STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL

A PERFORMANCE AUDIT of THE ARIZONA RESOURCES INFORMATION SYSTEM

MARCH 1980

A REPORT TO THE
ARIZONA STATE LEGISLATURE

REPORT 80-1

DOUGLAS R. NORTON, CPA
AUDITOR GENERAL

OFFICE OF THE
AUDITOR GENERAL

March 28, 1980

The Honorable Bruce Babbitt, Governor
Members of the Arizona Legislature
Mr. Joe T. Fallini, State Land Commissioner

Transmitted herewith is a report of the Auditor General, A Performance Audit of the Arizona Resources Information System. This report is in response to a July 19, 1979, resolution of the Joint Legislative Budget Committee.

A summary of this report is found on the blue pages at the front of the report. A response to this report by the State Land Commissioner is found on the yellow pages preceding the appendices of the report.

My staff and I will be happy to meet with the appropriate legislative committees, individual legislators or other state officials to discuss or clarify any items in the report or to facilitate the implementation of the recommendations.

Respectfully submitted,

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SUMMARY

The Arizona Resources Information System (ARIS) was created through the actions of the Governor in 1971 and initially staff was assigned to the Department of Economic Planning and Development. In early 1972, ARIS was transferred to the Department of Property Valuation which was merged into the newly formed Department of Revenue on July 1, 1974.

Through a joint agreement with the U.S. Geological Survey and the National Aeronautics and Space Administration, the State of Arizona procured high-altitude photographs and orthophotoquads (base maps at a standard scale). ARIS staff supervised the acquisition and sale of these maps and conducted various demonstrations concerning the processing and usage of natural resources data.

In 1978, the Legislature passed Senate Bill 1307 (later codified as Arizona Revised Statutes Sections 37-171 through 176) transferring ARIS to the State Land Department through the creation of the Information Resources Division. The statutory duties for the Division include, among others, providing a data bank for the State Land Department, producing maps and related information for geographic areas and coordinating activities of State governmental agencies and political subdivisions regarding use of satellite imagery.

ARIS and its activities have been funded primarily through the State General Fund. Staffing has ranged from three to five full-time equivalent positions each year.

Our review of the Arizona Resources Information System revealed that the history of ARIS is replete with improper or nonexistent planning and unclear purpose. As a result, as of March 1, 1980, ARIS represented a $1.5 million investment in aerial photographs and maps and a relatively sophisticated computer system which performs only rudimentary record-keeping tasks. (page 12)

Our review also revealed that data processing acquisitions for ARIS are a chronology of apparent unauthorized expenditures and improperly recorded expenses that would represent violations of Arizona statutes and the fiduciary responsibility of State officials. (page 30)

In addition, our review disclosed legislation is needed to clarify the intended purpose of the Information Resources Division. (page 46)

The report contains information regarding the value and usage of orthophotoquads. Definitions of remote sensing and geographic information systems are included. (page 51)

It is recommended that consideration be given the following:

- The Legislature appropriate funds for the 1980-81 fiscal year to allow for a 12 month lease/purchase of the central processing unit requested in the Information Resources Division 1980-81 budget request. Expenditure of such an appropriation should be contingent upon: 1) approval by the Data Processing Division of the Department of Administration of the lease/purchase, and 2) the signing of a formal lease/purchase agreement between the State Land Department and the equipment vendor. (page 28)

- The State Land Department, Department of Administration's Data Processing Division and the National Conference of State Legislatures' resource team should conduct a detailed user-needs study and develop a system plan by September 30, 1980. Additional ARIS data processing equipment acquisitions should be contingent upon the preparation of the user-needs study and its review and acceptance by the appropriate legislative committees. (page 28)

- If it is determined that such an information system is needed, the Legislature should clearly define the scope, goals and users of the system. (page 29)

- Future State Land Department requests for ARIS-related data processing equipment and approval of other expenditures should be based on user-needs surveys and system plans. (page 29)

It is also recommended that:

- The State Land Department throughly review its internal accounting controls over the use of funds and the resulting classification of expenditures. This review should include all sources of funds used by the Land Department and not be limited to State-appropriated funds. (page 44)

- Following this review, the State Land Department institute the necessary changes to prevent future unauthorized and illegal uses of funds. (page 45)

- When questions arise regarding the classification of expenditures, the accounting staff of the State Land Department consult with the accounts and controls section of the Division of Finance to ensure proper classification. (page 45)

- The State Land Department institute a procedure for the periodic review of insurance coverage provided by the Risk Management Division of the Department of Administration and update this coverage on a timely basis. (page 45)

- The Legislature amend Arizona Revised Statutes Section 37-173 if it is determined the development of a computerized data bank should be continued. The statute should expressly state the types of additional information which may be collected, the specific needs of other identified State agencies for which data may be collected, if any, and the financial or other arrangements which would apply to such a liaison. (page 50)

INTRODUCTION AND BACKGROUND

In response to a June 19, 1979, resolution of the Joint Legislative Budget Committee, the Office of the Auditor General has conducted a performance audit, in accordance with Arizona Revised Statutes (A.R.S.) 41-1279, of the Arizona Resources Information System (ARIS) now located within the Information Resources Division (IRD) of the State Land Department (SLD).

ARIS began as a result of two independent actions of the Federal and the Arizona State governments in 1969 and 1970.

In 1969, the National Aeronautics and Space Administration (NASA) funded research projects in Arizona that resulted in the establishment of the Arizona Regional Ecological Testing Site (ARETS) as a joint venture of the University of Arizona and the Department of the Interior, U.S. Geological Survey (USGS). The purpose of the venture was to consolidate research designed to test and evaluate the uses of subspace (U-2 planes) and space (satellite) remote sensors*, the products from these sensors (photographs and images of earth), and their application to the management of environmental and resources problems. The ARETS project photography was scheduled to encompass the southern third of Arizona.

In November 1970, the Arizona Game and Fish Department, in conjunction with the Arizona Outdoor Recreation Coordinating Commission (AORCC), sponsored a seminar for interested State, local and Federal officials concerning the Land Use Information System developed by Cornell University.

After the seminar, the Governor appointed a steering committee to explore the possibilities of developing a land-use inventory for Arizona. The committee issued a report on July 20, 1971, to the Governor's Office stating:

* For a description of remote sensing and geographical or natural resource information systems, see page 56.

> "Arizona is in a unique position to develop a fine land use inventory system from the standpoint of combining high altitude photography, common base maps and to expand a geodetic coordinate system being established along roadways in Arizona by the ALISS* program...
>
> ...after being briefed on NASA photography, many state agencies expressed a need for having state-wide aerial coverage at a scale of 1:120,000. As a result of this interest, usages for this coverage were enumerated and a formal request for state-wide coverage have been forwarded to NASA from the Governor's Office." (Emphasis added)

The committee also recommended that the Governor's Office, rather than any single State agency, be responsible for directing the effort.

In November 1971, a staff director for the Land Use Inventory Project, as ARIS was then called, was assigned to the Governor's Office, Department of Economic Planning and Development, from the Arizona Highway Department. Three staff members for the project were hired using Emergency Employment Act funds.

In a March 1, 1972, news release, the Governor announced the name, goal and first objective of the project.

> The orderly growth and proper development of Arizona, based on the most appropriate uses to which the land and resources can be put, is the goal of a new state organization..."
>
> "First objective of the Arizona Resources Information System, created at the request of Governor Williams, is to compile a state-wide land use inventory.

A Policy Committee was established with 12 members, representing various agencies of State government, who would formulate policy for ARIS and commit resources as needed from their departments. A Working Committee was also organized to attempt to ensure that the system developed would meet the needs of the agencies, be compatible with existing data systems and to call Policy Committee meetings when needed.

* Accident Location Information and Surveillance System (ALISS) is a geographically based information system developed by the Arizona Highway Department.

On March 24, 1972, the Governor transferred ARIS to what was then the Department of Property Valuation when in his estimation the organization and initial details of the program had been established. On May 24, 1972, the Legislature passed House Bill 2736 authorizing the Director of the Department of Property Valuation to acquire NASA orthophoto base maps* for use by all departments of Arizona State government and others in need of such maps. House Bill 2736 also provided $408,700 to the Governor to fund ARIS for the fiscal year beginning July 1, 1972, and to enable the State to purchase orthophoto base maps.

On July 10, 1972, the Governor signed, as the Arizona representative, a three-way agreement among the State of Arizona, USGS and NASA creating the Arizona Land Use Experiment (ALUE). Through this agreement: 1) NASA would photograph the entire State using U-2 planes, 2) USGS would use the photographs to produce orthophotoquads*, and 3) the State of Arizona would train State agency personnel in the use of these maps and acquire equipment to enhance their interpretation.

The estimated completion time for the production of orthophotoquads was originally June 1974. However, the final set of orthophotoquads was not produced until 1975.

ARIS staff planned pilot projects to demonstrate how remote sensing data could be used in conjunction with other data sources. These projects were intended to demonstrate storage, retrieval, analysis and display of land-related information. In January 1974, a computer committee was established to review and evaluate available computer software systems. In October 1974, the committee reported the results of these evaluations and recommended that a specific computer system be used for the pilot project. In January 1976, the committee reported the completion of the pilot project using Santa Cruz County data on public land: boundaries, land ownership, transportation, natural vegetation, water, elevation and land use. The pilot project demonstrated various agency applications and was shown to 52 Federal, State and local government agencies. The committee also recommended that ARIS purchase the software system used in the pilot project. The Legislature, however, did not approve funding for the recommended software system.

* For a description of orthophoto base maps (orthophotoquads) see page 51.

During the 1973 legislative session, Senate Bill 1019 was passed and signed by the Governor, which established the Department of Revenue and transferred the powers and duties of the Department of Property Valuation, including the ARIS program, into the new Department as of July 1, 1974.

It should be noted that during fiscal years 1973-74 and 1974-75, the Director of ARIS also served as Deputy Director of the Environmental Planning Office* and that the ARIS staff provided support to the Environmental Planning Commission* in a number of activities such as the use of maps, meeting with Federal agencies, coordinating and participating at public hearings, and general consolidation and analysis of information.

Major accomplishments of the ARIS program during its first four years, as outlined in an ARIS report dated January 1976, were:

- Development of the Arizona Land and Resource Classification Code,
- Publication of Information Resources: Land and Natural Resource Planning (together with the Office of Economic Planning and Development),
- Providing services to the private sector, and
- Development of a centralized system of photography, maps and space imagery together with specialized viewing equipment.

The Policy Committee, which was established in 1972 but which apparently had not met since July 1974, was reactivated in 1976 at the behest of a legislative appropriation subcommittee to review the ARIS goals and direction. At an August 12, 1976, meeting, the Policy Committee reaffirmed the following ARIS goals as originally developed in 1973:

> "ARIS will coordinate information systems relating to land and be a central bank for:
> a. Land Status Information (ownership)
> b. Land Use Data (use)
> c. Land information such as vegetation, soils, topography, surface and sub-surface resources (characteristics)
> d. Maps, orthophotoquads, photography.

* In 1973 the Arizona Environmental Planning Commission was created and charged with the responsibility of developing a State land-use planning program for Arizona (A.R.S. 37-161 et seq.). The act also created an Office of Environmental Planning in the Office of the Governor with the responsibility of developing a comprehensive and coordinated land-use planning program.

"By providing these products and statistics, ARIS will serve:

a. State operational information needs
b. State research project assistance
c. County and local government assistance
d. The public."

In the 1976, 1977 and 1978 sessions, the Legislature considered statutory recognition, future direction and a State agency location for ARIS, while funding and staff were maintained at a base or reduced level. In May 1978, Senate Bill 1307 (later codified as A.R.S. 37-171 through 176)* passed the Legislature and was signed by the Governor, transferring the ARIS program to the SLD through the creation of the Resources Division, presently called Information Resources Division (IRD). The legislation also establishes statutory duties for IRD (ARIS)** including:

- Provide a computerized information data bank for the SLD,
- Provide current information regarding revenue-producing activities and monitor changes over time by remote sensing techniques,
- Produce maps and inventories at standard scale for any area defined by its designated geographical, governmental or jurisdictional boundaries to include combinations of data elements,
- Provide maps, aerial photographs and other remote sensing techniques related to State trust lands to assist in the valuation process.
- Function as the Arizona affiliate office for the National Cartographic Information Center (NCIC).
- Coordinate those activities of State governmental agencies and State political subdivisions with respect to their utilization of the NASA Earth Resources Satellite Program, Landsat,*** in discharging their responsibilities in the fields of agriculture, wildlife, forestry, land, mineral, water and other resource management.

* Appendix I contains a copy of these statutes.

** See page 9 for an explanation of the nomenclature used when referring to the ARIS program after the creation of IRD.

*** For a description of Landsat and other remote sensing techniques, see page 56.

For purposes of this audit, only those activities originally associated with ARIS were examined. Therefore, the Engineering and Survey Section of the IRD, within the SLD, was not within the scope of this audit. In the interest of consistency and ease of reading, the User Service Section and Technology Application Section services of the IRD are referred to as IRD (ARIS) throughout the report.

ARIS actual expenditures and full-time equivalent employees (FTEs) for fiscal years 1972-73 through 1978-79, and the first seven months of fiscal year 1979-80, are shown in Table 1. These expenditures were financed through the State General Fund.

TABLE 1

SUMMARY OF STATE-FUNDED ARIS ACTUAL EXPENDITURES FROM FISCAL YEAR 1972-73 THROUGH FISCAL YEAR 1978-79 AND THE FIRST SEVEN MONTHS OF FISCAL YEAR 1979-80

	1972-73*	1973-74*	1974-75*	1975-76*	1976-77	1977-78	1978-79	First 7 Months 1979-80**	Total
Number of FTEs	4.0	5.0	5.0	5.0	3.0	4.0	5.0	5.0**	
Personal services	-0-	$ 33,000	$ 44,900	$ 47,409	$ 43,900	$ 45,748	$ 70,258	$39,048	$ 324,263
Employee-related expenditures	-0-	4,100	6,200	7,140	6,400	15,718	14,119	7,871	61,548
Professional outside services	$ 14,800	700	57,400	8,602	20,000	16,069	15,000	1,941	134,512
Travel: In-State	300	700	1,300	400	1,000	1,573	1,994	1,323	8,590
Out-of-State	1,400	1,500	2,400	998	-0-	1,189	966	201	8,654
Other operating expenditures	160,100	238,700	131,200	50,153	66,400	56,747	79,692	49,447	832,439
Capital equipment	9,300	48,200	13,500	-0-	-0-	5,300	46,100	-0-	122,400
Total expenditures	$185,900	$326,900	$256,900	$114,702	$137,700	$142,344	$228,129	$99,831	$1,492,406

* The expenditures do not include the personal services and employee related costs for positions funded through Federal monies (3.0 positions in fiscal year 1972-73) or for the Project Director position on loan from what was then the Arizona Highway Department from November 1971 through July 1976.

** The amounts shown for the first seven months of fiscal year 1979-80 include all claims paid through 1/31/80 except those directly related to three positions (FTEs) transferred from the Land Use and Planning Division of the State Land Department and constituting the Engineering and Survey Section of the IRD.

The Office of the Auditor General expresses its gratitude to present and former employees of the Arizona Resources Information System; the Department of Revenue; the Department of Transportation; the State Land Department; and Mr. Paul Tessar, Director, Natural Resource Information System Project, National Conference of State Legislatures, Denver, Colorado, for their cooperation, assistance and consideration during the course of our audit.

FINDING I

THE HISTORY OF THE ARIZONA RESOURCES INFORMATION SYSTEM (ARIS) IS REPLETE WITH IMPROPER OR NONEXISTENT PLANNING AND UNCLEAR PURPOSE. AS A RESULT, AS OF MARCH 1, 1980, ARIS REPRESENTS A $1.5 MILLION INVESTMENT IN AERIAL PHOTOGRAPHS AND MAPS AND A RELATIVELY SOPHISTICATED COMPUTER SYSTEM WHICH PERFORMS ONLY RUDIMENTARY RECORD-KEEPING TASKS.

From its inception in 1972 until May 1978, many of the stated purposes and goals of the Arizona Resource Information System (ARIS) as expressed by the executive branch of Arizona government never received legislative sanction or approval. In May 1978, the Legislature: 1) transferred ARIS personnel, property, funds and functions to the State Land Department within the newly formed Information Resources Division (IRD), and 2) established as one of the purposes of IRD (ARIS) the development of a computer-oriented resource information system. However, ARIS management (prior to May 1978) and IRD management (since May 1978) have consistently failed to develop necessary information system plans, user-need studies or cost estimates to facilitate the expansion of the IRD (ARIS) function, in spite of repeated advisements and admonishments to do so. As of March 1, 1980, approximately $1.5 million in State funds have been spent on a resource information system that is embryonic as to development, has limited utility and to a large degree provides similar services as other entities in Arizona.

Lack of Legislative Sanction or Approval

Prior to 1978, ARIS was somewhat of an enigma in Arizona State government in that the only statutory description of ARIS was contained in the following 1972 amendment to the duties of the Director of the Department of Property Valuation:

"...acquires National Aeronautics Space Administration orthophoto base maps for use by all departments of state government and others in need of such maps, charge for duplication and sale and deposit in state general fund.

. . . . . .

...sell contact prints of National Aeronautics and Space Administration orthophoto base maps acquired by the Director and deposit such revenues in state general fund." (Emphasis added)

To accomplish the purchase of the orthophoto base maps, the 1972 Legislature appropriated $408,700 as follows:

"The sum of four hundred eight thousand seven hundred dollars is appropriated to the governor to fund the Arizona resources information system for the fiscal year beginning July 1, 1972, and to enable the state to acquire from the national aeronautics and space administration orthophoto base maps of the entire state of Arizona for use by all departments of Arizona state government." (Emphasis added)

The above statements constitute the sum and substance of expressed legislative intent with regard to ARIS from 1972 to May 1978. This expression of legislative intent regarding the purpose of ARIS is far narrower than that expressed by the executive branch as the following statements exemplify:

November 8, 1971

In a memorandum to the Governor an assistant explained that a coordinated, multi-agency land-use inventory system was envisioned:

"...The land use inventory system would develop a coordinated effort among several agencies in the use of one system for their needs. This system will provide a basis for any information used by any State Agencies which can be tied to a parcel of land. This system has a great deal of potential for use by County and City governmental units, and it is being designed with that prospect in mind.

By starting out with the Agencies currently using machines to store information concerning land, we can add information and Agencies in a logical progressive manner, and as it is justified. We will be starting with a manageable organization and a manageable problem, which can be expanded as the need dictate." (Emphasis added)

March 1, 1972

A gubernatorial press release described the proposed ARIS as follows:

> "This information system will be capable of keeping track of any piece of information which can be related to a parcel of land. This would include land ownership, improvements on the land and census track information.
>
> . . . . . .
>
> The system...will be able to keep a record of any size parcel of land, ranging...from 50 square feet to 50,000 acres." (Emphasis added)

March 10, 1972

A letter from the Governor to the Secretary of Interior summarized the long-range goals of ARIS as follows:

> "The system, known as the Arizona Resources Information System, will include such features as high altitude NASA photography, a cartographic quality orthophoto base, thematic overlays, a standard land classification system compatible with the Federal system under development, computerized input and output capability by Public Lands Description or by a geodetic coordinate system and a provision to accept future information which may be obtained via satellite.
>
> The above represent goals in a long-range program..." (Emphasis added)

April 25, 1973

A "Statement on the Functions of the Arizona Resources Information System" prepared by ARIS management expressed the purposes and goals of ARIS as follows:

> "ARIS will be the principal organization for the collection and dissemination of specific types of information concerning some of the physical resources of the State of Arizona....ARIS will coordinate information systems relating to land and be a central bank..."

(For land ownership, and characteristics as well as maps, orthophotoquads and photography).

> "...ARIS will serve..."

(State agencies, research projects, county and local governments and the public).

"1. ARIS will develop a central data bank system...

2. ARIS will serve as a clearinghouse and library for all data falling within its area of responsibility, and will maintain references on location, accessibility, content of data developed and maintained by others...

3. ARIS will develop and recommend the use of a standard land-use classification system, standard geographic location system and standard maps and map scales...

4. ARIS will be the principal coordinator in Arizona with Federal, state, local and private agencies, institutions and organizations developing or using land resource and land use data...

5. ARIS will be a service organization and will maintain equipment for receiving and interpreting photographs, imagery, maps and other visual land-use information sources..." (Emphasis added)

It should be noted that from fiscal year 1973-74 through 1975-76 numerous ARIS management budget requests for staff, equipment and other items related to establishing a computer-information system within ARIS were characterized as being outside of legislative intent in budget analysis prepared for the Legislature by the Joint Legislative Budget Committee staff.

Failure to Develop Necessary Information System Plans, User Need Studies or Cost Estimates

The management of ARIS (prior to May 1978) and IRD (since May 1978) have consistently failed to develop necessary information system plans, user need studies or cost estimates.

The need to adequately plan for ARIS and to conduct user studies was recognized and enumerated even before ARIS was initiated in 1972. However, in the eight years of ARIS existence, these preliminary processes have never been performed as is illustrated in the following synopsis of advisements and admonishments to ARIS management to do so.

July 20, 1971

An assessment of the development of a land-use inventory system for Arizona was prepared upon the request of a Special Assistant to the Governor. In this assessment, elements for system success were identified including the need for system planning.

> "In order to logically develop a land use system for the state, the prime elements to be developed initially are the uses which such an inventory system would fulfill. By first listing the needed output, the source of input information can then be developed to best meet these needs....
>
> From a technical standpoint it appears that aerial photography, maps, geodetic coordinates and data processing can be combined into a functioning system. The major items to consider at this time are: Whether a definite need exists for a land use inventory system, determination of necessary legislative and financial support required, which agencies would input information and which agencies need information from the data bank." (Emphasis added)

The assessment also noted the need to: 1) determine priorities among data requirements, 2) develop agreements and legislation outlining the responsibilities of system participants, and 3) identify the trade off between costs of input data and benefits:

> "If Arizona's needs can be itemized and legislative and financial support developed, a system could be designed in Arizona which would be tailored to the priority needs of the state.
>
> . . . . . .
>
> Such a system would not rely solely on aerial photography but would also contain data developed by field observations and certain recorded data such as zoning, etc. Joint agreement will be required among state agencies on type and quality of data needed.
>
> . . . . . .
>
> Interest in a land use inventory is generally high, however, detailed development of such a system will probably bring out limitations in the availability in personnel and funds to develop a system...Possibly, legislation would be required in the area of responsibility for participating in or operating the system.
>
> . . . . . .

"The cost of a land use inventory system could be high. It must be carefully planned to insure that the cost of input data is realized in benefits (time and or money) without creating too detailed a system requiring high maintenance of information to be current." (Emphasis added)

January 11, 1973

A memorandum to the Governor from an assistant dated January 11, 1973, identified the absence of ARIS planning as a problem:

"There is a problem with long term planning, but I think (the Project Director) will move to correct that in the near future. (The Project Director) will organize the State agency working committee to develop a four or five year plan for this project and then help each agency develop their own functional plans to fit into the overall picture." (Emphasis added)

April 21, 1978

At the request of ARIS management, the Data Processing Division (DPD) of the Department of Administration conducted a brief survey* of ARIS automation needs. On April 21, 1978, the completed survey** was transmitted to the Department of Revenue, in which ARIS was then located. The Department of Administration personnel noted in the survey the potential transfer of ARIS to the State Land Department and attempted to include information for such an eventuality. In its survey, the Data Processing Division identified again the need for ARIS users to be defined and a system plan developed.

The survey noted that, although computer-aided mapping and data manipulation had been proposed repeatedly for ARIS, a fully operational system was never, as of April 1978, developed:

* The Office of the Auditor General conducted a similar survey of State, Federal and local resource agencies to ascertain uses of and need for aerial photographs, maps and a resource data information system. Of the 32 agencies surveyed, 24 stated that they had used at least one of the following ARIS services; maps, Landsat imagery, or other cartographic products.

Further, of the 32 agencies surveyed, nine indicated a desire for a resource data information system, but only seven stated that they currently had the abilities to provide input to such a system. Appendix II is a summary of the survey results.

