establish and maintain a State-level Data Dictionary containing location and coding structures of data maintained by AGIC membership.
- N. Coordinate and facilitate the development of projects of common interest among independent groups.

Expected Benefits:

Establishing these specific administrative duties for the State Cartographer's Office provides for an efficient division of labor between the Cartographer and ALRIS and clarifies the relationship of this office with AGIC.

ALRIS DUTIES AND RESPONSIBILITIES

Objective:

To clarify the relationships and responsibilities of the ALRIS program.

Strategies:

- Establish the following specific duties and responsibilities for ALRIS:*
 - A. Provide training to the GIS community in software, data, and applications maintained and supported by AGIC and by the State Cartographer's Office.
 - B. Develop GIS data bases and applications.
 - C. Provide the GIS community with technical assistance in the use of GIS technology.
 - D. Maintain and operate a computer facility for the purpose of providing GIS information.
 - E. Manage GIS projects to effectively and efficiently provide commonly used GIS information.
- Develop an annual project plan and submit it to AGIC for review.*
- Evaluate staffing and resource needs for ALRIS to meet current and future work load demands and propose any staff or budget increases as necessary.*

Expected Benefits:

At present, the role of ALRIS vis a vis the State Cartographer is unclear. These strategies clarify an efficient division of labor: The State Cartographer's Office will function as the State GIS administrative unit, and ALRIS will provide operational support for the development, maintenance, and distribution of State GIS data.

ADMINISTRATIVE AND LEGAL ISSUES
OBJECTIVES AND STRATEGIES

CERTIFIED DATA BASE DEVELOPMENT

Objective:

To develop a certification process for cataloging and distributing important geographic information data bases.

Strategies:

- Establish a procedure for certifying important data bases that are shared among the GIS community.

Note: The certification procedure will not attempt to control unauthorized access to AGIC-sponsored data bases. The remaining objectives and strategies that follow on data maintenance, ownership, etc. will apply to certified as well as non-certified GIS data bases.

- Summarize findings and define standards that address ownership, data accuracy, data maintenance, and security. These will be used to support the certification process.

Expected Benefits:

The certification process will formalize the exchange of data among the GIS community and provide a record of the location and use of important GIS data resources.

ADMINISTRATIVE AND LEGAL ISSUES
OBJECTIVES AND STRATEGIES

DATA SHARING

Objective:

To establish administrative procedures to promote GIS data sharing.

Strategies:

- Develop and publish the inventory of existing data resources, based upon the survey conducted by AGIC. (See Data Resources Objectives and Strategies and Action Plan.)*
- Based upon an evaluation of the results of the AGIC data inventory and needs survey, develop a summary of the status of GIS in Arizona and widely distribute this report. (See Data Resources Action Plan.)*
- Conduct an annual survey of digital spatial data in Arizona.*
 - A. Revise the survey form as necessary.
 - B. Compile previous responses and ask agencies to update their responses.
 - C. Reissue the survey.
 - D. Investigate the prospect of assistance from the universities in evaluating the results.
 - E. Explore the possibility of developing an on-line query system to identify available data in the state by geographic area.
- Assist the State Cartographer in developing GIS data base standards and guidelines in cooperation with AGIC committees.
- Identify and determine areas of possible overlap for key state agencies in promulgating GIS standards.
 - A. Review existing authorization statutes for relevant state agencies and identify overlaps.
 - B. Clarify the roles of the Arizona Department of Administration and the State Cartographer in establishing hardware standards.
 - C. Clarify the roles of the Arizona Department of Revenue and the State Cartographer in defining parcel mapping standards.
 - D. Identify any other relationships that require clarification.

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

- Develop a model intergovernmental agreement for sharing data between public agencies. Develop similar cooperative agreements for use by public agencies, utilities, and other nonprofit organizations.

Expected Benefits:

Conducting and publishing an annual survey of existing digital spatial data in Arizona will enable agencies to identify sources of data that may be useful to them. Any standards, procedures, and model agreements developed by AGIC will facilitate data sharing between different organizations.

DATA MAINTENANCE

Objective:

To develop methods for providing periodic maintenance of GIS data bases.

Strategies:

- Develop specific maintenance strategies for AGIC-sponsored data bases and recommend maintenance approaches for other GIS data bases. (See Data Resources section.)
- Organize workshops that emphasize the importance of planning for data base maintenance and updates.
- Explore techniques that agencies can use to inform users of data updates, to develop registries, to create legal agreements regarding charging for subscription services, etc.
- Conduct further research to clarify the consequences and problems associated with updating a data layer, such as to conform with a revised geodetic control grid.

Expected Benefits:

Implementing these strategies will help to avoid the cost of having several organizations maintaining or enhancing the same data. Ensuring that periodic updates are performed will protect the substantial initial investment associated with data base creation.

DATA OWNERSHIP

Objective:

To establish standards for data ownership and rights of data base producers.

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Strategies:

- Develop standard agreements to clarify ownership and terms and conditions associated with data resale and reuse.
- Clarify how ALRIS and other public agencies can deal with legally restricting access to proprietary data that they acquire from other sources.
- Explore techniques to preserve information about the origin of data, such as by creating a registry.
- Review the uniform commercial code, copyright laws, and other legal provisions in Arizona in light of their application to digital information and determine the most appropriate approach to addressing ownership/custodian issues.
- Further explore the potential for cooperative agreements to serve as a way to acquire data and to establish procedures for controlling access to that data. For example, provisions could be included to specify and clarify usage for AGIC members or private organizations.

Expected Benefits:

These strategies will clarify the legal rights of data ownership with regard to the sale of data to private and public organizations.

QUALITY ASSURANCE

Objective:

To develop procedures for establishing and documenting data quality.

Strategies:

- Develop general guidelines, standardized procedures, and formats for the following:
 - A. Documentation
 - B. Quality assurance and control
 - C. Techniques for computing accuracy levels
 - D. Other information as needed and recommended by the Data Resources Committee
 - E. Recommended procedures for handling particular problems
- Explore any prospects of obtaining assistance from the Arizona Department of Administration or the universities regarding recommendations related to traditional MIS data design and data base management practices to improve the quality of GIS information.
- Organize materials related to guidelines and procedures into a practical "Data Development Guide"

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

for Quality Assurance" and distribute this report throughout the GIS community. Encourage agencies to follow the guidelines.

Expected Benefits:

These strategies will establish standards for data quality. They will reduce the risk of time loss resulting from unknown data quality and the possibility of litigation arising from errors in interpretations.

