



ARIZONA GEOGRAPHIC
INFORMATION COUNCIL

ASLD and GIS in Arizona

The Role of the Arizona State Land Department
in the Development of GIS in Arizona

Updated September 2018

Table of Contents

Executive Summary	1
Introduction	3
Section 1: Brief History of GIS in Arizona State Government	4
ASLD Leadership.....	6
Section 2: The Current GIS Organization in ASLD	8
Arizona Land Resources Information System (ALRIS)	8
Arizona Geographic Information Council (AGIC)	9
State Cartographer's Office (SCO)	9
Arizona State Land Department GIS Section	10
Section 3: Success Stories in Statewide GIS Coordination	11
Acknowledgments.....	16
Note	16
Appendices	17
Appendix A: Key GIS Events in Arizona	18
Appendix B: History and Development of GIS in the Arizona State Government	19
Appendix C: The Role of the Arizona State Land Department in Arizona State GIS Development	31
Appendix D: The Arizona Land Resource Information System (ALRIS)	33
Appendix E – The Arizona Geographic Information Council (AGIC).....	35
Appendix F – The Arizona State Cartographer's Office	43
Appendix G – Status of Arizona GIS in 2018.....	46
Appendix H: History and Development of AGIC	49
Appendix I – History of GIS in Other State Agencies.....	61
Appendix J: National GIS Coordination – FGDC and NSGIC	63

Executive Summary

This report was developed to inform the Land Commissioner and Arizona State Land Department (ASLD) management about the pivotal role ASLD played in the development of Geographic Information Systems (GIS) in the State of Arizona and why GIS, geospatial data sharing, and GIS coordination are still vital to the Department.

ASLD has been a leader in the coordination of the state's GIS, which has not only benefited ASLD, but other state agencies as well. Through ASLD's leadership, sharing data across agencies has been improved from both a legal and technical viewpoint, culminating in the creation of AZGeo, Arizona's geospatial clearinghouse. These efforts have allowed ASLD and other agencies to share, access, and use data from their authoritative sources, saving time and money in data creation and maintenance costs.

The report focuses on the role of ASLD in the development of the:

- Arizona Land Resource Information System (ALRIS)
- Arizona Geographic Information Council (AGIC)
- State Cartographer's Office (SCO)

This report identifies developments, issues, and benefits relating to the establishment of key institutions in Arizona's GIS coordination. It also identifies why it is important for ASLD to continue to champion GIS; so, ASLD and other State agencies benefit from the data, applications, and services derived from a healthy and contributing Arizona GIS community.

ASLD benefits from AGIC and State GIS Coordination in many ways, including:

- Data Sharing: By promoting and facilitating data sharing, ASLD and AGIC provide both legal and technical opportunities and options for agencies, including ASLD, to share data – this data sharing supports ASLD business needs.
- Coordination and Standards: By supporting AGIC and AGIC committees, ASLD provides the leadership needed to develop, gain consensus on, and implement

data guidelines which facilitates the use of standards so that data shared by agencies are authoritative and accessible. This also creates the environment for other agency data to integrate with ASLD data.

- AZGeo: ASLD provides operations and management support for AZGeo the Arizona geospatial clearinghouse. AZGeo is possible because of the coordination, standards, and data sharing guidelines developed by AGIC and supported by ASLD. AZGeo allows ASLD, and other agencies, to share, access, and leverage geospatial data and GIS applications to meet their business and program needs.

By maintaining a leadership role, ASLD has an opportunity to continue to shape the future of GIS development, coordination, and expansion in Arizona. ASLD will also be able to capitalize on the benefits of GIS coordination and data sharing in Arizona.

This report recommends ASLD continue to assure resources are available to:

- Support approved AGIC priorities and activities
- Facilitate interagency geospatial data development
- Promote interagency data sharing
- Sustain AZGeo
- Develop a Statewide GIS Coordination Role to support ASLD, ALRIS and AGIC

Following the report, the Appendices provide a much more detailed history of GIS in Arizona, and the role of ASLD in that history, based on historic documentation found in the ASLD archives. These documents were used extensively to provide a background and historic record to validate the need and development of GIS and statewide coordination. Documents referenced are included in the Bibliography at the end of this report. This report also relied on current information and input from State agency management and staff involved with Arizona GIS coordination.

Introduction

For over 100 years, the Arizona State Land Department (ASLD) has been managing Arizona's Trust land to oversee the Land Trust and to maximize its revenues for the beneficiaries of the Trust. Since the early 1980s, ASLD has not only been a strong user of GIS to better manage the Trust but has also been a leader in the development of GIS for all Arizona government agencies. Working with the Arizona Land Resource Information System (ALRIS) and the Arizona Geographic Information Council (AGIC), two groups dedicated to the support of GIS in Arizona and housed within ASLD, the State Land Department has provided a valuable source of systems, data, and knowledge that is utilized by everyone in the state. While the effects of GIS use in Arizona can be seen everywhere, the history of ALRIS and AGIC are known only to a small number of GIS experts. The purpose of this paper is to present a short history of the groups and to act as a resource for more in-depth information.

Section 1: Brief History of GIS in Arizona State Government

The development of modern Geographic Information Systems (GIS) in Arizona state government began in the late 1970s. At that time the federal government's Landsat satellite program was spurring interest in GIS and remote sensing throughout the country. Federal Technology Transfer programs were beginning to work with states to adapt federally developed GIS software for state agency applications. In Arizona, several state agencies had individually initiated development of geo-processing capabilities. In 1979, Arizona Governor Bruce Babbitt initiated the creation of the Arizona Mapping Advisory Committee (AZMAC) for the purpose of assisting the US Geological Survey (USGS) in setting mapping priorities for Arizona by identifying state issues and priorities.

In July 1980, the Arizona Joint Legislative Budget Committee (JLBC) passed a resolution to determine if Arizona state agencies needed an "Automated Natural Resource Information System" with GIS capabilities. A study team consisting of State members familiar with digital mapping technology was assembled and included members from:

- Arizona Department of Transportation (ADOT)
- Arizona Department of Revenue (ADOR)
- Arizona Department of Water Resources (ADWR)
- Arizona State Land Department (ASLD)

Originally, JLBC concluded that the system should be developed and then housed in the ADOT. However, ASLD met with the other study team members and made the case that ASLD could best support the new GIS system because of State Trust Lands management requirements. Ultimately, with JLBC concurrence, agency officials decided the system should be placed in the State Land Department by expanding and redefining the ASLD Arizona Resource Information System (ARIS) program by adding GIS capabilities.

In 1982, the Arizona Land Resource Information System (ALRIS) was established within ASLD by the Arizona State Legislature ([ARS 37-172](#)) “to provide a

geographic information system for...public agencies in the state...provide training and consultation in the use of the system, related technical services and limited production services to system users” ([ARS-37-173](#)).

Members of AZMAC worked to determine high priority geographic data layers and communicated their findings to ALRIS. While this interaction achieved some success, the committee soon realized a major problem was a lack of attention to and coordination of GIS activities at the higher levels of management in state government. The lack of large statewide databases, the high cost of creating those databases, the high overlap in agency spatial data needs, and the need to integrate the data (spatially) began to push AZMAC towards developing strategies to coordinate GIS technology at higher levels in state government. Between 1987 and 1988, AZMAC began two initiatives designed to increase coordination in the development of the state geographic information base:

- Reform AZMAC into a Geographic Information Council, which would be governed by an executive management board composed of management level staff.
- Develop the State Cartographer’s Office (SCO).

In 1989, the Arizona Geographic Information Council (AGIC) was established by [Executive Order 89-24](#) as Arizona’s primary forum and oversight group for geographic information and geographic information technology issues and coordination efforts. AGIC was tasked with identifying standards, development, and implementation strategies to provide a framework in order to optimize the State’s investment in geographic data and technology. AGIC replaced AZMAC and was directed to **serve as an advisory council to the Arizona State Land Department (ASLD)** to provide guidance and direction in the management of a State Geographic Information System. AGIC was to be composed of an Executive Management Board with members from seven state government agencies (State Land, Water Resources, Environmental Quality, Game and Fish, Transportation, Revenue, Administration) and have technical committees which would advise the board on GIS related issues. Having management level staff from the agencies was necessary so that individual agencies would have the power to implement the GIS initiatives deemed important to GIS in Arizona.

ALRIS was doing an excellent job as a GIS system and database provider and, via AGIC, there were people from different agencies talking about their GIS needs. But in the early 1980s it became apparent that **a dedicated position needed to be available to communicate shared needs between agencies, find the resources available to the larger group, and help all agencies understand the relevance of GIS to their business needs.** To address that need, **the State Cartographer's Office was established within ASLD in state statute ([ARS 37-172](#)) in 1988.** The Land Commissioner was designated as the Arizona state cartographer and given the authority to delegate all related responsibilities to an administrative officer of the division. However, with no funding allocated for the position there were no resources available to do effective work. In 1996, after years of effort supporting GIS advancement in the state, ASLD funded the State Cartographer's Office (SCO) out of their own budget. The SCO was housed under the ASLD Director of Administration in the Resource Analysis Division (RAD) and included the State Cartographer and Assistant State Cartographer positions. In creating and funding these positions, ASLD continued to champion GIS progress in Arizona, to the benefit of all public agencies and citizens.

ASLD Leadership

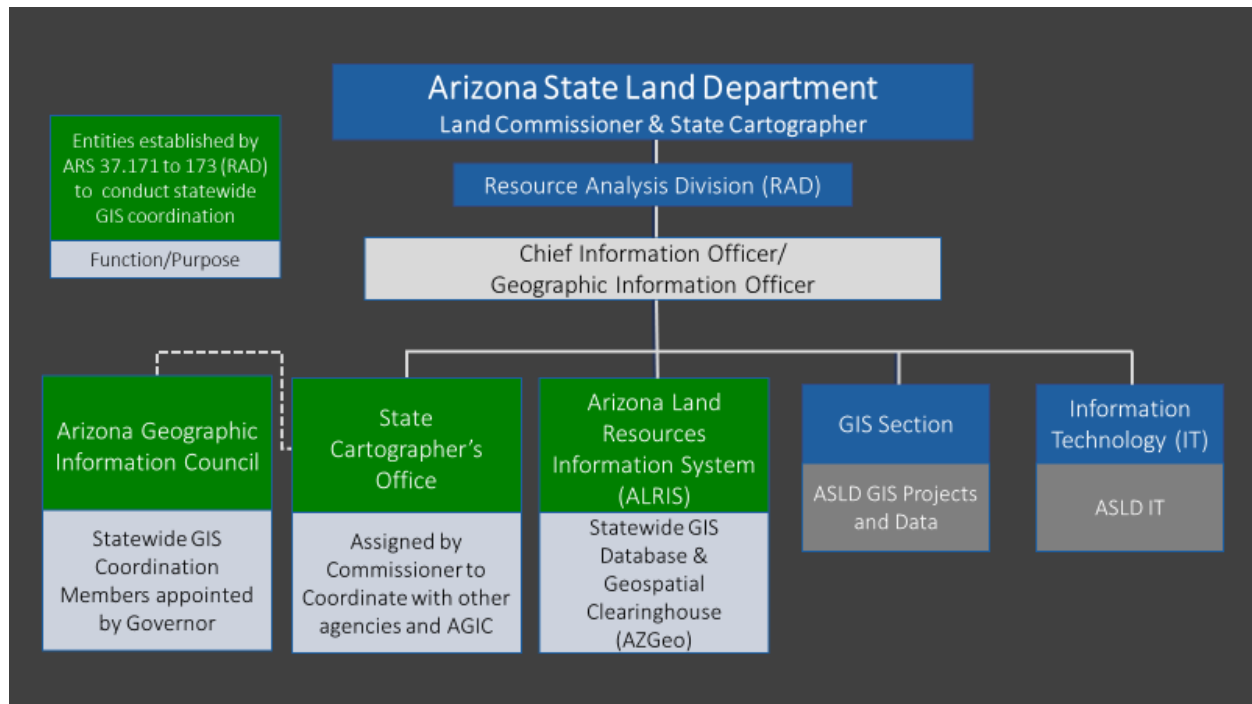
ASLD led in the creation of ALRIS, AGIC, and the SCO to form an institutional core within state GIS so that coordination, standards, and services could be developed. The purpose was that agencies would work together to ensure coordinated and effective development of Arizona's GIS. ASLD understood that there was a high cost to developing geospatial data and systems, but once they were created there would be an enormous benefit in analysis of that data to create useful information, produce maps, and provide products and services to allow data driven decision making. ASLD led the way in the creation of a system which allowed all of Arizona's public agencies to work together to share the investments and reap the rewards.