** Appendix III contains a copy of this survey.

"Budgetary constraints were cited as the primary reason for this failure. As a result, only relatively unsophisticated services could be provided. Among the most important of these has been the collection and dissemination of high altitude aerial photographs and various maps generated for the most part by federal agencies. These have received wide use in the land resource-related activities of the State and will probably continue to be popular in the future."

Conclusions of the survey were:

"1) A demand for automated mapping and related services exists among the users surveyed. (No attempt was made to determine the actual level of services needed to satisfy these users.)

2) ARIS equipment can be upgraded and a complete system provided....

3) New technology, improved prices and growing demand for service argue for an entire new system. Because of the necessity to do a thorough study of requirements, installation of new hardware would be at least a year from favorable decision and budget authorization. The study should consider other alternative sources of support including other State data centers." (Emphasis added)

The survey recommended both interim and long-range action for the development of ARIS, among which was the immediate study of user needs and a plan to meet these needs:

"These recommendations are based on the assumption that those users who presently have need for ARIS-type services will continue to support the program and contribute resources as required.

1. If funds are available, ARIS should proceed now to (a) acquire the necessary hardware to complete their present system and (b) hire a fully qualified programmer-analyst to begin talking to users and translating their requirements into system capabilities....Equipment should be leased for one year if possible...."

(A list of equipment was attached.)

"This would be an interim step to enable users to begin to receive automated output as quickly as possible....

"2. A committee of ARIS staff and users should initiate (now) a detailed study of user needs and objectives and develop a three-year plan for meeting these needs. The plan should make clear commitments to achieve objectives if funding is available. The history of unfulfilled objectives is such that nothing less than this should be offered. DPD will assist with the planning if requested.

3. As soon as requirements are defined in #2 above and specification can be drafted, obtain bids for and order a new hardware system tailored to the needs of the users unless service is to be obtained from another source....

4. After #2 is complete, begin detailed design of a geographical data base to meet users' needs. This process will require the active participation of all users...

5. After plan is complete, a committee of users and ARIS staff (and this office, if requested) should establish a formula for charging for the use of ARIS services." (Emphasis added)

October 1979

On October 9, 1979,* the IRD (ARIS) Director sent a letter to the State Automation Director** requesting review and approval of six pieces of computer hardware at a purchase price of $48,600. This letter cited the April 1978 survey as identifying and approving the equipment purchases.

> "I believe these replacement items are identified in the original system approval project report provided by you and your staff last year."***

In a reply dated October 17, 1979,**** the State Automation Director noted the report did not approve equipment and had assumed system expansion would be cost-justified and based on users of the system other than the Land Department.

* Appendix IV contains a copy of this letter.

** The Department of Administration Assistant Director for Data Processing is the State Automation Director.

*** A review of the April 1978 survey report reveals that these pieces of equipment are not included in the list for replacement or addition.

**** Appendix V contains a copy of this reply.

"The original system approval project report referred to in the next to the last paragraph of your letter is in actuality a report on a survey of requirements of the Arizona Resources Information System which was prepared by DPD and issued April 21, 1978. The report contained recommendations but no approvals. The recommendations were based upon the system being used by agencies other than just the Land Department, and it was expected that expansion of the system beyond acquiring the necessary hardware to complete the present system (Recommendation 1-a) would be based upon cost justifying the need for expansion.

We have not seen any evidence that the value or benefits derived from or expected to be derived from the system have been identified and quantified...." (Emphasis added)

State Land Department Attempt to Document the Need for Data Processing Equipment Purchases

On February 7, 1980, the State Land Department sent an EDP Acquisition Report to the Data Processing Division in an attempt to meet the Division's requirement that the need for data processing equipment acquisitions be documented. This 30-page narrative report prepared by the Land Department consisted of former transmittals to the Data Processing Division, unacknowledged direct quotes from national publications and generalized statements regarding the need for certain natural resources information as is detailed below:

7 pages	direct unacknowledged quotes from a national publication
10 pages	prior transmittals to Data Processing Division
11 pages	generalized statements of need for information
2 pages	State Land Department goals and objectives
30 pages	

An example of a generalized statement of need for water information as stated in the Implementation Plan portion of the report, is:

> "Water Supply - Surface water demands from users exceed the present supply potential particularly in Arizona. In Arizona, water demands are approximately 8 million acre-feet and the present renewable supply is about 5 to 6 million acre-feet. The water deficit is being satisfied through ground water depletion. When surface water supplies are abundant during wet years, storage facilities cannot retain all the production for use in dry years.
>
> Water Availability - Because demand for water exceeds the supply, rights to existing water are over-appropriated in many areas. Management practices require the use and consumption of water that may not be available."

It should be noted that the report did not identify amount of data, specific descriptions of data needed, data presently available, source of future data, time frames for implementation or specific dollar costs and returns for accumulation of the data.

The report prepared by the Land Department is particularly deficient when compared to user needs studies for natural resource information systems prepared in Illinois, Washington and Colorado. Studies prepared in these states typically considered the following:

1. data collected and/or needed,
2. local and state uses of data,
3. private sector uses,
4. data collection procedures,
5. coverage needed,
6. frequency updates needed
7. scale needed,
8. statistical reports or other products,
9. storage at the agency, and
10. personnel and funds devoted to data accumulation.

Compared to these studies, the ARIS report to the Data Processing Division represents only generalized statements of need without sufficient documentation.

ARIS is Embryonic in Development, Has Limited Utility and Provides Similar Services as Other Entities in Arizona

Since fiscal year 1972-73, approximately $1.5 million in State funds have been dedicated to the creation and development of ARIS. The status of the ARIS system as of March 1, 1980, is:

1. A depository and/or index to orthophotoquads, aerial photographs and maps of Arizona and the United States primarily produced by the Federal government and other State agencies,
2. Sale of these maps and photographs to the public and other agencies,
3. Staff assistance in the interpretation and use of such maps and photographs, and
4. Rudimentary computer applications on sophisticated equipment performing record-keeping tasks related to activities within the Land Department. (See Appendix VII-4 through VII-8.)

Embryonic Development and Limited Utility

At the request of the office of the Auditor General, the Director* of the Natural Resources Information Systems Project with the National Conference of State Legislatures** (NCSL) provided technical assistance and assessed the operational computer status of IRD (ARIS).

* The Project Director's services were provided at no cost to Arizona. Appendix VI contains a copy of the Project Director's resume.

** The National Conference of State Legislatures (NCSL) is an organization funded by the states and governed by a 43-member Executive Committee to: 1) improve the quality and effectiveness of state legislatures, 2) assure states a strong, cohesive voice in the Federal decision-making process, and 3) foster interstate communication and coordination.

According to the NCSL Project Director, an overall ARIS computer system assessment as of March 12, 1980, can be summarized* as rudimentary, developmental programs that do not justify the use of sophisticated computer equipment. In a report the Director stated:

> "ARIS, through a variety of circumstances, has developed a fairly sophisticated computer hardware configuration. System software, however, is in a rudimentary, developmental stage. Current software can, for the most part, be characterized as simple record-keeping routines.
>
> Based on demonstrations observed, there currently appears to be little software operational on the system...."

(Five applications currently are operational).

> "These applications do not justify the current sophisticated configuration. They could be very easily supported on a time-share administrative computer, although conversion to another computer system might be expensive and time consuming...."

The five current applications include:

1. A water rights claimants master record system that answers inquiries and summarizes reports of the 2,800 claims on file,
2. A fire management system that contains lists of fire-fighting equipment by rural fire stations in the State, but whose incomplete files prevent fully operational use,
3. An urban forestry data file that lists individual trees in the five participating municipalities; however, lack of funds and staff have rendered this application nonoperable,
4. A forestry tree seedling management system that lists trees available by species and tree orders since 1976 for tree inventory usage, distribution of trees to orderers and management reports, and
5. An automated drafting system that assists engineers in the State Land Department by automating the drafting of some State Trust Land maps.

* Appendix VII contains a complete copy of the Project Director's report.

Other applications in varying stages of conceptualization and development include software for manipulation of geographic information (only the automated mapping portion cited above is implemented), Landsat analysis (software being developed by NASA), forest management (software being developed by U.S. Forest Service), water use simulation (not currently used), range management model (software under development), and minerals system (projected to be developed in 1981).

As to whether the present data files represent a natural resource data bank or information system, the NCSL Project Director commented:

> "The general applicability of any geographic resource information system must rest upon a solid foundation of spatial data files. While there are spatial attributes in some of the previously discussed files,...they are not geographically based files.
>
> Although there are many plans to develop a spatial data base, and many promising applications of such data, there are currently no systematic, automated files on land cover, range resources and conditions, forested areas, wildlife habitat areas, mineral resources, water resources or any other topics of interest....
>
> . . . . . .
>
> A great deal of work remains before Arizona will have a fully operational statewide geographic information system. If this were Creation, ARIS would be about at 10:30 Monday morning...." (Emphasis added)

Thus, although the concept of a computerized resource information system has been discussed since 1971 and statutorily mandated for IRD (ARIS) since 1978, IRD (ARIS) still has "a long row to hoe"* before Arizona will have a computer data bank on natural resources.

* It should also be noted that as of March 21, 1980, the programmer II position assigned to IRD (ARIS) computer system development was vacant. This absence of a Programmer II will in all probability further impede the development of IRD (ARIS).

It should be noted also that, according to the NCSL Project Director for the National Resource Information System project, up to two weeks of NCSL staff time could be provided at no charge to the State to: 1) further assist and present this audit, and 2) conduct a detailed review of IRD (ARIS) for recommendations on system-plan and user-needs surveys.

Further, in cooperation with the Council of State Planning Agencies (CSPA), NCSL staff has proposed to coordinate the formation of a resource team of persons with backgrounds in State geographic information systems to redesign and redirect ARIS, as requested, at no charge to the State. The NCSL Project Director suggested a team of nine persons affiliated with various Western state's governments, NASA and State universities.

Provides Similar Service as
Other Entities in Arizona

ARIS provides similar services as at least two other entities in Arizona - the University of Arizona and the Arizona Department of Transportation.

University of Arizona

The University of Arizona was the recipient of a grant in 1970 to manage the Arizona Regional Ecological Test Site (ARETS) to test the feasibility of remote sensing applications. As an outgrowth, the National Aeronautics and Space Administration provided a continuing grant to the University in 1971 entitled "Applications of Remote Sensing to State and Local Government." The grant is now part of the University's Applied Remote Sensing Program, which exists for the interpretation of high-altitude photography and Landsat imagery.*

* Appendix VIII contains a description of the equipment, procedures and projects of the University of Arizona program.

According to the University, the objective of this program is service-oriented and its intent is to work jointly with local, state and federal agencies responsible for planning, zoning and environmental monitoring and assessment. Thus, remote sensing techniques are applied to specified agency problems and provide data upon which policy decisions are based.

Since January 1972, the University of Arizona program has initiated 34 and completed 26 projects. Five of these projects were initiated in fiscal year 1978-79 -- two for Arizona State governmental agencies, one for an Arizona city, one for an Arizona county and Council of Government and one for a private sector organization. Funding for the 1978-79 year is included in Table 2.

TABLE 2

FUNDING FOR APPLIED REMOTE SENSING PROGRAM
AT THE UNIVERSITY OF ARIZONA, FISCAL YEAR 1978-79

	Funds	Percent of Total
NASA Grant	$100,000	57%
Other sources (State, regional, private through contracts)	76,305	43
	$176,305	100%

At the request of a legislative appropriations subcommittee in 1976, the Assistant Director of the Office of Arid Land Studies prepared a statement regarding the University's operations in remote sensing as compared to ARIS stated goals. The Assistant Director concluded that the Program at the University appeared to overlap ARIS objectives in certain areas including: 1) coordinating remote sensing technology such as the use of satellite and aerial imagery and photography, 2) acting as a service agency to maintain equipment for receiving and interpreting photographs, maps, imagery and other visual land use information sources, 3) preparing thematic overlays of land use and natural resources for State agency programs, and 4) transferring technology to county and city governments.

Department of Transportation

The Arizona Department of Transportation (ADOT) maintains aerial photography, remote sensing and computer mapping capabilities for its own use and that of other agencies.

ADOT has the capability, through aerial cameras and agency aircraft, to shoot low-to-medium altitude photographs of Arizona. A photographic laboratory, digitizer, plotters and other equipment are used to develop, interpret and reproduce photographs, maps and digital data. In addition, field survey instrumentation and support are available, and data processing remote linkage is maintained between the photogrametry section and the ADOT data processing center.

Aerial photography services and production of topographic and planimetric* maps have been provided to other agencies upon request to the ADOT Director. Agencies receiving such services include the State Land Department, Federal Highway Administration, Game and Fish Department and Department of Corrections.

ADOT offers aerial photographs for sale from its extensive library. It should be noted that the equipment used to develop and print these photographs is also used to produce some aerial photographs and all orthophotoquads that IRD (ARIS) sells to the public.

* Topographic maps display position and elevation of natural and man-made features while planimetric maps display only position.

CONCLUSION

Both historically and currently the scope and goals of the Arizona Resources Information System have been inconsistently stated, accepted and applied. Although identified as essential nine years ago and again in 1978, ARIS has not documented justifiable user-need for the system and currently has no plan to guide and coordinate system development, to define data needs and uses, to justify equipment needs or to determine priority of system applications. The combination of unclear goals, unidentified user needs and the absence of a system plan has resulted in confusion in the legislative and equipment-acquisition processes with resulting lack of legislative support, indefinite system direction and the unjustifiable use of sophisticated computer equipment to perform rudimentary record-keeping tasks.

RECOMMENDATION

It is recommended that consideration be given to the following:

- The Legislature appropriate funds for the 1980-81 fiscal year to allow for a 12 month lease/purchase of the central processing unit requested in the Information Resources Division 1980-81 budget request. Expenditure of such an appropriation should be contingent upon: 1) approval by the Data Processing Division of the Department of Administration of the lease/purchase, and 2) the signing of a formal lease/purchase agreement between the State Land Department and the equipment vendor.

- The State Land Department, Department of Administration's Data Processing Division and the National Conference of State Legislatures' resource team conduct a detailed user-needs study and develop a system plan by September 30, 1980. Additional ARIS data processing equipment acquisitions should be contingent upon the preparation of the user-needs study and its review and acceptance by the appropriate legislative committeee.

- If it is determined that such an information system is needed, the Legislature should clearly define the scope, goals and users of such a system. (See Finding III, page 46)

- Future State Land Department requests for ARIS-related data processing equipment and approval of other expenditures be based on user-needs surveys and system plans.

FINDING II

DATA PROCESSING ACQUISITIONS FOR THE ARIZONA RESOURCES INFORMATION SYSTEM ARE A CHRONOLOGY OF APPARENT UNAUTHORIZED EXPENDITURES AND IMPROPERLY RECORDED EXPENSES THAT WOULD REPRESENT VIOLATIONS OF ARIZONA STATUTES AND THE FIDUCIARY RESPONSIBILITY OF STATE OFFICIALS.

Since its inception in 1972, the ARIS program has been fraught with apparent unauthorized expenditures and improperly recorded expenses regarding data processing acquisitions. In obtaining data processing equipment, programs and services, Department of Administration standard data processing acquisition procedures have been circumvented and documents supporting proposed equipment acquisitions have been inaccurate. These practices would constitute violations of the fiduciary responsibility, which is incumbent upon State officials, to ensure that: 1) expenditures are properly authorized, 2) costs are correctly classified to reveal the true and actual nature of expenditures, and 3) standard acquisition procedures are not circumvented.

Fiduciary Responsibilities

According to Black's Law Dictionary, a fiduciary is defined as "a person holding the character of a trustee...in respect to the trust and confidence involved in it and the scrupulous good faith and candor which it requires."

The fiduciary responsibilities of State agency officials are defined in various sections of the Arizona Revised Statutes (A.R.S.) and in the State accounting manual. These responsibilities, among others, include: approving expenditures, ensuring that expenses are properly recorded and adhering to required acquisition procedures.

When reviewing proposed expenditures for approval, a responsible State official must determine that expenditures are properly authorized as described in A.R.S. Section 35-154:

"A. No person shall incur, order or vote for the incurrence of any obligation against the state or for any expenditure not authorized by an appropriation and an allotment. Any obligation incurred in contravention of this chapter shall not be binding upon the state and shall be null and void and incapable of ratification by any executive authority to give effect thereto against the state.

B. Every person incurring, or ordering or voting for the incurrence of such obligations, and his bondsmen, shall be jointly and severally liable therefor. Every payment made in violation of the provisions of this chapter shall be deemed illegal, and every official authorizing or approving such payment, or taking part therein, and every person receiving such payment, or any part thereof, shall be jointly and severally liable to the state for the full amount so paid or received." (Emphasis added)

Once an expense has been incurred, an agency official must ensure that the costs are properly classified. A classification system is included in the State accounting manual issued by the DOA Division of Finance under the authority of A.R.S. Section 35-131, which states:

"A. In accordance with generally accepted governmental accounting principles, the assistant director for finance of the department of administration shall develop and prescribe for the use of all budget units a uniform accounting system so designed as to insure compliance with all legal and constitutional requirements including respecting the receipt and expenditure of and the accountability for public funds.

. . . . . .

E. The assistant director for finance shall prescribe uniform classifications for receipts and expenditures and forms for the periodic reporting of financial accounts, transactions and other matters by budget units compatible with the reports required of the assistant director for finance under this section. Additional records or accounts may be maintained by budget units when required for reporting to the federal government or other funding source." (Emphasis added)

Further, A.R.S. Section 35-172 requires the Finance Division to subdivide the general expenditure classes provided in appropriations "...in such a manner that the true and actual cost of each object will be reflected perpetually on the (finance) division's books."

Finally, A.R.S. Section 41-712 requires the Department of Administration, Data Processing Division to develop, implement and maintain a coordinated statewide plan for data processing and data communication systems. Proposed data processing acquisitions of State agencies must be reviewed and approved by the Data Processing Division to ensure that the new acquisitions will conform with the State plan for data processing. Such review and approval is also prescribed by the State accounting manual. Any acquisition of data processing equipment or services without the required Data Processing Division approval constitutes an unauthorized expenditure by definition.

Apparent Unauthorized Expenditures

As previously noted, one of the primary fiduciary responsibilities of State officials is to ensure that funds appropriated for a specific use are not expended for other purposes. Our review revealed several ARIS expenditures for data processing acquisitions that were apparently not properly appropriated and as such would constitute unauthorized expenditures. Such apparent violations of fiduciary responsibility began with the initial ARIS budget in fiscal year 1972-73 and continued through the current fiscal year, 1979-80. These expenditures are chronicled below.

Use of ARIS Funds to Purchase
Computer Equipment Used by the
Department of Property Valuation

House Bill 2376, passed during the 1972 session, appropriated funds to the Governor's office for the ARIS program. According to this bill:

> "Sec. 2. Appropriation; purpose
>
> A. The sum of four hundred eight thousand seven hundred dollars is appropriated to the governor to fund the Arizona resources information system for the fiscal year beginning July 1, 1972, and to enable the state to acquire from the national aeronautics and space administration orthophoto base maps of the entire state of Arizona for use by all departments of Arizona state government.

"B. The funds appropriated in subsection A are to be available in the amounts and for the purposes following:

Personal services	$ 12,400.00
Office space	5,000.00
Equipment -	
Furniture	1,900.00
Viewing	14,500.00
Travel-in and out-of-state	4,400.00
Supplies and photo reproduction	11,000.00
Contingency	15,000.00
Orthophoto base sheets	200,000.00
Equipment	18,000.00
Outside services	126,500.00
Total	$408,700.00

Sec. 3. Exemption

The appropriation made by this act is exempt from the provisions of section 35-190, Arizona Revised Statutes, relating to lapsing of appropriations."

ARIS reported expending $185,900 during fiscal year 1972-73 - $9,300 of which was spent on office and viewing equipment. In the following year, since this was a nonlapsing appropriation, the fund balance of $222,800 was transferred, with ARIS, to the Department of Property Valuation. ARIS carryover was not commingled with other departmental funds but was maintained as a separate account. Thus, expenditures from the 1972-73 carryover funds are distinguishable from expenditures of the fiscal year 1973-74 and subsequent budget appropriations.

During fiscal year 1973-74, the Department of Property Valuation purchased a Data General minicomputer system. The following system components were purchased with the 1972-73 carryover funds from the original ARIS appropriation:

Tape drive	$ 5,900.00
Central processing unit	9,858.01
CRT display unit	4,831.38
Disc memory unit	8,410.00
Magnetic tape controller	4,000.00
Total	$32,999.39

Other system components were purchased for $35,610 using other Department of Property Valuation funds. According to the former Director of the ARIS program, he neither authorized nor was aware of the use of ARIS funds for the above purchases.

In addition, the former Director stated that the system components were never the property of nor used by the ARIS program during his term as program director (January 1972 through August 1976). Finally, the former Director stated that it was the Director of the Department of Property Valuation who had final control over the use of ARIS funds.

According to a Legislative Council memorandum dated March 5, 1980*, the use of ARIS funds to purchase equipment was "...unauthorized because monies were taken from funds appropriated to one budget unit for a specific purpose and used by another budget unit for a different purpose."

Computer Equipment Purchases
Not Authorized by the Legislature

On June 30, 1975, ARIS funds were used to purchase additional memory and circuitry boards for the same Data General minicomputer. However, the ARIS fiscal year 1974-75 budget request did not include a provision for data processing equipment. Further, the JLBC staff recommendation for the ARIS fiscal year 1974-75 budget made no mention of funds for data processing equipment. Finally, no authorization was received from the Assistant Director for Finance to transfer funds from the ARIS program.

In the March 5, 1980, memorandum,* the Legislative Council noted that these purchases appeared to be unauthorized . The Legislative Council stated:

> "The 1974-75 fiscal year purchases appear to be unauthorized under the facts given since the assistant director for finance did not approve the transfer as required by Arizona Revised Statutes section 35-173. That section prescribes that if monies are appropriated to a budget unit by programs, as was the case in the Laws 1974, chapter 203 appropriation, funds may be transferred between and within programs only with the approval of the assistant director for finance."

* Appendix IX contains the full text of this memorandum.

Computer Equipment Purchases In Excess of Budget Authorization and Questionable Expenditure of Groundwater Transfer Program Funds

In February 1977, the Data General minicomputer system was transferred to the ARIS program. During the period from January 1977 through June 1978, the ARIS program expended approximately $9,800 on data processing acquisitions of which $6,000 was spent on the overhauling and upgrading of the Data General computer.

In 1978, the Legislature transferred the ARIS program to the State Land Department and appropriated $46,100 for equipment. According to the Appropriations Report, 1978-79, prepared by the JLBC, this amount included:

> "Equipment - The appropriation provides $5,600 for one hard copier and $40,500 for missing components of a digital computer system as itemized below:
>
> | | |
> |---|---|
> | 8K Memory Board | $ 3,600 |
> | Electrical Cabinet | 1,200 |
> | 10 Megabyte Disc with Software | 13,400 |
> | Line Printer | 11,800 |
> | Digitizer | 10,500 |
> | TOTAL | $40,500" |

However, during fiscal year 1978-79, IRD (ARIS) expended $82,398.71* on data processing equipment as follows:

8K memory	$ 3,360.00**
300LPM printer	13,125.00**
10MB disc drive	10,605.00**
6085-A console	3,244.50**
Multiplexor	1,575.00**
192MB disc drive	33,152.46**
Digitizing system	12,686.75
Eclipse S/130 CPU (3-month rental)	4,650.00
Total equipment acquisitions	$82,398.71

* An additional $42,074.49 was expended by ARIS for other data processing items such as supplies and maintenance during fiscal year 1978-79.

** In August 1978, ARIS staff requested and received the required authorization from the Data Processing Division of the Department of Administration for the acquisition of this item.

IRD (ARIS) funds were used to pay for $49,246.25 of the above total. The remaining $33,152.46 was funded with Groundwater Transfer Program monies which were also under the authority of the State Land Department. The $33,152.46 was used to purchase the 192MB disc drive shown in the previous list.