LIABILITY CONCERNS

Objective:

To establish criteria for minimizing litigation that might arise from data sharing.

Strategies:

- Obtain legal counsel to more fully research liability issues associated with data sharing and recommend appropriate strategies.
- Develop standardized agreements that agencies can use to reduce their liability when they allow others to access their data. These agreements would include the following components:
 - A. Disclaimer language to clarify appropriate usage
 - B. A section describing the expected accuracy, source material(s), and quality assurance techniques used
 - C. Age of the data and frequency of updates
 - D. A place where the recipient must sign and acknowledge limitations, etc.
- Identify someone in the Arizona Bar who can oversee research into liability issues associated with GIS and coordinate review and acceptance of any standardized contracts with the Attorney General's office, as well as municipal and county attorneys, to ensure contract uniformity throughout the state.
- Encourage all public agencies in Arizona to adopt standardized contracts developed by AGIC.
- Monitor the status of litigation of Kentucky's access and pricing provisions, which are modeled after Arizona's statutes. Propose revisions to the Arizona statutes as appropriate, pending the outcome of the case.*
- Explore the possibility of research assistance from the universities on legal issues associated with geographic information resources.

Expected Benefits:

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

These strategies will ensure that users of GIS information receive advance notification of the appropriate usage of that data. This action will minimize the potential risk to agencies when marketing their data to other public or private sector organizations.

DATA SECURITY

Objective:

To ensure that security considerations are included in the data sharing process.

Strategies:

- Conduct research as necessary to identify any need for additional security measures that agencies should employ to protect the quality of their GIS data. Recommend proposed strategies.
- Seek legal advice to determine whether agencies can temporarily withhold certain information while they are in the midst of developing management plans to protect a particular resource (e.g., location of rare and endangered species or archeological sites where premature release of this information might jeopardize the resource).
- Ensure that any legal research pertaining to public access acknowledges the confidentiality of certain public records.

Expected Benefits:

These strategies will reduce the risk of compromising confidential data and will minimize the chance for possible litigation.

PUBLIC ACCESS VERSUS COST RECOVERY

Objective:

To establish a fair and equitable pricing policy for data base access.

Strategies:

- Formulate and adopt a public access policy.
- Formulate and adopt a pricing and cost recovery policy for public agencies.
 - A. Agree on philosophical direction:
 - Approach A: If data is developed with public funds, it should be readily accessible to

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

all other public agencies and nonprofit organizations. Fees will be assessed only to offset reproduction and distribution costs.

Approach B: In recognition of the tremendous costs associated with data creation and maintenance and the severe funding constraints faced by government, AGIC supports the use of cost recovery programs. Charges would be applicable to government as well as the private sector. Provisions to allow credit for equivalent in-kind services and other arrangements in lieu of cash payments would have to be developed.

- B. Enlist the aid of an accountant or other consultant to develop an acceptable framework for justifying costs associated with reproduction, distribution, etc. If the cost recovery approach is to be utilized, develop a basis for computing these charges. Each agency may have different unit costs for products, but the basic framework for defining pricing would be standardized.
 - C. Distribute to public sector GIS agencies a report on pricing and cost recovery, including standardized forms. Encourage them to utilize this methodology.
 - D. Develop agreements designed to reimburse agencies for cost recovery of important data bases.
 - E. Explore alternatives to charging public agencies for access to data, such as allowing in-kind services, credits, equivalent data exchanges, etc.
- Develop a policy for allowing data access and pricing for commercial purposes.
 - A. Evaluate existing models and adopted policies and practices employed in other states.
 - B. Obtain legal counsel and assistance from accountants and other consultants to develop a legally defensible and fair basis for access and pricing relating to data being sought for commercial purposes.
 - C. Develop a report on recommended policies and procedures related to commercial data usage. Distribute this report to the public and private sector.
 - Hire a consultant to review, and propose revisions to, existing statutes dealing with open records to ensure that they conform to the access and pricing policies adopted by AGIC. Monitor the pending Kentucky lawsuit (referenced above).
 - Explore opportunities for governments to offer value-added products and services. Evaluate potential demand and develop appropriate fee structures to shift reliance from a focus on selling data to one of providing services.
 - Evaluate the feasibility of establishing an expanded state geographic information center in conjunction with the State Cartographer's Office. This center could provide a central clearinghouse for access to GIS data generated by public sector agencies. This would relieve individual agencies from responding directly to requests from the public for digital data. Such requests are expected to increase dramatically in the future. This center could also provide value-added services, depending upon the data sharing model agreed upon.
 - Explore the prospects of improved public access to geographic information in cooperation with libraries and other public relations and education programs.

Expected Benefits:

ADMINISTRATIVE AND LEGAL ISSUES OBJECTIVES AND STRATEGIES

These strategies are intended to develop a realistic approach to allowing access to GIS data, thereby balancing the public's right to knowledge about government activities with the agencies' need to recover the tremendous costs associated with developing GIS data in times of tight budgets.

FUNDING

Objective:

To establish adequate and stable sources of funding for GIS development.

Strategies:

- Aggressively explore innovative approaches to funding GIS data development and maintenance programs in Arizona, such as cost recovery programs.
- Encourage agencies to share the costs of data base creation and updates.
 - A. Assist in identifying agencies with common needs to share funding of projects.
 - B. Establish standard intergovernmental agreements that clarify resource responsibilities and reimbursement arrangements.
 - C. Facilitate shared funding of projects by offering to help administer common funds.
 - D. Explore additional measures to foster cooperative projects.
- Further explore the prospect of joint data development through federal grant programs, such as with the U.S. Geological Survey and the Environmental Protection Agency.*
- More extensively utilize the ALRIS Revolving Fund for common projects.
- Develop a guide to help agencies more accurately estimate the time, human resources, and material costs associated with GIS data development and maintenance in order to increase the prospect of successful and realistic programs.
- Explore any prospects of more cooperative projects with the utilities and the private sector.

Expected Benefits:

These strategies seek to identify potential sources of funding that can be used to finance the development of GIS and important spatial data bases in Arizona.

INFORMATION EXCHANGE OBJECTIVES AND STRATEGIES

GENERAL GOAL:

To foster the sharing of information and ideas and to disseminate information about GIS-related activities throughout the state.

KEY OBJECTIVES AND POSSIBLE STRATEGIES:

Following is a summary of key objectives and possible strategies to achieve the general goal and address the problems and opportunities identified in the Information Exchange Situation Assessment in Chapter IV.