ASLD led efforts to revise State Land statutes and establish the Resource Analysis Division (RAD). RAD statutory provisions allowed ASLD to establish the following institutions and to realize the benefits of GIS coordination and data sharing:

- ALRIS: ([ARS 37.173.2](#)) to... provide a geographic information system for the state land department and other public agencies in this state...
- AGIC: ([ARS 37.177.A](#)) The Arizona geographic information council is established in the department... ([ARS 177.D.2](#)) Facilitate interagency coordination for the purpose of geospatial data sharing and supporting a geospatial clearinghouse...
- State Cartographer's Office: ([ARS 37.172.F](#)) The office of state cartographer is established within the division. The commissioner is designated the state cartographer, but the commissioner may delegate the responsibilities and functions of the state cartographer under this chapter to an administrative officer of the division.
- State Geospatial Clearinghouse (AZGeo): ([ARS 37.173.1](#)) Establish a clearinghouse of information... for geospatial data and statewide geographic information...

Section 2: The Current GIS Organization in ASLD

The organizational chart and information below provide insights into how the different groups currently relate to and support one another.



Arizona Land Resources Information System (ALRIS)

ALRIS is a group within the Resource Analysis Division of ASLD. ALRIS works with Arizona's state agencies to provide their GIS needs, including the creation of a GIS Data Clearinghouse, something that was required by the Arizona legislature ([ARS-37-173](#)). ALRIS is advised by and works closely with AGIC. ALRIS duties are performed by ASLD staff that also support ASLD GIS business needs. The GIS Data Clearinghouse requirement is now being implemented as AZGeo, accessible to all state and local agencies and, with some limitations, to the general public.

Arizona Geographic Information Council (AGIC)

AGIC identifies standards, development, and implementation strategies to provide a framework in order to optimize the State's investment in geographic data and technology. It works closely with ALRIS to help support the needs of GIS in the state. In 2009 AGIC became a Legislative Council ([SB1318](#)). In order to be efficient and to maximize limited resources, the coordination of GIS programs and activities is essential. The purpose of AGIC is to provide this coordination to avoid the following common problems:

1. Users creating their own standards for data sets resulting in mostly incompatible databases.
2. A lack of coordination creating the potential for duplication of work, data, and mistakes.
3. Federal dollars available for GIS research and data development being divided and used less efficiently among the many users without statewide coordination.

AGIC serves as an advisory council to the Arizona State Land Department to provide guidance and direction in the management of a State Geographic Information System.

State Cartographer's Office (SCO)

The purpose of the SCO is to communicate shared needs between agencies, find the resources available to the larger group and help all agencies understand the relevance of GIS to their business needs. In 2017, as a result of an assessment done by the group MSS (<https://mssbta.com/>), it was determined that the SCO was non-essential to ASLD core business needs and recommended the SCO be dissolved and the responsibilities be absorbed by the GIS Section. Based on this finding, the SCO staff was eliminated, and its duties were delegated to existing ASLD GIS staff.

Arizona State Land Department GIS Section

The ASLD GIS Section is a group within the Resource Analysis Division of ASLD. This section supports the business needs of ASLD which involve GIS. In addition, they now support some of the duties of the SCO and assist ALRIS in conducting its activities.

Section 3: Success Stories in Statewide GIS Coordination

While individual agencies within the state of Arizona have been able to utilize GIS to support their own business needs, ALRIS, AGIC, and the SCO have worked together to build a variety of projects which benefit all state agencies and therefore the citizens of Arizona. Under the guidance of AGIC, the State Cartographer has been able to bring in funding and agency partnerships to implement a variety of statewide GIS projects, including the following:

- AZGeo Development and Governance
 - The AZGeo Clearinghouse is an initiative of the Arizona Geographic Information Council. AZGeo is designed to provide GIS users with links to Internet map services, FGDC compliant metadata, and geospatial data downloads. AZGeo is maintained and hosted by the Arizona State Land Department. Data on AZGeo includes GIS layers for administrative boundaries, demographics, environmental factors, hydrology, imagery, indices, mining, natural features, transportation, and more.
- AGIC Education and Training Symposium
 - The symposium is an annual conference that provides for geospatial information exchange, education, and training.
- Next Generation 9-1-1 (NG911)
 - Develops geospatial data to meet the requirement of establishing a statewide NG911 system.
- Emap/Data Uploader
 - Online address editing tools, hosted in AZGeo, available by state and local agencies to develop authoritative, current, and accurate data for NG911 and other approved applications.

- LiDAR and 3DEP
 - AGIC and AGIC member organizations are able to partner and collaborate with the 3D Elevation Program (3DEP) to help fund and generate new high-resolution LiDAR-based elevation data. AGIC can consider a state plan or process toward eventual completion of LiDAR data statewide. 3DEP data are in the public domain and can be provided to AGIC to house and distribute via AZGeo.

- National Agriculture Imagery Program (NAIP) Imagery
 - AGIC has been involved heavily in the NAIP program since inception in 2007. AGIC has always been considered a “State Partner” to NAIP and has assisted in the coordination by allowing state requirements to be considered for this acquisition to our State data repositories. AGIC’s role as State Partner is to evaluate specifications and buy up options prior to the flight. Post flight, AGIC acquires and inspects the data, then provides the imagery via a portable hard drive to AZGeo where it is made available to users.

- Arizona All Roads Network: An Implementation of USDOT All Roads Network of Online Data (ARNOLD)
 - The Federal Highway Administration (FHWA) requires that each State shall establish a safety data system covering all public roads, including non-State-owned public roads and roads on tribal land in the State, in a geospatial manner, which FHWA calls All Roads Network of Linear Referenced Data (ARNOLD). The geospatial network will enable FHWA's review and acceptance of the certified public roadway mileage information in a timelier manner and with greater accuracy, efficiency, and precision. Beyond the FHWA requirements, Arizona also maintains privately owned and limited access roads in order to support addresses and E911.

- National Address Database (NAD)
 - AGIC facilitates NAD and Arizona Address Database (AZAD) development through the collection, validation, standardization, and integration of local address points. AGIC supports the development and maintenance of a statewide address point database and utilizes these points for E9-1-1 and NG9-1-1 and other approved applications. AGIC hosts AZAD and related applications on AZGeo. AGIC facilitates agreements and funding to operate and maintain AZAD and NAD.

- Census & Local Update of Census Addresses (LUCA)
 - AGIC contributes to Census data collection efforts to validate addresses for LUCA by sharing AZAD data with state and local partners. These efforts supply the Arizona GIS Community with demographic data that aids in economic development and a more accurate census count.

- Arizona Broadband Mapping Project
 - Arizona received National Telecommunications and Information Administration (NTIA) funding to develop Broadband capacity in rural Arizona. The SCO coordinated with the Arizona Department of Administration State 9-1-1 Office and the Arizona Department of Transportation to develop address and road centerline data and database. This information was used to determine the level of broadband services throughout the state and help plan where broadband services needed to be improved. Data from the project has been useful for many other projects requiring good address and roads data. This project was conducted for over five years and ended in 2015.

- Statewide Parcel Data Layer
 - AGIC provides the framework for the coordinated development of a statewide parcel dataset for use in NG911 and available to a select set of partners; ASLD directly benefits as one of the recipients. Data updates and ongoing development are facilitated through the use of AZGeo.

Parcel data can tie into the Arizona Department of Revenue (ADOR) data to assist ASLD in State Trust Land valuations and planning.

- Statewide Address Point Data Layer
 - AGIC provides the framework for the coordinated development of a statewide address point dataset for use in NG911 and other key geospatial projects, such as LUCA and the Secretary of State's Voter Registration Geospatial database. Data updates and ongoing development are facilitated through the use of AZGeo. Address point data can tie into ADOR data to assist ASLD in State Trust Land valuations and planning.

Benefits of State GIS Coordination to ASLD

Through its support of the Arizona Geographic Information Council (AGIC), ASLD has benefited from a statewide coordination of GIS in the following ways:

- **Data Sharing:** By promoting and facilitating data sharing, ASLD and AGIC provide both legal and technical opportunities and options for agencies, including ASLD, to share data – this data sharing supports ASLD business needs.
- **Coordination and Standards:** By supporting AGIC and AGIC committees, ASLD provides the leadership needed to develop, gain consensus on, and implement data guidelines which facilitates the use of standards so that data shared by agencies are authoritative, and accessible. This also creates the environment for other agency data to integrate with ASLD data.
- **AZGeo:** ASLD provides operations and management support for AZGeo the Arizona geospatial clearinghouse. AZGeo is possible because of the coordination, standards and data sharing guidelines developed by AGIC and supported by ASLD. AZGeo allows ASLD, and other agencies, to share, access, and leverage geospatial data and GIS applications to meet their business and program needs.

Key Recommendations to ASLD

By maintaining a leadership role, ASLD has an opportunity to continue to shape the future of GIS development, coordination, and expansion in Arizona. ASLD will also be able to capitalize on the benefits of GIS coordination and data sharing in the state.

ASLD should continue to assure resources are available to:

- **Support approved Arizona Geographic Information Council (AGIC) priorities and activities**
- **Facilitate interagency geospatial data development**
- **Promote interagency data sharing**
- **Sustain AZGeo**
- **Develop a Statewide GIS Coordination Role to support ASLD, AGIC, and the Arizona Land Resource Information System (ALRIS)**

Acknowledgments

This report was coordinated by the Arizona State Land Department, Arizona State University, and the Arizona Geographic Information Council (AGIC), with report development support and funding assistance from the Arizona State Land Department. The following individuals greatly facilitated this report:

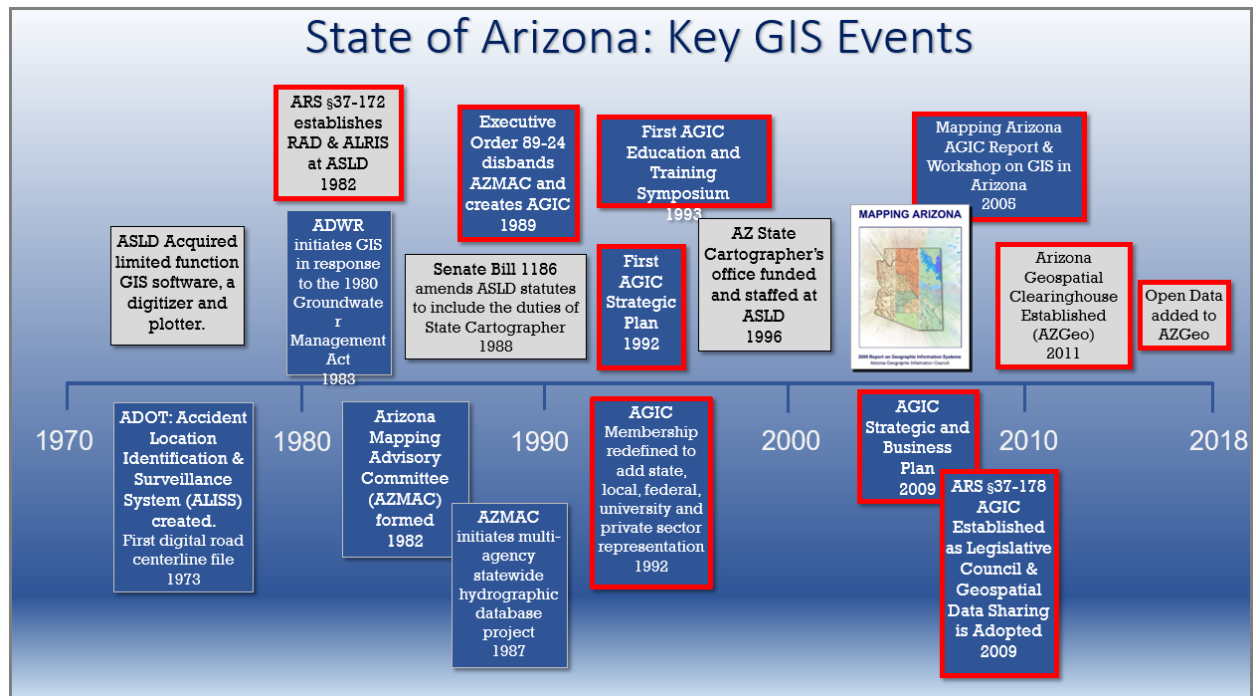
- Gene Trobia, ASU Researcher and Past State Cartographer
- Jenna Straface, Senior GIS Analyst, Arizona State Land Department
- Shea Lemar, Senior Project Manager, Arizona State University
- Ryan Johnson, Chief Information Officer, Arizona State Land Department
- Glen Buettner, Grants and Planning, Arizona Department of Forestry and Fire Management
- Lucas Murray, Senior GIS Analyst, Arizona Department of Economic Security

Note

This report condenses four decades of history into a short report. For more information on GIS in the Arizona government, please refer to the Appendices and Bibliography.