The fiscal year 1978-79 appropriation for the Groundwater Transfer Program does not provide expenditure classes; thus, it is difficult to determine legislative intent with regard to the Groundwater Transfer Program. However, the Appropriations Report, 1978-79, which was prepared by the JLBC, shows that the original basis for the Groundwater Transfer Program appropriation did not include any equipment purchases. Further, in a February 25, 1980, memorandum, the Legislative Council stated:

> "...we were unable to determine whether part of the groundwater transfer appropriation authorized by Laws 1977, chapter 29 was intended to acquire the data processing equipment which was purchased.
>
> Assuming that groundwater transfer funds were authorized and properly expended to purchase the data processing equipment, the retention by the IRD of the equipment and data is in violation of Laws 1979, chapter 139, section 80, which required in relevent text that:
>
> A. All personnel, equipment, records, furnishings and other property, and all funds remaining unexpended and unencumbered, and funds appropriated for fiscal year 1979-80, of the water division of the state land department are transferred to the Arizona water commission on the effective date of this act.
>
> * * * * * * * * * *
>
> C. All data and investigational findings of the water division of the state land department are transferred to the Arizona water commission on the effective date of this act....
>
> . . . . . .

> "If the groundwater transfer funds were not authorized to purchase the described data processing equipment, use of the funds to purchase the equipment would be an unauthorized expenditure of state monies and would subject a person to liability under Arizona Revised Statutes, section 35-196 and the state could pursue appropriate remedies under Arizona Revised Statutes title 35, chapter 1, article 6 to recover state monies illegally paid." (Emphasis added)*

Thus, it appears that: 1) purchasing data processing equipment may not be an authorized use of Groundwater Transfer Program funds, and 2) the retention of the 192 MB disc drive by the Information Resource Division was a statutory violation.**

In August 1978, IRD (ARIS) included a request for $28,000 in the Replacement Equipment portion of its 1979-80 budget request. The funds were to be used to replace the central processing unit (CPU) of the IRD (ARIS) minicomputer system. The Legislature did not appropriate funds to IRD (ARIS) for equipment purchases for fiscal year 1979-80.

In June 1979, IRD (ARIS) began renting the requested equipment, a Data General Eclipse S/130 CPU. The installation charges and first three quarterly rental payments have been paid out of various funds as is shown in the following table:

* Appendix X contains the full text of this memorandum.

** As of March 1, 1980, the disc drive unit was located at the State Land Department and was included in the State Land Department's inventory. In addition, it should be noted that the disc unit is not used in the Groundwater Transfer Program.

TABLE 3

SUMMARY OF FUNDS USED TO PAY FOR CENTRAL PROCESSING UNIT RENTAL EXPENSES

Object	Funds Used to Pay For Equipment Installation Charges and Rentals		
	Information Resources Division	Cooperative* Fire Control	Timber** Suspense
6/04/79 Installation	$3,600		
6/04/79 Three months rental	$4,650		
9/18/79 Three months rental		$4,650	
12/18/79 Three months rental		$3,720	$930

It should be noted that no approval was received from the Department of Administration Assistant Director for Finance for the transfer of monies from the fire control or timber suspense funds as required.

In addition, according to the IRD (ARIS) administrator and a representative of the equipment supplier, no written agreement regarding the terms or length of the equipment rental exists.

Further, the Department of Administration, Data Processing Division, did not approve this EDP acquisition and the rental agreement was not processed through the State Purchasing Office.

* The Cooperative Fire Control Fund is a nonreverting fund in which U.S. Forest Service reimbursements are deposited.

** The Timber Suspense Fund is a nonreverting fund in which the revenues generated by the sale of timber from State trust lands are deposited.

In a February 29, 1980, Legislative Council memorandum,* the status of the IRD (ARIS) CPU rental is explained:

> "Arizona Revised Statutes section 41-712 requires the Department of Administration Data Processing Division to develop, implement and maintain a coordinated statewide plan for data processing and data communications systems. Review and approval by the data processing division of data processing acquisitions by state budget units is necessary to insure that the proposed new equipment conforms with the state plan for data processing. This approval is also prescribed by the state accounting manual issued by the Department of Administration Division of Finance under the authority of Arizona Revised Statutes sections 35-131 and 41-722. The state accounting manual also requires equipment leases entered into for the first time to have the approval of the attorney general. Use of funds without the specified approval would be an unauthorized expenditure of state monies and would subject a person to liability under Arizona Revised Statues section 35-196 and would call into play the provisions of Arizona Revised Statutes section title 35, chapter 1, article 6, concerning the recovery of the state monies illegally paid." (Emphasis added)

It should be noted that several other fiscal year 1978-79 data processing acquisitions also appear to be unauthorized expenditures because specified DPD approval was not received.

Legislative Council also noted problems regarding: 1) the use of funds for the IRD (ARIS) program other than those funds appropriated for IRD (ARIS), and 2) the lack of a written rental agreement, stating:*

> "A more serious question arises regarding the use of monies from the cooperative fire control fund and the timber suspense fund. Arizona Revised Statutes section 35-173, subsection C requires a budget unit to receive the approval of the assistant director for finance to "transfer funds from one class or subclass to another" or to "transfer funds between and within programs if funds are appropriated to the budget unit by programs". Since no approval was received from the assistant director for finance, the use of monies from the two previously named funds for the September and December equipment rental payments would appear to violate Arizona Revised Statutes section 35-173 and constitute a class 1 misdemeanor under Arizona Revised Statutes section 35-197. While monies are not appropriated to these two funds, funds are appropriated to the land department by program and so we believe that Arizona Revised Statutes section 35-173 is applicable.

* Appendix XI contains the full text of this memorandum.

"The state accounting manual specifically requires data processing equipment lease agreements to be approved by the data processing division and the attorney general. This procedure appears to contemplate the existence of a written agreement evidencing the lease. Additionally Arizona Revised Statutes section 35-151 requires encumbrance documents to be issued by budget units to cover all state obligations. The division of finance is required to examine such documents to determine if the proposed expenditure is for a valid public purpose. Failure to have a written rental agreement would severely handicap the finance division's ability to determine the validity of an expenditure. Additionally, the lack of a written agreement, considering the amount of monies involved, is an example of extremely poor business practice. Public authorities have a duty to act in good faith and in the best interests of the governmental agency involved. Hertz Drive-Ur-Self System v. Tucson Airport Authority, 81 Ariz. 80, 85, 299 P.2d 1071, 1074 (1956). In this instance, that duty would seem to require a written rental agreement for the computer equipment." (Emphasis added)*

It should be noted that the civil liability and criminal provisions mentioned in the Legislative Council memorandum are as follows:

A.R.S. section 35-154

"B. Every person incurring, or ordering or voting for the incurrence of such obligations, and his bondsmen, shall be jointly and severally liable therefor. Every payment made in violation of the provisions of this chapter shall be deemed illegal, and every official authorizing or approving such payment, or taking part therein, and every person receiving such payment, or any part thereof, shall be jointly and severally liable to the state for the full amount so paid or received." (Emphasis added)

A.R.S. Section 35-196

"Any state officer or employee who illegally withholds, expends or otherwise converts any state money to an unauthorized purpose shall be liable, either individually or on his bond, for the amount of such money, plus a penal sum of twenty per cent thereof, and an action may be instituted by the assistant director for the division of finance or the attorney general immediately upon the discovery thereof." (Emphasis added)

* Appendix XI contains the full text of this memorandum.

A.R.S. Section 35-197

> "Any officer, agent or employee of the state who knowingly fails or refuses to comply with any of the provisions of this chapter is guilty of a class 1 misdemeanor." (Emphasis added)

Improper Classification of Expenditures

In addition to the apparent unauthorized use of funds and the circumvention of standard data processing acquisition procedures, the rental charges of the CPU were improperly classified. The June 4, 1979, claim stated:

> "...3 months rental on special custom equipment to support ECOSYM.*"

However, it should be noted that the claim does not state the rental is for data processing equipment.

Further, the $4,650 expenditure was classified as data processing equipment - maintenance contracts. On the invoice for the rental, immediately after the vendor's description, is a handwritten instruction to record the expense as "EDP Maint. 080-70, 72836."

In the February 29, 1980, memorandum,** Legislative Council addressed the problem of improperly recorded expenses, stating:

> "An intentional improper classification of an expenditure on an encumbrance document would appear to subject a person to the civil liability provisions of Arizona Revised Statutes sections 35-154 and 35-196 and the criminal provisions of section 35-197."

To determine the extent of improper recording of IRD (ARIS) data processing acquisitions, a review was made of all such expenditures for fiscal year 1978-79. Of 32 data processing-related claims reviewed, 14 were improperly classified. The 14 claims totaled more than $25,730 and included:

- Equipment installation recorded as Maintenance contract
- Equipment overhaul recorded as Maintenance contract
- Software purchases recorded as Data processing supplies, no object code.

* ECOSYM is a group of forestry modeling programs being developed jointly by the State Land Department and the U.S. Forest Service.

** Appendix XI contains the full text of this memorandum.

These claims were reviewed with the Chief Accountant for the Land Department, who agreed that the expenses were improperly classified. In his defense of the improper classifications, the Chief Accountant pointed out that the ARIS program (IRD) was a new addition to the State Land Department in fiscal year 1978-79 and that the Land Department accounting staff was not familiar with ARIS expenses. As a result, the accounting staff relied on IRD (ARIS) staff to provide help on expense classifications.

The Auditor General's staff contacted the Director of the Accounts and Controls Section of the Division of Finance regarding the classification of data processing expenditures. The Director not only provided the proper classification code but he also explained the reasons for use of specific object codes.

Misleading Statements

Documents supporting proposed data processing acquisitions have contained inaccurate statements. In two instances, including the fiscal year 1979-80 budget request, IRD (ARIS) documents have stated that legislation had authorized specific amounts for capital expenditures, while in fact it had not.

The first instance occurred on August 3, 1978, when IRD (ARIS) sent a document entitled "Arizona Land Department - Information Resources Division - Arizona EDP Acquisition Report" to the Assistant Director for Data Processing Division (State Automation Director). The document states, "This documentation is intended to complete the formal functions and authority of the Arizona EDP acquisition Process of the State Land Department, Information Resources Division, Map-oriented Directory System (MODS)."

The following statement was made on page seven of the document:

> "The following RFQ* for hardware, software, publications and services are appropriate to complete the State Land Department, Information Resources Division, MODS interactive mapping/graphics and geographic data management system."

* Request for Quotation (RFQ) is a part of the bidding process of the State Purchasing Office.

Further, the following statement was made on the last page of the document:

"ECONOMIC PROFILE

Authorized capital expenditures were provided by the legislature (S.B. 1307) & (S.B. 1391) July 1, 1978

Equipment----------	SB 1307	$32,090.00
	SB 1391	$31,000.00"

Based on this document, the DPD approved the requested acquisition. In the approval letter, the Assistant Director for Data Processing Division stated:

> "This recommendation is limited to this specific request and the use of existing funds already allocated." (Emphasis added)

The second instance occurred in August 1979 when IRD (ARIS) requested $48,000 for the "...replacement and installation of a Data General S/130 central processing unit" in its fiscal year 1980-81 budget request. The expenditure justification was that "This is the second part of a two phase, two year request authorized by S.B. 1307 of the 1978 legislative session."

However, it should be noted that neither of these bills specifically authorized funds for data processing acquisitions. In a memorandum dated February 25, 1980*, Legislative Council stated:

> "1977 Senate Bill 1391 and 1978 Senate Bill 1307, as enacted, did not specifically authorize the purchase of data processing equipment as stated in the IRD communication."

Inadequate Insurance Coverage

Our audit of the ARIS Program included a review of the insurance coverage provided by the Department of Administration, Division of Risk Management for the ARIS data processing equipment. This review revealed that the Data General Eclipse S/130 CPU currently is not insured. Further investigation revealed that because DOA data processing acquisition procedures were circumvented when the Data General Eclipse S/130 CPU was acquired, Risk Management was not properly notified of its existence, precluding proper insurance coverage.

* See Appendix X for the full text of this memorandum.

CONCLUSION

Data processing acquisitions of the ARIS program have resulted in apparent violations of State laws and fiduciary responsibilities. Such apparent violations include: 1) unauthorized expenditures, 2) circumvention of standard acquisition procedures, 3) illegal transfer of funds, 4) failure to act in the best interest of the governmental agency, 5) improper classification of expenditures, and 6) inadequate insurance coverage for data processing equipment.

RECOMMENDATIONS

It is recommended that:

- The State Land Department thoroughly review its internal accounting controls over the use of funds and the resulting classification of expenditures. This review should include all sources of funds used by the Land Department and not be limited to State-appropriated funds.

- Following this review, the State Land Department institute the necessary changes to prevent future unauthorized and illegal uses of funds.

- When questions arise regarding the classification of expenditures, the accounting staff of the State Land Department consult with the Accounts and Controls Section of the Division of Finance to ensure proper classification.

- The State Land Department institute a procedure for the periodic review of insurance coverage provided by the Risk Management Division of the Department of Administration and update this coverage on a timely basis.

FINDING III

LEGISLATION IS NEEDED TO CLARIFY THE INTENDED PURPOSE OF THE INFORMATION RESOURCES DIVISION.

When the Legislature transferred ARIS personnel, property and funds to the newly-formed Information Resources Division (IRD) within the State Land Department in May 1978, it stipulated that the duties of IRD would include providing the Land Department with an information data bank. Whether the Legislature intended that IRD perform this function for other State agencies is not clear. As a result, legislation is needed to clarify legislative intent regarding the purpose of Information Resources Division.

In the 1978 legislative session, Senate Bill 1307 was passed to create, by the transfer of ARIS, the Information Resources Division (IRD) within the State Land Department. The resulting Arizona Revised Statutes (A.R.S.) 37-173,* effective May 18, 1978, defined the duties of the IRD to include:

> "1. Provide an information data bank for the state land department by computer compositing the data from remote sensing technology with other technical information and the geographical base resulting from the Arizona orthophotoquad program.
>
> . . . . . .
>
> 6. Coordinate these activities of state government agencies and state political subdivisions with respect to any utilization by them of the (NASA) earth resources satellite program, Landsat, in discharging their responsibilities in the fields of...resource management" (Emphasis added)

Further, A.R.S. 37-174 describes the powers of the IRD to include:

> "The resources division may:
>
> 1. Establish a liaison relationship with political subdivisions of this state for purposes of collecting, compiling, processing and making available resource information." (Emphasis added)

* Appendix I contains the full text of the statutes regarding ARIS and the Resources Division.

It should be noted that these statutes state that the IRD may allow political subdivisions to use the State Land Department information data bank but does not require IRD to do so.

In a letter to the State Automation Director, and in its 1980-81 budget request, the State Land Department stated that the IRD computer information data bank was to be used by other State agencies as well as the State Land Department.

A November 26, 1979, letter* to the State Automation Director from the State Land Department:

> "The Arizona State Land Department, Information Resources Division is required to provide a computer information data bank of natural resources which can be used by various divisions within the Department, including the field offices.
>
> . . . . . .
>
> The benefits of this system for the Department and others are as follows:...
>
> . . . . . .
>
> 5) Other agencies are preparing to access the system for information such as the Game and Fish Department, graphical analysis of the Kaibab National Forest for data overlays of animal locations in a form of UTM coordinates, deer densities, elevation zones, vegetation types. Parks and Recreation want a geographical data base of the parks, vegetation types, trails. Water Commission has proposed a geographical mapping data base for the flood early warning system which will also be used by Emergency Services. A recent request by the Governor to support the inventory and mapping needs of the Arizona Natural Heritage Program." (Emphasis added)

* Appendix XIII contains the full text of this letter.

The State Land Department 1980-81 budget request:

> "...to continue development of a centralized management information system for collecting and disseminating information concerning the land, water and natural resources of Arizona. Key components are the development and use of standards in terminology and format, the relationship of land and resource data to accurate geographical location, efficient utilization of the latest applicable technologies and the timely availability of information to the public and the State of Arizona and its agencies. (Emphasis added)
>
> . . . . . .
>
> The central processing unit is required to run all computer operations. The resource information system produces data files for the benefit of land, water, and natural resources programs of the Arizona State Land Department and other state agencies." (Emphasis added)

In addition, the goals adopted by the Arizona State Land Department as of January 1980 include, within the IRD, a goal to:

> "...develop natural resource information system for the Arizona State Land Department and other physical resource oriented state agencies." (Emphasis added)

In a memorandum dated February 20, 1980,* the Legislative Council reviewed and interpreted the ARIS system parameters as expressed in State law:

> "1. Title 37, chapter 1.2, Arizona Revised Statutes, requires that the resources division develop an information data bank for the state land department that other political subdivisions of this state may use.
>
> 2. Arizona Revised Statutes section 37-173 requires that the entire information data bank be computerized."

* Appendix XII contains the complete text of this memorandum.

In a related memorandum from the Legislative Council dated March 4, 1980,* the definition of a political subdivision was provided and the exclusion of State agencies from those named as possible liaison users was discussed:

> "1(a). 'Political subdivision' means a subdivision of the state which is defined by geographical boundaries set by political authority and having a separate political organization.
>
> 1(b). It is not clear whether the legislature did not include state agencies in section 37-174, Arizona Revised Statutes, because it intended to explicitly exclude state agencies or because it deemed that there already was an inherent implied power to form liaison relationships with other state agencies.
>
> 2. The information resources division does not have authority to develop a computer composited information data bank which includes data for the use of other state agencies or which is designed to meet their needs, except if such data overlaps with data relevant to the needs of the state land department." (Emphasis added)

Therefore, according to the Legislative Council, the development of data bank files specifically for the needs of agencies other than the State Land Department would not be within the parameters of State law unless such data files are also relevant to the Land Department.

Further, the Legislative Council suggested clarification of the law, if it is intended that the data bank include information useful to State agencies other than the State Land Department:

* Appendix XIV contains the complete text of this memorandum.

"Since an administrator (who) may otherwise be subjected to an infinite variety of issues is seeking to draw a line between unauthorized relationships on one hand and merely inappropriately directed ones on the other, if the legislature intends the data bank to include information useful to state agencies other than the state land department, Arizona Revised Statutes section 37-173 should be amended. The statute should expressly state the types of additional information which may be collected, the specific needs of other identified state agencies for which data may be collected and the financial or other arrangements which would apply to such a liaison.

The statute should also be amended to state the priorities for information to be collected by the resources division. The existing statute provides no guideline for the resolution of competing information demands nor method for allocating services among competing clients."

CONCLUSION

Legislative intent with regard to the scope of IRD services is not clear. Legislation is needed to clarify whether or not IRD should provide an information data bank to other State agencies as well as the State Land Department.

RECOMMENDATION

It is recommended that consideration be given to the following:

The Legislature amend A.R.S. 37-173 if it is determined the development of a computerized data bank should be continued. The statute should expressly state the types of additional information which may be collected, the specific needs of other identified State agencies for which data may be collected, and the financial or other arrangements which would apply to such a liaison.

OTHER PERTINENT INFORMATION

PRODUCTION AND USE OF ORTHOPHOTOQUADS

An orthophotoquad is a high-altitude photograph that is geographically accurate and consistent with the U.S. Geological Survey (USGS) 1:24,000* scale topographic** map. The production of orthophotoquads in Arizona is the result of a Federal-State cooperative agreement to apply remote sensing technology. Orthophotoquads have been used extensively by Federal, State, local and private land-use management entities within Arizona.

Production of Orthophotoquads

During the late 1960s and early 1970s, several factors influenced the production of orthophotoquads in Arizona. These factors included the: 1) need for a Statewide cartographic*** base document, 2) willingness of Federal and State officials within Arizona to experiment with high-altitude photography as a data source, and 3) National Aeronautics and Space Administration's (NASA) goal to apply remote sensing techniques to operational uses in State agencies.

In the early 1970s USGS had not completed topographic maps for Arizona.**** This type of base map is commonly used for land management. USGS production of orthophotoquads would result in a cartographic base at a fraction of the time and cost of field-surveyed and hand-drawn maps. Therefore, USGS was amenable to orthophotoquad production.

* Scale is one inch equaling 24,000 feet of land measurement.

** According to Webster's New Collegiate Dictionary, 1975, topographic is defined as "of, relating to or concerned with the art or practice of graphic delineation, usually on maps or charts of natural and man-made features, of a place or region especially in a way to show their relative positions and elevation."

*** According to Webster's New Collegiate Dictionary, 1975, cartographic is defined as relating to "the science or art of making maps."

**** USGS at the time was less than half finished with the Statewide topographic series of maps, and estimated final completion would take ten years or more. As of February 20, 1980, USGS had not completed this series.

Several State agencies, particularly what was then the Arizona Highway Department, were interested in possible applications of remote sensing technology to their operations. NASA also was interested in demonstrating the use of high-altitude remote sensing technology as a forerunner to applications of space satellite data.

These interests culminated in 1972 in the establishment of the Arizona Land-Use Experiment (ALUE) which was a three-party agreement among the U.S. Department of Interior, NASA and the State of Arizona.

Objectives of the agreement were :

1. Acquire high-altitude photography for a cartographic and thematic data base of the State of Arizona for experimental analyses by State agencies,
2. Reduce, analyze and annotate these data for comprehensive land use analyses that are directly related to management responsibilities of the State of Arizona and of the Department of Interior within Arizona,
3. Incorporate the land use information into ongoing and new State agency programs,
4. Document social and economic benefits obtained through use of these data sources,
5. Prepare a manual that can be used by other states in applying remote sensing methods in the solution of management problems, and
6. Provide a plan for future requirements for updating land-use information using data acquired from spacecraft, high-altitude aircraft, low-altitude aircraft and ground surveys.

The agreement included provisions for the production and use of orthophotoquads and other remote sensor data, and also required that plans be established for future use of the data in Arizona and other states.

Under the agreement, the U.S. Department of Interior would produce 50 orthophotoquads for experimental purposes at no cost to the State. In May 1972, the State Legislature approved $200,000 for purchase of half the orthophotoquads necessary to record the topography of Arizona. This sum plus an additional $200,000 included in the fiscal year 1974-75 ARIS appropriation were used to purchase a complete set of orthophotoquad negatives* and to produce positive prints for sale by ARIS, now the Information Resource Division of the State Land Department. Cost of reproduction as of February 1980 was $9.50 per print; the Information Resources Division charges $12.50 per print provided to all users, including other State agencies. Sales of orthophotoquads are summarized in Table 4.

TABLE 4

SALES OF ORTHOPHOTOQUADS
FISCAL YEARS 1974-75 THROUGH 1978-79

	Fiscal Year				
	1974-75	1975-76	1976-77	1977-78	1978-79
Dollar sales during the fiscal year	$23,725	$29,096	$15,062	$21,150	$45,925
Sale price per orthophotoquad	$6.50	$8.50	$8.50	$12.50	$12.50
Number of orthophotoquads sold	3,650	3,423	1,772	1,692	3,674**

Use of Orthophotoquads

In 1977, a private consultant to NASA Ames Research Center published a report entitled Benefit and Impact of the Arizona Land-Use Experiment. In Table 5 the primary users of orthophotoquads are listed as well as the applications of these photographs.

* The topography of the Grand Canyon is so severe that accurate technical corrections of the orthophotoquads cannot be accomplished. Therefore, the Grand Canyon is not included in the complete set.

** The University of Arizona purchased a complete set (1,474 orthophotoquads) in June 1979.

TABLE 5

PRIMARY USERS AND THEIR APPLICATIONS
OF ARIZONA ORTHOPHOTOQUADS

Users	Percent* of Orders	Applications	Percent of Usage
Private Sector	48%	Base Map	23%
Federal Government	25	Development Planning	22
State Government	10	Ground Features	17
Local Government	6	Vegetation/Geology	13
Universities	6	Land Development	9
Individuals	5	Site Locations	9
		Mining	4
		Survey	3
Total	100%	Total	100%

Also listed in the consultant's report were applications by Arizona State governmental agencies. Table 6 summarizes these applications.

* The percentages were based on all purchases of orthophotoquads during a limited period of time.

TABLE 6

APPLICATIONS OF ORTHOPHOTOQUADS BY
ARIZONA STATE AGENCIES AS OF JANUARY 1977

Agency	Applications
Arizona Department of Transportation	Used in a project to accurately identify roads in Arizona. Also used in the planning of new roads and highways.
Arizona State Land Department	Generally used to identify land use; also used in one project done with the Univerisity of Arizona to produce a map of geothermal reservoirs in southern Arizona.
Arizona Department of Revenue	Generally used to identify land use for assessment purposes. This use diminishes as the orthophotoquads become older.
Arizona Office of Economic Planning and Development	Used in review of the potential environmental impact of land-use changes or industrial development.
Arizona Water Commission	Used to generate information regarding flood assessment and control, and water availability.
Arizona Oil & Gas Conservation Commission/Arizona Solar Energy Research Commission	Used to locate areas of potential energy production.