Those strategies which are recommended to be implemented in the coming year are denoted by an "*". Specific action steps to accomplish these objectives and strategies in the next year are further detailed in Chapter VI.

GIS INFORMATION

Objective:

To organize a State GIS Conference and workshops.

Strategies:

- Organize an annual "GIS Fair" that serves to introduce the public to GIS technology.*

Guidelines: The purpose of the conference is to disseminate information to professionals in all levels of government, the private sector, and the general public. The conference must provide information in a format that is easily understood and will demonstrate the increasing utility of GIS technology. The conference should have a multi-disciplinary approach and should not promote or align itself with any particular vendor.

- Encourage participation from all levels of government, the private sector, and relevant professional organizations (e.g., engineers, land surveyors, planners, etc.)*
- Solicit joint sponsorship of the conference with the universities and rotate the conference site accordingly.*
- Enroll people and organizations who can present GIS workshops, demonstrations, and educational sessions and can offer assistance as needed to produce periodic workshops.*
- Appoint a Conference Committee to plan and organize the annual conference and other periodic workshops.*
- Conduct occasional surveys of members in the state GIS community to identify unmet needs and topics of interest.

INFORMATION EXCHANGE OBJECTIVES AND STRATEGIES

Expected Benefits:

A regularly scheduled State Conference and periodic workshops on GIS and related technologies would provide an excellent forum for learning about the latest developments in this rapidly growing field. Participant interaction will foster increased communication between all GIS users.

Objective:

To develop and disseminate GIS informational materials.

Strategies:

- Develop a canned slide show, publish a book of plots, and print a brochure to present the benefits of GIS technology. These materials can be used to disseminate information to the public through organizations, county fairs, library exhibits, etc. AGIC should aid these organizations in disseminating this information.
- Develop a GIS road show that could be taken to rural locations to demonstrate the potential for GIS applications.
- Develop general guidelines to aid agencies in recruiting and selecting candidates for GIS positions.
- Produce an annual GIS calendar showcasing GIS applications in the state. Secure a budget that allows AGIC to print enough copies for wide distribution to the GIS community and the general public.*
- Publish an annual directory of GIS users statewide.
- Compile and publish an inventory of contacts, clearinghouses, and spatial data in Arizona.*
- Explore methods for improving public access to important data bases, perhaps through the public library system using CD-Rom.

Expected Benefits:

Developing and distributing slide shows, brochures, and guidelines would provide an efficient and effective way to convey essential GIS information to assist managers and technical staff in GIS design and implementation. Publishing a calendar would increase awareness, within the GIS community as well as among top administrators and the general public, regarding the potential applications of GIS. Compiling and producing a current directory and inventory would enable users to obtain convenient access to information about other GIS users and existing data sources. Improving public access to GIS data would give private citizens a better understanding of government services.

INFORMATION EXCHANGE OBJECTIVES AND STRATEGIES

Objective:

To strengthen GIS information and support services at the State level.

Strategies:

- Explore additional sources of funds to increase the support staff at ALRIS.
- Secure necessary funding and implement the Office of the State Cartographer. (Refer to recommended Administrative and Legal strategies for a more detailed discussion of this issue.)*

Expected Benefits:

Increasing ALRIS staff and implementing the State Cartographer's Office would provide personnel essential for furnishing necessary technical assistance and serving as a central clearinghouse to meet the state's needs for GIS information.

AGIC ACTIVITIES

Objective:

To increase public awareness of AGIC's role and responsibilities.

Strategies:

- Develop a brochure to describe the mission and goals of AGIC.*
- Prepare an annual report to highlight AGIC's accomplishments.*
- Hold at least one meeting of the AGIC Executive Management Board in a different part of the state in conjunction with one of the regional GIS consortia.*
- Expand notifications of AGIC meetings. Develop a subscription service for those who want to receive meeting packets in advance.*
- Explore the possibility of having Arizona Highways (and other noted publications) do an article on AGIC and GIS in Arizona.

Expected Benefits:

INFORMATION EXCHANGE OBJECTIVES AND STRATEGIES

Communication and understanding between AGIC, regional GIS consortia, local governments, and other groups in the state would be greatly enhanced. As "GIS Champion", AGIC will be committed to improving communication and to strengthening these relationships. This commitment will ensure the successful development of GIS in Arizona.

Objective:

To improve the existing AGIC Newsletter.

Strategies:

- Assign the responsibility of newsletter editor to someone in the GIS community who can devote sufficient time to publication.*
- Create an editorial board to solicit articles and assist the editor. This board should consist of three members: one representing a university, one from a state agency, and one from a non-metropolitan area.*
- Produce the newsletter on a more regular and frequent basis.*
Guidelines: The newsletter should be issued at least four times each calendar year. Cutoff dates for articles should generally be four weeks in advance of the next edition.
- Increase distribution of the AGIC newsletter. Include more local governments and the news media on the circulation list. To ensure that the list remains current, request that recipients confirm their interest in continuing to receive the newsletter on an annual basis.*
- Explore the feasibility of charging a subscription fee and offering advertising space to cover costs of more frequent production, if necessary.*
Guidelines: Ideally the Newsletter should be produced by AGIC as a free service.
- Explore different formats for the newsletter.
- Include regular articles on AGIC Executive Management Board and Committee activities.*
- Solicit the contribution of articles of general interest from the state GIS community.*
Guidelines: The newsletter should be a service to GIS users and other interested people. In particular, articles describing GIS success stories and acknowledging people who make a contribution to AGIC and GIS should be featured.
- Include information on GIS employment opportunities.

Expected Benefits:

INFORMATION EXCHANGE OBJECTIVES AND STRATEGIES

Improving the quality, frequency, and distribution of the AGIC Newsletter will ensure that the GIS community has a consistent and reliable source of information about GIS activities in the state.

EDUCATION OBJECTIVES AND STRATEGIES

GENERAL GOAL:

To ensure that qualified personnel are available to meet the GIS needs of the public and private sectors and to strengthen GIS-related education programs in Arizona.

KEY OBJECTIVES AND POSSIBLE STRATEGIES:

Following is a summary of key objectives and possible strategies to achieve the general goal and address the problems and opportunities identified in the Education Situation Assessment in Chapter IV.

Those strategies which are recommended to be implemented in the coming year are denoted by an "*". Specific action steps to accomplish these objectives and strategies in the next year are further detailed in Chapter VI.

HUMAN RESOURCES

Objective:

To identify the needs for professional and technical GIS personnel in Arizona.