APPENDICES

Appendix A: Key GIS Events in Arizona



Appendix B: History and Development of GIS in the Arizona State Government

Start of GIS in the State

The development of modern Geographic Information Systems (GIS) in Arizona State government began in the late 1970s. At that time the federal government's Landsat satellite program was spurring interest in GIS and remote sensing throughout the country. Federal Technology Transfer programs were beginning to work with states to adapt federally developed remote sensing and raster (cell) based GIS software for state agency applications.

In Arizona, several state agencies had already initiated development of geo-processing capabilities during the 1970s. The Arizona Department of Transportation (ADOT) began to internally develop a system called the Accident Location Identification and Surveillance System (ALISS) in 1970. ALISS, although not a modern interactive GIS with spatial overlay and analysis capabilities was an important development in the history of GIS in Arizona because it represented Arizona's first statewide digital spatial database.

By the late 1970's, the State Land Department (ASLD) had also initiated spatial data processing acquiring some limited function GIS software and peripheral devices such as a digitizer and a plotter.

In 1972 the Arizona Land Use Experiment (ALUE) resulted from a three-part cooperative agreement between the State, the National Aeronautics and Space Administration (NASA) and the U.S Department of Interior (DOI) United States Geological Survey (USGS). NASA agreed to fly the entire state using U-2 aircraft, USGS agreed to construct orthophotoquads from the imagery and the State of Arizona introduced the data to the user community and provided direction for state programs. This U-2 imagery is currently housed in the basement of ASLD. This led to the use of remote sensing data for use by ASLD, and other state agencies, to manage Arizona's land and natural resources.

Focus on Organization: Arizona State Mapping Advisory Committee (AZMAC)

In November 1979, the Arizona Mapping Advisory Committee (AZMAC) was formed in response to a letter sent from Governor Babbitt to J.R. Swinnerton, Chief, Western Mapping Center, U.S. Geological Survey (USGS). The purpose of the committee was to assist the USGS in setting mapping priorities for Arizona to help address state mapping issues and needs.

Although AZMAC's main objectives were to establish traditional paper mapping priorities, a digital mapping subcommittee was formed in 1981. The formation of the subcommittee marked the beginning of organized inter-agency concern for digital geographic data in state government. The subcommittee's first activity was to assemble a listing of digital geographic data available in the state. A questionnaire was the first attempt to systematically survey agencies for information regarding their digital geographic data. The questionnaire also included questions on digital geographic data needs. Additionally, in 1981 AZMAC created a subcommittee to describe the duties of a potential State cartographer and work towards developing the office. In November 1982, AZMAC was given official status as a State Government committee. Executive Order 82-10 signed by Governor Babbitt sanctioned the committee but did not require participation from state agencies.

During the late 1970's and early 1980s, other events were taking place that would help foster the development of GIS within Arizona state government. In 1980, the Arizona Auditor General's Office conducted a performance audit on the Arizona Resource Information System (ARIS) program at the State Land Department. The ARIS program, which had been recently transferred to the State Land Department from the Department of Revenue, functioned as a state geographic information center. The program primarily was involved with map publishing but had collected a considerable amount of computer hardware and some rudimentary software for spatial data handling. The main conclusion of the Auditor General's report was that the ARIS program "lacked adequate planning, had an unclear purpose".

In July 1980, the Arizona Joint Legislature Budget Committee (JLBC) passed a resolution asking for technical assistance to determine if Arizona state agencies needed an "Automated Natural Resource Information System" to supply their programs with natural resources and related data in digital form. JLBC, the National Conference of State Legislatures and the Council of State Planning Agencies formed a study team to perform the evaluation. The members of the team consisted of people familiar with digital mapping technology for government application.

The JLBC study committee addressed three specific areas of the GIS evaluation: user needs, systems and software, and institutional arrangements. The ARIS program was to be examined to help clarify its role. The committee's study concluded that there was ample evidence for the development of a spatial data system based on user needs. The committee report described the basic duties of the system they called the Information Network for Operational Resource Management (INFORM) and provided the state general guidelines on system hardware/software and staffing. The committee also concluded that the system should be housed in an existing department of state government and that the Department of Transportation (ADOT) should be the host agency. Although the study team recommended that the system be placed in ADOT, agency officials from ADOT, ASLD, and the Arizona Department of Water Resources (ADWR) felt that because land and water functions were potentially of greater need, the system should be placed in ASLD by expanding and redefining the ARIS program. JLBC concurred with the agency's recommendation.

It became apparent that GIS technology needed to develop larger spatial databases which could be integrated with each other and with other existing agency databases. In recognition of this need, the Arizona Mapping Advisory Committee (AZMAC) initiated a multi-agency project to develop a statewide hydrographic database, which was perceived to be a critical need for the state. The project, initiated in 1987, represented the first coordinated attempt to cooperatively develop a statewide spatial database.

AZMAC's focus on statewide data development and the initial work on the hydrography project soon forced the committee to realize the major problem of GIS in the state was a

lack of attention and coordination of GIS activities at the higher levels of management in state government. GIS activities have traditionally been conducted and managed by technical personnel or lower level managers. The lack of large statewide databases, the high cost of creating the databases, the high overlap in agency spatial data needs and the need to integrate the data (spatially) began to push AZMAC towards developing strategies to coordinate GIS technology at higher levels in state government.

Between 1987 and 1988, AZMAC began two initiatives designed to increase coordination in the development of the state geographic information base. The initiatives were developed to:

- Reform AZMAC into a Geographic Information Council, which would be governed by an executive management board composed of management level staff
 - This led to the formation of the Arizona Geographic Information Council (AGIC)
- Develop an Office of The State Cartographer
 - This led to the formation of the Arizona State Cartographer's Office (SCO)

It was believed that by completing these initiatives the state would have sufficient mechanisms to achieve a higher level of coordination from which all agencies would eventually benefit. AZMAC had previously done a considerable amount of work on the first initiative but struggled throughout the early 1980s to establish the State Cartographer's Office. In 1982, the state developed a proposal to the U.S. Geological Survey (USGS) to provide office space, computer system time, secretarial services, and other support in exchange for the USGS supplying the cartographer's salary and benefits. By the time the proposal had been reviewed by the USGS. Federal policy required state cost share support for salary. The committee could not find the necessary state support for the office.

Interest in the State Cartographer continued through the mid 1980's. In 1986, AZMAC began to reexamine the issue. In November 1987 AZMAC produced a document entitled "Arizona State Cartographer Position Proposal". The document included justifications for the position, assigned duties, proposed state/federal funding and proposed legislation to

establish the office. AZMAC presented the proposal to the legislature in 1988. The legislation SB 1186 was heard by the Senate Natural Resources and Agriculture Committee in February 1988. The Senate committee passed the bill in a modified form by amending ASLD Statutes to include the duties of the State Cartographer. Funding for the office was not allocated by the Legislature in conjunction with the bill.

History of the Arizona Land Resource Information System (ALRIS)

In 1982, the INFORM system, which was renamed the Arizona Land Resources Information System (ALRIS) assembled a core set of GIS software and hardware to develop the state's first complete GIS system. Software was purchased from Environmental Systems Research Institute (Esri) and consisted of PIOS (Polygon Information and overlay system), GRID mapping system, TOPO system and a digitizing system. NASA's ELAS software, a public domain package for remote sensing and raster GIS processing was also installed along with a LEXIDATA image display device.

ALRIS Early Activities

The ALRIS program began developing GIS applications and digital geographic data for state government. The most significant of these early projects was the initiation of a cooperative project with the State Land Department's Forestry Division and the U.S. Forest Service. The project's goal was to create 3 statewide databases:

- Landlines (township, range, and section lines)
- Land Surface Status (Governmental Owners and Managers such as National Forests, Parks, Military Reservations, BLM Land, State Trust Land, Indian Reservations, etc.)
- Vegetation Database (with emphasis on forested areas)

A staff of temporary contract employees was hired to digitize township, range, and section lines from 7.5' USGS quad sheets, Forest Service maps from the Forest Service and land ownership from Bureau of Land Management (BLM). The vegetation database was produced by classifying Landsat multi-spectral scanner data for the entire state except for the Navajo Reservation and the Yuma County area. The initiation of the "Landlines"

project, at the State Land Department represented the state's first attempt to develop a large statewide database in a GIS environment. The databases initiated in the project were complete several years later in 1986 and are presently in active use.

ALRIS Early Goals

According to an ASLD Program Summary Report (1992) ALRIS goals were to:

- Ensure that state and other public agencies can utilize GIS technology to its fullest extent in carrying out their legislatively mandated functions.
- Increase the efficiency and reduce the costs of using GIS technology in Arizona

ALRIS program goals were achieved by conducting five major types of program activities.

- Database Development and Maintenance
 - Design, develop, and maintain statewide, multi-purpose digital spatial databases for use by as many agencies as possible. The databases will contain land, natural resource, and socioeconomic spatial data. An important design and development criterion is that the spatial databases be structured such that they can be linked to important tabular databases maintained by other public agencies. ALRIS works through the Arizona Geographic Information Council (AGIC) to coordinate the design and development of spatial databases.
- Development and Maintenance of a GIS Hardware and Software Facility
 - Acquire, install, and maintain hardware and software tools to support the development of GIS databases and applications.
- Education Consulting and Information
 - Develop and implement, for public agency employees, educational and technology transfer programs and special seminars regarding the use of GIS technology. Provide consulting and assistance to public agencies in the use of GIS technology for operational, planning, and management activities.
- GIS Software Development

- Design, programming, testing, documentation, and distribution of generic GIS software for general-purpose use by public agencies.
- Digital Geographic Data Clearinghouse
 - Serve as a clearinghouse for digital spatial data for both public and private GIS systems to help reduce total costs for GIS in Arizona. One of the most expensive parts of creating and operating a GIS is the creation and maintenance of digital spatial databases. ALRIS regularly supplies data for GIS systems. Often file format conversions and geographic clipping (cutting out areas of interest) are performed for the agencies receiving the data. Occasionally plot maps and/or tabular information from the digital data are also supplied.

Early Local and Federal Government GIS Development

Since the 1970's, GIS became a powerful tool and the use of this technology in the public and private sectors grew rapidly across the country and in Arizona. A trend of increasing utilization of GIS technology began by the 1980's and now most major Arizona federal, state, county and large municipal governments utilize GIS. Usage in the private sector also expanded significantly. Both public and private organizations discovered the value of GIS to enhance decision-making and improve service delivery.