Through interviews with users of the orthophotoquads and related imagery, the consultant identified the following shortcomings:

1. The user did not have enough trained people to fully utilize the information, or the user did not have sufficient time to convert operations to use the new technology,
2. The time required to obtain the imagery from the Earth Resources Observation System (EROS) Data Center was too slow for operational use,
3. Some of the photographic images were of poor quality, and
4. The information was becoming outdated because of land-use changes since the photographs were taken. Additionally, the consultant surveyed several entities that seemingly could use orthophotoquads, but had not done so, discovering that lack of knowledge about the orthophotoquads was the most frequent reason for nonuse.

DEFINITIONS OF A GEOGRAPHIC OR NATURAL RESOURCES INFORMATION SYSTEM AND REMOTE SENSING

A geographic or natural resources information system is an information system* which contains data about the physical environment and its natural resources.

As defined in Geographic Information Systems, Methods and Equipment for Land Use, 1977, published by the International Geographic Union, natural resources data includes a means to identify the exact location of a specific natural resource, such as a forest or lake:

* An information system is a closed loop of steps that includes: 1) the observation or gathering of data, 2) data handling to convert data so it can be analyzed in 3) data analysis models and the results used in 4) a decision-making process.

> "Data descriptive of the various natural and cultural aspects of the earth's surface frequently have a spatial component. That is to say, data describing objects, entities or conditions incorporate some identifier that prescribes where they are...They are linked to (a) place by a location identifier such as the coordinates of latitude and longitude, the identifier of a grid call, or the name of an administrative area." (Emphasis added)

The traditional method, explained in this publication, of linking a natural resource to its geographic location is through the use of a map:

> "Many (such) spatial data have their location identified simply by being plotted on a map. The map itself is a framework of latitude and longitude coordinates, and the position of the items in space is defined by their positions on the map within that coordinate framework."

A geographic or natural resource information system can be either manual or computer-aided. If such data is transferred from a map to a magnetic tape or disk on a computer, it is eventually converted to a location identifier code to facilitate computer analysis. Products from such a system should be documents (either tabular or graphic) that are usable for decision-making, either in land-use planning or other responsibilities concerned with natural resource management. For example, an information system supporting urban growth management would include, among other items, the following data:

1) land currently in urban use,
2) land capable of supporting urban development, and
3) land with a high capability for agriculture.

If data for several years were available in these categories concerning a particular region, changes in land use and the suitability for future urbanization or prime agricultural development could be analyzed. Products of such a system could include:

1) tabulations of the amount of land and its use,
2) maps of actual use over the years, and
3) maps of urban and agricultural lands best suited for future development.

Data for such systems can be acquired through two sources:

1) independent identification and collection of data, or
2) acquisition and combination of data collected by other agencies.

Considerations in choosing which data source to use include:

1) accessibility of data,
2) funds available for data gathering,
3) reliability and accuracy of data,
4) level of detail and specificity,
5) completeness and extent of geographic coverage,
6) timeliness of the data being acquired, and
7) frequency for updating the data.

The sources of data independently identified and collected include: 1) ground surveys of resources through field inspections or observations, and 2) aerial photography or remote sensing.

The purpose of ground surveys is to record data about the location of resources on the earth's surface. These locations are established by taking multiple random or regular measurements and samples of the resource being recorded. Flat geographic representations of the curved surface of the earth (maps) which portray the location of the resource are produced through mathematics.

The major difference between the use of ground surveys and aerial photography or remote sensing is that, unlike ground surveys, relationships are observed through photographs and only a few ground observations are needed for verification.

Three sources exist for aerial photographs or remote sensing: 1) commercial contractors, 2) various governmental agencies, and 3) satellite imagery.

When acquiring aerial photography by contract, costs of the data vary according to type of aircraft and photographic equipment used, while accuracy of the data varies according to equipment, film and the altitude from which the photographs are taken.

When acquiring existing aerial photographs from governmental agencies (primarily USGS, NASA and the U.S. Department of Agriculture), the costs of the data are limited to reproduction and handling costs, while the accuracy is determined by aircraft altitude, cameras and type of film used.

The major source of satellite photographs (or images) is Landsat earth orbiting satellites which transmit a constant stream of information about the earth to ground-based receiving stations.

According to A Legislator's Guide to Landsat, published by the National Conference of State Legislatures, Landsat operates through the use of remote sensor systems:

> "Landsat orbits the earth 14 times each day at an altitude of about 560 miles. Each satellite returns to the same orbit every 18 days recording the same series of images. There are two sensor systems on board...(one) which is basically a television sensor, and (another) which records differences in sun reflectance from earth-surface features."

After recording the images through sensors the Landsat satellite transmits them to earth. According to the guide published by the National Conference of State Legislatures:

> "...intensity levels are converted into digital form and are transmitted back to ground receiving stations on earth. Data for any part of the United States are transmitted to one of three U. S. receiving stations. There are seven others at present throughout the world, with several more being planned.

> "From the receiving stations the data is relayed to the Master Data Processing Facility at Goddard Space Flight Center in Greenbelt, Maryland, where it is stored on computer-compatible tapes (CCTs). The data can be converted from the tape format into photograph-like images in black and white or color. Reproducible negatives and computer tapes are then sent to the Earth Resources Observation System (EROS) Data Center in Sioux Falls, South Dakota, for storage and distribution."

Landsat now consists of three satellites launched during the 1970s as described in A Legislator's Guide to Landsat:

> "The first Landsat (then called ERTS-1) was launched by the National Aeronautics and Space Administration (NASA) in July 1972. Its purpose was to demonstrate the value of continuous, worldwide data gathering from an orbital platform. Landsat-2 was launched in January, 1975, and its orbit was synchronized with that of Landsat-1 so that together, cloud cover permitting, they could provide almost complete global coverage every nine days. Landsat-1, with an expected 'life-span' of one year, functioned until January, 1978. A third satellite, Landsat-3, was put into orbit March 5, 1978, so that once again nine-day interval coverage was achieved."

Additional Landsat satellites are expected to be operational for remote sensing in early 1982.

Products of the Landsat images are either aerial photographs or computer tapes of the images in digital form. Procedures for interpretation of the photographs are almost identical to those used in interpreting photographs from conventional aircraft. Interpretation of Landsat computer tapes is more complex, but can yield more detailed information.

Whether to obtain photographs from subspace aircraft or satellites is dependent upon the use for the data and the resulting level of accuracy (or ground resolution) needed.

Table 7 contains examples of sources for aerial photographs and remotely sensed images, the ground resolution produced, the capabilities of identification with each source and applications for natural resource management.

TABLE 7

EXAMPLES* OF SOURCES FOR AERIAL PHOTOGRAPHS AND REMOTELY SENSED IMAGES, GROUND RESOLUTION PRODUCED, IDENTIFICATION CAPABILITIES AND APPLICATIONS

Source	Resolution	Sample and Identification Capabilities	Sample Applications
Low-altitude aerial photography	1 - 10 feet	Dirt roads, individual trees, very small objects	Urban land use
Medium-altitude aerial photography	10 - 20 feet	Paved roads, stands of trees, structures	Regional land cover
High-altitude aerial photography	20 - 50 feet	Major roads, vegetation associations, large stands of trees, large structures	Regional land cover
Future Landsat satellite	100 feet	State highways, vegetation associations, large stands of trees, very large structures	Regional land cover
Current Landsat satellites	260 feet	Interstate highways, vegetation zones, forested area, crop types, urbanized areas	Regional land cover Resource inventory & planning

* Source: Paul Tessar, Project Director, Remote Sensing Project, NCSL.

Bruce Babbitt
Governor

Arizona
State Land Department
1624 WEST ADAMS
PHOENIX, ARIZONA 85007

Joe T. Fallini
Commissioner

March 27, 1980

Mr. Douglas R. Norton
Auditor General
112 North Central, Suite 600
Phoenix, Arizona 85004

Dear Mr. Norton:

Enclosed is our written comments on the draft report of the performance audit of the Arizona Resources Information System which was received in this office on March 21, 1980. Some revisions of the draft report were made as a result of our discussion on March 25, 1980. In the short time available to respond, we are not able to submit detailed comments. We have however made the attached comments in the time frame available.

Sincerely,

Joe T. Fallini
Commissioner

JTF:lr
Enclosure

March 27, 1980

STATE LAND DEPARTMENT COMMENTS ON DRAFT REPORT
OF THE AUDITOR GENERAL, ENTITLED:
"A PERFORMANCE AUDIT OF THE ARIZONA RESOURCES INFORMATION SYSTEM"

We have had inadequate time to respond in detail to the Auditor General's report on the Performance Audit of the Arizona Resources Information System. In the limited time available, the following are our comments:

1. Comments on "introduction and Background"

Page 4 - The report appears to adequately summarize the history of the ARIS program from 1971 to the present.

2. Comments on Finding I

Page 12 - The State Land Department agrees with this finding which states that prior to 1978, the ARIS program had an unclear purpose, both from a legislative and administrative standpoint, and planning appears to have been inadequate. Since 1978, we believe progress has been made in clarifying the statutory role of ARIS. The law enacted in 1978 (A.R.S. 37-173, May 18, 1978) defined, for the first time, the duties of ARIS which were, in short, (1) to "Provide an information data bank for the State Land Department" and (2) to "coordinate the activities of state government agencies and state political subdivisions" in the use of the earth resources satellite program. This latter role includes the authority to act as "liaison" with political subdivisions for the purpose of collecting, compiling, processing and making available resources information.

We are aware of the varying interpretations of the meaning of this statute. The Land Department is of the opinion that the legislation establishes a primary role for ARIS in supporting land use decision making (from both a mapping and data standpoint within the Department and to other users to the extent the capability and need exists. To this end, it has been, and will continue to be, a very useful management tool, albeit it has not

been used to its fullest capability. The Auditor General apparently believes the broader natural resource data coordinating role should be the predominant role for the ARIS program. We believe this is the issue that needs clarification in the statute and that a users needs study and more detailed planning are necessary prior to such a legislative change.

We do not agree with the statement made in the finding and in the body of the chapter that the sophisticated ARIS equipment acquired over the years "performs only rudimentary record-keeping tasks. The ARIS system provides an extensive photographic mapping capability that has been used extensively in decisions regarding the leasing, sale and exchange of state lands and in the management and surveillance of the 9.6 million acres of trust land under the jurisdiction of the State Land Department. In recent months several important uses of the computer capability of ARIS have been developed and are in varying stages of completion. These include a computerized fire management system, agriculture lease auditing system, an innovative forest management system, and a capability to computerize information produced from the range surveys, - establishing for the first time a current data base on carrying capacity, range conditions, vegetation and other range resource information. A more detailed discussion of these and other proposed uses of the system is contained in Appendix VII of the report.

Considering the small field staff of the Department, it is essential that modern computer and mapping techniques be employed to assist in management. On the ground survey capability is severely limited and the "eyes" of the ARIS program, if properly used, can be useful in offsetting the shortage in field staff. We believe that the report's description of the tasks of ARIS as "rudimentary record keeping" is misleading and incorrect and demonstrates a lack of understanding of the importance of the ARIS in managing the trust land resources.

3. Comments on Finding II:

Page 30 - The accounting section of the Land Department has reviewed many of the IRD data processing claims and does agree that some errors have unintentionally been made in the classification of the claims. However, because of the technical terminology used, in some cases it is difficult to ascertain exactly what the data processing charge was for, as evidenced by the fact that Accounts and Controls did not return any encumbranceses or claims to the Department for clarification or correction of the object code. It also has been the practice of the Accounting Section to contact Accounts and Controls in the Department of Administration in the past for assistance, although it was not done in these instances.

Past reviews of the Land Department's accounting procedures by the Auditor General have stated, as appears in the one completed in December 1978, that "In our opinion, the financial statements referred to above, other than the financial statement of the General Fixed Assets group of accounts, present fairly the financial position of the various funds and account groups of the State of Arizona Land Department at December 31, 1978 and the results of operation of such funds for the 18 months then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year."

We believe it would be inappropriate to comment on the accuracy of the report as it pertains to expenditures of funds prior to May, 1979. However, we are of the opinion that legislative appropriations for ARIS since May 1979 have been expended in accordance with legislative direction. Furthermore, we do not agree that such expenditures have resulted in violations of state laws and fiduciary responsibilities.

The errors made in the leasing of the Data Eclipse S130 computer demonstrate a need to substantially tighten accounting controls with respect to expenditure

of funds for acquisition of ARIS equipment and we have initiated such controls, including a prohibition on acquisition of any equipment without the expressed approval of the Data Processing Division of the Department of Administration. The Commissioner and Deputy Commissioner have had extensive discussions within the last several months with the JLBC representative, DOA officials and Auditor General's staff in attempting to clear up this matter. The Land Department is of the opinion that any discrepancies in complying with accepted leasing and accounting procedures were inadvertant and unintentional and that the extensive discussion under Finding II with respect to "apparent violations of fiduciary responsibilities" and state laws are premature and unsubstantiated.

4. Comments on Finding III:

The Land Department generally agrees with the finding and supporting discussion in this section of the report.

5. Comments on "Summary":

Page 1, paragraph 5 - The Land Department does not agree as explained previously in comments on Finding I, that the ARIS computer system performs "redimentary record keeping tasks only."

Page 2, paragraph 1 - The Land Department does not agree as explained previously in comments on Finding II, that the history of the ARIS equipment acquisitions represents a chronology of unauthorized expenditures and improperly recorded expenses. It is inappropriate for the Commissioner to comment on such expenditures prior to May, 1979. While we agree that errors were made in the leasing of the S130 computer, we do not believe they were intentional and do agree that any officials fiduciary responsibility to the agency nor any statutes have been violated as alledged in the draft report. As mentioned, the Commissioner has already taken steps to assure that proper accounting procedures will be strictly adhered to in the future.

Pages 2 through 3 - The Land Department generally agrees with the remaining findings and recommendations.

APPENDIX I

ARIZONA STATUTES REGARDING ARIS AND THE INFORMATION RESOURCES DIVISION OF THE STATE LAND DEPARTMENT

Arizona Statutes creating the Information Resources Division of the State Land Department

§ 37-171. Definitions

In this chapter, unless the context otherwise requires:

1. "Administrator" means the administrator of the resources division.

2. "Remote sensing" means the measurement and interpretation of both conventional photography and imagery obtained by sensor systems that interact the electromagnetic radiation with sold, liquid and gaseous matter and the instruments and their platforms used to obtain remote sensing data.

3. "Remote sensing techniques" means the processing of data to allow the interpreter to obtain the maximum information from remote sensing devices.

4. "Resources division" or "division" means the resources division of the state land department. Added Laws 1978, Ch. 52, § 1, eff. May 18, 1978.

Laws 1978, Ch. 52, § 4 provides:
"Transfer of personnel, equipment and funds.

"There are transferred to the state land department on the effective date of this act all personnel, records, equipment and unexpended and unencumbered funds of the Arizona resource information system."

1978 Reviser's Note:
In paragraph 3, "remote" was substituted for "remove" pursuant to authority of section 41-1304.02.

§ 37-172. Resources division; administrator; employees; compensation

A. There is established within the state land department the resources division.

B. The state land commissioner shall appoint an administrator of the division.

C. The administrator shall be responsible for the administrative functions of the resources division.

D. The administrator may employ, with the approval of the commissioner, the employees necessary to carry out the provisions of this chapter.

E. Compensation for the administrator and other employees of the resources division shall be established pursuant to § 38-611. Added Laws 1978, Ch. 52, § 1, eff. May 18, 1978.

Cross References
Compensation, see § 38-611.
State Land Commissioner, see § 37-132.

§ 37-173. Duties

The resources division shall:

1. Provide an information data bank for the state land department by computer compositing the data from remote sensing technology with other technical information and the geographical base resulting from the Arizona orthophotoquad program.

2. Provide current information regarding revenue producing activities and monitor changes over time by remote sensing techniques.

3. Produce maps and inventories at standard scales for any area defined by its designated geographical, governmental or jurisdictional boundaries to include combinations of data elements.

4. Provide maps, aerial photographs and other remote sensing techniques related to state trust lands to assist in the valuation process by determining location and description of the following classes of property:

(a) Producing mines, personal property used in such mines, improvements to such mines and mills and smelters operated in conjunction with such mines.

(b) Producing oil, gas and geothermal resource interests.

(c) Gas, water and electric utilities and pipelines.

(d) Community antenna television systems and microwave services.

(e) Forestry management lands requiring burn permits.

(f) Real and personal property of railroad companies.

(g) Standing timber.

(h) Water ditches constructed for mining, manufacturing or irrigating purposes.

(i) Improvements on unpatented land, mining claims or state land.

5. Function as the Arizona affiliate office for the national cartographic information center, with support from the United States geological survey, to access archived maps and imagery data sources to assist the mapping, inventorying and data handling segments of the division.

6. Coordinate those activities of state government agencies and state political subdivisions with respect to any utilization by them of the national aeronautics and space administration, earth resources satellite program, Landsat, in discharging their responsibilities in the fields of agriculture, wildlife, forestry, land, mineral, water and other resource management. Added Laws 1978, Ch. 52, § 1, eff. May 18, 1978.

1978 Reviser's Note:
Pursuant to authority of section 41-1304.02, the second sentence of paragraph 1 was numbered as paragraph 2 and the following paragraphs were renumbered to conform. In renumbered paragraph 4, the spelling of "determining" was corrected.

§ 37-174. Powers

The resources division may:

1. Establish a liaison relationship with political subdivisions of this state for purposes of collecting, compiling, processing and making available resource information.

2. Apply for and accept grants, contributions and appropriations for carrying out the functions of the division.

3. Contract for professional services if such work or services cannot be satisfactorily performed by its employees or by any other state agency.

4. Request and utilize the advice and services of all 'ederal, state, local and regional agencies.

5. Correspond, confer and represent its own interest or the interest of any political subdivision upon request. Added Laws 1978, Ch. 52, § 1, eff. May 18, 1978.

1978 Reviser's Note:
In paragraph 1, the words "with political subdivisions of this state" following "information" were transposed to follow the word "relationship" pursuant to authority of section 41-1304.02.

§ 37-175. Information; cost

The resources division shall make information available to any person requesting such information at a uniform rate adequate to cover the cost of providing such information. Added Laws 1978, Ch. 52, § 1, eff. May 18, 1978.

§ 37-176. Deposit of monies; claims

A. Monies received from any source by the resources division shall be promptly paid by the administrator to the state treasurer and shall be deposited to the credit of the state land department.

B. Claims for expenses shall be approved by the administrator. Added Laws 1978, Ch. 52, § 1, eff. May 18, 1978.

Arizona Statutes amending the powers of the Director of the Department of Property Valuation

House Bill 2376

AN ACT

RELATING TO STATE GOVERNMENT; AUTHORIZING PURCHASE OF ORTHOPHOTO BASE MAPS FROM NATIONAL AERONAUTICS AND SPACE ADMINISTRATION; AUTHORIZING DIRECTOR OF DEPARTMENT OF PROPERTY VALUATION TO CHARGE FOR DUPLICATION AND SALE OF ORTHOPHOTO BASE MAPS AND DEPOSIT REVENUES IN GENERAL FUND; AMENDING SECTION 42-123, ARIZONA REVISED STATUTES, AND MAKING AN APPROPRIATION.

Be it enacted by the Legislature of the State of Arizona:

Section 1. Section 42-123, Arizona Revised Statutes, is amended to read:

42-123. **Powers and duties of director**

A. The director shall:

1. Exercise general supervision over county assessors in the administration of the state property tax laws of the state for the purpose of insuring that all property is uniformly valued for state property tax purposes.

2. Prescribe rules and regulations relating to the enforcement of the powers and duties of the department under the provisions of this title.

3. Require the use by the county assessors of prescribed forms for the listing and valuing of property for tax purposes, the reporting of changes in valuations and for such other purposes as may be required by the director under the provisions of this title.

4. Require county assessors to maintain uniform maps and records.

5. Adopt standard appraisal methods and techniques for use by the department and county assessors in determining the valuation of property, and prepare and maintain manuals and other necessary guidelines reflecting such methods and techniques in order to perpetuate a current inventory of all property subject to taxation and the valuation thereof. In

the standard appraisal methods and techniques adopted current usage shall be included in the formula for reaching a determination of full cash value and when the methods and techniques adopted prescribe the use of market data as an indication of market value, the price paid for future anticipated property value increments shall be excluded.

6. Require the county assessors to meet with the director at the state capitol, or at a place designated by him, at least twice a year for the purpose of considering matters relating to property taxation. The traveling expenses of assessors in attending such meetings shall be paid by the respective counties.

7. Investigate property valuations and any matters relating to property taxes and require the production of any private or public record relating to such valuations or property taxes. The director or his agents may enter upon and examine any and all property within the state for the purpose of determining its full cash value and require any officer whose duties relate to the assessment or collection of taxes to report to him at such time and in such manner as he prescribes. In the event the owner or possessor of property refuses entrance to the director or his agents, the valuation of such property may be estimated by the director.

8. Require the use by county assessors of such a data processing system as the director may prescribe, provided that any county assessor having a data processing system compatible with the system prescribed by the director may continue to use his own system as long as it is coordinated with the system prescribed by the director.

9. The director shall contract with the counties to furnish electronic data processing equipment in instances where the counties do not have the equipment necessary to meet the requirements of the director.

10. Furnish assistance to the county assessors in order to implement placement on the rolls of the valuations determined under article 2.1 of this chapter and to assure a uniform valuation of all property throughout the state for property tax purposes, including but not limited to the providing of services of department personnel to the counties, provided that subsequent to June 30, 1968 the cost of providing the services of department personnel to the counties shall be charged to the county served.

11. Furnish the state board with such information as it may request.

12. AT SUCH TIME AS THE STATE ACQUIRES FROM THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ORTHOPHOTO BASE MAPS FOR USE BY ALL DEPARTMENTS OF ARIZONA STATE GOVERNMENT AND OTHERS IN NEED OF SUCH MAPS, CHARGE FOR DUPLICATION AND SALE OF THESE MAPS AND DEPOSIT SUCH REVENUES IN THE STATE GENERAL FUND.

B. The director may:

1. Examine into all alleged violations of the provisions of this title relating to the valuation of property and the assessment and collection of taxes and request the attorney general or the county attorney in their respective counties to commence and prosecute actions and proceedings or to represent counties to commence and prosecute actions and proceedings or to represent the department in litigation to enforce the laws relating to taxation and orders, or the rules and regulations of the department. When in the opinion of the director and in the opinion of the attorney general or

the county attorney of the county in which the public official serves, a public official, who performs valuing, taxing or equalizing functions, is guilty of official misconduct or neglect of duty, the director shall take whatever steps are necessary to insure that complaints are filed and prosecutions commenced against such officials for their removal from office. A complaint by the director charging official misconduct or neglect of duty of a public officer shall be delivered to the county attorney or to the attorney general who shall file the original with the superior court in the county in which the public official serves and cause a copy thereof to be served upon such public official. Proceedings upon such complaints shall be in accordance with the provisions of subsections B and C of section 38-342, and sections 38-343 and 38-345.

2. Study the tax systems of other states.

3. Employ technical experts and assistants and make contracts for services as may be required to carry out its duties.

4. Appoint advisory committees representative of various classes of property.

5. Request the attorney general to initiate a mandamus action if any assessor fails to follow any regulation, rule, order or direction of the director or the department or if the director determines that an assessor, or a county board of equalization has practiced discrimination in the valuation of property. For the purposes of this section, county boards of equalization and the county assessors are state officers within the meaning of article 6, section 5 of the constitution of Arizona.

6. Contest any proposed valuation or classification or any proposed change in valuations or classifications before any county board of equalization or before the state board of property tax appeals. If any decision of any county board of equalization or of the state board of property tax appeals is, in the opinion of the director, erroneous, the director may appeal such decision to the superior court in the manner provided in section 42-151, on or before the final date a taxpayer may file an appeal from the valuation or classification of his property.

7. SELL CONTACT PRINTS OF ANY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ORTHOPHOTO BASE MAPS ACQUIRED BY THE DIRECTOR AND DEPOSIT SUCH REVENUES IN THE STATE GENERAL FUND.