Strategies:

- Analyze the responses to AGIC's 1992 survey and construct a profile of existing and projected personnel needs for GIS installations in Arizona.*
- Collect GIS-related job descriptions from known GIS installations and summarize typical education, skills, experience, and salary requirements for various positions.*
- Conduct a follow-up survey of public and private sector organizations with current or planned systems for the purpose of identifying more specific GIS personnel needs statewide.

Guidelines: Information should be gathered in the following areas: current and expected staffing levels; types of professional and technical positions needed; required education, skills, knowledge, and abilities; and preferred expertise with particular GIS software and hardware systems.

- Analyze the survey results. Develop a report describing the needs for GIS personnel in Arizona, and distribute this information throughout the state. (This can be combined with other reports.)
- Present the results regarding state GIS personnel needs to the universities to assist them in planning their GIS curricula.*

Expected Benefits:

By gaining a more accurate picture of the needs for GIS personnel in Arizona, AGIC, the universities, and others will be better able to design human resource development and education programs that respond

EDUCATION OBJECTIVES AND STRATEGIES

directly to current and future statewide demands.

Objective:

To improve information about GIS career opportunities.

Strategies:

- Encourage adoption of a GIS job classification series and job descriptions for State government, with appropriate salary ranges, and make this information available to other public sector GIS managers and personnel departments in the state.*
- Prepare and distribute a brochure on GIS employment opportunities in Arizona, based upon results of the personnel needs survey. (This information could be combined into a report with other education information.)
- Explore the possibility of establishing an electronic bulletin board for information about current job opportunities. (A bulletin board could also be used for other announcements.)*
- Conduct periodic salary surveys for GIS positions. Explore the possibility of including GIS positions in regular personnel salary surveys conducted by state and local government organizations.*
- Identify people who would be willing to serve on GIS personnel selection panels, similar to a speakers bureau, and inform government managers that this service is available upon request.*
- Explore the feasibility of conducting a multi-agency job fair to recruit candidates for GIS positions.

Expected Benefits:

Developing model GIS job descriptions and improving access to information about GIS-related job opportunities will help make Arizona's GIS employment market more mature. These actions will also assist agencies in recruiting the most qualified professional and technical people to make their GIS programs succeed.

EDUCATION AND TRAINING

Objective:

To identify existing GIS education resources in Arizona and to clarify future training needs.

Strategies:

EDUCATION OBJECTIVES AND STRATEGIES

- Compile and publish a directory of all GIS and related courses offered by ALRIS, the universities, the community colleges, and the private sector. Conduct periodic updates to ensure that the lists remain current. (This item can be combined into one report with employment information.)*
- Conduct a survey to identify particular needs and priorities for ongoing training statewide. (This survey can be done in conjunction with the proposed personnel needs survey, noted above.)*
- Encourage agencies that offer on-site training to open classes to those outside the organization whenever space is available.*

Expected Benefits:

Organizing and publicizing information about available education and training resources will allow people who were not previously aware of these services to take advantage of the programs. Clarifying needs and priorities for future training will prove valuable to ALRIS and the academic community and will help them to adapt their programs to better serve the state as a whole.

Objective:

To expand the ALRIS GIS training program.

Strategies:

- Based upon results of the personnel inventory and needs surveys (mentioned previously) and other available information, identify gaps in training needs that are not being addressed by the universities or colleges.*
- Identify specific courses that could be sponsored by ALRIS, either through the use of existing training staff or by contracting with the universities or other organizations.*
- Utilize the State Land Department Revolving Fund as a mechanism for increasing the number of GIS training courses offered to public sector agencies.*
- Publicize the proposed program of ALRIS GIS courses to all public sector agencies in the state, with a particular focus on local government.*

Expected Benefits:

ALRIS has already provided valuable training to hundreds of people in the public sector GIS community. Expanding this important program will help agencies respond to the demand for advanced courses and will encourage local governments to more fully participate in this training program.

EDUCATION OBJECTIVES AND STRATEGIES

Objective:

To develop a strong partnership between the academic and GIS communities in Arizona.

Strategies:

- Appoint a Human Resources and Education Committee that will serve as a standing AGIC committee to oversee implementation of personnel and education development and to help coordinate programs.*
- Review results of the inventories of personnel and training needs with the universities.*
- Recommend revisions to the GIS university curricula as necessary in response to statewide needs.*

Guidelines: Universities should provide exposure to GIS software packages and applications to enable students to receive the training necessary to secure employment.

- Provide letters and other demonstrations of support for the three universities, as needed, to ensure continuation of their GIS-related degree programs.*
- Explore opportunities to augment the GIS education programs at all three universities in cooperation with ALRIS and other organizations. Examples include sharing computer lab facilities and expanding course offerings.*
- Identify potential needs for further collaborative academic research projects related to GIS.*
- Establish a stronger relationship with the community colleges that offer computer-aided drafting and design (CADD) and GIS courses. Include a representative on the Human Resources and Education Committee.*
- Investigate the feasibility of creating a GIS Technician certification program in conjunction with the universities and community colleges.
- In cooperation with the universities, organize an annual state GIS conference. (See the Information Exchange Strategies section.)*

Expected Benefits:

Forging a stronger partnership between GIS users and academic institutions will facilitate two-way communication and encourage a true symbiosis to emerge. GIS users will have the chance to convey their needs for personnel and research, and the colleges and universities will have the opportunity both to tailor their programs in response to statewide needs and to offer leadership in solving problems requiring academic research.

Objective:

To expand GIS job opportunities for students.

EDUCATION OBJECTIVES AND STRATEGIES

Strategies:

- Encourage other public and private GIS installations to utilize student interns (paid internships, if possible).*
- Help agencies identify tasks that interns can perform. Assist state agencies in securing approval of internship positions. Coordinate GIS internships with established internship programs such as those administered by the Governor's Office.*
- Compile a list of agencies with internship opportunities and distribute this information to the colleges and universities.
- Develop a student guide on how to find a GIS job in state and local government.
- Identify GIS topics requiring further research and investigate providing financial support for student research assistantships at the universities to conduct this research. Depending upon the topic, AGIC could either sponsor such research efforts or encourage agencies to work directly with the universities.*
- Offer reduced rates for students interested in attending any AGIC conferences and workshops.
- Explore the feasibility of offering other AGIC-sponsored programs to encourage and recognize excellence in students. Examples could include recognition awards for student papers or projects or financial, book, or scholarship awards.