In the 1980s, Pima County developed a comprehensive GIS and other county agencies quickly followed and developed their GIS capabilities.

Cochise County first used GIS in redistricting in response to the 1990 Census. They found they could easily generate alternative plans for new election precincts using this technology. GIS has also aided the County in assigning street addresses as part of an extensive rural addressing program.

The City of Phoenix initially developed GIS to evaluate new applications for liquor licenses. Computerized vicinity maps were generated showing proposed site locations together with existing liquor establishments, schools, churches, and crime locations. Workload associated with processing these requests was reduced by 50%.

The City of Mesa began using GIS as part of its pavement management program to more efficiently plan and budget for necessary street repairs. The police department used GIS to study crime patterns in the city and to develop appropriate response strategies.

Salt River Project began using GIS and related technologies to plan and manage its extensive electrical facilities network more effectively. They found GIS enabled them to more accurately forecast demands for electrical load growth and to plan for locating future substations.

The Bureau of Land Management tried using GIS to improve resources management practices and allocate limited staff more efficiently. They initially used it 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.

The Bureau of Indian Affairs initially 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.

Arizona Academic Activities

While Arizona universities offered coursework in remote sensing, photogrammetry, computer mapping, and other such related fields in the 1970s, they did not become heavily involved with GIS technology until the 1980's. In 1980, Arizona State University offered its first course with "GIS" in the title. The University of Arizona and Northern Arizona University also initiated formal GIS coursework in the 1980's. At present, all three Universities, and most other colleges and community colleges, offer coursework, certificates and degrees in GIS and other geospatial technology disciplines.

ASLD Expands Departmental Use of GIS

Initially, GIS data was created for use on specific projects. When the project was done, the data was generally discarded. This was not an efficient use of staff time. The benefit is in using spatial data to do analysis, the cost is developing the data in the first place. ASLD developed GIS capabilities internally with the ASLD GIS Section. Over time, it

became evident that as the use of GIS became more complex and mature, the geospatial data required for analysis was not all developed by ASLD. Indeed, most data was developed and managed by federal, state, and local agencies. To better meet the needs of ASLD, GIS data was collected, standardized, documented, and put into a database (ALRIS), so the data could be used for more than one project, "Build once. Use many."

ASLD Resource Analysis Division (RAD)

As ASLD increased its use of GIS to meet departmental business needs, The Information Resources Division (IRD) initially operated ASLD business systems. ALRIS and department business IT systems were integrated into an upgraded hardware platform and organized under a new division called the Resource Analysis Division (RAD).

Directives

Arizona Revised Statutes, Chapter 37-172, 173, Resource Analysis Division, 1982, amended in 1984 and 1988 originally established the Resource Analysis Division in the State Land Department, and in 1988 established the Office of the State Cartographer in the Department. It designated the State Land Commissioner as the State Cartographer, with a provision enabling the office to delegate responsibilities. The legislation also stated that the Resource Analysis Division shall "Establish a Clearinghouse of Information and a Central repository for map and imagery products and digital cartographic data ... [and] Prepare standards and specifications for developing and producing cartographic and aerial photographic products and GIS." The division was also designated to serve as a liaison with the U.S. Geological Survey and other agencies "to coordinate activities in this state relating to collecting, compiling, producing and processing cartographic materials, satellite imagery and land resource information, cartographic database, [and] coordinate the development of a public land survey system monument database."

The State Land Commissioner has many responsibilities including that of the State Cartographer. The Commissioner can fulfill that role or assign the responsibilities of State Cartographer to ASLD staff. Because of the continuing development of GIS and increased complexity of managing data from multiple federal, state, and local agencies, AGIC

identified the need for the State Cartographer's Office. In 1988, State Cartographer's Office was established in state statute:

37-172. Resource analysis division; administrator; employees; compensation; state cartographer

F. The office of state cartographer is established within the division. The commissioner is designated the state cartographer, but the commissioner may delegate the responsibilities and functions of the state cartographer under this chapter to an administrative officer of the division.

Although established in statute, there was no identified funding for the State Cartographer's Office. In 1992, ASLD management created a work group consisting of members of the AGIC Administrative and Legal Committee, as well as ASLD management. The work group developed a list of specific duties for the State Cartographer position. These duties included the following:

- Provide staff for Arizona Geographic Information Council (AGIC) activities; including staff to assist in facilitating all AGIC technical committees.
- In conjunction with AGIC, develop requirements for an annual operational plan.
- Submit the annual plan for review and approval by AGIC.
- Promulgate rules and procedures to support AGIC-approved policies and standards.
- Monitor adherence to established policies and standards for commonly funded projects and projects funded through the State Cartographer's Office.
- Represent the State of Arizona on national and regional committees addressing GIS-related issues.
- Coordinate and facilitate the development of projects of common interest among independent groups.
- Supervise the State Cartographer's Office and its staff.

- Facilitate the development and operation of on-line information databases and other information-related activities of the Office.

In addition, the ASLD Director of Administration working with ADOR Human Resources and the Joint Legislative Budget Committee, determined the State Cartographer position would be classified with the class title: EDP Planning Analyst II. In FY96, the ASLD budget included funding for the State Cartographer, Assistant State Cartographer, and budget for the Office of State Cartographer under the ASLD Director of Administration in the Resource Analysis Division (RAD). The first State Cartographer was hired in December 1996 and an Assistant State Cartographer was hired in 1997 for the State Cartographer's Office at the direction of the State Land Commissioner.

RAD Role in State GIS: ALSD, SCO and AGIC

The State Cartographer's Office conducted many projects. Since funding was not always available through the General Fund, the RAD Revolving Account became a valuable tool to accomplish many projects, develop geospatial data and GIS web sites and applications, conduct training, and help meet the GIS coordination needs of ASLD and the State of Arizona.

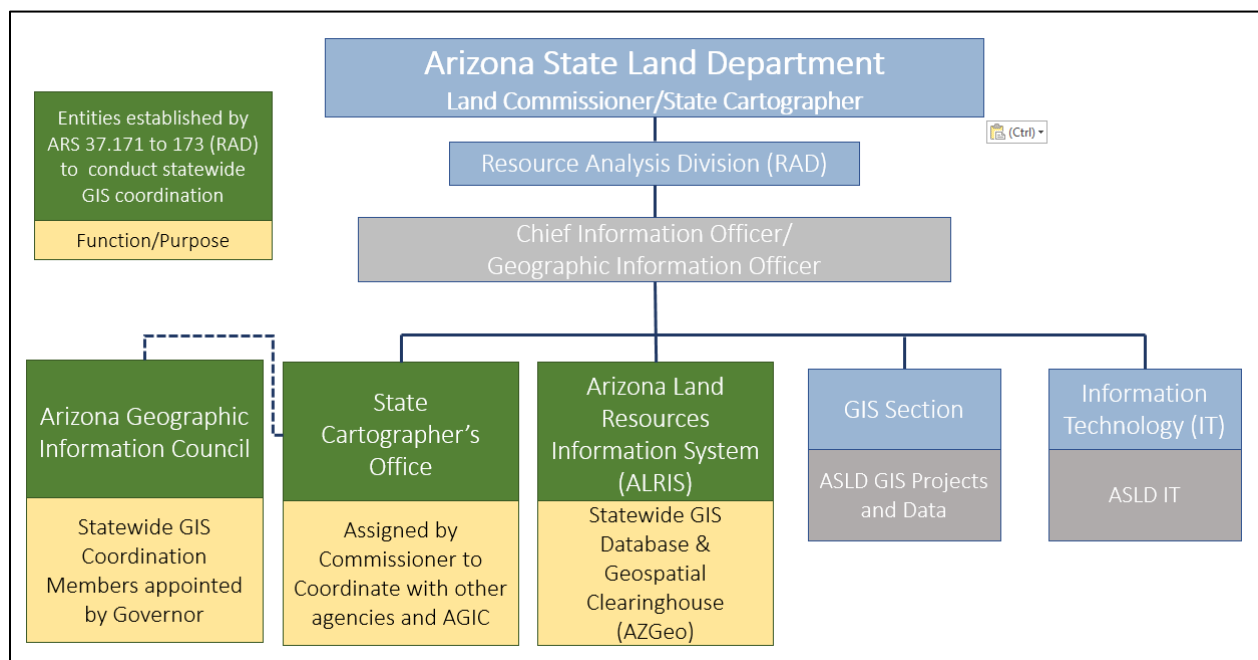
The RAD Revolving account allowed revenues to be deposited in an account so that ASLD could expend revenues on activities authorized in statute. These revenues did not lapse and be required to spend by the end of the fiscal year. This was important because many projects had timeframes that extended well beyond an individual fiscal year. The allowed the SCO to work on projects that had long term timeframes and benefits.

The RAD Revolving Account is established in State Statute 37-176. Revolving fund; source of monies; claims

- A. Monies received by the division pursuant to this article, other than appropriations, shall be promptly deposited, pursuant to sections 35-146 and 35-147, by the administrator in a fund to be known as the resource analysis division revolving fund. Monies in the resource analysis division revolving fund are exempt from section 35-190, relating to the lapsing of appropriations.

- B. Expenses to be paid from the resource analysis division revolving fund shall be limited to data processing supplies and support for the geographic information system, including equipment, software and supplies, contract services, maps, equipment and software maintenance, equipment repair and geographic system training. Claims for expenses shall be approved by the administrator.

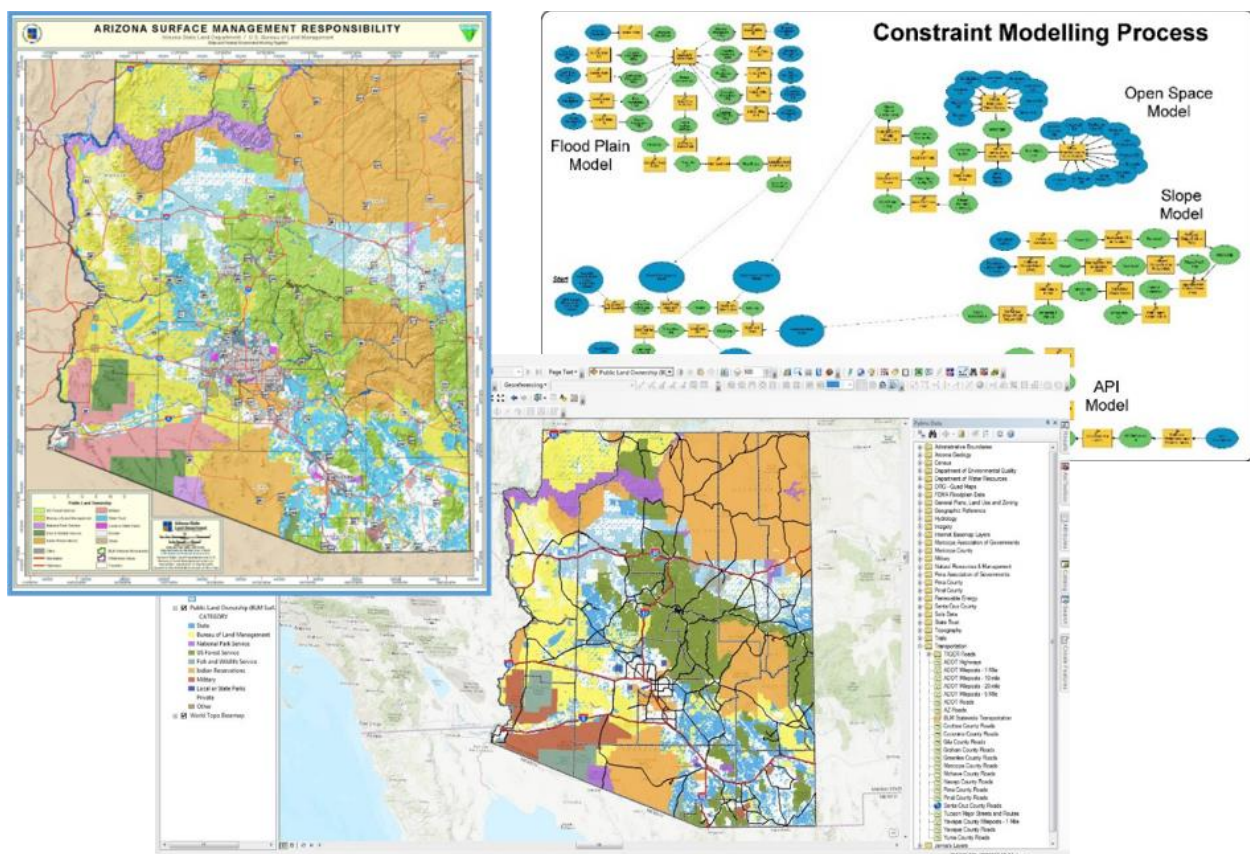
In 2009, Arizona statutes were amended so that recommendations developed by AGIC would be presented to the State Cartographer's Office. The relationships of GIS coordination entities are primarily located within the ASLD organization as follows:



In 2017, as a result of an assessment done by the group MSS (<https://mssbta.com/>) which determined that the SCO's office was non-essential to the core business needs of ASLD and recommended the SCO be dissolved and the responsibilities be absorbed by the GIS. Based on this finding, the SCO staff was eliminated. Duties of the SCO were delegated to existing ASLD GIS staff.