Sec. 2. **Appropriation; purpose**

A. The sum of four hundred eight thousand seven hundred dollars is appropriated to the governor to fund the Arizona resources information system for the fiscal year beginning July 1, 1972, and to enable the state to acquire from the national aeronautics and space administration orthophoto base maps of the entire state of Arizona for use by all departments of Arizona state government.

B. The funds appropriated in subsection A are to be available in the amounts and for the purposes following:

Personal services	$ 12,400.00
Office space	5,000.00
Equipment -	
Furniture	1,900.00
Viewing	14,500.00
Travel-in and out-of-state	4,400.00
Supplies and photo reproduction	11,000.00
Contingency	15,000.00
Orthophoto base sheets	200,000.00
Equipment	18,000.00
Outside services	126,500.00
Total	$408,700.00

Sec. 3. **Exemption**

The appropriation made by this act is exempt from the provisions of section 35-190, Arizona Revised Statutes, relating to lapsing of appropriations.

Sec. 4. **Emergency**

To preserve the public peace, health and safety it is necessary that this act become immediately operative. It is therefore declared to be an emergency measure, to take effect as provided by law.

Approved by the Governor - May 24, 1972

Filed in the Office of the Secretary of State - May 24, 1972

APPENDIX II

OFFICE OF THE AUDITOR GENERAL
SURVEY OF POTENTIAL AGENCY USERS OF MAPS, LANDSAT IMAGERY AND OTHER CARTOGRAPHIC PRODUCTS

APPENDIX II

OFFICE OF THE AUDITOR GENERAL
SURVEY OF POTENTIAL AGENCY USERS OF MAPS,
LANDSAT IMAGERY AND OTHER CARTOGRAPHIC PRODUCTS

PART I: CARTOGRAPHIC SERVICES, EXCLUDING LANDSAT

1. Has your agency obtained maps or other cartographic information from the Information Resources Division or ARIS?

	State Agency	Local Agency	Federal Agency	Total
Yes	14	6	4	24
No	1	7	-	8
Total	15	13	4	32

2. What cartographic products has your agency received from the Division?

	State Agency	Local Agency	Federal Agency	Total
Topographic maps	12	1	2	15
Land status maps	8	2	-	10
Flood-prone area maps	7	-	-	7
Urban study maps	5	-	-	5
Orthophotoquads	11	5	4	20
Aerial photographs	10	1	1	12
Total	53	9	7	69

(Multiple agency responses within totals)

Other products mentioned: Vegetation cover maps (2), geologic maps, soil maps, land subsidence maps, Landsat imagery, land-use maps.

3. What was (were) the primary reason(s) for obtaining the cartographic product from the Division?

	State Agency	Local Agency	Federal Agency	Total
Wide range of products	7	-	-	7
Less expensive source	4	-	-	4
Only known source	7	3	2	12
Timely source	9	1	3	13
Total	27	4	5	36

(Multiple agency responses within totals)

Other reasons stated by the agencies: Convenient source (2), unique products (2), "Official" Agency.

4. What other sources of cartographic products does your agency use and what products do these sources supply? (Only those sources most frequently mentioned)

Source	Type of Products	State Agency	Local Agency	Federal Agency	Total
U.S. Geological Survey	Topographic maps, geological maps, orthophotoquads	8	7	4	19
Arizona Department of Transportation	Highway maps, aerial photography, County cadastral maps	4	6	-	10
University of Arizona, Office of Arid Land Studies	Vegetation maps, flood-hazard maps, wildlife habitat maps, satellite imagery	2	3	-	5
U.S. Soil Conservation Service	Soil maps, vegetation analysis maps, flood-plain study maps	2	5	1	8
Cities and counties	Parcel maps, land-use maps, road maps, water information maps	1	4	-	5
Private companies	Aerial photographs and many other products	3	2	1	6
U.S. Forest Service	Land-use patterns in National Forests	1	2	-	3
	Total	21	29	6	56

(Multiple agency responses within totals)

5. Of all the cartographic product sources, which one is the primary supplier of your agency's product needs? (Only those agencies mentioned most frequently)

Source	State Agency	Local Agency	Federal Agency	Total
U.S. Geological Survey	5	1	3	9
Information Resources Division or ARIS	6	1	-	7
Arizona Department of Transportation	1	1	-	2
No response	3	10	1	14
Total	15	13	4	32

PART II: LANDSAT IMAGERY

6. Has your agency ever used Landsat-derived information?

	State Agency	Local Agency	Federal Agency	Total
Yes	11	4	3	18
No	4	9	1	14
Total	15	13	4	32

7. If yes, when and how did your agency use the information?

Use	State Agency	Local Agency	Federal Agency	Total
Inventory of productive and abandoned agricultural land	2	-	-	2
Definition of water courses and flood hazards	1	1	-	2
Study of geologic and hydrologic conditions	2	1	1	4
Classification of vegetation types and other land cover inventories	2	2	2	6
Tracking of pollutant planes	1	-	-	1
Overall perspectives of the region	3	1	-	4
Identification of hazardous-waste disposal sites	1	-	-	1
Total	12	5	3	20

(Multiple agency responses within totals)

8. Would the uses be considered experimental or operational?

	State Agency	Local Agency	Federal Agency	Total
Experimental	7	4	3	14
Operational	8	1	1	10
Total	15	5	4	24

(Multiple agency responses within totals)

9. Of what benefit was the information to your agency?

		State Agency	Local Agency	Federal Agency	Total
Almost no benefit	1	-	-	-	-
	2	-	-	-	-
Limited benefits	3	6	2	2	10
	4	3	1	-	4
Exceptional benefits	5	2	-	1	3
No response		-	1	-	1
Total		11	4	3	18

10. To what extent will your agency use Landsat-derived information in the future?

		State Agency	Local Agency	Federal Agency	Total
Hesitate to make future use	1	-	-	-	-
	2	-	-	-	-
Limited future uses	3	5	4	2	11
	4	1	-	-	1
Extensive future uses	5	5	-	1	6
Total		11	4	3	18

11. Do you have any major criticisms of Landsat-derived information?

Major Criticisms Stated by Agencies: Digital and image resolution not fine enough for extensive use in resource management; Images are often distorted around the periphery; Image scale is not compatible with USGS quadrangles; Spatial resolution is poor.

12. One criticism of Landsat data voiced by at least two agencies has been that the product resolution is of unsatisfactory quality. If the resolution of Landsat information could be upgraded, would your agency be able to make operational use of the data?

	State Agency	Local Agency	Federal Agency	Total
Yes	7	3	2	12
No	1	1	1	3
No response	3	-	-	3
Total	11	4	3	18

Operational Uses Stated by Agencies: Classifications and mapping of land cover and land use; Symptomatic indication of population changes; Monitor and evaluation of wildlife habitats, vegetation communities and agricultural lands; Evaluation of the environmental effects of pollution and hazardous-material disposal sites; Review of environmental-impact statements.

13. What entities, other than your agency, provided resources or services to your Landsat-application projects(s)?

Entity	Resource or Service	State Agency	Local Agency	Federal Agency	Total
University of Arizona, Office of Arid Land Studies	Interpretation of imagery, production of maps, training, field support	1	3	-	4
NASA	Imagery, interpretation of imagery, funds for analysis	-	-	1	1
U.S. Geological Survey	Imagery and digital tapes, interpretation of imagery	2	-	1	3
Information Resources Division or ARIS	Technical assistance, use of equipment, other services	1	-	-	1
Arizona State University	Research assistance	1	-	-	1
U.S. Forest Service	Information and services	1	-	-	1
U.S. Weather Service	Meterological data	1	-	-	1
	Total	7	3	2	12

(Multiple agency responses within totals)

14. If the Information Resources Division or ARIS provided a resource or service, of what contribution did the resource or service make to the use of Landsat imagery by your agency?

		State Agency	Local Agency	Federal Agency	Total
Little or no contribution	1	2	3	-	5
	2	-	-	-	-
Average contribution	3	5	1	1	7
	4	1	-	-	1
Extensive contribution	5	2	-	-	2
Total		10	4	1	15

15. In using Landsat, what resources did your agency apply to the project(s)?

Resource Provided by Agency	State Agency	Local Agency	Federal Agency	Total
Field support to verify interpreted results	3	1	1	5
Staff to interpret and analyze data	3	-	1	4
Equipment to interpret and analyze data	-	-	1	1
Base maps and/or supporting aerial photography	2	-	1	3
Total	8	1	4	13

(Multiple agency responses within total)

16. Landsat imagery is satellite-produced imagery which can be used to identify vegetation cover and other land status information. The imagery is available in either computer-compatible digital form or 13,225 square-mile photographic scenes.

Has or will your agency consider/considered using Landsat imagery in the future? (Only for those agencies which have never used Landsat imagery in the past. See question 6.)

	State Agency	Local Agency	Federal Agency	Total
Yes	4	5	1	10
No	-	2	-	2
No response	-	2	-	2
Total	4	9	1	14

17. For what purpose has your agency considered using Landsat imagery? (Only those agencies who answered Yes to Question 16)

Uses Proposed by Agencies: Visual land status perspective; Selection of potential sites for the application of solar energy; Measurement of solar radiation; Monitor and evaluation of mining and grazing activity; Studies of water quality; Land-use classification and analysis.

PART III: INFORMATION SYSTEM

18. Has your agency had any contact with the Information Resources Division of the State Land Department regarding a natural resource information system?

	State Agency	Local Agency	Federal Agency	Total
Yes	12	5	2	19
No	3	7	2	12
No response	-	1	-	1
Total	15	13	4	32

19. What was the nature of the contact with the Division?

Nature of Contact Stated by Agencies	State Agency	Local Agency	Federal Agency	Total
Discussion of system capabilities and possible applications by agency	5	1	1	7
Informal communication concerning Division's objectives and capabilities	4	2	-	6
Contact through State data coordination network	2	-	-	2
Addition of agency materials to existing cartographic network managed by the Division	1	-	1	2
No response	-	2	-	2
Total	12	5	2	19

(Total represents those agencies answering Yes to Question 18.)

20. Has your agency been provided the opportunity to express its data processing needs to the Information Resources Division?

	State Agency	Local Agency	Federal Agency	Total
Yes	9	2	2	13
No	3	4	-	7
No response	3	7	2	12
Total	15	13	4	32

21. What are your agency's projected needs for an automated cartography system? Does your agency have access to such a system at this time?

Projected Needs Stated by Agencies	State Agency	Local Agency	Federal Agency	Total
Up-to-date maps and digital analysis for use in planning and research	3	-	-	3
Up-to-date maps and digital analysis for recurring agency operations	4	1	-	5
Digitization of existing maps for processing at the Arizona Department of Transportation or elsewhere	1	-	-	1
Have not projected needs at this time	1	2	1	4
No significant need at this time	6	6	1	13
No response	-	4	2	6
Total	15	13	4	32

Access to System Stated by Agencies	State Agency	Local Agency	Federal Agency	Total
Access to Federal computer systems with automated mapping	-	-	3	3
Limited or no access to such a system at this time	10	4	-	14
No response	5	9	1	15
Total	15	13	4	32

22. What products would a natural resource information system have to provide in order to satisfy your agency's projected data needs?

Natural Resource Information System Products Requested by Agencies	State Agency	Local Agency	Federal Agency	Total
Digitized land related data for statistical analysis*	3	3	1	7
Updated land-related data in map form*	9	5	3	17
Capability of graphical display of land-related data*	2	1	-	3
Special equipment for image viewing	1	-	-	1
Aerial photography	2	1	-	3
Total	17	10	4	31

(Multiple agency responses within totals)

23. As in any information system, data must be available for this system's success. The Director of the Information Resources Division has stated that most of the data will be obtained through Landsat or user agencies. Does your agency have any land status or related data which could be used in a natural resource information system? What is this data?

Agency Responses Included the Following Data Elements: Vegetation inventories; wildlife and fish habitation data; hydrologic and water quality information; demographic data; tax assessment data; archaeologic and cultural data; recreation area locations; highway system location; mineral, geologic and mining data; waste disposal locations; air quality data.

* Land-related data refers to many types of data that can be geographically referenced. Examples of these data stated by agencies include: land use, land cover, topographic, geologic, hydrologic, meteorological, vegetation, water quality, climatologic, recreational areas, air quality, soil conditions and geothermal conditions.

24. Has the Information Resources Division contacted your agency concerning the capture of this data for the information system?

	State Agency	Local Agency	Federal Agency	Total
Yes	4	1	1	6
No	9	11	3	23
No response	2	1	-	3
Total	15	13	4	32

25. Assuming that data entry will be completed by the data supplier, will your agency be able to supply data to the information system? When?

Agency Ability to Supply Data	State Agency	Local Agency	Federal Agency	Total
Cannot assess ability to input data at this time*	4	3	-	7
Data is available and can be entered into the system**	5	-	2	7
Data is available, but agency is unable to input data at this time	3	1	1	5
Not applicable or no response	3	9	1	13
Total	15	13	4	32

26. Would your agency suffer excessive expenses or undue hardships in supplying this data? Would additional staff be needed?

	State Agency	Local Agency	Federal Agency	Total
Unable to make assessment at this time	4	1	-	5
Additional personnel would be needed or excessive expenses would be incurred	1	3	1	5
No hardships or expenses	5	-	2	7
Information classified as confidential might be declared unavailable	1	-	-	1
Not applicable or no response	4	9	1	14
Total	15	13	4	32

* Several agencies indicated that additional information concerning the data formats, requested volumes, etc. would have to be established prior to assessing their ability to input data.

** Several agencies indicated that data entry could be supplied if the agency received additional resources and/or the data was in a format compatible to entry into the information system.

27. What alternatives are available to your agency in obtaining automated cartography and other data processing services?*

	State Agency	Local Agency	Federal Agency	Total
Private enterprise	3	-	2	5
University of Arizona, Office of Arid Land Studies	1	2	-	3
Federal agencies	1	1	3	5
Developed internally or with a contracting agency	3	1	-	4
None known at this time	5	2	-	7
Total	13	6	5	24

(Multiple agency responses within totals)

28. If the Information Resources Division did complete a natural resource data base with automated mapping capabilities, would your agency use the Division's services?**

	State Agency	Local Agency	Federal Agency	Total
Yes	13	6	2	21
No	1	2	-	3
No responses	1	5	2	8
Total	15	13	4	32

* Several agencies have access to general data processing services and the compilation of the responses refers only to alternative automated cartography services. Additionally, several respondents replied that the stated alternatives may be duplicative or excessively expensive, an indication that the alternative may not be the best solution.

** Several responses indicated that extensive use of the information system would depend upon the detail and content of the information and services provided.

29. What other services would you like to see the Division supply?

Other Services Requested by Agencies:

1. Provide specific information about the products and services available from the Division and how they can be applied by agencies.

2. Provide information regarding current remote-sensing and multi-agency geographic information system developments.

3. Provide geographic information system services in this State and coordinate those activities with other related geographic information systems such as the Accident Location and Identification Surveillance System (Arizona Department of Transportation) and the Geographic Base File/Dual Independent Mapping Encoding (Maricopa Association of Governments).

4. Coordinate the Division's remote-sensing activities with those activities currently operational at the University of Arizona, Office of Arid Land Studies.

5. Provide clearinghouse and library services for the use of current and historical maps, aerial photography and other publications of natural resource data.

6. Provide technical training for technology transfer and on-site services for the application of remote-sensing technology.

APPENDIX III

REPORT ON THE SURVEY OF REQUIREMENTS OF THE ARIZONA RESOURCES INFORMATION SYSTEM

REPORT ON THE
SURVEY OF REQUIREMENTS
OF THE
ARIZONA RESOURCES INFORMATION SYSTEM

by

Department of Administration
Data Processing Division

Jack Stanton
State Automation Director

April 1978

Introduction

The management of Arizona Resources Information System (ARIS) requested that an independent survey of the automation needs of their organization be made by the Data Processing Division (DPD) of the Department of Administration. The survey is intended to answer the following questions:

1. What demand exists within State agencies for services now or potentially available from ARIS?
2. What modifications or enhancements to the existing hardware configuration and software are required to make the entire system functional at the originally chartered and designed level?

Since pending legislation proposes that ARIS be transferred from the Department of Revenue to the Land Department, an attempt has been made here to provide information for the benefit of the Land Department since it may, in the near future, become responsible for ARIS. Permission to conduct the survey was obtained from the Director of the Department of Revenue.

Background

ARIS was created by the Governor in 1972 to serve as the central source of land and other physical resource data in the State. To achieve its objective, computer aided mapping and data manipulation capabilities were proposed and a system of hardware and software defined. To oversimplify the record, the components that were installed were never integrated into a fully operational system because several key elements were not acquired. Budgetary constraints were cited as the primary reason for this failure. As a result, only relatively unsophisticated services could be provided. Among the most important of these has been the collection and dissemination of high altitude aerial photographs and

various maps generated for the most part by federal agencies. These have received wide use in the land resource-related activities of the State and will probably continue to be popular in the future.

Survey Approach

DPD has attempted to answer the questions posed above by first assessing the demand for service from ARIS and then recommending hardware, software and organizational resources to meet the demand. It was accepted that there might be little or no demand in which case no upward development of ARIS resources would be recommended.

To complete the first phase, interviews were conducted with all identified user groups currently or potentially served by ARIS. These included the following:

Department of Revenue--Property and Special Taxes
Game and Fish Department--Planning
OEPAD--Planning
Department of Transportation--Planning
Land Department--Planning, Natural Resources
Department of Economic Security--Planning
Oil and Gas Commission--Administration and Planning
Outdoor Recreation--Planning
Water Commission--Planning

Twenty-four managers and professional employees who attended the various interview meetings were asked a standard set of questions which usually led to general discussion and additional questions. The basic questions were:

- What services do you presently receive from ARIS?
- What additional services do you need from ARIS?
- Is there another available source of these services?
- Would you be willing to pay for ARIS services?

In the course of the interviews, it was possible to identify the needs of the various users and to classify these into several groups that could be met by ARIS. Our recommendations address these common needs to the extent that they can be met by automation methods.

To gain further insight into the state of the art of automated mapping, we visited the Mapping Project Manager of the City of Phoenix where a year-long study of needs has just culminated in the receipt of bids for a complete system. This experience was extremely valuable to us in defining the capabilities offered today and the related economic considerations.

In addition to the interviews described above, discussions were held with representatives of EBO and with the ARIS staff. A brief study of currently available components in the computer marketplace was also made to ascertain the feasibility of adding to the existing system.

Conclusions

Needs:

The results of the questioning and discussion indicated clearly that the vast majority of users interviewed needed and wanted an expanded ARIS-type resource. Of the nine agency/employee groups queried, the following results were obtained.

Strongly Supportive	Supportive	Indifferent
7	1	1

The needs most frequently identified by the majority of users were the following. They are listed in order of importance as we have interpreted them.

1. Mapping capability based on digized input for the following applications:
   a. geologic formations

b. mineral resources
c. water rights ownership
d. water resources, flood plains, etc.
e. surface boundaries--ownership (tax areas)
f. recreation areas
g. vegetation
h. transportation planning
i. wildlife and habitat
j. overall use planning

2. Development of physical features data base with flexible output capabilities to meet analysis, modeling and other requirements for most areas indicated under #1 above.
3. Ability to inventory resource data with common location characteristics for all categories identified in #1 above.
4. Current aerial photographs with high resolution and at scales compatible to user needs.

One may conclude that 1, 2, and 3 are all variations on the same theme - a complete data base with mapping software. The reason these are stated as separate needs is because some of those interviewed felt that they could manage with only #1. Others who needed #3 were interested in tabular or comparative digital data only instead of mapping capability. And there were a few who need only photographs. It should be noted that a substantial number of users did not have a clear understanding of the potential capabilities of automated mapping even though they knew what their own needs were.

Equipment:

With respect to the existing configuration and software, the conclusions drawn are based mainly on our interviews with ARIS staff and from discussions with the City of Phoenix representative. The equipment in place at ARIS was acquired from several vendors approximately six years ago. Some of the principal components are no longer manufactured. Thus, in addition to the problem of

multi-vendor maintenance responsibility for a single system, there is a question of physical and technical obsolesence. It is possible, however, to add the components necessary to complete the system, but the maintenance problem might get even worse if additional manufacturers are represented. The purchase cost of needed components is approximately $50,000.

New technology has evolved rapidly in the past six years and during this time the cost of equipment has actually decreased while performance has increased. The expanded capabilities and cost advantage are a strong incentive to look at new hardware for ARIS.

Software:

Very little software exists at ARIS beyond the basic operating system. This is due to the fact that no qualified programmer-analyst has worked on the ARIS staff since the very early years. The required programming language to operate the present equipment is Fortran. Contact was made with the DOA Data Center and they have no one qualified to assist ARIS at present. The mapping field is specialized but there should be no reasons other than budgetary ones why a qualified programmer-analyst could not be hired. Several valuable software products are available for purchase at present.

The conclusions can be summarized as follows:

1. A demand for automated mapping and related services exists at present among the users surveyed. (No attempt was made to determine the actual level of services needed to satisfy these users.)
2. ARIS equipment can be upgraded and a complete system provided. Maintenance problems would continue. Software development could begin but no programming capability exists at present.

3. New technology, improved prices and growing demand for service argue for an entire new system. Because of the necessity to do a thorough study of requirements, installation of new hardware would be at least a year from favorable decision and budget authorization. The study should consider other alternative sources of support including other State data centers.

Recommendations

These recommendations are based on the assumption that those users who presently have need for ARIS-type services will continue to support the program and contribute resources as required.

1. If funds are available, ARIS should proceed now to (a) acquire the necessary hardware to complete their present system and (b) hire a fully qualified programmer-analyst to begin talking to users and translating their requirements into system capabilities. If an equipment operator is required, one should either be hired or a present staff member trained. Equipment should be leased for one year if possible. (See list and diagram) This would be an interim step to enable users to begin to receive automated output as quickly as possible. The limiting factor would be hiring the qualified programmer-analyst. Development should be limited here with an eye to implementing #3 below.
2. A committee of ARIS staff and users should initiate (now) a detailed study of user needs and objectives and develop a three-year plan for meeting these needs. The plan should make clear commitments to achieve objectives if funding is available. The history of unfulfilled objectives is such that nothing less than this should be offered. DPD will assist with the planning if requested.
3. As soon as requirements are defined in #2 above and specifications can be drafted, obtain bids for and order a new

hardware system tailored to the needs of the users unless service is to be obtained from another source. Lease or buy system on installment basis and plan to acquire at least one additional programmer for software development. Monthly equipment cost or external service will run $6,000-$10,000. This new system, if selected, should completely replace the existing system after an orderly conversion period.

4. After #2 is complete, begin detailed design of a geographical data base to meet users' needs. This process will require the active participation of all users, both in the design phase as well as in implementation.
5. After plan is complete, a committee of users and ARIS staff (and this office, if requested) should establish a formula for charging for the use of ARIS services.

It is very important that all those who will be affected by the implementation of the above recommendations have a clear understanding of the benefits, costs, and time span involved. To initiate this type of communication, it might be advisable to invite representatives of hardware manufacturers or their customers to visit the Capitol for workshops or discussion meetings.

The effect of the transfer of ARIS and of these recommendations upon the Land Department will be to add an additional management responsibility and, depending on the wishes of the Legislature, a possible added use of Land Department revenues. Users of automated mapping services within Land, and there are several, should benefit from the closer association. No direct benefit to or conflict with current data processing functions of the Land Department should be expected. It might be economical and efficient to combine these functions under one capable D.P. Manager although it should be recognized that making ARIS a successful operation will be a heavy responsibility in itself.