Expected Benefits:

Students interested in pursuing careers in GIS would have access to more entry-level positions and would have an opportunity to gain the necessary experience to meet Arizona's future demands for highly skilled GIS professionals.

Objective:

To develop new "special topic" workshops and other GIS-related training materials.

Strategies:

- Explore opportunities to conduct GIS workshops at major conferences in the state, such as those hosted by the League of Arizona Cities and Towns, the Association of Counties, the County Supervisors Association, and the Rural Economic Development Conference.
- Develop a series of special GIS courses to assist managers and other technical staff in designing and implementing a successful GIS.

EDUCATION OBJECTIVES AND STRATEGIES

- Explore the possibility of conducting training sessions with the regional GIS consortia.
- Identify and compile currently available materials such as publications and videos that could serve as helpful reference materials. Make them available to interested groups.
- Establish GIS reference centers, where collections of GIS-related periodicals, books, and conference proceedings can be organized and made available to people who are interested in doing research on GIS issues. Three such centers (one in Phoenix, perhaps at ALRIS, and one each in Tucson and Flagstaff) would benefit people throughout the state.
- Organize a speakers bureau, composed of individuals who possess a range of expertise in GIS and related topics and who would be available to talk with interested groups.*

Expected Benefits:

Many agencies are proposing development of GIS for their organizations in the next few years. Manager-oriented training sessions will greatly assist these organizations in system planning and implementation. This will help them to avoid pitfalls and to develop successful programs. These outreach workshops will also increase awareness of the value of GIS to decision makers.

VI. ACTION PLAN

ACTION PLAN

As an aid to implementation of the high-priority strategies identified in the previous sections, the subcommittees developed more detailed first-year action plans for each of the five issues. These action plans clarify when tasks need to be completed, who will be responsible, and what resources will be necessary to accomplish the recommended actions.

The action plan for each of the five issues is included in this chapter.

Arizona Geographic Information Council

DATA RESOURCES 1992-1993 ACTION PLAN

GENERAL GOAL: To efficiently develop and effectively manage the geographic information resources of Arizona.

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
To identify the requirements and priorities for geographic data in the state.	Utilize survey methods to determine the requirements of all levels of government, utilities, and the private sector for geo-based data.	Completed	Data Resources Committee	
	Analyze and compile the results of the data survey and document the priority rankings and accuracy requirements by jurisdiction for all major geographic data themes.	Completed	Data Resources Committee	
To plan and initiate the development and maintenance of statewide geographic data resources that have multiple-purpose value and can be used by all levels of government, utilities, and the private sector.	Establish formal interagency task forces to finalize organization approach and to prepare cooperative data base development and maintenance plans for each of the following data coverages: <ul style="list-style-type: none"> - Geodetic control/land disposition - Land ownership/parcels - Transportation - Water resources - Administrative boundaries 	10/1/92-11/31/92	Data Resources Committee	
	Implement data base development plans: <ol style="list-style-type: none"> a. Prepare logical data base designs. b. Develop physical data base designs. c. Identify source materials. 	12/1/92-1/31/93 2/1/93-4/30/93 2/1/93-2/28/93	Data Task Forces " "	

DATA RESOURCES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	<ul style="list-style-type: none"> d. Develop data conversion specifications and procedures. e. Define data development project organizations (personnel and/or other). f. Document hardware/software resources. g. Develop data maintenance procedures. h. Prepare a summary report. i. Present the plan to the AGIC Board. j. Conduct a pilot project. k. Revise and modify plans as needed. l. Develop a detailed work plan/schedule. m. Implement the data development plan. 	<ul style="list-style-type: none"> 5/1/93-7/31/93 5/1/93-7/31/93 7/1/93-7/31/93 6/1/93-7/31/93 8/1/93-8/31/93 9/1/93-9/15/93 10/1/93-12/31/93 10/1/93-12/31/93 1/1/94-1/31/94 2/1/94 	<ul style="list-style-type: none"> " " " " " " " " " 	To be determined
To establish data standards that will enable cooperative GIS projects and data exchange.	Review existing federal data standards and evaluate their applicability for Arizona.	3/93	Data Resources Committee, Technology Committee	
	Develop data standards for the top five priority data coverages/themes.	4/1/93-5/31/93	Data Task Forces	
	Present the standards to the AGIC Board.	9/1/93-9/15/93	Data Task Forces	
	Publish the standards.	11/1/93-11/30/93	Data Task Forces	

DATA RESOURCES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Designate the State Cartographer to maintain a State GIS data dictionary.	11/93	State Land Dept.	Funding to implement the State Cartographer's office
	Review and summarize data exchange-related information from the AGIC survey.	To be determined	Data Resources Committee, Technology Committee	
To improve information about existing data resources and geographic information systems in Arizona.	Compile, organize, and publish the results of the 1992 statewide data survey.	11/1/92-12/31/92	ALRIS	Est. \$2,000
	Designate the State Cartographer as the administrative authority for managing a long-term program for collecting, updating, and disseminating statewide information about GIS data resources.	11/93	State Land Dept.	Funding to implement the State Cartographer's office To identify potential sources of revenue and establish funding mechanisms for cooperative GIS data development and maintenance programs. Estimate the costs of developing/maintaining the top five priority GIS data themes. 8/93-10/93 Data Resources Committee To be determined

DATA RESOURCES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Conduct a cost/benefit analysis for developing/maintaining the top five priority GIS data themes.	10/1/93-11/30/93	Admin. & Legal Committee	
	Identify and evaluate potential funding strategies.	12/1/93-12/30/93	Admin. & Legal Committee	
	Develop recommendations for funding strategies.	1/1/94-1/31/94	Admin. & Legal Committee	
	Present recommendations to the AGIC Board.	2/1/94-2/15/94	Admin. & Legal Committee	
	Implement the funding strategies.	3/1/94-7/31/94	Admin. & Legal Committee	To be determined

Arizona Geographic Information Council

TECHNOLOGY

1992-1993 ACTION PLAN

GENERAL GOAL: To develop efficient and effective methods for the physical exchange of geographic information via hardware, software, and communications.