Appendix C: The Role of the Arizona State Land Department in Arizona State GIS Development

The Arizona State Land Department (ASLD) has been a champion of Geographic Information Systems (GIS) development in Arizona. As a major land steward in Arizona, ASLD has long been using GIS to help manage the large amounts of state lands entrusted to ASLD. GIS has been useful to create, manage, and analyze land-related data with the aid of computers. ASLD uses GIS to perform complex modeling of geospatial data as well as analyze and develop management plans for State Trust Lands for a variety of management and development purposes. In addition to being one of the first major GIS users in the state of Arizona, ASLD assisted other State agencies in developing their own GIS programs.



Much of the early focus was on individual departments implementing GIS technology and developing geospatial data in silos, but it soon became evident that more comprehensive

organizational structures were needed to govern GIS and manage geospatial data in Arizona. To better realize the statewide benefits and reduce the overall cost of GIS with the state, ASLD took the lead in and was responsible for creating the:

- Arizona Land Resource Information System (ALRIS)
- Arizona Geographic Information Council (AGIC)
- State Cartographer's Office (SCO)

Appendix D: The Arizona Land Resource Information System (ALRIS)

The Arizona Land Resource Information System (ALRIS) was established by the Arizona State Legislature in 1982 ([ARS 37-172](#)). The goal of ALRIS is to "provide a geographic information system for...public agencies in the state...provide training and consultation in the use of the system, related technical services and limited production services to system users." Since its initiation, the ALRIS program has provided a wide variety of support services for Arizona's Geographic Information Systems (GIS) community.

ALRIS Program Goals and Activities

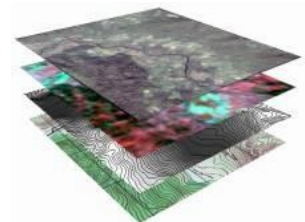
The ALRIS program goals cover five major types of program activities:

- Database Development & Maintenance
- GIS Hardware & Software Support
- Education Consulting & Information
- GIS Software Development
- Digital Geographic Data GIS Clearinghouse

Some of the ALRIS program's activities are conducted in conjunction with the Arizona Geographic Information Council (AGIC), a board appointed by the governor to facilitate the development of geographic information and GIS in Arizona. Other activities are conducted directly in association with various state, federal, local, or tribal agencies in Arizona.

Database Development & Maintenance

ALRIS focuses on design, development, and maintenance of a statewide multi-purpose digital spatial database which is used by a variety of Arizona public agencies. The database contains spatial data for land, natural resources, and socioeconomic data. A key design and development criterion has always been that the spatial databases be structured such that they can be linked to important tabular databases maintained by other public agencies.



GIS Hardware & Software Support

ALRIS acquires, installs, and maintains hardware and software tools which support the development of GIS databases and applications. In addition, they manage a GIS hardware and software facility for use by public agencies. ALRIS was also tasked with providing access to the facility to any public agency in Arizona, particularly for short term projects

Education Consulting and Information

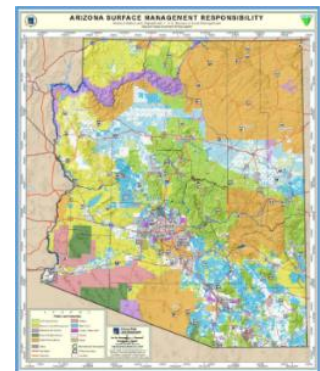
ALRIS develops and implements educational and technology transfer programs and special seminars addressing GIS and remote sensing technology for use by public agency employees. It provides consulting and assistance to public agencies in the use of GIS technology for operational, planning, and management activities.

GIS Software Development

ALRIS designs, programs, tests, documents, and distributes GIS software for general-purpose use by public agencies.

Digital Geographic Data Clearinghouse

One of the most expensive parts of creating and operating a GIS is the creation and maintenance of digital spatial databases. In order to decrease total cost of GIS in Arizona, ALRIS acts as a clearinghouse for digital spatial data. File format conversions are often performed for agencies receiving the data. Occasionally geographic data subsetting is performed, and plot maps and/or tabular information associated with the digital data are supplied.



Appendix E – The Arizona Geographic Information Council (AGIC)

The Arizona Geographic Information Council (AGIC) was established by [Executive Order 89-24](#) as Arizona's primary forum and oversight group for geographic information and geographic information technology issues and coordination efforts. AGIC identifies standards, development, and implementation strategies to provide a framework in order to optimize the State's investment in geographic data and technology. Through cooperation and partnerships, AGIC facilitates the acquisition, exchange and management of geographic information and technology for the State of Arizona to benefit state agencies and the Arizona GIS community. AGIC meets on a regular basis and conducts an Annual GIS Conference to address and coordinate statewide geographic information and technology issues, requirements, and solutions. In 2009, AGIC became a Legislative Council (SB1318). Changes to Arizona Revised Statutes Title 37 modernized the original statutory language. [ARS 37-173](#) emphasized enterprise GIS, [ARS 37-178](#) introduced language to enhance geospatial data sharing, and [ARS 37-177](#) established AGIC in statute.

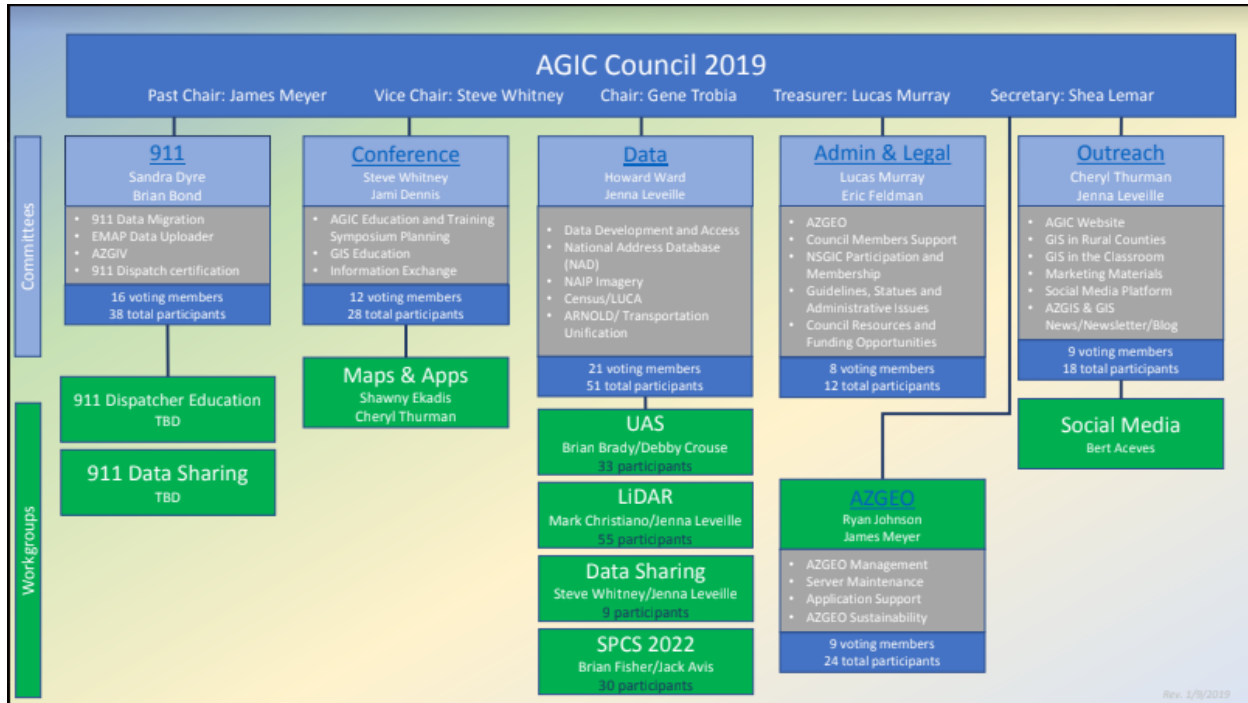
The Need for AGIC

Since the 1970's the use of GIS has grown rapidly across the country. By the end of the current decade all federal, state, county, and large municipal governments are expected to be using GIS. Usage in the private sector is also expanding significantly. However, the siloed development of these systems can create problems:

1. Users create their own standards for data sets resulting in mostly incompatible databases.
2. A lack of coordination creates the potential for duplication of work, data, and mistakes.
3. Federal dollars available for GIS research and data development will be divided and used less efficiently among the many users without statewide coordination.

Thus, in order to increase efficiency and maximize limited resources, the coordination of GIS programs and activities is essential. The purpose of AGIC is to provide this coordination.

The current composition of AGIC Leadership, Committees and work groups are summarized in the following graphic.



AGIC Leadership

- **President:** James Meyer, Arizona Department of Transportation (ADOT)
- **President Elect:** Gene Trobia, Arizona State University (ASU)
- **Past President:** Kevin Blake, Yavapai County
- **Treasurer:** Lucas Murray, Arizona Department of Economic Security (ADES)
- **Secretary:** Shea Lemar, Arizona State University (ASU)

Council work groups

- **Transition:** The Council created this work group to address the loss of SCO staff and potential impacts on the future of AGIC and AGIC activities (now sunset)

- **AZGeo:** The Council created the AZGeo workgroup to plan, document, and pursue recommendations to optimize the long-term viability of the AZGeo GIS Clearinghouse including:
 - Governance/Agreements/Contracts
 - Funding and Resources
 - Technical Opportunities: Servers/Cloud/Software
 - Services

AGIC, Committees, Work Groups and Major Activities:

- **Administration and Legal Committee:** Co-chairs: Lucas Murray, ADES & Gene Trobia, ASU
 - The mission of the Administration and Legal Committee is to support the AGIC Council in matters surrounding its administration and statutory responsibilities. The Administration and Legal Committee works with ASLD and other AGIC committees to further the agenda of the Council as set in statute. The committee accomplishes this by:
 - Tracking Council membership and promoting full participation
 - Tracking and promoting sound Council finances
 - Facilitating interagency coordination in support of Council goals
 - Assisting in the development and review of requirements and standards for a variety of projects
 - Interfacing with other organizations that have an interest in the geospatial community of our state
 - **Workgroups**
 - *Budget and Planning Workgroup:* Determines priorities and resources required to continue AGIC functions without the support of the State Cartographer's Office. (Now sunset)

- **Data Committee:** Co-Chairs: Gene Trobia (ASU) & Jenna Straface, ASLD
 - The mission of the Data Committee is to promote geospatial data sharing and appropriate strategies to support AZGeo; facilitate interagency coordination of geospatial data sharing and support AZGeo to enhance and support state, federal, and local government business systems; incorporate user requirements on matters related to geospatial data, services, standards, applications, and activities to improve data sharing and use.
 - Committee focus areas include:
 - Data Development and Access
 - National Address Database (NAD)
 - NAIP Imagery
 - Census/LUCA
 - ARNOLD/ Transportation Unification
 - **Workgroups**
 - *UAS Workgroup:* The AGIC Unmanned Aerial Systems (UAS) workgroup helps organizations and individuals incorporate or contract for UAS services. It also identifies and develops educational resources.
 - *LiDAR Workgroup:* The AGIC LiDAR workgroup promotes all aspects of LiDAR (Light Detection and Ranging) efforts in the State of Arizona including information exchange to facilitate LiDAR acquisition and collaboration (especially through 3DEP program), distribution of products via AZGeo, education and outreach, and the development of best practices and data standards materials.
 - *Data Sharing Workgroup:* The AGIC Data Sharing workgroup researches best practices for GIS data sharing and publishes guidelines to assist organizations in making their GIS data as widely and freely available as possible.