ARIS EQUIPMENT AND PROPOSED BASIC ADDITIONS

Installed ARIS computer equipment

Hardware:

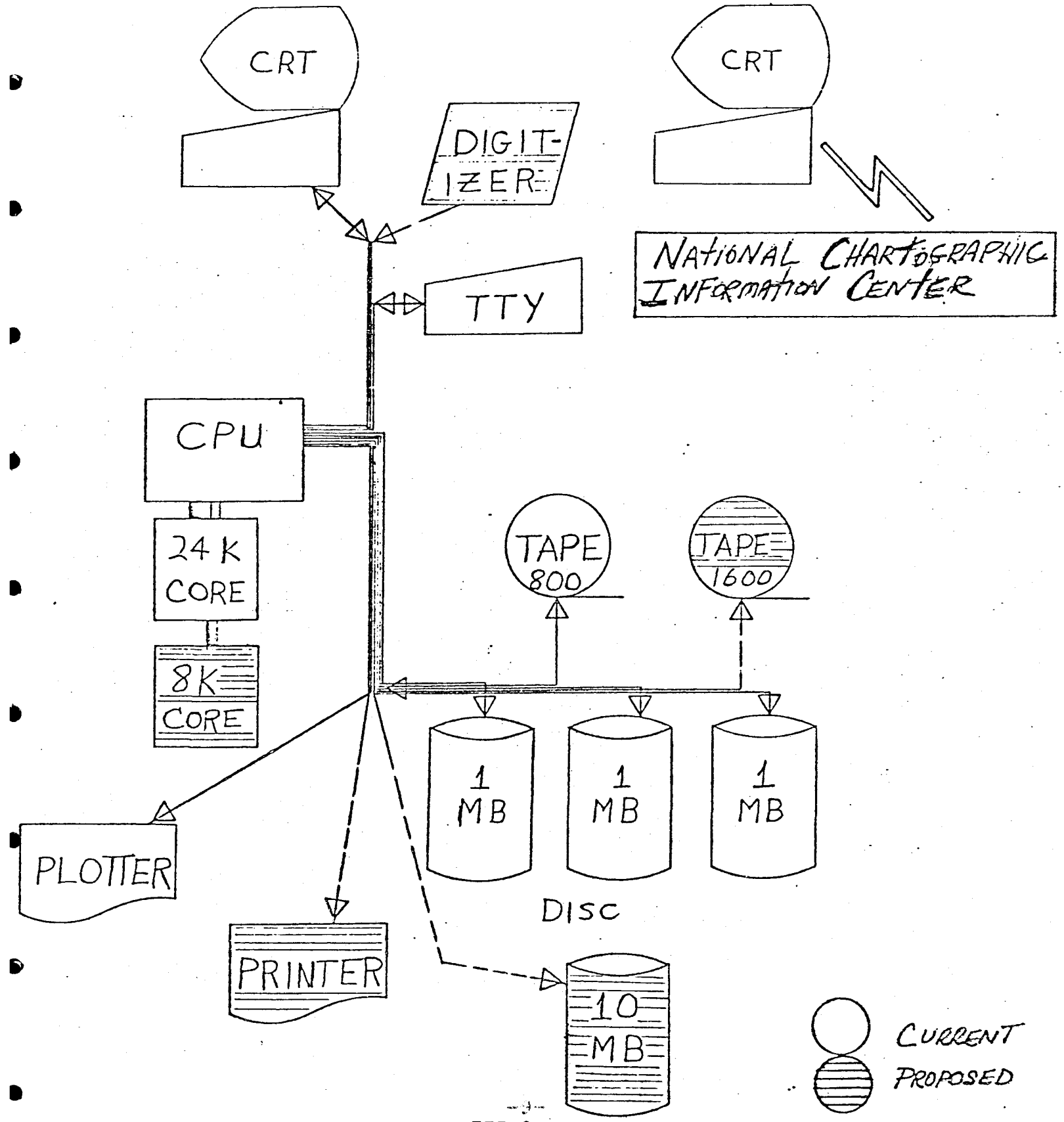
CPU	-	Data General Nova 800 Jumbo, 24K memory, auto program load feature
Tape	-	Wanco model 10A, 800 BPI, 9 track
Disc	-	3 Data Disc model 8410, 1 MB each, fixed head
Terminals	-	2 Tektronix CRT's model 4010-1 with graphic capabilities. One modified for switch selectable 110-9600 baud communications.
Plotter	-	Zeta Research model 3600

Current upgrades needed and available

Hardware:
- 8 K core memory
- 10 MB disk
- 300 LPM printer
- 1600 BPI tape drive
- Digitizer

Software:
- RDOS operating system software
- Parcel mapping software
- Georgia Tech software enhancements
- Georgia Tech mapping data base (in township, range, section and quarter section)

CURRENT AND INTERIM CONFIGURATION



APPENDIX IV

OCTOBER 9, 1979, LETTER TO THE STATE AUTOMATION DIRECTOR FROM IRD (ARIS) DIRECTOR

Arizona
State Land Department
INFORMATION RESOURCES DIVISION
1624 W. ADAMS RM 300
PHOENIX, AZ 85007
(602) 271-4081

October 9, 1979

Mr. Jack Stanton
State Automation Director
Data Processing Division
Department of Administration
State Capitol, West Wing
Phoenix, Arizona 85007

Dear Mr. Stanton:

The Arizona State Land Department has completed the budget request for FY 80-81, which includes the following computer hardware replacement items for your review and approval.

1.	Data General Eclipse S/130 Computer Model 8611-NB a. This Model includes 256 KB b. Map board c. Battery back-up d. ERCC	$24,500
2.	Floating Point Board Model 8613	2,000
3.	4 line Port - ULM 5 board - 2 each (8 lines total)	3,600
4.	Tape Drive Unit Model 6026 (9 track - 800/1600 selectable)	14,500
5.	Dasher TPI - terminal - Model 6081-A	3,050
	TOTAL REQUESTED	$48,600

Item one will replace the present Nova 800 computer which will allow the system to be used in a time sharing environment. The present Nova 800 computer is a single user system making it very difficult to continue program development and user system time together. Last year the Nova 800 was maintained by the company on a type II level. It now is becoming difficult to maintain, and provide service to the users.

The present tape drive is a 800 BPI, 9 track unit but it doesn't allow us to process Landsat tapes, which are normally 1600 BPI, 9 track. The replacement proposal will allow us to use the 1600 BPI mode or transfer, formated data 800 BPI - tape unit one to tape unit two.

The Dasher TPI terminal will be added to the system, enabling it to be used as a master input/output device, freeing the present CRT to be used as a user terminal.

With the installation of the Eclipse S/130 computer we will use the Data General Advanced Operating System (AOS) allowing time sharing, multi-language use and increased user availability.

We are presently under a Federal grant to test a system called "Ecosim" interactive Fortran simulator package for Forestry management.

Under this grant we are renting a Eclipse S/130 system to test the Forestry package, allowing linkage to occur between the Forestry office in Flagstaff using a LA36 terminal and the system. An additional benefit of this test is to insure the proposed replacement of the NOVA 800 with the Eclipse system is the most cost effective move. We feel extremely strong about the results of this test haven proven the ease of transfer from one operating software to another with no difficulty.

I believe these replacement items are identified in the original system approval project report provided by you and your staff last year.

We hope the request meets your review and approval requirements. Please call me if you have any questions.

Sincerely,

Michael S. Castro, Director
Information Resources Division
Arizona State Land Department

cc: Shafiq Jamali

MSC/be

APPENDIX V

OCTOBER 17, 1979, LETTER TO IRD (ARIS) DIRECTOR FROM THE STATE AUTOMATION DIRECTOR

STATE OF ARIZONA

DEPARTMENT OF ADMINISTRATION
DATA PROCESSING DIVISION

MEMORANDUM:

TO : Michael S. Castro

DATE : 10/17/79

FROM : Jack Stanton

SUBJECT: Information Resources Division Budget Request for FY 80-81 (Reference your letter dated 10/9/79)

The original system approval project report referred to in the next to the last paragraph of your letter is in actuality a report on a survey of requirements of the Arizona Resources Information System which was prepared by DPD and issued April 21, 1978. The report contained recommendations but no approvals. The recommendations were based upon the system being used by agencies other than just the Land Department, and it was expected that expansion of the system beyond acquiring the necessary hardware to complete the present system (Recommendation 1-a.) would be based upon cost justifying the need for the expansion.

We have not seen any evidence that the value or beneifts derived from or expected to be derived from the system have been identified and quantified. The paragraph immediately following the five recommendations states in part,

> "It is very important that all those who will be affected by the implementation of the above recommendations have a clear understanding of the benefits, costs and time span involved..."

While we continue to support the use of ARIS, we cannot approve or support the expansion of the system based upon the material we have received to date.

JR:ro

cc: Don Olson, EBO
Ron Gauthier, SPO

APPENDIX VI

RESUME OF THE DIRECTOR OF THE NATURAL RESOURCES INFORMATION SYSTEMS PROJECT WITH THE NATIONAL CONFERENCE OF STATE LEGISLATURES

RESUME

Paul A. Tessar

EDUCATION:

Graduate: Masters of Urban Planning -- Specialization in Quantative Methods and Computer Applications (two-year program), May 1974, University of Illinois, Urbana, Illinois.

Undergraduate: B.A. with Honors in History, June 1972, University of Illinois, Urbana, Illinois.

AWARDS AND HONORS:

South Dakota State Government Employee of the Month, February 1976.

University of Illinois/American Institute of Planners, Student of the Year, 1974.

AREAS OF COMPETANCE:

- Natural Resource Information System design, development, management and administration.
- Application of new technologies in natural resource planning and management processes.
- Land use and natural resource information analysis and application.
- Digital and manual remote sensing and analysis techniques.
- Land capability and suitability modeling.
- Development of interagency cooperative projects.
- Program Administration, including budget preparation and allocation; work planning, implementation and evaluation; contract negotiation and execution; and personnel hiring, supervision and evaluation.
- Statistical tools and methodologies, including multivariate analysis.
- Computer graphics and data display.
- Use of FORTRAN and Assembly Language.
- Computerized modeling and projection.

WORK EXPERIENCE:

2/78 to Present: Natural Resource Information Systems Project Director, National Conference of State Legislatures. Responsible for conducting a national communication and technical assistance program for state legislatures on Landsat and natural resource information systems' technology. Specific tasks include preparation of a national Remote Sensing newsletter focused on state applications of NRIS technology; conduct of state level workshops and committee briefings on NRIS technology, applications, limitations and costs; provision of technical assistance to legislators, staff or legislative committees; development of A Legislator's Guide to Natural Resource Information Systems and related oral presentations; staffing of NCSL Natural Resource Information Systems Task Force; supervision of state natural resource legislation surveys; preparation of a report on State Institutional and Technical Approaches to Landsat Utilization; and, a liasion with relevant state and federal agencies.

5/77 - 2/78 Assistant Remote Sensing Project Director, National Conference of State Legislatures. Responsible for assistaing in the implementation of a nationwide satellite remote sensing communications program designed to acquaint key state legislators and staff with the capabilities, applications, and limitations of Landsat technology. Specific tasks include preparation of a remote sensing newsletter; completion of a general brochure on Landsat geared to nontechnical readers; involvement in the planning and conducting of a series of five regional workshops; development of A Legislator's Guide to Landsat; frequent contacts with legislators and legislative and executive staff; and, providing feedback to NASA on technology transfer efforts from a state perspective.

2/76 - 6/77 Head, Planning Information Assistance Section, South Dakota State Planning Bureau. Responsible for all data identification, gathering, analysis, display, and application activities of the South Dakota State Planning Bureau's Planning Information System. Specific responsibilities include software and database development; production of a 400-page statistical abstract of South Dakota; applications assistance to information users; negotiation of interagency cooperative agreements; technical assistance to land resource analysis by local government; development of contracts with University research bureaus; budget management and preparation; work planning; intra- and interagency coordination; information systems development; policy research and proposal; overall section administration; and, supervision of a professional staff of seven.

7/75 - 2/76	Supervisor, Planning Data Analysis and Production Unit, South Dakota State Planning Bureau. Responsible for all planning data and analysis activities of the State Planning Bureau's Planning Information System. Specific responsibilities included database design; software development; data gathering and production; Landsat digital data analysis; land suitability studies; technical assistance to the application of output products in the planning process; and, supervision of a professional staff of four.
6/74 - 7/75	Chief, Land Resource Information System, South Dakota State Planning Bureau. Primary responsibility for all aspects of a statewide Land Use and Natural Resource Inventory and Information System, including conceptualization, planning, development, analysis, documentation and operation. Other responsibilities included development of machine procesing techniques for digital satellite data; supervision of an entry level planner; cataloging of existing natural resource data for a state Resource Information Center; and, development of interagency cooperative programs.
8/73 - 6/74	Research Assistant, Departments of Geography and Civil Engineering, University of Illinois. Primary responsibilities included development of software and analysis techniques for multispectral digital satellite imagery, and generation of land cover classifications for use in the preparation of an environmental impact statement for a proposed dam site (1/2 time).
9/72 - 5/74	Teaching and Research Assistant, Department of Urban and Regional Planning, University of Illinois. Assisted with graduate courses in Multivariate Statistical Analysis (Spring, 74) and Quantitative Methods (Fall, 73); did programming on a computer-based educational policy simulation, and statistical analysis for a transportation study on the mobility of the rural elderly (Spring, 73); lead discussion sections for an introductory Urban and Regional Planning course (Fall, 72). (Each 1/4 time).
5/73 - 7/73	Programmer, Champaign County Land Use/Housing Survey, Champaign County Regional Planning Commission. Developed analysis and editing software for a municipal land parcel information system.

PUBLICATIONS AND CONFERENCE PAPERS

State Institutional and Technical Approaches to Landsat Utilization, Paul A. Tessar and Becca Smith, National Conference of State Legislatures, September, 1979.

A Legislator's Guide to Landsat, Paul A. Tessar, Charles Palmer, and Sally Bay Cornwell, National Conference of State Legislatures, July, 1978.

"Working Paper for Land Use Planning Working Group", Paul A. Tessar, AIAA/NASA Conference on Aerospace Technology Transfer to the Public Sector, Crystal City, Virginia, November, 1977.

"Natural Resource Information Needs in the States", Paul A. Tessar and Sally Bay Cornwell, Proceedings of Legislative Workshops on State Uses of Satellite Remote Sensing, November, 1977.

Landsat: Down to Earth Views From Space, Paul A. Tessar and Sally Bay, National Conference of State Legislatures, June, 1977.

The Landsat Imagery Analysis Package: User Documentation, The Landsat Imagery Analysis Package: System Documentation, Paul A. Tessar, Roger L. Miller, Jerry Schlesinger, and Jeff Eidenshink, South Dakota State Planning Bureau, January, 1977.

The Digital Terrain Analysis Package: User Documentation, The Digital Terrain Analysis Package: System Documentation, Paul A. Tessar and Roger L. Miller, South Dakota State Planning Bureau, January, 1977.

"The Landsat Imagery Analysis Package: Automated Land Use Classification and Multidimensional Geographic Analysis", Paul A. Tessar and Jeff C. Eidenshink, Proceedings of the Second Annyal William T. Pecora Memorial Symposium, Sioux Falls, South Dakota, October, 1976.

"Applications of Digital Remote Sensing and Natural Resource Information to Land and Water Resource Planning in South Dakota", Paul A. Tessar, Proceedings of the Conference on Remote Sensing for the South and Southwest, Texas A & M University, College Station, Texas, September, 1976.

"The South Dakota Land Resource Analysis Program", Paul A. Tessar, Innovations In Land Use Management, University of North Dakota, Grand Forks, ND, June, 1976.

"Remote Sensing and Natural Resource Planning: Where Do We Go From Here?", Paul A. Tessar, State Planning Issues, Vol. 1, No. 1, Council of State Planning Agencies, Lexington, Kentucky, Spring, 1976.

"Remote Sensing: A New Tool for Environmental and Natural Resource Planning", Paul A. Tessar, Planning and Public Policy, Vol. 2, No. 1, University of Illinois, Urbana, February, 1976.

"Landsat: Space Technology in Natural Resource Planning", Paul A. Tessar, C. Ken Mayer, William Elkier, and Mary Verlaque, Public Affairs, No. 64, University of South Dakota, Vermillion, South Dakota, February, 1976.

"Innovative Methods for the Generation of State and Regional Land Use Information", Paul A. Tessar, and Oscar M. Lund, Proceedings of the American Institute of Planners Confer-in '75, San Antonio, Texas, October, 1975.

"The South Dakota Cooperative Land Use Effort: A State Level Remote Sensing Demonstration Project", Paul A. Tessar, Dennis R. Hood and William J. Todd, Proceedings of the NASA Earth Resource Survey Symposium, Houston, Texas, June, 1975.

A Land Use and Natural Resource Inventory Demonstration Project for South Dakota, Paul A. Tessar, Dennis R. Hood and Oscar M. Lund, South Dakota State Planning Bureau, February, 1975.

Introduction to the South Dakota Land Use Inventory System, Paul A. Tessar, South Dakota State Planning Bureau, January, 1975.

Land Use/Housing Survey -- Update Procedures, Paul A. Tessar, Champaign County Regional Planning Commission, June, 1973.

PROFESSIONAL REFERENCES

Available from: Placement Officer
Department of Urban and Regional Planning
University of Illinois
Urbana, Illinois 61801

Steve Merrick, Commissioner, South Dakota State Planning Bureau, State Capitol, Pierre, SD 57501.

Harley T. Duncan, Deputy Commissioner, South Dakota State Planning Bureau, State Capitol, Pierre, SD 57501.

Oscar M. Lund, North Dakota State Planning Division, 4th Floor, State Capitol, Bismarck, ND 58501

James R. Villone, Director, Criminal Justice Studies Program, University of South Dakota, Vermillion, SD 57069.

Carl V. Patton, Department of Urban and Regional Planning, University of Illinois, Urbana, Illinois, 61801.

Albert Z. Guttenberg, Department of Urban and Regional Planning, University of Illinois, Urbana, Illinois, 61801.

Michael P. Brooks, Head, Department of Urban and Regional Planning, University of Illinois, Urbana, Illinois 61801.

APPENDIX VII

FINAL REPORT OF THE DIRECTOR OF THE NATURAL RESOURCES INFORMATION SYSTEMS PROJECT WITH THE NATIONAL CONFERENCE OF STATE LEGISLATURES

TECHNICAL ANALYSIS OF THE CURRENT AND PROPOSED ARIZONA RESOURCE INFORMATION SYSTEM (ARIS)

Final
Report

Prepared by:

Paul A. Tessar, Director
Natural Resource Information Systems Project
National Conference of State Legislatures
1405 Curtis Street
Suite 2300
Denver, Colorado 80202

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BACKGROUND

The Arizona Auditor General's Office, Performance Audit Division, is currently performing a program audit of the Arizona Resource Information System (ARIS). The ARIS program, formerly a division of the Department of Revenue, is being implemented by the Information Resources Division of the State Land Department.

Staff from the Auditor General's Office requested technical assistance in executing the program audit from the National Conference of State Legislature's Natural Resource Information Systems Project. This report is intended to respond to this request and address the specific technical assistance objectives of the Auditor General's Office. (See Appendix B)

The focus of this report is on the hardware, software and applications - present and future - of ARIS. The National Cartographic Information Center (NCIC) local assistance function, the orthophotoquad program, and especially the engineering section were not investigated in depth and are dealt with only in a cursory fashion.

The findings in this report are based on two three-day visits to Phoenix, several interviews with ARIS staff, numerous phone conversations, several demonstrations of current ARIS capabilities and the expertise of the author in implementing a similar program in the State of South Dakota over a three-year period. All conclusions are those of the author and do not represent official views of NCSL or any other organization.

NCSL would like to thank the Arizona Auditor General's Office for providing this opportunity to supply technical assistance services to the Arizona Legislature.

ARIS SOFTWARE, DATA FILES AND APPLICATIONS

ARIS, through a variety of circumstances, has developed a fairly sophisticated computer hardware configuration. System software, however, is in a rudimentary, developmental stage. Current software can, for the most part, be characterized as simple record-keeping routines.

System Software - Current

Based on demonstrations observed, there currently appears to be little software operational on the system. The software package utilized for most applications is ADS/APS (Applications Definition System/Applications Processing System). This package is used for three basic purposes:

- compose CRT "screens" for data input, onto which a clerk superimposes the desired inputs for archival;
- compose CRT "screens" for data retrieval, upon which data from the archives is displayed; and
- format hard copy reports and summaries of system files.

These applications do not justify the current sophisticated hardware configuration. They could be very easily supported on a time-share mainframe administrative computer although conversion to another computer system might be expensive and time consuming. Current applications programs utilizing this ADS/APS facility and their present, near future and eventual uses include:

- Water Rights Claimant Master Record System. Contains 1 record for each "statement of claimant" that has been filed under the adjudication process of the State Water Commission. Information stored will include name of the claimant; date, amount and source of the claim; and types, quantities and areas of permitted uses. There are currently about 2,800 claims in the file, with about 10,000 total claims expected upon completion of the two basins in the adjudication process. Currently operational capabilities are limited to inquiries and summary reports

of claims already entered into the system.

Major near future uses could include automation of adjudication of claim disputes, provision of input data for water use models, and evaluation of the impacts of applications for new claims. According to ARIS staff, some parts of the water use model are implemented (for example, total water use by 50-square mile areas can be calculated), some are not; all require a hydrologist's skills to run, and the model is not currently used.

Eventual usage, in conjunction with Landsat data, could be to monitor irrigation areas to assure that claimants utilized no more water or irrigated no more land than their permits allowed. This application is of interest to the State Water Commission and the Agricultural Appraisal Section of the SLD.

- Fire Management System. There are two major data files in this system. The station file contains information such as the station name, phone numbers and location, and supervisor's name and home phone. The equipment file contains listings and descriptions of all equipment. Current software allows inquiries on equipment and personnel by individual stations and summary reports of all stations and equipment. Some state stations (approximately 200 of the 2,000 existing) and equipment (approximately 1,500 pieces of 5,000 total) are in the data files. Current procedures are to manually locate stations near a fire on a map and use the software and files to determine personnel and equipment available to assist their dispatch in a timely fashion.

  Major near future use will be to automatically locate the three stations nearest to a fire site. A zone file will be used to divide the state into districts for each station's immediate range of effective response. Federal rural fire stations and equipment will also be added to the system.

In two years, the information in this system will be used to help prepare the state fire management plan. Eventually, a fire fuel model will also be added to the system. This will allow fire control personnel to model the dynamics of a wildfire so that real time management decisions can be made, such as whether to suppress a fire, merely contain it, or allow it to run its course.

- Urban Forestry Data File. There are three types of records in this system. The first is the Master Town File which has administrative information on participating municipalities (Phoenix, Scottsdale, Fredonia, Pima County Parks, Tuscon and South Tuscon). The second is the species file, which contains individual records of 105 species, their value, etc. The third type is the individual tree file, which contains thousands of records - one for each park and street tree - and includes information such as species, location, condition, value, required maintenance, etc. The major applications (by only Scottsdale to date) were scheduling of tree maintenance, valuation of existing municipally-owned trees, assisting the budget process, and assistance in planning future plantings.

  This application system is not currently used. Most of the user agencies are no longer funded for this program, and the State Land Department staff person who knew how to run the system and utilize the results has left for other employment. There are plans to hire a new Urban Forester in the Forestry Division of SLD, and it is likely that Phoenix will renew funding to participate in the system at that time.

- Forestry Tree Seedling Management System. This system has two basic types of data files. The first, which contains about 25 records, is the seedling availability file which lists the number of trees available by species. The second, which contains hundreds of records, is the

seedling order file. Each pickup or mailout order is listed on one record, along with information on the orderer and order costs, shipping dates, and purpose of the planting (e.g. windbreak).

There are data in the files on tree orders back through 1976. Current uses are to schedule seedling removal, keep track of inventory still available, coordinate distribution to orderers (by mail) or to pickup centers, and summarize program activities for management purposes. These tasks were formerly done with manual files. They were automated because of the difficulties of storing, organizing and accessing the data in a manual system with a staff of two clerks. This staff is now able to keep ahead of the workload because of the assistance of the computer. The system is operated remotely from the Flagstaff office.

Near future use, after software development is completed, will be to select a random sample of customers after one- and five-year periods to determine whether the trees were planted properly and to document their current conditions. State law requires all orders to be checked on after one- and five-year intervals, but limited manpower makes this impossible.

- Automated Drafting System. This system is used to assist the engineering section by automating the drafting of maps of State Trust Lands and land status. Proprietary routines from ESCATEC, Engineering Automation ("Eagle" Package), Talos digitizer and Zeta plotter have been combined in this system to interface the necessary hardware and software.

  Rough, hand-drawn maps are input to the system via the Talos digitizer. Engineering calculations (e.g., bearing and range, areas, etc.) are performed within the system automatically. Final output maps (each of a 1-square mile area) are drawn on the Zeta plotter at varying scales.