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
To increase understanding about data exchange options.	Develop a taxonomy of physical data exchange options and report the options in an AGIC Technology Guide.	By 7/93	Technology Committee	\$200
	Create recommendations for physical exchange methods based on exchange needs. Report the recommendations in the Technology Guide.	By 7/93	Technology Committee	None
	Develop a list of DBMS links to GIS systems and report them in the Technology Guide.	By 7/93	Technology Committee	None
To increase understanding of the present and potential future demand for data exchange by Arizona's GIS sites.	Review and summarize data exchange-related information from the AGIC survey. Work with the Data Resources Committee to determine how information should be published. Publish and distribute the information.	Unknown; need to meet with Data Resources Committee	Technology Committee, Data Resources Committee, others?	Unknown
	Develop a follow-on survey to create a matrix of data exchange pathways and needs and the potential for wide-area telecommunications.	By 1/94	Technology Committee	\$100

TECHNOLOGY
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
To establish standards and/or guidelines for GIS technology.	Review existing federal data standards and evaluate their applicability for Arizona.	By 4/93	Technology Committee, Data Resources Committee	
	Review the results from AGIC's survey on software, hardware, and network communications standards. Develop recommendations that would maximize an organization's ability to exchange data.	By 7/93	Technology Committee	None
	Report recommendations to AGIC and the State Cartographer's Office.	By 7/93	Technology Committee	None
	Publish a summary and recommendations in the Technology Guide.	By 7/93	Technology Committee	None
To increase awareness of the relationship between GIS and telecommunications.	Identify other groups or organizations in Arizona that have an interest in the development of Arizona's telecommunications infrastructure.	Ongoing	Technology Committee, AGIC	None
	Contact the identified potential cooperative groups and brief them on potential GIS service needs.	Ongoing	Technology Committee	None
	Determine ways in which AGIC can cooperate with these groups for further development of the necessary physical infrastructure and standards.	Ongoing	Technology Committee, AGIC	None
	Monitor technological advances related to GIS and inform AGIC and other interested groups of important trends. Make recommendations in response to changes, as appropriate.	Ongoing	Technology Committee	None

TECHNOLOGY
1992-1993 ACTION PLAN

Arizona Geographic Information Council

ADMINISTRATIVE AND LEGAL ISSUES

1992-1993 ACTION PLAN

GENERAL GOAL: To establish state-level laws and administrative policies that create an effective structure for developing and managing geographic information resources.

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed	
To strengthen AGIC as an organization.	Revise the composition of AGIC's Executive Management Board.				
	a. Evaluate alternative membership and organizational structures.	10/92	Admin. & Legal Committee		
	b. Explore the feasibility of creating an open at-large membership category.	10/92	"		
	c. Adopt the most appropriate structure.	11/92	AGIC Exec. Mgmt. Board		
	Establish AGIC in statute.				
	a. Define a strategy for securing passage of the bill.	10/92	Admin. & Legal Committee	Technical assistance from Land Dept. Legislative Liaison	
b. Draft legislation.	By 11/92	"			
c. Obtain sponsorship and broad support.	11/92	"			
d. Introduce the legislation.	1/93	"			
e. Monitor the legislative process and testify, as needed, to secure passage of the bill.	Spring 93	" , State Land Dept., AGIC, others			
	f. Obtain Governor's approval of the bill.	By 6/93	Admin. & Legal Committee		

ADMINISTRATIVE AND LEGAL ISSUES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	g. Revise the Executive Order as appropriate.	By 8/93	AGIC Exec. Mgmt. Board, Governor	
	Establish standing committees for: <ul style="list-style-type: none"> a. Administrative and Legal b. Data Resources c. Technology d. Conference/Newsletter e. Education f. Other ad hoc committees and subcommittees 	By 11/92	Committee Chairs, AGIC Chair	
	Revise AGIC bylaws.	6/93 to 8/93	Admin. & Legal Committee	
To redefine and clarify AGIC's role and relationships.	Clarify and strengthen the relationship between AGIC and the regional consortia.	Ongoing	AGIC, Regional Consortia	
	Develop an annual operational plan. <ul style="list-style-type: none"> a. Develop more detailed task breakdowns for actions in the Strategic Plan. 	10/92 to 1/93	AGIC Committees "	
	<ul style="list-style-type: none"> b. Revise timeframes and estimated resources as needed. c. Make work assignments. d. Adopt an annual operational plan. 		" " AGIC Exec. Mgmt. Board	

ADMINISTRATIVE AND LEGAL ISSUES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Develop a first-year budget. <ul style="list-style-type: none"> a. Review and evaluate costs of implementing the actions in the Strategic Plan. b. Identify administrative and staffing costs. c. Identify available revenue sources and recommend increases of member agency contributions as needed. d. Develop and adopt a budget. 	10/92 to 12/92 " " 12/92	Lynn Larson, Peggy O-K " " AGIC Exec. Mgmt. Board	Total AGIC budget resources need to be determined
	Provide regular reports to the AGIC Executive Management Board on the progress of implementing the Strategic Plan.	Ongoing	Committee Chairs	
	Establish additional specific duties for AGIC as described in the Strategic Plan.	10/93 (by adopting plan)	AGIC Exec. Mgmt. Board	
	Review and comment on the proposed work programs of ALRIS and the State Cartographer's Office.	Ongoing	AGIC Executive Mgmt. Board, ALRIS, State Cartog.	
To implement the Office of the State Cartographer in the State Land Department.	Prepare background material to support legislation to fund the State Cartographer's Office in conjunction with legislation for AGIC (see above). <ul style="list-style-type: none"> a. Identify staffing and supply needs. b. Estimate costs and develop an operating budget. c. Identify sources of revenue other than legislative appropriation. 	10/92 to 11/92	Admin. & Legal Committee, State Land Dept.	Cost of State Cartographer's Office to be determined

ADMINISTRATIVE AND LEGAL ISSUES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	d. Add language to the bill for AGIC requesting necessary funding for the Cartographer's Office.			
	Assist the State Land Commissioner in hiring a State Cartographer.			
	a. Secure funding for the State Cartographer's Office.	By 7/93	AGIC Exec. Mgmt. Board	Contingent upon passage of legislation
	b. Develop a job description.	11/92 to 7/93	Admin. & Legal Committee, State Land Dept., Personnel	
	c. Establish an appropriate grade level and salary range.	By 7/93	State Land Dept.	
	d. Advertise the position and screen candidates.	8/93 to 9/93	State Land Dept.	
	e. Recommend a top candidate to the Land Commissioner.	9/93	AGIC Exec. Mgmt. Board	
	f. Hire an individual.	10/93	State Land Dept.	
	g. Hire additional support staff as appropriate.	10/93 to 11/93	State Cartog.	
To clarify the relationships and responsibilities of the State Cartographer's Office.	Establish the specific administrative duties and responsibilities for the State Cartographer as described in the Strategic Plan.	11/92 (by developing job description)	State Land Dept.	
To clarify the relationships and responsibilities of the ALRIS program.	Establish the specific technical support duties and responsibilities for the ALRIS program as stipulated in the Strategic Plan.	10/92 (with plan adoption)	ALRIS	
	Develop an annual project plan and submit it to the AGIC Executive Management Board for review.	1/93	ALRIS	