- **Conference Committee:** Co-Chairs: Jami Dennis, Maricopa Association of Governments & Steve Whitney, Pima County, and the Tucson Area GIS Cooperative
 - The mission of the Conference Committee is to conduct an annual symposium that provides for geospatial information exchange, education, and training.
 - **Workgroups**
 - *Maps & Apps Workgroup:* The Maps and Apps workgroup plans and organizes the mapping contest and application contest at the conference.

- **Outreach Committee:** Co-Chairs: Cheryl Thurman, TerraSystems Southwest & Jenna Straface, ASLD
 - The mission of the Outreach Committee is to facilitate informational exchange between federal, state, tribal, regional, and local governments, the private sector, and professional associations. The committee is also tasked with collecting information on user requirements on matters related to geographic information systems, technologies, products, services, standards, programs, and activities. The goals of the committee include:
 - Increasing AGIC awareness and participation
 - Updating and maintaining the AGIC webpage and social media
 - Updating AGIC outreach materials, such as tri-fold pamphlets and AGIC newsletters.
 - Supporting and participating in important GIS activities within Arizona, such as educational workshops, local user group meetings, and GIS Day events.
 - **Workgroups**
 - *Social Media Workgroup:* The Social Media workgroup focuses on building and maintaining AGIC profiles on various social media platforms, including LinkedIn, Facebook, and Twitter.

- **9-1-1 Committee:** Chair: Sandra Dyre, ADOA
 - Committee focus areas include:
 - NextGen 9-1-1 Data Migration
 - On-going monitoring of evolving NENA NG9-1-1 data standards
 - Adaptation of NENA NG9-1-1 data standards for use in Arizona and communication of these standards to 9-1-1 community
 - Development of various procedures and tools to assist in the transformation from local to Arizona NG9-1-1 standards.
 - Collection, assessment, and update of 9-1-1 related data sets, including address points, road networks and emergency service boundaries
 - EMAP/911 Data Uploader
 - Development, documentation, and training for the Emergency Address Portal (EMAP) web mapping application on AZGeo
 - Development, documentation, and training for the 9-1-1 data uploader application on AZGeo
 - AZGIV
 - 911 Dispatch GIS Certification

Current AGIC Activities

- **AZGeo Development and Governance:** Opportunities to sustain and expand the functionality and benefit of AZGeo
- **AGIC Education and Training Symposium:** Planning of the annual state GIS conference which is the main information exchange of GIS for the Arizona GIS Community
- **Next Generation 9-1-1 (NG911):** Developing geospatial data to meet the requirement of establishing a statewide NG911 system

- **EMAP/Data Uploader:** Online address editing tools to develop current and accurate data for NG911 and other approved applications
- **3DEP (Lidar):** Coordinating state groups and opportunities to develop Lidar elevation data for Arizona
- **NAIP:** Coordination of the GIS Community to participate in the production of statewide 4 band orthoimagery on an ongoing basis
- **UAS:** Developing information to assist GIS professionals to use Unmanned Aircraft Systems (UAS) to develop geospatial data for use in GIS applications
- **Arizona All Roads Network:** Developing a statewide GIS database of all roads in Arizona
- **NAD:** Implementing an Arizona Address Database (AZAD) in coordination with the development of the National Address Database (NAD) in which Arizona is a national leader
- **Census/LUCA:** Coordinate with state and local agencies to develop accurate Census data for use in the decennial Census and other Census purposes
- **Data Sharing Guidelines:** Developing guidelines to facilitate the standardization and sharing of geospatial data in Arizona

Historic AGIC Accomplishments - The following are a list of some AGIC activities and accomplishments:

- State Homeland Security Strategy (SHSS) developed (2003)
- Arizona Map populates The National Map (2005)
- Arizona Geodata Portal developed (2005)
- FEMA grant received; Mapping Arizona document produced (2005)
- NGS Funding (Earmark and Cooperative Agreements): Height Modernization Program: Establish Arizona COORS Network (2006 – 2014)
- Arizona Statewide Orthophotography Program: New 4 Band Ortho Imagery – Updated every 2-3 years (2007 – 2018)
- AZ3D Initiative: Arizona Homeland Security Website (2008)
- SB 1318 signed into law by Governor Brewer (2009)

- FGDC grant received to assist AGIC Strategic and Business Planning (2010)
- AGIC Geospatial Data Sharing Guidelines (2013)
- ADOT assumes management of Arizona Continuously Operating Reference System (CORS) Network (2014)
- AGIC Geospatial Data Sharing Guidelines (Updated 2018)

Appendix F – The Arizona State Cartographer’s Office

The State Cartographer's Office (SCO) was established in State statute in 1988 and was funded by the Arizona State Land Department in 1996. The SCO was created in large part due to the efforts of the Arizona Geographic Information Council (AGIC) in the belief that establishing funding for the SCO was a high priority in order to fulfill the objectives of the AGIC Strategic Plan. AGIC's Strategic Plan identifies and clarifies AGIC as a policy board and the SCO as the state GIS database developer as well as the standards and database coordinator.

The State Cartographer is responsible for developing and managing a long-term program for developing, collecting, updating, and disseminating statewide information about GIS data resources in an Arizona GIS clearinghouse. AGIC has identified as one of the main duties of SCO, the exploration of alternative funding sources for the development and maintenance of GIS data, which includes examining legal issues related to the access, cost recovery, and sharing of that data.

Accomplishments

The State Cartographer’s Office obtained and managed many grants and conducted many projects, many of which were able to be implemented because of the RAD Revolving Account. Use of the RAD Revolving Account was critical to the development of GIS and geospatial data in Arizona because many of the projects took longer than one fiscal year to accomplish. The Revolving Account could be used to pool funding to accomplish GIS requirements established in statute, identified by ASLD management and AGIC to further the effective and efficient use of GIS in Arizona.

The SCO sought grant and other opportunities with federal, state, local and tribal governments, the private sector, and academia to obtain funding, resources, and mandates to accomplish projects. Many of these projects involved implementing systems and applications and creating physical and organizational infrastructure that did not exist at the time. The RAD Revolving Fund, as well as state statutes authorizing the SCO, allowed these projects to occur in a non-traditional state fiscal environment. Without the

support of ASLD management and administration, and AGIC, these projects and systems would never have been implemented.

Examples of grants, agreements and projects conducted, partnered, or managed by the SCO include:

- FGDC Clearinghouse Development Cooperative Agreement
- FGDC State Coordination Cooperative Agreement
- NGS Height Modernization Project
- FGDC AGIC Strategic Plan Cooperative Agreement
- Arizona Imagery Server Project: AZ Statewide Orthophotography – Updated every 2-3 years
- AZ3D: In cooperation with ADOA, AZ Dept of Homeland Security and AcTIC
- FGDC Cooperative Agreement Award
 - Clearinghouse Strategic Plan
 - Clearinghouse Business Plan
- Arizona State Lands Renewable Energy Development Website
- NTIA Arizona Broadband Planning Project
- ADOA Arizona Broadband Mapping ISA
- ADOT Arizona All Roads Network ISA
- ADOA FirstNet Public Safety Broadband Mapping Project (ISA)
- Arizona 9-1-1 Data Development Project (ADOA ISA)
- Arizona Broadband Mapping Project Support
- Arizona FirstNet Project Support
- Arizona Address Editor Tool Development
- ADOT All Roads Network Project: Road Editing Tool Development
- Support to ALRIS and the ASLD GIS Program as needed

Current Status

In 2017, as a result of an assessment done by the group MSS (<https://mssbta.com/>) which determined that the SCO's office was non-essential to the core business needs of ASLD and recommended the SCO be dissolved and the responsibilities be absorbed by the GIS. Based on this finding, the SCO staff was eliminated. Duties of the SCO were delegated to existing ASLD GIS staff.

Appendix G – Status of Arizona GIS in 2018

In 2017 an assessment done by the group MSS (<https://mssbta.com/>) determined that the SCO's office was non-essential to the core business needs of ASLD and recommended the SCO be dissolved and the responsibilities be absorbed by the GIS. Based on this finding, the SCO staff was eliminated. Duties of the SCO were delegated to existing ASLD GIS staff. Through extended communication and coordination with ASLD GIS staff, AGIC board members and ASLD staff have developed transitional plans and methods to deal with the loss of SCO staff in the short term. ASLD leadership provided information and direction that helped mitigate many of the concerns AGIC expressed when informed of the loss of the SCO. However, the AGIC board members feel this is an ongoing issue requiring long-term solutions. AGIC has a very active agenda and there are many issues that the Council are currently dealing with. AGIC is self-directed in many ways, but it resides within ASLD statutory mandates and needs the leadership ASLD provides. AGIC would like to see ASLD maintain and strengthen the institutional core of AGIC, ALRIS, and the SCO so that ASLD and the Arizona GIS Community will continue to realize the benefit of the Arizona Geospatial Clearinghouse (AZGeo) and investments made in GIS throughout Arizona. By maintaining a leadership role, ASLD has an opportunity to shape the future of GIS development in the State of Arizona.

Key issues that are critical to ASLD, AGIC and the Arizona GIS Community:

- The State of Arizona needs organized geospatial coordination such as that historically provided by SCO, AGIC, and ASLD.
- ASLD benefits greatly from robust geospatial coordination in Arizona.
- ASLD is positioned to continue in this important leadership role and has the opportunity to help shape the future of GIS development in the state.

Current Arizona Agency Use of GIS

Virtually every major federal, state, and local Arizona agency has a GIS and most of the available geospatial data is produced by federal, county, and local governments. The

advantage of federal data is the development of national framework (foundational data such as roads, streams, geodetic control, and parcels) data and data standards. The advantage of local data is that it is developed at a higher resolution, tends to be parcel based, and is updated regularly to meet local government business needs. This data is of high value to ASLD and the Arizona GIS community.

According to Esri Arizona sales representatives, the number of Arizona government agencies currently using Esri GIS software includes:

- 24 State Agencies
- 32 Tier 1-3 Counties and Cities
- 110 Tier 4-5 Cities and other municipalities
- 166 Total Arizona government customers

The majority of these government agencies have more than one license. Phoenix, Maricopa County, Peoria, Mesa, Flagstaff, Chandler, Tempe, and Surprise have Enterprise Agreements (EA) which provides access to unlimited deployments of Desktop and Server/Enterprise. The average expenditure on software license maintenance (outside of Maricopa County & Phoenix) is approximately \$57k.

Private Sector GIS Development

Environmental Systems Research Institute (Esri) was a small GIS company when ASLD first purchased its GIS software. ASLD obtained a license for Esri's Polygon Overlay Information System (PIOS) and a cell-based GIS overlay system called GRID. ASLD purchased license number five of Esri software licenses. Since then, Esri went on to develop ArcInfo and is now the largest seller of GIS software in the world. It now has tens of thousands of worldwide GIS licensed users. A large geospatial industry now flourishes both nationally and in Arizona. This includes software companies, data production and applications developers, as well as geospatial technology companies. GIS is also being used in many web applications.