An additional option exists to input standard legal descriptions rather than digitized map data. Calculations and output are the same as above.

Systems Software - Developmental

A number of software systems are currently in varying stages of development. These include:

- ESCATEC - A generalized Geographic Information Systems (GIS) software package developed by a California firm for Data General minicomputers. To date, only those routines needed to support automated drafting applications by the engineering section have been implemented (see preceding section).

  Implementation of the remaining portions of the package should allow more sophisticated geographic data entry, manipulation, analysis and output.

- Landsat Analysis Software - Several software packages (from Georgia Tech, JPL and NASA/Ames) are available but have not yet been implemented due to time constraints.

- ECOSIM Model - An ecological component simulation for use in forest management. Version 1 is available but nonfunctional. Software modules developed by the University of Arizona did not function and were not properly documented. A functioning and documented Version 2 is currently being developed by the U.S. Forest Service Range Experiment Station at Arizona State University with cooperation from the Flagstaff SLD office, and will be implemented by ARIS when complete.

- Water use simulation model - Will use data from Water Rights file to model surface and groundwater usage and aquifer depletion. This model is not currently used.

- Range carrying capacity and herbage production model - Will use data from the Range Division and Landsat to determine range carrying capacity, occurrences of overgrazing, vegetation regeneration etc., for use in range modeling and management, with a capability to produce map outputs. According to ARIS staff, 2/3's of the software is ready to use, mapping is just getting underway, and the software for the range management model must still be developed.
- Minerals system - To be implemented during the next fiscal year. According to ARIS staff, engineering data on mine location, size and dimensions will be entered to the system for baseline data to enforce lease provisions in court. Eight thousand records of mineral and mining operations, located at three different sites, will be entered, centralized and streamlined.

Summary of Current Range of Applications

The current system, once ongoing data entry and limited software development are complete, will support the following missions:

- Systemize and automate water rights records to simplify adjudication of competing claims and to assist allocation of new water rights;
- Assist city park departments in scheduling tree maintenance and monitoring tree conditions (not currently used);
- Assist State Forester in administering tree seedling program and monitoring program results and compliance; and
- Automate the drafting of State Trust Lands and land status maps.

Future Range of Applications

With the existing hardware, moderate software enhancement and expanded automated data files, the system could support the following missions and applications:

- Automate fire station and equipment inventories to assist in timely and adequate responses to wildfire emergencies;
- Assist the assembly, input, preprocessing, analysis, comparison and use of various types of mapped or imaged natural resource data (e.g., land cover, hydrology, soils, topography, geology/minerals, environmental quality, development constraints, wildlife habitat, agricultural productivity, climatic factors, etc.);
- Produce output maps and statistics to facilitate use of quantitative natural resource data factors and models in resource planning, management and monitoring;
- Monitor land and water cover and surface conditions on a monthly, state-wide basis through the use of Landsat data;
- Assist forest management of state lands through the use of ECOSIM model;
- Analyze and quantify groundwater usage to assist in water resource development and management;
- Monitor water usage (irrigation) to determine if permitted water rights are being observed through the use of Landsat and water rights files;
- Monitor agricultural land usage (double or triple cropping) through the use of Landsat and a state lease provision file, to determine if lease provisions on state-owned lands are being observed;
- Assist the management of state-owned rangelands; and
- Assist the enforcement of mineral leases on state lands.

Future Range of Landsat Applications

Landsat is one of the most promising applications technologies being incorporated in ARIS. In 1982, two new Landsats with a ground resolving power of less than 100 ft. will be launched. Many applications requiring finer detail than current satellites can provide (260 ft.) will become feasible. Given Arizona's relatively cloud-free skies, repetitive, statewide coverage every eight days should be available. Below is a sampling of the types of applications possible in Arizona with this next generation of Landsat.

- Water Resources
  - Locating and mapping surface water bodies;
  - Mapping the extent of snow cover to predict future supplies and warn of potential flood conditions;
  - Estimation of water usage by irrigated agriculture; and
  - Monitoring of flood extent and damage.
- Agriculture
  - Crop and cropland inventories;
  - Estimation of yields;
  - Monitoring of crop disease and insect infestations;
  - Mapping and identification of irrigated crops; and
  - Rangeland management.
- Forestry
  - Timber inventories;
  - Forest type mapping;
  - Forest harvest monitoring; and
  - Disease and stress detection.

- Routing and Siting
  - Selection of transportation and transmission corridors;
  - Analyzing environmental impacts of energy facility development; and
  - Location of potential resource development opportunities.
- Wildlife Habitat Analysis
  - Mapping of vegetation types;
  - Monitoring urban encroachments on wildlife areas; and
  - Estimation of carrying capacities.
- Geologic Applications
  - Mineral exploration;
  - Detection of geologic hazards (faults, slide zones, etc.); and
  - Exploration for groundwater.
- General Applications
  - Mapping of urban and rural land cover;
  - Land cover change detection;
  - Location of flood plain areas;
  - Monitoring of surface mine expansion and reclamation; and
  - Studying man's impact on the land.

Status of Other Data Files

The general applicability of any geographic resource information system must rest upon a solid foundation of spatial data files. While there are spatial attributes in some of the previously discussed files (i.e., location of fire stations, water diversion points or wells), they are not geographically based files.

Although there are many plans to develop a spatial data base, and many promising applications of such data, there are currently no systematic, automated files on land cover, range resources and conditions, forested areas, wildlife habitat areas, mineral resources, water resources or any other topics of interest. A state-wide digital topographic file is currently on order and, once the ESCATEC package is running, will provide useful topo and slope data.

ARIS HARDWARE

This section is rather technical. Some readers may choose to skip ahead to the next section, *Remote Sensing Applications*, beginning on Page 20.

Current Hardware Configuration

- Data General Eclipse S130 Central Processing Unit with 256K main memory
- Data General Nova 800 CPU with 32K memory
- 800 BPI tape drive
- 192 Megabyte (MB) removable disk pack
- 10 Megabyte removable disk pack
- 2.5 Megabyte disk pack
- Three 1 Megabyte disk packs (currently inoperable)
- 300 lines per minute line printer
- Teletype Model 33 terminal with paper tape reader
- Dasher CRT master console
- Communications hardware for dial-up user terminals
- Digitizer Station
  - Very large Talos graphic tablet digitizer table
  - CRT control station (COPS-10)
  - Microprocessor control
  - Rear projection equipment to use digitizer as a "screen" for image data
- Graphics Station
  - Zeta 36" 4 pen plotter
  - Tektronics 4010 Graphics CRT
  - Microprocessor control
  - Dasher CRT user terminal

- National Cartographic Information Center Remote Inquiry Station (not interfaced with rest of system)

  - Tektronics 4010 Graphics Terminal

  - Dedicated phone line and modem

Uses of Hardware

- CPU's - S130 is the heart of the system. It performs all data processing except routine formatting and calculations performed by digitizer and graphics microprocessors. The S130 is also used to "drive" all the rest of the system peripherals. Main memory of 256K Bytes is barely adequate for current applications.

  - The Nova 800 CPU is a virtual "museum piece". Unavailability of maintenance service along with extremely limited memory (32K), and inability to concurrently service multiple users severely limits capabilities on the old CPU.

- Data Storage Hardware - 800 BPI tape drive is used for tape input and output. Through the use of tape, large data files can be stored "off-line" until they are needed, thus minimizing the need for "on-line" storage. The lack of a capability to read 1600 BPI tapes presents a small, but not insurmountable, problem.

  - 192 MB removable disk drive is used for all "on-line" data storage and retrieval. All systems and application software, as well as the current small data files are housed on this drive.

  - The three 1 MB disk packs are currently inoperable. They are dated, outmoded, and their manufacturer has gone out of business.

- Input/Output Peripherals - Teletype 33 is used for systems console on the Nova 800.

  - Dasher Terminals. One is used as a user work station. The other is used as a systems console for the S130. Both are adequate alphanumeric terminals.

- Line Printer is used for alphanumeric hard copy listing. The 300 lines per minute output speed is adequate for current and future operations.

- Tektronics 4010 Graphics Terminals. One is used as an alphanumeric NCIC terminal. The other is used as an alphanumeric control terminal for the ZETA plotter. Neither are currently used in graphic mode.

- Talos digitizer is used to translate mapped or image data to a computer compatible format. This allows the data to be processed digitally. A COPS-10 terminal is used in conjunction with the Talos as a central unit.

- ZETA drum plotter is used to output digital data files in a graphic format.

Level of Equipment Utilization - Current and Recommended

- CPU's - The NOVA 800, Teletype 33 console, and 2.5 MB disk are not currently utilized. The 800 should be surplused, the Teletype used as either the console for the S130 or as an additional user terminal, and the 2.5 MB disk either surplused or used on the S130 system.

  - The Eclipse S130 is currently very underutilized, but will be used much more fully in production mode. Use of a sophisticated Dasher terminal as a systems console is probably not necessary - the teletype or another cheap ($1000) terminal would be adequate for this function. CPU speed is adequate for implementation of an operational system. Memory may be adequate for initial development phase, but will soon need to be expanded to 512K for any operational work.

- Data Storage Hardware - 800 BPI tape drive does not appear to be over-utilized. This single tape drive should be adequate, although uncomfortably, for systems development phase. A second 1600/800 BPI tape drive will be required for a fully operational system. For now, 1600 BPI tapes can be translated to 800 BPI format using the ADOT or other large computers, and the 192 MB disk used for intermediate output files with a copy step to tape for later archival. The latter is somewhat inconvenient and time consuming, but should not present major problems.

  - 192 MB Disk Pack is currently very underutilized. This situation will change as data files are filled, however.

  - 10 MB Disk Pack is used to store backup operating system and other software. This pack should be used to store primary and applications software and data files, such as the fire station file, which must be accessible at all times. This would allow multiple disks to be mounted on the single 192 MB drive sequentially. This would require

scheduling of users in some cases, but would greatly increase disk storage capacity at very little cost ($50 per disk pack).

- 3 - 1MB disk packs are currently inoperable and should be surplused.

- Input/Output Peripherals - Dasher terminals should both be used as user work stations. I have no basis for judging amount of current utilization.

  - Teletype 33 is not currently used. Could probably be used as a systems console on S130 or user terminal.

  - Line Printer is somewhat underutilized at present, but will be used more extensively as more applications become operational.

  - Tektronics 4010 terminals are not utilized in graphics mode, but should be. Using them as alphanumeric terminals utilizes very little of their capabilities. Graphics terminals such as the 4020 have the capability to draw maps and other graphic data displays such as pie charts, line plots and histograms. Alphanumeric terminals can only display letters and numbers in fixed rows and columns. Dashers or other cheap alphanumeric terminals should be used as alphanumeric work stations, with the 4010's being saved for use as graphic work stations.

  - Talos digitizer capabilities are underutilized, even if the device is busy full time. Current capabilities are limited to simple acreage calculations using microprocessor and support of automated drafting applications on the S130. Both of these applications could be supported on a much smaller table. Input of map data (e.g., a soil survey) to a polygonal or grid data base would more fully utilize the capabilities of this sophisticated device. A Graphic CRT (e.g., 4010) should be interfaced with the Talos to allow real time previewing of digitizing to facilitate error correction.

- Zeta plotter is currently very underutilized. The only operational application is in support of automated drafting by the engineering section. With the proper data base and software, this plotter could be a powerful tool to output multicolor source or analytical maps.

Limitations of Existing Hardware

The current hardware configuration (including the leased S130 CPU) has very few serious limitations. The system constraints have more to do with speed of processing, number of users who can concurrently utilize systems resources, and total throughput than with actual level of capabilities possible. System constraints and bottlenecks and suggested solutions (additional hardware) are outlined below.

- Need for the S130 CPU. The Nova 800 CPU is obsolete and of little use. The S130 Eclipse is a reliable, powerful and cost-effective replacement and should be retained unless the IRD is to be disbanded. The current unit can be purchased for about $36,000 or rented for about $18,000/year (according to IRD staff).
- Only 256K of memory on the Eclipse S130 CPU. This will limit the number of concurrent system users, and will not allow implementation of upgraded operating systems. For approximately $8,000, an additional 256K of core can be installed. This should be considered for the 1981 fiscal year.
- Only 1 - 800 BPI tape drive available. It will not be possible to read or write 1600 BPI tapes. Most digital data files available are at 1600 BPI. They can be reformatted to 800 BPI elsewhere, however, in a few days' time. Also, because there is only 1 tape drive, it will be impossible to read one tape, process the data, and write an output tape. The large disk, however, can be used as an intermediate output file and later copied to tape. This will reduce overall throughput substantially for Landsat data processing. Once throughput becomes a

problem, an additional 1600/800 BPI tape can be added for about $12,000.

- Potentially inadequate number of user terminals. Two terminals are not enough to support systems development and multiple applications. Utilizing the Teletype 33 or an inexpensive Decwriter (approximately $1600) for the systems console will free up one Dasher terminal. Interfacing the NCIC terminal (Tektronics 4010 - about $100-200) with the Eclipse will bring the total to four. If this is inadequate, Decwriters or other inexpensive terminals can be added for $800 - $2,000 apiece.
- On-line storage may not be adequate in the long range. As data bases grow in size and more sophisticated users demand rapid access to them, it may be necessary to add a second or even third big disk. One large disk would always be on-line, and the other could be used in swap mode. A 192 MB disk can be purchased for about $31,000.
- Lack of a color image display device. As Landsat applications increase, it will probably be necessary to add such a terminal to the system. This will greatly increase analyst productivity and data throughput, and will also provide for enhanced color output capabilities. Approximate cost range is $20,000 - 45,000.

Required Hardware Upgrade for Basic Capabilities

With the exception of retention of the Eclipse S130 CPU and the addition of 256K memory, all of the above hardware additions can be delayed until an adequate user base is developed and demands on the system outstrip available resources. At that time, it may be feasible to finance system upgrades through user charges rather than state appropriations.

The basic system (including the S130) is quite powerful in terms of hardware capabilities. All the applications described above will be possible in development and limited operation mode. Every user will not be able to have access to the system on demand, but with a little scheduling and adequate facilities management, every user will be able to get their job done in a fairly timely manner. As bottlenecks and resource conflicts become serious, steps can be taken to ameliorate them.

REMOTE SENSING APPLICATIONS

Current Libraries

ARIS currently has complete orthophotoquad coverage (1972-3 vintage) available statewide. ADOT provides reproduction services.

In addition, access to national airphoto and satellite libraries is facilitated through affiliation with the National Cartographic Information Center. Reproduction services are provided by the EROS Data Center and others.

ARIS currently has complete Landsat photographic and digital coverage (1977 vintage) available statewide. They are currently considering ordering complete 1978, 1979 and 1980 coverage. They should also consider ordering complete coverage for 1972, 1973 or 1974, as this data (orany other Landsat data acquired before 11/76) will no longer be available from the federal government after the end of 1980.

Current Remote Sensing Analysis Capabilities

ARIS staff currently have the capability to visually (or manually) interpret aerial or satellite photos using standard photogrammetric techniques.

There is also a capability for semi-automated image interpretation of aircraft or satellite photos. Using the rear projector, remote sensing data (including multiple images or maps) can be superimposed on the digitizer, and visual interpretations entered directly to the computer via the Talos digitizer. These are currently entered in plot command format, which does not allow area calculations or permanent archival of the data. Future input by polygons will get around these problems.

The capability to digitally interpret Landsat data is in the early stages of development. A program to make line printer maps of pre-categorized Landsat data is currently operational. The baseline hardware configuration will support image processing applications.

Future Remote Sensing Analysis Capabilities

Complete Landsat digital interpretation capabilities will be developed in the future. End to end computer processing capabilities will have to include the following procedures:

- Data reformatting - to put information in an easier-to-use format.
- Geometric correction - to deskew and rotate the Landsat data so that it is North-oriented and to scale.
- Selection of sample data - to extract "training fields" to teach the computer to recognize various land cover types.
- Categorization of large areas - to classify the data for various sized study areas.
- Map preparation - to output the categorized data for varying areas, with varying aggregations of categories, at varying scales.
- Map comparison - to facilitate analysis of changes in land cover over time.

A LONG ROW TO HOE

A great deal of work remains before Arizona will have a fully operational statewide geographic information system. If this were the Creation, ARIS would be about at 10:30 Monday morning. Successful implementation will require the following:

- Retention of the existing leased Eclipse S130 with 256 or 512 K ($36,000 - $44,000 purchase price)
- Two to three calendar years
- Six to nine person years
  - two systems analysts
  - one manager/user liason person
- Interagency and Interdivisional Cooperation to define:
  - user needs (data, software, processing requirements)
  - system financing assistance (once operational)
  - existing data sources of general interest to input to data base

Landsat data processing will require the gathering of ground truth or ground verification data. Approximately 1 to 3 person months would be required to gather one-time statewide ground truth from USDA records and available air-photos for each date of Landsat coverage.

Range of Alternatives to Restructure Program

There are several alternatives available to restructure the ARIS program should the legislature wish to do so. The recommended level of service should be based upon the results of a thorough user need study and the availability of staff and funding to provide such services. Potential options include:

A. Information reference center only - 1 FTE required (NCIC clerk)
   1. Maintain Orthophotoquad Collection and basic user assistance function.
   2. Maintain NCIC affiliate status to assist users in locating and ordering maps and remote sensor data
   3. Transfer engineering section to another division of SLD

B. Computer service center for State Land Department - 3 professional FTE's required (Director, NCIC Clerk, Systems Analyst)
   1. Capabilities in A above to all state agency users
   2. Basic computer services for State Land Department (capabilities as outlined in A & B of Appendix A)
   3. Retain engineering section in IRD

C. Computer service center for state natural resource agencies - 4 professional FTE's required (Director, NCIC Clerk, Systems Analyst, User Liaison staff)
   1. Capabilities in A & B above to all users
   2. Capabilities as outlined in C of Appendix A for State Land Department

D. Full state-wide agency-wide geographic information system service
   (all capabilities outlined above and in Appendix A)
   5 professional FTE's required (Director, NCIC Clerk, Systems Analyst, Systems Programmer, User Liaison staff)

Technical Assistance Available to Arizona to Review and Systematize ARIS Systems Design

Further NCSL Assistance

Up to two weeks of NCSL Natural Resource Information Systems Project staff time could be provided over the next five weeks at no charge to the state. Potential activities include:

- Further assistance to Auditor General's Office in preparation and presentation of the ARIS program audit.
- Detailed review of ARIS Systems Design with recommendations as to further required planning and user needs survey elements.

Formation of a Resource Team

In cooperation with the Council of State Planning Agencies (CSPA), NCSL staff could coordinate the formation of a "resource team" of state geographic information system experts. CSPA and NCSL could fund travel and subsistence expenses for such a group for a one-week period. Potential areas of expertise and consultants are:

Coordinators: Paul Tessar, NCSL and Peggy Harwood, CSPA
Hardware/Software: Nick Faust, Georgia Tech
Software Systems: Willie Todd, NASA Ames
User Needs Surveys: Frank Westerland, University of Washington
Landsat Applications: Sue Norman, NASA Ames
Institutional Arrangements: Dave Ferguson, Texas Natural Resources Information System
Graphic Information Systems: Tom Dundas, Montana Geo-Data System
Tom Loveland, EROS Data Center

Additional consultants could be located as other areas of expertise were identified. Formation of such a resource team would assist in the redesign and redirection of the ARIS program, if so desired. Specific tasks could

be identified, and quantitative and qualitative performance criteria established. This approach could facilitate a follow-up program audit to determine program status at a later date.

If the use of a resource team is desired, a fair amount of planning and scheduling would be required. Approximate timing and tasks are outlined below:

Task	Time Required	Cumulative Time
Assemble Team and get travel clearances	3 weeks	3 weeks
First working session	1 week	4 weeks
Administer User Needs Survey	2 weeks	6 weeks
Summarize survey results	1 week	7 weeks
Develop final Resource Team report and recommendations	3 weeks	10 weeks

If the final report and recommendations are needed by July 1, it would be necessary to request this assistance by April 15.

APPENDIX A

Characterization of Stages of GIS Development/Sohpistication

A. Manual Capabilities

1. Ability to locate and apply mapped or imaged spatial data
2. Ability to visually interpret remote sensing data and manually produce maps

B. Rudimentary Computer Capabilities

1. Ability to input mapped spatial data or visually interpreted remote sensing data to a data base (e.g., calculate acreages)
2. Ability to do simple single factor manipulations
   a. Translation of categories (e.g., soil type to physical property)
   b. Aggregation of categories to a higher level classification (e.g., Residential or Industrial to Urban)
   c. Change of scale (larger or smaller than source data)

C. More Advanced Capabilities

1. Ability to do more advanced single factor manipulations
   a. Map derivation (e.g., calculate slopes from elevation data)
   b. Change analysis (e.g., land cover change using 1975 and 1980 data)
2. Ability to do two factor compositing (e.g., croplands on steep slopes)
3. Ability to digitally interpret Landsat data

D. Full Compositing/Modeling Capabilities

1. Ability to develop and solve complex spatial models
   a. Calculate expected soil erosion by water based on land cover, slopes, physical properties of soils, precipitation, etc., for 1-acre cells.
   b. Predict crop yields based on crop type, potential soil productivity, precipitation, crop condition, etc., by quarter section.
   c. etc.

2. Ability to produce advanced output products

   a. Line plotter maps

   b. Color-coded maps

   c. Detailed statistics (e.g., 3-level cross-tabulation such as crop type vs. slope vs. soil erodibility)

****

E. ARIS Current Capabilities

   1. All manual capabilities

   2. Computer capabilities - B.1 only

F. ARIS Capabilities currently under development

   1. Near term - All through B.2 and C.3

   2. Eventual - All--according to ARIS staff

APPENDIX B

DEFINITION OF TECHNICAL
ASSISTANCE NEEDS FROM NCSL
By March 1, 1980

OBJECTIVE 1:

To determine status of present "natural resource information system."

1. What is the equipment being utilized and for what?
2. What portion of equipment capabilities are being utilized? What is not utilized?
3. What are the programs/applications of the system (including their status, who uses them and why)?

   Includes, but not limited to, following system program/applications:

   a. Water Rights Claimant Master Record System
   b. Urban Forestry Geo-master Data File
   c. Forestry Tree Seedling Management System
   d. Ecosystem Component Simulation Models
   e. Water Interactive Simulation Model
   f. Rangeland, carry and herbage production simulator program.

4. What is the status of files by type of "natural resource"? -- i.e., range, minerals, habitat, water, etc.

OBJECTIVE 2:

To determine capabilities and limitations of current system.

1. Utilizing results of demos, document and note range of applications possible with existing equipment, software and files.
2. With additional software, what further applications are possible?
3. What are limitations of existing system even with software additions?
4. What additional applications would be possible with minimal additional monies ($50,000 or less)?

OBJECTIVE 3:

To determine capability of using and usage of aerial photography or other remote sensing methods.

1. Document current library of photos.
2. Document usage and staff capability for interpretation.

OBJECTIVE 4:

To determine "how far" current systems status is from a state-wide geographic natural resource information system.

1. Compare current system capabilities (documented from Objectives 1 and 2 plus ARIS staff capabilities) to what is needed to obtain full state-wide system, including:

a. amount of additional equipment
b. time to develop system (calendar years)
c. staff time to develop (man years)
d. amount of inter-agency cooperation
e. amount of ground verification needed

2. What would be capabilities and limitations of such a state-wide natural resources information system?

FINAL PRODUCT

Written analysis that answers questions outlined and results in achievement of Objectives.

Oral analysis to be provided before leaving Phoenix.

Written analysis to be completed by February 22, 1980.

Additional Documentation Requested Orally on 2/13

- Characterization of stages of GIS development/sophistication, including analysis of where Arizona is.
- Range of alternatives to restructure program.
- Potential Technical Assistance available to Arizona to systematically and rigorously design ARIS.

APPENDIX VIII

THE APPLIED REMOTE SENSING PROGRAM AT THE UNIVERSITY OF ARIZONA

Applied Remote-Sensing Program at the University of Arizona

The University of Arizona has maintained since 1975 a Committee on Remote Sensing composed of 13 members, representing six colleges (Agriculture, Business and Public Administration, Earth Sciences, Engineering, Liberal Arts and Mines), the Optical Sciences Center and the Office of Arid Land Studies. The purpose of the Committee is to coordinate remote-sensing activities at the University, including the development of an academic program in remote sensing and the coordination of multi-discipline research on remote-sensing techniques and applications. The applied remote-sensing work is conducted primarily through the Applied Remote Sensing Program under the Office of Arid Land Studies.