ADMINISTRATIVE AND LEGAL ISSUES
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Evaluate staffing and resource needs for ALRIS to meet work load requirements. Propose any staff or budget increases as needed.	As needed	ALRIS/ State Land Dept., AGIC Exec. Mgmt. Board	ALRIS resource needs to be determined
To establish criteria for minimizing litigation that might arise from data sharing.	Monitor the status of litigation of Kentucky's public access and pricing statutes, which are modeled after Arizona's. Propose revisions to statutes as appropriate, pending the outcome of the case.	Ongoing	Admin. & Legal Committee	
To establish adequate and stable sources of funding for GIS development.	Further explore the prospect of joint data development through federal grant programs.	Ongoing	Admin. & Legal Committee, Data Resources Committee	Data development resource needs to be determined

Arizona Geographic Information Council

INFORMATION EXCHANGE

1992-1993 ACTION PLAN

GENERAL GOAL: To foster the sharing of information and ideas, and to disseminate information about GIS-related activities throughout the state.

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
To organize a State GIS Conference and workshops.	Appoint a Conference Committee to plan and organize the annual conference and to produce periodic workshops.	Oct 92	AGIC Exec. Mgmt. Board	
	Organize an annual "GIS Fair."	By 5/93	Conference Committee	Expenses to be offset by registration and vendor fees
	Encourage participation from all levels of government, the private sector, and the general public.	Ongoing	Conference Committee	
	Solicit joint sponsorship of the conference with the universities and rotate the conference site.	By 12/92	Conference Committee	
	Enroll people and organizations to present GIS workshops.	Ongoing	Conference Committee	
To develop and disseminate GIS informational materials.	Produce an annual GIS calendar showcasing GIS applications. Widely distribute copies.	By 1/93	ALRIS	\$500 for courtesy copies; additional calendars to be sold at cost

INFORMATION EXCHANGE
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Compile and publish an inventory of contacts and digital spatial data in Arizona. (Refer to the Data Resources Action Plan.)	Underway	ALRIS	\$2,000 for reproduction and postage
To strengthen GIS support services at the State level.	Secure funding necessary to implement the State Cartographer's Office. (Refer to the Administrative and Legal Issues Action Plan.)	By 7/93	Admin. & Legal Committee	see Administrative and Legal Action Plan
To increase public awareness of AGIC's role and responsibilities.	Develop a brochure to describe AGIC's mission and goals.	By 1/93	Volunteer	\$200 for 500 copies
	Prepare an annual report to highlight AGIC's accomplishments.	By 7/93	AGIC Secretary	
	Hold at least one AGIC Executive Management Board meeting in a different part of the state in conjunction with one of the regional GIS consortia.	1-2 times per year	AGIC Chair	
	Expand notification of AGIC meetings. Develop a subscription service for meeting packets.	By 1/93	ALRIS	charge subscription fee to cover costs?
To improve the existing AGIC Newsletter.	Appoint a Newsletter Editor.	By 10/93	AGIC Exec. Mgmt. Board	
	Appoint a three-member Editorial Board.	By 10/93	AGIC Exec. Mgmt. Board	
	Produce the newsletter more frequently and establish cutoff dates for articles.	4 times per year	Editor	

INFORMATION EXCHANGE
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Increase newsletter distribution and ensure that the circulation list remains current.	N/A	ALRIS	
	Explore the feasibility of charging a subscription fee and offering advertising space to cover costs of more frequent newsletter production.	By 1/93, if necessary	AGIC Exec. Mgmt. Board	costs offset by fees
	Include articles on AGIC Executive Management Board and Committee activities.	Ongoing	AGIC Secretary	
	Solicit contributing articles of general interest from the state GIS community.	Ongoing	Editor, Editorial Board	

Arizona Geographic Information Council

EDUCATION

1992-1993 ACTION PLAN

GENERAL GOAL: To ensure that qualified personnel are available to meet the GIS needs of the public and private sectors, and to strengthen GIS-related education programs in Arizona.

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
To identify the needs for professional and technical GIS personnel in Arizona.	Appoint a Human Resources and Education Committee to coordinate program activities.	By 10/92	AGIC Exec. Mgmt. Board	
	Analyze 1992 AGIC survey results to construct a profile of existing and projected GIS personnel needs in Arizona.	By 1/93	Human Resources & Education Committee	
	Collect GIS job descriptions and summarize typical requirements for various positions.	By 4/93	Human Resources & Education Committee	
	Present results of state personnel needs assessment to state universities.	By 7/93	Human Resources & Education Committee	
To improve information about GIS career opportunities.	Encourage adoption of a GIS job classification series and job descriptions for state government, with appropriate salary ranges.	By 1/93	Ariz. Dept. of Administration	
	Provide copies of State GIS job descriptions to other public sector GIS managers and personnel departments.	By 2/93	Human Resources & Education Committee	est. \$25 for reproduction and postage

EDUCATION
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Explore possibilities of establishing an electronic bulletin board to provide information about GIS job opportunities.	By 10/93	Human Resources & Education Committee	computer system, bulletin software, someone to keep notices current, unknown costs
	Conduct salary survey of GIS positions in the state.	By 4/93	Human Resources & Education Committee	
	Identify people who would be willing to serve on personnel selection panels, and inform managers that this service is available upon request.	By 12/93	Human Resources & Education Committee	
To identify existing GIS education resources in Arizona and clarify future training needs.	Compile a listing of all GIS and related courses offered by ALRIS, the universities, community colleges and the private sector.	By 4/93	Human Resources & Education Committee	
	Conduct a survey to identify needs for on-going training statewide.	By 4/93	ALRIS	
	Publish a directory of available training. (This could be done separately or combined into another report.)	By 10/93	Human Resources & Education Committee	
	Encourage agencies that offer on-site training to open up classes to those outside the organization.	Ongoing	Human Resources & Education Committee	
To expand the ALRIS GIS training program.	Identify gaps in GIS training which are not being addressed by the universities and colleges.	By 7/93	ALRIS	instructors, materials,