In 2013, a report prepared by Oxera, and commissioned by Google, found that global geospatial services generated \$150-\$270 billion in revenues. By way of comparison, this

was broadly equivalent to the \$140 billion in revenue generated from the global security services industry or about one-third of the global airline industry's revenue of \$494 billion then. According to another report by The Boston Consulting Group, within the US economy alone, the geospatial services industry was estimated to employ more than 500,000 people, generate \$75 billion in annual revenues, and have an overall economic impact estimated at \$1.6 trillion annually in revenues. According to a GeoBuiz 2018 report, the global geospatial market size now stands at nearly \$300 billion and is likely to reach \$440 billion by 2020.

Appendix H: History and Development of AGIC

Increasing Need for State GIS 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, and population data to support their operations. Creating digital GIS data is expensive, and without coordination, there is the 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 of all the spatial data sets that have been identified in Arizona, most are acquired from other organizations. This illustrates the importance of data sharing. To maximize limited resources, coordination of GIS data development efforts is essential. The National States Geographic Information Council (NSGIC) has a saying about the benefit of GIS coordination, "Build once. Use Many."

It became evident to ASLD that as the use of GIS became more complex and mature, the geospatial data required for analysis was not all developed by ASLD. Indeed, most data was developed and managed by federal, state, and local agencies. To maximize the benefit of using GIS to better manage State Lands, ASLD saw the benefit of coordinating the use of GIS and geospatial data between agencies. AGIC became a solution where everyone benefits because it now not only benefitted ASLD, but other agencies that participated in GIS coordination.

Focus on Organization: Institution Building and Governance

Although tremendous progress had been made in utilizing GIS technology in state government, two significant problems began to emerge during the mid and late 1980's. The first problem was the lack of sufficient statewide spatial databases. This problem was perceived as preventing GIS from being used by many agencies, because individual agencies would need to develop data over the entire state (or least large portions of it). It became evident that large databases would be required to transition GIS from the project

phase and into an institutional phase so that GIS could be applied to many applications. The second was the need for a governance structure which would manage standardized geospatial data and seek agreements for to coordinate the use of GIS within ASLD and between State departments. This led to the development of ALRIS, and over time, AGIC and the SCO to coordinate between state, federal, local, and tribal agencies, and the private sector.

AGIC Established as a Governor's Executive Board

In response to the need for greater coordination in interagency data standards and systems development, AZMAC began to consider modifying its institutional structure. In March, 1988 the AZMAC chairperson and several other committee members began working to restructure the organization. It was decided that an effective method of restructuring the committee was to ask the Governor to rescind the 1982 Executive Order establishing AZMAC and to issue a new one which would create an Executive Management Board.

In September of 1988, the AZMAC membership voted to approve the plan and approach the Governor's Office for assistance. The process eventually resulted in the issuance of Executive Order 89- 24 by Governor Mofford in October 1989.

Executive Order 1989-24 disbanded AZMAC and established the Arizona Geographic Information Council (AGIC). The Council's primary purpose was to coordinate the management of statewide geographic information and to "provide guidance and direction in the management of a State Geographic Information System.

The initial language of the order establishing ALRIS and AGIC focused on GIS to replace traditional mapping. The statutory language was project oriented because ASLD wanted to assure that GIS would be used to meet the ongoing mapping and business needs of ASLD. In 1992, AGIC expanded beyond state agencies to include federal, local, and state agencies, as well as the private sector. Over time, AGIC became a true statewide coordination council (Executive Order 1992-17; Governor Symington).

It was for 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. At that time, AGIC's 29-member Executive Management Board was composed of representatives from federal, state, and local governments, as well as regional GIS consortia, the universities, and the private sector. While AGIC began efforts to develop cooperative multi-participant projects, it recognized that, to meet the needs of the state, a comprehensive strategic plan of action would need to be developed.

AGIC 1992 Strategic Plan

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 Tribal 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 incorporated the results of a survey of existing digital spatial data and future needs. A total of 120 organizations responded to the survey.

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.

The first AGIC Strategic Plan was developed in 1992 and focused on five strategic issues:

- Administrative and Legal Recommendations
- Data Resources Recommendations
- Technology Recommendations
- Education Recommendations
- Information Exchange Recommendations

A primary focus of the Strategic Plan 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 Plan recommended many actions to improve existing laws and procedures, none was 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 the office was not appropriated at that time. 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 proposed 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 clarified 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 established operating procedures for AGIC as an organization. In addition, the plan called for actions designed to facilitate data sharing, including resolution of problems associated with data ownership, quality, and security.

AGIC Established as Legislative Council

The need to realize the benefit of obtaining, managing, and using GIS and geospatial data required greater coordination and organization. ASLD identified the need to update the roles and responsibilities of ALRIS, AGIC and the SCO.

Existing statutes were written when GIS was primarily used as an emerging information technology to conduct projects as an alternative to manual mapping. As geospatial technologies advanced and ASLD realized a greater need for data access and sharing, there were issues that needed to be addressed to improve statewide GIS data sharing and realize the benefits of statewide enterprise GIS coordination.

Issues AGIC believed needed to be addressed to improve data sharing included:

- The ability for agencies to share data
- The rights of data custodians
- Improving the ability of agencies to share data without having to charge fees

- Limiting the liability of data custodians
- Restrictions on the requirements to share critical infrastructure data

ASLD directed the State Cartographer and ASLD GIO to work with the State Attorney General's Office and ASLD Legislative Liaison to update state statutes to reflect the need for enterprise GIS in the State of Arizona.

For the Arizona geospatial community, this is a significant piece of legislation. Governor Jan Brewer signed the bill (SB1318) into law on July 10, 2009, effective September 30, 2009. This law establishes AGIC as a legislatively mandated council, and:

- Includes provisions for sharing geospatial data among public agencies. A written agreement among public agencies will not be required.
- Allows a public agency to share geospatial data for which it is the custodian. The public agency also would retain custodial ownership of the data it shares.
- Allows a public agency to prohibit the redistribution of its data by other public agencies if notification of the prohibition is given.
- Permits a public agency to exempt shared geospatial data from fees that would otherwise be prescribed by public records law (A.R.S. § 39-121.03, Subsection A, Paragraph 3).
- Exempts a public agency that shares geospatial data from liability for errors, inaccuracies, or omissions in the data. Furthermore, the public agency will be held harmless from all damage, loss or liability arising from the use of shared data.
- Allows a public agency that receives or shares geospatial data to withhold the data from public disclosure if it is critical infrastructure information. Critical infrastructure is defined in statute as the systems and assets that are so vital to Arizona and the U.S. that destruction of them would have a debilitating effect on security, economic security, public health, or safety.
- Requires that a clearinghouse and a central repository for geospatial data and GIS services be established.

In this effort, led by ASLD, AGIC was legislatively authorized as a state council by Governor Brewer in July 2009. This achieved AGIC's longstanding goal for stability and sanction in the coordination of statewide GIS and geospatial matters. The Council also expanded its membership to 35 members to include more members of the Arizona GIS community. The Mission Statement for AGIC was also updated:

The mission of the AGIC is to coordinate the development and management of geographic information in Arizona. AGIC supports the use of GIS and geospatial technologies to address problems and better manage the natural infrastructure and economic resources of the state.

AGIC 2010 Strategic Plan

The Strategic and Business Planning Process was initiated in 2009 by AGIC to promote how an Arizona Geospatial Clearinghouse could share geospatial data and GIS services in ways that help the state and its constituents' benefit.

Background

The Strategic and Business Planning Process was initiated in 2009 by AGIC to promote innovative thinking and discussion on solutions that meet the geospatial requirements and needs of Arizona. The planning process set out to help define the organizational structure and business model that helps meet those needs, and for this purpose, relied heavily on outreach to the geospatial community in Arizona. It also set out to identify how an Arizona Geospatial Clearinghouse can share geospatial data and GIS services in ways that help the state and its constituents benefit.

Stakeholders from around the state expressed what they thought was important in these matters, and this plan reflects their input. Input was captured through multiple means during the second half of 2009, primarily relying on a series of Workshops held around the state, and an online survey. The planning process was open and transparent, but not rigidly scientific in terms of guaranteeing that all possible perspectives were equally represented. Nonetheless, a broad and diverse spectrum of the GIS stakeholder

community was invited to advocate for their views, and a variety of perspectives were certainly represented.

Planning Impetus:

- February 2009: Federal Geographic Data Committee (FGDC) National Spatial Data Infrastructure (NSDI) Cooperative Agreement Partnership (CAP) Grant Award for Arizona to support GIS Strategic & Business Planning (\$50,000)
- July 2009: Governor Jan Brewer signed Senate Bill 1318 into law on July 10, 2009, effective Sept. 30, which includes:
 - Establishing AGIC in legislation
 - The requirement to establish a clearinghouse of information and a central repository for Geospatial Data and Statewide GIS Services
 - Focus on developing Enterprise GIS (shift away from project focus)
 - Facilitating data sharing

AGIC Strategic Plan Summary

The Arizona Geographic Information Council (AGIC) initiated a planning process to meet the geospatial needs and requirements of Arizona more effectively. AGIC applied for funding assistance through the Federal Geographic Data Committee (FGDC), as part of the Fifty States Initiative to advance the National Spatial Data Infrastructure (NSDI). In February 2009, Arizona was selected as a grant recipient, specifically to support Strategic and Business Planning for Geographic Information Systems (GIS). When Senate Bill 1318 (SB1318) was signed into law by Governor Brewer in July of 2009, it became a key focal point for the AGIC Steering Committee leading the planning process.

There is an active and knowledgeable stakeholder community of GIS professionals across the state, involved in many different aspects of government and the economy. Expertise in the technology is a prerequisite for many jobs that depend on the availability of geospatial data. The productivity-related benefits of GIS are generally recognized in the professional community, and geospatial data is used in many jobs and business processes related to the generation of revenue and the delivery of services, such as taxation, utilities, permitting, public safety and many other daily operations.

Outreach was conducted, and input was collected from the diverse community of geospatial stakeholders throughout the state during 2009, including a series of Regional Workshops held in Flagstaff, Kingman, Phoenix (Peoria), and Tucson. In addition, an online survey was conducted to gather input from GIS users and managers. Based on the input from the workshops and survey, preliminary findings and recommendations were compiled and presented at the Annual AGIC Conference, which was held in Tucson, in November 2009. As a result of these efforts, the following goals were developed:

Strategic and Programmatic Goals

- Strategic Goal #1
 - Facilitate the productive application and sharing of geospatial data and GIS and location- based services to address the needs of Arizonans by establishing a Clearinghouse with statewide accessibility.
 - Programmatic Goals
 - Develop a Business Plan for implementing a Clearinghouse.
 - Collect information on user requirements on matters related to geographic information systems, geospatial data, technologies, products, services, standards, programs, and activities and prioritize those requirements to inform decision-making for the implementation of the Clearinghouse.
 - Get necessary support from stakeholder, decision-makers, and funding agents for GIS and geospatial data.
 - Tie into GITA (now ASET) State IT Plan which mentions GIS as a priority for shared use (i.e. IT Goal)
 - Assess where geospatial data spending is redundant, where a Clearinghouse could satisfy the needs for access to data without duplicate spending.
 - Design and build a Clearinghouse with statewide accessibility and use data from the original source where possible.

- Strategic Goal #2:
 - Achieve greater fiscal responsibility and efficiency through the wise governance of GIS services and geospatial data.
 - Programmatic Goals
 - Conduct a survey of state agencies on the AGIC executive management board on spending for GIS technology and geospatial data.
 - Create a Task Force to assess the role and responsibilities of a Geospatial Information Officer (GIO) for the State of Arizona.
 - Assess the current AGIC Bylaws in light of SB1318 and this Strategic Plan and modify as necessary to be in compliance.
 - Develop stronger relationships and find relevant ways to broaden regional committees to become both engaged and involved in the AGIC organizational structure, to further enhance the representation of cities and counties in statewide geospatial matters.

Full details can be found in the AGIC Strategic Plan and the Strategic Planning Methodology are in Appendix A of the Strategic Plan document.