EDUCATION
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Identify new course offerings that could be taught by ALRIS staff or by contract with the universities or other organizations.	By 7/93	ALRIS	
	Utilize the State Land Department Revolving Fund to increase the number of ALRIS courses offered to public agencies.	As needed	State Land Dept./ ALRIS	costs to be determined
	Publicize the proposed program of ALRIS GIS courses to all public sector agencies in Arizona with a particular focus on local government.	By 10/93	ALRIS	
To develop a strong partnership between the academic and GIS communities in Arizona.	Review results of identified personnel and training needs with the universities.	By 7/93	Human Resources & Education Committee	
	Recommend revisions to the GIS university curricula as necessary in response to statewide needs.	As needed	Human Resources & Education Committee	
	Provide letters and other demonstrations of support for the three universities to ensure continuation of their GIS-related degree programs.	As needed	Human Resources & Education Committee	
	Explore opportunities to augment the GIS education programs at all three universities in cooperation with ALRIS and other organizations, such as sharing facilities.	Ongoing	Human Resources & Education Committee	

EDUCATION
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Identify potential needs for collaborative academic research projects related to GIS, and select one of high priority. Explore using students to assist in research (see below).	By 7/93	Universities, Human Resources & Education Committee	
	Establish a stronger relationship with the community colleges that offer computer aided drafting and GIS courses. Include a representative on the Human Resources and Education Committee.	Ongoing	AGIC, Human Resources & Education Committee	
	In cooperation with the universities, organize an annual state GIS conference. (See the Information Exchange Action Plan.)	By 5/93	Conference Committee, Universities	registration fees to offset expenses
To expand GIS job opportunities for students.	Encourage other public and private GIS installations to utilize student interns (paid internships, if possible).	Ongoing	Human Resources & Education Committee	student intern wages
	Help agencies identify tasks that interns can perform and assist state agencies in securing approval of internship positions, such as through the Governor's Internship program.	By 7/93	Human Resources & Education Committee	student intern wages
	Explore opportunity to fund one university student research assistantship to support research on a GIS topic.	By 7/93	Human Resources & Education Committee, Universities	student research assistant wages
To develop special new topic workshops and other GIS-related training materials.	Organize a speakers bureau of people with a range of expertise on GIS and related topics that would be available to talk with interested groups.	By 12/93	Human Resources & Education Committee	

EDUCATION
1992-1993 ACTION PLAN

Key Objectives	Strategies and Action Steps	Time Frame	Responsible Parties	Resources Needed
	Compile all the information available on GIS careers and education into a publication entitled "Report on GIS Jobs and Training in Arizona" and distribute it statewide.	By 12/93	Human Resources & Education Committee	est. \$300 for reproduction and postage

VII. APPENDICES

AGIC STRATEGIC PLANNING COMMITTEE AND SUBCOMMITTEES

STRATEGIC PLANNING COMMITTEE

CHAIR:	Ben A. Froehlich	ARIZONA DEPT OF ADMINISTRATION
	William C. Bayham	CITY OF PHOENIX
	Thomas C. English	U.S. BUREAU OF INDIAN AFFAIRS
	Diana Barnes Freshwater	THE PLANNING CENTER
	Wayne K. Hood, III	ARIZONA DEPT OF ENVIRONMENTAL QUALITY
	Charles F. Hutchinson	UNIVERSITY OF ARIZONA
	Gary J. Irish	ARIZONA LAND RESOURCE INFO SYSTEM
	Lynn M. Larson	ARIZONA STATE LAND DEPT
	Frank J. Secondo	ARIZONA DEPT OF WATER RESOURCES
	J. R. Swinnerton	U S GEOLOGICAL SURVEY

Data Resources Subcommittee

Chair:	William C. Bayham	CITY OF PHOENIX
	Barbara Cooper	MARICOPA COUNTY
	Alan DeLoera	YAVAPAI COUNTY
	Chris Flaccus/Ward Kinney	CITY OF FLAGSTAFF
	Seth L. Franzman	ARIZONA DEPT OF REVENUE
	Phil Friesen	COCHISE COUNTY
	Gary J. Irish	ARIZONA LAND RESOURCE INFO SYSTEM
	Merle Johnson/Steve Whitney	PIMA COUNTY
	Sally Lanier	ARIZONA GAME AND FISH DEPT
	John Louis	ARIZONA DEPT OF TRANSPORTATION
	Mike Miller	CITY OF PHOENIX
	Howard Stapleton	ARIZONA DEPT OF WATER RESOURCES
	David Totman	ARIZONA DEPT OF ENVIRONMENTAL QUALITY
	David Varela	SALT RIVER PROJECT
	Rita Walton	MARICOPA ASSOCIATION OF GOVERNMENTS

Technology Subcommittee

Chair:	Gary J. Irish	ARIZONA LAND RESOURCE INFO SYSTEM
	Howard Billings	ARIZONA DEPT OF WATER RESOURCES
	Frank Harrison	MARICOPA COUNTY
	Robert MacArthur	UNIVERSITY OF ARIZONA
	Brian Miller	US WEST COMMUNICATIONS
	Mark Mulligan	CITY OF PHOENIX
	Curtis Overall	ARIZONA STATE LAND DEPT
	Jim Price	ARIZONA DEPT OF ADMINISTRATION
	Mike Sicurello	PIMA COUNTY

Administrative and Legal Subcommittee

Chair:	Ben A. Froehlich	ARIZONA DEPT OF ADMINISTRATION
	E. Jim Gardner	MARICOPA COUNTY
	Wayne K. Hood, III	ARIZONA DEPT OF ENVIRONMENTAL QUALITY
	Lynn M. Larson	ARIZONA STATE LAND DEPT

AGIC STRATEGIC PLANNING COMMITTEE AND SUBCOMMITTEES

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Scott Hutchinson
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John Regan
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NORTHERN ARIZONA UNIVERSITY
PIMA COUNTY
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Education Subcommittee

Co-chair: Thomas C. English
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ARIZONA STATE UNIVERSITY
ARIZONA DEPT OF ADMINISTRATION
ARIZONA LAND RESOURCE INFO SYSTEM
NORTHERN ARIZONA UNIVERSITY
SALT RIVER PROJECT

IN ADDITION, Peggy O'Sullivan-Kachel, of the Arizona Department of Administration, served on the Strategic Planning Committee and on each of the subcommittees to provide planning and administrative support.

AGIC STRATEGIC PLANNING COMMITTEE AND SUBCOMMITTEES