AGIC 2010 Business Plan

Overview

This Business Plan for the Statewide Geospatial Clearinghouse focused on Strategic Goal #1 of the state's GIS Strategic Plan, to "Facilitate the productive application and sharing of geospatial data and GIS and location-based services to address the needs of Arizonans by establishing a Clearinghouse with statewide accessibility." This is directly consistent with current state statute (ARS 37-173.D.1-3).

The near-term focus was on establishing a state-managed infrastructure, with a central repository and links to the best available data from data originators and stewards where possible.

The success of the Clearinghouse would be determined by its contribution to statewide initiatives and business drivers that require reliable geospatial base map data against which program- specific data can be displayed and analyzed. Noteworthy in this context is the common need for base map data across several key statewide initiatives, including the Arizona Renewable Energy Project, AZ3D (for emergency response and planning), and the Arizona Broadband Mapping Project.

Sharing geospatial data, services, and knowledge via the Clearinghouse would cut down on costly duplication of effort associated with collecting the same data many times by different people and agencies. It also results in productivity improvements through quicker search results and easier access to data and information. Together, less duplication of effort and more productivity would have a positive impact on the statewide economy and the successful performance of statewide initiatives and will contribute to efficiency and fiscal responsibility.

A practical organizational approach was necessary to establish the Clearinghouse. The recommended approach was to leverage the Arizona Geographic Information Council (AGIC) organization and its committee structure. In addition, a sponsoring agency needed to be officially designated with the responsibility for implementing the Clearinghouse.

There are existing examples of websites in Arizona that contain useful collections of geospatial data, including metadata, which could be immediately useful ingredients for the new Clearinghouse. The actual review of existing infrastructure as part of this planning discovery process, including examples described in the body of this document, reinforced the need for a Clearinghouse. The existing websites are not readily discoverable by a broader community of users who want to find data, perform analysis, and create maps. The sites are aimed at GIS professionals, not general users, thereby diminishing their availability to support all of the strategic initiatives underway in the state.

The investment to build the Clearinghouse and its baseline functionality, database structure, and data management workflows could be planned in phases.

This Business Plan provides details to support the implementation of “Strategic Goal #1” from the Arizona GIS Strategic Plan, which was based on a specific requirement of Senate Bill 1318 (SB1318) to establish a Geospatial Clearinghouse (Clearinghouse). The Clearinghouse is also required by the Arizona Renewable Energy Project for all state agencies to share consistent framework and renewable energy data, and to support the state’s Broadband Infrastructure initiative. Active projects, such as the Arizona Renewable Energy Project, AZ3D and the Arizona Broadband Project could be used to assist in the development of the Geospatial Clearinghouse.

Business Plan Goals

1. Establish a Geospatial Clearinghouse

The strategic goal that is addressed by this plan, and its related success factors, are stated in Goal 1 of the AGIC Strategic Plan: “Facilitate the productive application and sharing of geospatial data and GIS and location- based services to address the needs of Arizonans by establishing a Clearinghouse with statewide accessibility.”

2. Clearinghouse Defined

The term “clearinghouse” is widely used in the GIS community. The Federal Geographic Data Committee, in this national context, defines clearinghouse as:

A distributed system of servers located on the Internet which contain field-level descriptions of available digital spatial data and services. The descriptive information, known as metadata, is collected in a standard format to facilitate query and consistent presentation across multiple participating sites. Clearinghouse uses readily available Web technology for the publication and discovery of available geospatial resources.

In the case of Arizona, it was determined the near-term focus would be on establishing a state-managed infrastructure, with a central repository and links to the best available data from data originators and stewards where possible.

Otherwise, there would be a risk that the data synchronization required to keep content data current would not be timely and repeatable. Over time, the

Clearinghouse is envisioned to embrace greater local government participation and utilization.

3. Clearinghouse Context

The plan provided a context for why the goal of establishing a Clearinghouse was important, i.e., to support the set strategic issues and business drivers that benefit from GIS. To define and prioritize this set, input was solicited from the Arizona GIS stakeholder community on commonly recognized issues and drivers across the state. More specifically, stakeholders were asked to identify the statewide issues for which GIS can or is adding value and contributing to fiscal responsibility and efficiency.

A result of the AGIC Strategic Plan and the Business Plan was the development and implementation of the Arizona Geospatial Clearinghouse (AZGeo).

Appendix I – History of GIS in Other State Agencies

Arizona Department of Water Resources

The first part of the 1980's marked the initiation of GIS activities at several state agencies other than ASLD. The 1980 Groundwater Management Act had a significant impact on the development of GIS in Arizona. The act required the Arizona Department of Water Resources (ADWR) to inventory irrigated land and establish water rights over large areas of the state. In June of 1984, through a cooperative agreement with the State Land Department, ADWR began using the ALRIS computer system to initiate the development of a grandfathered water rights spatial database. In the spring of 1985, ADWR installed the ARC/INFO GIS software on a PRIME 550 minicomputer thus creating an independent GIS facility dedicated to water resources applications.

Arizona Game and Fish Department

In the early 1980's, the Arizona Game and Fish Department (AGFD) initiated GIS activities. In 1983-84, the department began digitizing its big game distribution maps utilizing the ALRIS computer system. Additional data on wildlife distributions and other data layers such as vegetation, water catchments and management units were also digitized during this period. In late 1985, the Game and Fish Department created an internal study team to assess GIS and the department's existing and projected use of the technology. The team produced an assessment document which contained the recommendation that the department continued to utilize GIS on the ALRIS system via modem/telephone but that peripheral hardware such as a digitizer and plotter and a PC ARC/INFO system be established within the department.

Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality (ADEQ) began use of GIS technology in 1987, the year the agency was created, to develop surface and groundwater pollution applications.

Arizona Department of Transportation

Throughout the 1980s the Arizona Department of Transportation (ADOT) had been increasing its capabilities for computer processing of spatial data. The agency developed sophisticated photogrammetric and Computer Aided Design (CAD) systems to process spatial data. Some of this data processing was used to maintain the department's ALISS database. In 1988 ADOT began a process of adding GIS to its spatial data processing technologies.

Arizona State Parks Department

The Arizona State Parks Department used GIS for examining land status, access, and hydrography along the Verde River for recreation potential. The department developed a statewide rivers assessment program. A large attribute database was developed and linked to the state hydrography database being sponsored by AGIC.

Arizona Department of Economic Security

The Arizona Department of Economic Security (ADES) initiated using GIS technology for use in state economic and social welfare work. The department developed budget requests for GIS hardware and software and trained several staff members. ADES used ALRIS and other agencies to develop a statewide socioeconomic database from the TIGER files. This database development effort was sponsored by AGIC.

Arizona Department of Revenue

The Arizona Department of Revenue (ADOR) evaluated GIS technology for use in applications such as property tax valuation and equalization and for assistance concerning the operational responsibilities of ADOR and the property tax administration duties of the Arizona county assessor's offices. ADOR implemented a multi-agency GIS, including County Assessors. ADOR also cooperated with ALRIS to maintain an incorporated city boundary database. The data, taken from ADOR source materials, was maintained by ALRIS program, and was made available to agencies in Arizona.

Appendix J: National GIS Coordination – FGDC and NSGIC

Federal Geographic Data Committee (FGDC)

The Federal Geographic Data Committee (FGDC) is singularly important at the federal government level because of its role to coordinate the development of geospatial data and use of GIS for Federal agencies (in many ways like what ASLD has done for the State).

In 1990, the Federal Office of Management and Budget (OMB) revised Circular A-16 to establish the FGDC and expanded the Circular to include more programs. In 1992, the FGDC created an initiative that identified core FGDC functions, established Framework Data, and established Policies and Development of Geospatial Standards. In 1994, Executive Order 12906 established the National Spatial Data Infrastructure (NSDI). This created standards for Framework data (geospatial data used by most users to make maps).

For many states, including Arizona, one of the most important FGDC initiatives was the establishment of the NSDI Cooperative Agreements Program (CAP). This was an annual program to assist the geospatial data community (including Arizona and other states) through funding and other resources in implementing the components of the NSDI. The program was open to State, local and Tribal governments, academia, commercial, and non-profit organizations. The program provided relatively small seed grants to initiate sustainable on-going NSDI implementations and emphasized partnerships, collaboration, and the leveraging of geospatial resources in achieving its goals. Since 1994, the NSDI CAP has supported over 700 projects.

The FGDC endorsed the Geographic Information Framework Data Standard in May 2008. The Geographic Information Framework Data Standard establishes common requirements for data exchange for seven themes of geospatial data identified as framework data themes in OMB Circular A-16, Revised. Framework data themes are critical to the NSDI, as they are fundamental to many different GIS applications. The NSDI Framework data themes are:

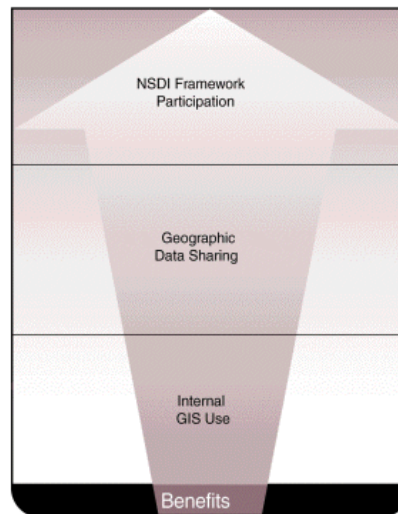
- Cadastral data (parcel data)
- Digital orthoimagery (aerial photography)
- Elevation (terrain surface)
- Geodetic control (accurate location reference points)
- Governmental Unit Boundaries (federal, state, local and tribal ownership)
- Hydrography (bodies of water such as streams, rivers, lakes, etc.)
- Transportation (features which transport between locations such roads, rail, etc.)
- Addresses (addresses and point locations)

In Arizona, CAP funding was used to establish the need for a geospatial Clearinghouse. Initially the Clearinghouse was a federal internet site that hosted links to geospatial data that met NSDI standards. Over time, these funds and the studies supported by them allowed ASLD, through the SCO and AGIC, the ability to coordinate with local agencies to share data, now through Arizona's State Geospatial Clearinghouse, AZGeo.

The SCO and AGIC adopted and approved a model where the best data (most resolute and current) is often developed and managed by local government. The State (Arizona) is in the best position to collect, standardize and share that data. The federal government creates the standards that allow framework data to be shared at all levels and across all boundaries of government.

Arizona has benefitted greatly by adopting the FGDC model. By accepting NSDI framework data standards, the SCO applied for CAP, and other federal grants, to obtain the resources to work with ASLD and AGIC members to develop geospatial data that benefits the ASLD, AGIC members and the Arizona GIS community. Local data is often developed to meet local business requirements of individual departments. Individual local data themes will not match the same data theme developed by another county or municipality. By adopting federal standards, the SCO and AGIC has adopted a target standard to use to transform local data into an integrated statewide standardized database. This allows the data to be used throughout the state, benefiting agencies at all levels of government. For example, individual local agencies use this data for projects that cross jurisdictional boundaries, ASLD has a consistent data model for data that helps

better manage state trust lands and the federal government gains standardized data to use to respond to wildland fires, floods and other events that require national response.



The National States Geographic Information Council (NSGIC)

The National States Geographic Information Council (NSGIC) promotes the efficient development and management of location-based information resources, and advocates for innovative, strategic use of these assets to advance the interests of states, tribes, regions, local governments, and the nation. NSGIC is a state led forum for developing, exchanging and endorsing geospatial technology and policy best practices. We share solutions to offer benefits across the geospatial ecosystem.

NSGIC facilitates connections between people and organizations across multiple sectors -- and the data and systems they use -- resulting in greater returns from the efficient use of geospatial technology.

NSGIC is active in developing and promoting geospatial advocacy initiatives that coordinate activities, knowledge, and policies of collaborative outreach to support informed decision-making.

AGIC is a NSGIC State Council Member and has benefited from participating in NSGIC committees, conferences, meetings, and activities. AGIC, ASLD and the SCO have been active NSGIC participants and used information about federal grants, programs and

project, and best practices to pragmatically implement projects and develop data, applications and services in Arizona.