University Libraries, Laboratories and Equipment Usable for Remote-Sensing Applications

The Office of Arid Land Studies maintains a library of Landsat, Skylab, Gemini and Apollo spacecraft imagery and high-altitude aerial photography. Viewing and photointerpretation equipment are available to analyze this imagery. A library of microfilm catalogs and microfilm of U.S. and foreign Landsat data is maintained. According to the University, a variety of specialized maps is included in the library. The Office also maintains a laboratory of computer-mapping programs, remote-sensing imagery and various equipment for imagery analysts. Data can be transferred to a map or the computer for storage and interpretation.

The Office claims computer programs that perform digital image processing and transformation of map projection. According to University documents these programs have several capabilities:

> "The majority of the programs deal with manipulation and portrayal of cellular data or interpretation of point data to continous data surfaces. Several programs allow data to be plotted as three-dimensional figures from any selected view-angle. Application of this laboratory's capabilities have included optimal transportation corridor identification, visual impact assessment and siting of energy facilities."

Equipment usable for remote sensing is available through the colleges that are represented on the Committee on Remote Sensing. This equipment includes devices for scanning photographic images, converting image samples to digital form and writing the digital value on magnetic tape for computer analysis; a lower-resolution photographic display consisting of a minicomputer, tape drive and drum recorder; a minicomputer and visual display unit capable of handling interactive color digital image display; and a digital analysis laboratory with two minicomputers, scanning microscopes and a visual display system. Several photographic processing laboratories are available at the University.

Projects of the Applied
Remote-Sensing Program

Since its inception in 1972, the Applied Remote Sensing Program has provided service in remote-sensing interpretation projects for ten State agencies, including the Department of Property Valuation, Aeronautics Department, Game and Fish Department, Water Commission, State Land Department, Oil and Gas Conservation Commission, the Office of Economic Planning and Development, the Department of Public Safety and the Department of Transportation, as well as the Arizona State Senate.

Subjects of these projects have included:

- Mapping urban land use, desert soil and emergency landing sites,
- Assessing wildlife management potential and status,
- Delineating geothermal reservoirs in southern Arizona,
- Determining the location of potential gas and oil fields,
- Defining southern Arizona riparian habitat spatial distribution and analysis,
- Assessing impact of water impoundment and diversion structures on vegetation in southern Arizona,
- Using thermal infrared technology in urban energy conservation, and
- Locating potential sites for drilling water wells.

Funding for University Program

Funds to operate the Applied Remote Sensing Project are supplied through a NASA grant and contractual fees. The following table contains a schedule of revenues since the program's inception in fiscal year 1972-73 through 1978-79.

REVENUE SOURCES FOR THE APPLIED REMOTE-SENSING PROGRAM
FISCAL YEARS 1972-73 THROUGH 1978-79

	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
NASA grant	$50,000	$ 75,000	$100,000	$100,000	$100,000	$100,000	$100,000
Contractual fees	-0-	26,790	33,000	18,950	71,559	237,343	76,305
Total revenue	$50,000	$101,790	$133,000	$118,950	$171,559	$337,343	$176,305

APPENDIX IX

MARCH 5, 1980,
LEGISLATIVE COUNCIL MEMORANDUM

ARIZONA LEGISLATIVE COUNCIL

MEMO

March 5, 1980

TO: Douglas R. Norton, Auditor General

FROM: Arizona Legislative Council

RE: Request for Research and Statutory Interpretation (0-80-10)

This is in response to a request submitted on your behalf by Gerald A. Silva in a memo dated February 26, 1980. No input was received from the Attorney General concerning this request.

FACT SITUATION:

House Bill 2376, passed during the 1972 session as Laws 1972, chapter 214, appropriated funds to the governor's office for the ARIS program. According to this bill:

"Sec. 2. Appropriation; purpose

A. The sum of four hundred eight thousand seven hundred dollars is appropriated to the governor to fund the Arizona resources information system for the fiscal year beginning July 1, 1972, and to enable the state to acquire from the national aeronautics and space administration orthophoto base maps of the entire state of Arizona for use by all departments of Arizona state government.

* * *

Sec. 3. Exemption

The appropriation made by this act is exempt from the provisions of section 35-190, Arizona Revised Statutes, relating to lapsing of appropriations."

During fiscal year 1973-74 when ARIS was located within the department of property valuation, the department purchased a Data General minicomputer system. The following components were purchased with the carryover funds from the original ARIS appropriation:

Tape Drive	$ 5,900.00
Central Processing Unit	9,858.01
CRT Display Unit	4,831.38
Disc Memory Unit	8,410.00
Magnetic Tape Controller	4,000.00
Total	$ 32,999.39

The remaining system components, at a cost of $35,610.00, were purchased with various other department of property valuation funds.

The former director of the ARIS program stated that he did not authorize and he was not aware of the use of ARIS funds for these purchases. He also stated that the equipment was not the property of or used by the ARIS program during his term as program director (January 1972 through August 1976).

On June 30, 1975, ARIS funds were again used to purchase additions to the department of revenue minicomputer system. At the time of this purchase, the minicomputer was not the property of or being utilized by the ARIS program.

The finance division did not authorize the transfer of funds for any of the above purchases.

QUESTIONS PRESENTED:

1. Do either the fiscal year 1973-74 or 1974-75 purchases constitute an unauthorized expenditure because the funds were not used for the authorized purposes (i.e., the ARIS program)?

2. Do either the fiscal year 1973-74 or 1974-75 purchases constitute an unauthorized use of funds because the division of finance did not authorize the transfer of funds from the ARIS program?

ANSWERS:

1. Article IX, section 5, Constitution of Arizona, provides, in relevant part:

> No money shall be paid out of the State treasury, except in the manner provided by law.

The Arizona supreme court has interpreted this provision to mean that:

> No money can be paid from the State treasury unless and except the legislature or the constitution itself has made an appropriation therefor, and it can only be used then for the purposes specified by the appropriation. Webb v. Frohmiller, 52 Ariz. 128, 79 P. 2d 510 (1938).

Since the purpose of the appropriation enacted in Laws 1972, chapter 214 was explicitly stated (to fund the ARIS program and to acquire NASA maps) any other use of the money by the department of property valuation would be an unauthorized expenditure.

Arizona Revised Statutes section 35-152, in effect at the time of the computer system purchase required that proposed expenditures be reviewed by the assistant director for finance to determine if they were authorized by an appropriation and if found to be unauthorized were required to be disallowed. Therefore under both the constitution and statutory law the use of the ARIS funds for the computer system should have been disallowed.

Laws 1974, chapter 203, section 1, subdivision 13 made a specific allocation of monies to the Arizona resources information system within the allocation to the department of property valuation. For the same reasons stated above, we believe that this money could not have been validly used for any other purpose by the department of property valuation.

2. The 1973-74 fiscal year purchases were unauthorized because monies were taken from funds appropriated to one budget unit for a specific purpose and used by another budget unit for a different purpose.

The 1974-75 fiscal year purchases appear to be unauthorized under the facts given since the assistant director for finance did not approve the transfer as required by Arizona Revised Statutes section 35-173. That section prescribes that if monies are appropriated to a budget unit by programs, as was the case in the Laws 1974, chapter 203 appropriation, funds may be transferred between and within programs only with the approval of the assistant director for finance.

cc: Gerald A. Silva
Performance Audit Manager

APPENDIX X

FEBRUARY 25, 1980,
LEGISLATIVE COUNCIL MEMORANDUM

ARIZONA LEGISLATIVE COUNCIL

MEMO

February 25, 1980

TO: Douglas R. Norton, Auditor General

FROM: Arizona Legislative Council

RE: Request for Research and Statutory Interpretation (0-80-2)

This is in response to a request submitted on your behalf by Gerald A. Silva in a memo dated January 28, 1980. No input was received from the office of the attorney general.

FACT SITUATION:

For the 1978-79 fiscal year the information resources division (IRD) of the state land department received an appropriation that included $46,100 for equipment.

On August 3, 1978 IRD sent a document entitled "Arizona Land Department - Information Resources Division - Arizona EDP Acquisition Report" to Mr. Jack Stanton, State Automation Director. The document states, "/t/his documentation is intended to complete the formal functions and authority of the Arizona EDP acquisition Process of the State Land Department, Information Resources Division, Map-oriented Directory System."

The following statement was made on page seven of the document:

> "The following RFQ for hardware, software, publications and services are appropriate to complete the State Land Department, Information Resources Division, MODS interactive mapping/graphics and geographic date management system."

Further, the following statement was made on the last page of the document:

"ECONOMIC PROFILE

Authorized capital expenditures were provided by the legislature (S.B. 1307) & (S.B. 1391) July 1, 1978.

Equipment ----------	SB 1307	$32,090.00
	SB 1391	$31,000.00"

Based on this document, the data processing division approved the requested acquisition. In the approval letter, Jack Stanton stated:

"This recommendation is limited to this specific request and the use of existing funds already allocated."

By April 16, 1979, the authorized equipment was installed for a total price of $79,605. The Data General 192 MB disk drive ($33,152.46) was paid for with groundwater transfer program funds, fund account #12-740-702-50. The balance of the equipment was charged to the information resources division, fund account #12-740-130-70. Effective April 24, 1979, the functions of the state land department relating to waters and water rights were transferred to the Arizona water commission, including responsibility for the groundwater transfer funds. The equipment purchased with the Groundwater Transfer funds was not moved to the water commission. However, water commission data is stored currently on a small portion of the disk space.

QUESTIONS PRESENTED:

1. Does 1977 Senate Bill 1391 or 1978 Senate Bill 1307 provide funds or specifically authorize the purchase of data processing equipment as stated in the IRD communication?

2. Does the use of groundwater transfer funds and subsequent IRD retention of the equipment constitute an unauthorized use of funds? Should such equipment be the property and its usage the responsibility of the water commission?

3. Under Arizona Revised Statutes, section 37-175, is IRD required to charge the water commission for data processing services? Is a formal intergovernmental agreement required when one state agency provides services to another? Are there any legal ramifications for not collecting fees if such collection is required (Arizona Revised Statutes section 35-143)?

ANSWERS:

1. 1977 Senate Bill 1391 was enacted as Laws 1977, chapter 29, an emergency measure effective May 2, 1977. That legislation included an appropriation of $490,000 to the state land department for expenses connected with the issuance of groundwater transfer certificates of exemption which the legislation had authorized. The Arizona Joint Legislative Budget Committee's Appropriations Report for 1977-78 indicates that a portion of the appropriation, $26,600, was for "equipment". We did not locate a more specific description of the equipment. (As you indicated after speaking with staff of the joint legislative budget committee, the Appropriations Reports of the committee serve merely as guidelines.)

1978 Senate Bill 1307 was enacted as Laws 1978, chapter 52, an emergency measure effective May 18, 1978. This legislation established the Arizona Resources Information System as a division of the state land department and transferred the functions from the department of revenue to the land department. As introduced, 1978 Senate Bill 1307 contained an appropriation of $285,000 to the land department "to fund the operations of the resources division established by this act."

One of the duties of the resources division specified in the bill was to:

> 1. Provide an information data bank for the state land department by computer compositing the data from remote sensing technology with other technical information and the geographical base resulting from the arizona orthophotoquad program.

The bill as enacted did not contain the appropriation, though the duties of the resources division remained the same.

However, in Laws 1978, chapter 206, the general appropriations bill, $46,100 was appropriated to the resources division of the land department. According to the Arizona Joint Legislative Budget Committee's Appropriations Report of July, 1978, the resources information system was appropriated $40,500 of that amount "...for missing components of a digital computer system as itemized below:

8K Memory Board	$ 3,600
Electrical Cabinet	1,200
10 Megabyte Disc with Software	13,400
Line Printer	11,800
Digitizer	10,500
Total	$ 40,500"

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Therefore, while 1978 Senate Bill 1307 (Laws 1978, chapter 52) did not contain an appropriation, the resources information system did receive an appropriation for equipment in the 1978 general appropriations bill.

2. As noted above we were unable to determine whether part of the groundwater transfer appropriation authorized by Laws 1977, chapter 29 was intended to acquire the data processing equipment which was purchased.

Assuming that groundwater transfer funds were authorized and properly expended to purchase the data processing equipment, the retention by the IRD of the equipment and data is in violation of Laws 1979, chapter 139, section 80, which required in relevent text that:

> A. All personnel, equipment, records, furnishings and other property, and all funds remaining unexpended and unencumbered, and funds appropriated for fiscal year 1979-80, of the water division of the state land department are transferred to the Arizona water commission on the effective date of this act.
>
> * * * * * * * * * *
>
> C. All data and investigational findings of the water division of the state land department are transferred to the Arizona water commission on the effective date of this act.

The act became effective on April 24, 1979.

If the groundwater transfer funds were not initially authorized to purchase the data processing equipment, the approval of Mr. Jack Stanton, director of the data processing division of the department of administration, as indicated in the facts given would not authorize the expenditure of funds because Mr. Stanton's approval was conditioned on the expenditure of funds "already allocated." He has no other authority to authorize the expenditure of funds.

Review and approval by the data processing division of the department of administration of data processing acquisition by state budget units is required to implement the mandate of Arizona Revised Statutes section 41-712. That statute requires the department of administration, data processing division to develop, implement and maintain a coordinated statewide plan for data processing and data communications system.

If the groundwater transfer funds were not authorized to purchase the described data processing equipment, use of the funds to purchase the equipment would be an unauthorized expenditure of state monies and would subject a person to liability under Arizona Revised Statutes, section 35-196 and the state could pursue appropriate remedies under Arizona Revised Statutes title 35, chapter 1, article 6 to recover state monies illegally paid.

We recommend additional fact research to determine whether the groundwater transfer monies were authorized for expenditure for the data processing equipment described. If so, the equipment should be transferred to the Arizona water commission. If not, the monies may be recovered in the manner provided for state monies illegally paid.

3. Arizona Revised Statutes, section 37-175 provides:

> The resources division shall make information available to any person requesting such information at a uniform rate adequate to cover the cost of providing such information.

"Person" is defined for general statutory use in section 1-215, Arizona Revised Statutes, which provides in pertinent part:

> "Person" includes a corporation, company, partnership, firm, association or society, as well as a natural person. When the word "person" is used to designate the party whose property may be the subject of a criminal or public offense, the term includes the United States, this state, or any territory, state or country, or any political subdivision of this state which may lawfully own any property, or a public or private corporation, or partnership or association.

No more specific definition of "person" appears in Arizona Revised Statutes title 37 or in chapter 1.2 of title 37 which establishes the resources division in the state land department. A state agency is not generally considered a "person". Therefore, Arizona Revised Statutes section 37-175 does not specifically require payment by a state agency for obtaining data processing services.

For your information, Mr. Jack Stanton has indicated that for data processing services this state is moving toward implementation of a policy which would require "cost recovery" for all data processing services. This policy might eventually require an agency such as the water commission to pay for the services under your fact situation, although the policy is not applicable at present.

Before considering whether a formal intergovernmental agreement is required between the resources division or the state land department and the water commission, we believe it is necessary to determine whether any agreement is necessary. This involves determining whether the data processing services cited in the fact situation must be provided by the division by statute, perhaps as required under Arizona Revised Statutes section 37-173, paragraph 6. We are unable to make that determination. If the data processing services are part of the services contemplated and mandated by Arizona Revised Statutes section 37-173, paragraph 6, we believe that no agreement is necessary. See 68 Op. Atty. Gen. 19-L (1968).

Arizona Revised Statutes title 37, chapter 1.2 does not require or even authorize the state land department or the resources division to enter into an intergovernmental agreement to provide certain services to other state agencies. Arizona Revised Statutes section 37-174, paragraph 1 does authorize a "liaison relationship" between the resources division and political subdivisions. A brief review of the statutes establishing the state land department indicates that no general authorization for entering into intergovernmental contracts or agreements has been extended to the department. This appears true for the Arizona water commission.

A recent opinion of the attorney general indicates that, if an agreement "for joint or cooperative action between public agencies" is entered into, the parties must comply with Arizona Revised Statutes section 11-951, et seq., thus a "formal" agreement is necessary (79 Op. Atty. Gen. 79 (1979)).

Arizona Revised Statutes section 11-952 concerns intergovernmental agreements and contracts and provides, in pertinent part:

> A. If authorized by their legislative or other governing bodies, two or more public agencies by direct contract or agreement may contract for services, or jointly exercise any powers common to the contracting parties and may enter into agreements with one another for joint or cooperative action . . . (Emphasis added)

Arizona Revised Statutes section 11-951 defines "public agency" to include "all departments, agencies, boards and commissions of this state".

We believe a great deal of confusion exists as to whether a formal intergovernmental agreement is required when one state agency provides services to another. The term "intergovernmental" implies an agreement between governments, such as between a state agency and a school district. However, the statutes cited above, which the attorney general has determined apply to any agreement "for joint or cooperative action between public agencies," are applicable to agreements between state agencies due to the quoted definition of "public agency".

Confusion exists throughout the statutes. For example, Arizona Revised Statutes section 35-148 refers to "interagency service agreements" and provides in pertinent part:

Interagency service agreements entered into between budget units may provide for reimbursement for services performed or advancement of funds for services to be performed.

We are uncertain whether an "interagency service agreement" is the same as an "intergovernmental" contract or agreement. Further, it is possible that state agencies provide services to each other without entering into any agreement or without proper legislative authorization to do so.

We recommend that the relevant statutes be amended to end the confusion existing on this subject.

If fees for information are not collected as required by Arizona Revised Statutes section 37-175, Arizona Revised Statutes section 35-143 is certainly applicable.

CONCLUSIONS:

1. 1977 Senate Bill 1391 and 1978 Senate Bill 1307, as enacted, did not specifically authorize the purchase of data processing equipment as stated in the IRD communication. See text of opinion.

2. Use of groundwater transfer funds may be an unauthorized use of funds. The data processing equipment should possibly be transferred to the Arizona water commission. See text of opinion.

3. IRD is not specifically required to charge the water commission for data processing services. A formal intergovernmental agreement may not be required. There are legal ramifications if fees are not collected as required by statute.

[1]See Arizona Revised Statutes section 32-2181, subsection F, paragraph 2.

cc: Gerald A. Silva
Performance Audit Manager

APPENDIX XI

FEBRUARY 29, 1980,
LEGISLATIVE COUNCIL MEMEORANDUM

ARIZONA LEGISLATIVE COUNCIL

MEMO

February 29, 1980

TO: Douglas R. Norton, Auditor General

FROM: Arizona Legislative Council

RE: Request for Research and Statutory Interpretation (O-80-8)

This is in response to a request submitted on your behalf by Gerald Silva in a memo dated January 28, 1980. No input was received from the attorney general concerning this request.

FACT SITUATION:

In August 1978 the Information Resources Division (IRD) of the State Land Department included a request for $28,000 in the "Replacement Equipment" portion of their 1979-80 budget request. The funds were to be used to replace the central processing unit (CPU) of IRD's Data General mini-computer system. The Legislature did not appropriate any funds to IRD for equipment purchases for F/Y 1979-80.

In June 1979, IRD began renting the requested equipment, a Data General Eclipse S/130 CPU. The installation charges and three quarterly rental payments have been paid out of the following accounts:

6/4/79	Installation charges	$3,600 12-740-30-70 (Information Resources Division - State funds)
6/4/79	Three months rental	$4,650 12-740-080-70 (Information Resources Division - State funds)
9/18/79	Three months rental	$4,650 12-740-801-00 (Cooperative Fire Control Fund - a joint Federal and State funded program)
12/18/79	Three months rental/partial	$3,720 29-740-801-00 (Cooperative Fire Control Fund - a joint Federal and State funded program)
12/18/79	Three months rental/partial	$ 930 39-740-901-00 (Timber Suspense Fund - a joint Federal and State funded program)

No approval was received for the transfer of monies from the fire control or timber suspense funds from the department of administration assistant director for finance.

According to Mike Castro, IRD administrator, and a representative of the equipment supplier, no written agreement regarding the terms or length of the equipment rental exists. As shown by the claims, the rental fees are billed on a quarterly basis.

According to Mr. Jack Stanton, State Automation Director, Department of Administration Data Processing Division, this EDP acquisition was not approved by his office. Further, according to Mr. Clifford Mader, Assistant Manager of Purchasing, the rental agreement was not processed through the State Purchasing Office.

In August 1979, IRD once again requested funds, $48,000, for the ". . . /r/eplacement and installation of a Data General S/130 central processing unit." in their F/Y 1980-81 budget request. The explanation for this equipment continued, "This is the second part of a two phase, two year request authorized by S.B. 1307 of the 1978 legislative session."

QUESTIONS PRESENTED:

1. Do existing laws resulting from S.B. 1391 (1977) and S.B. 1307 (1978) automatically provide funds or authorize any particular amount of data processing equipment as stated in the 1980-81 budget request?

2. Are the requirements (i.e., prior approval by DPD) outlined in Department of Administration EDP Acquisition Procedures binding on all state agencies? Are there any legal ramifications for use of funds without specified approval?

3. Would EDP acquisitions, for which federal reimbursements were received, be exempt from the D.O.A. requirements?

4. Do the June, September and December 1979 EDP equipment rentals constitute an unauthorized use of funds since purchase of the equipment was not authorized by the legislature?

5. In order for a state agency to execute the rental of a computer as described, should a written rental agreement exist? Considering the sums involved, should it be a lease-purchase agreement? Should such an agreement be competitively bid?

6. Do the attached claims and vendor invoices violate any Arizona statutes, rules and regulations or other guidelines regarding complete and accurate descriptions of the products received on claims and/or invoices submitted to the State for payment? Are there any legal ramifications for such violations?

7. Are there any legal ramifications for an agency improperly classifying an expenditure (object code) on an encumbrance document and/or claim (A.R.S. section 35-172)? For example, data processing equipment rental was reported as a data processing equipment maintenance contract (object code 72836). (See attached claim dated 6/4/79.)

ANSWERS:

1. S.B. 1391 was enacted as Laws 1977, chapter 29 and prescribed procedures for groundwater transfers. Additionally, $490,000 was appropriated to the State Land Department for expenses connected with the issuance of groundwater transfer certificates of exemption. S.B. 1307 was passed as Laws 1978, chapter 52 and transferred the Arizona resource information system from the department of revenue to the land department as the resources division. While an appropriation was in S.B. 1307 as introduced, it was deleted from the version that finally passed. Neither chapter automatically provided funds nor authorized any particular amount of data processing equipment.

2. Arizona Revised Statutes section 41-712 requires the Department of Administration Data Processing Division to develop, implement and maintain a coordinated statewide plan for data processing and data communications systems. Review and approval by the data processing division of data processing acquisitions by state budget units is necessary to insure that the proposed new equipment conforms with the state plan for data processing. This approval is also prescribed by the state accounting manual issued by the Department of Administration Division of Finance under the authority of Arizona Revised Statutes sections 35-131 and 41-722. The state accounting manual also requires equipment leases entered into for the first time to have the approval of the attorney general. Use of funds without the specified approval would be an unauthorized expenditure of state monies and would subject a person to liability under Arizona Revised Statutes section 35-196 and would call into play the provisions of Arizona Revised Statutes title 35, chapter 1, article 6, concerning the recovery of state monies illegally paid.

3. We are unable to locate any exemption for the acquisition of EDP equipment using state monies that are later reimbursed by federal funds.

4. For the reasons stated in point 2, the EDP equipment rentals could constitute an unauthorized use of funds. However, while the refusal of the 1979 legislature to appropriate monies specifically for equipment acquisition as requested is a valid expression of legislative intent on the matter, monies for such equipment could probably legitimately come from monies appropriated to the division for "other operating expenses". Although, according to the 1979-80 Appropriations Report of the Joint Legislative Budget Committee (JLBC), the amount for other operating expenses was approved on the basis of the following expenditure items, this category per se in the appropriation in actuality is so broad that equipment replacement would probably fit under it. The basis for the appropriation was:

Rent (Dept. of Administration)	$10,500
Maintenance and Repairs	5,000
Office and Library Supplies	33,900
Data Processing Supplies	6,000
Printing and Photographs	14,300
Postage and Mailing Costs	2,000
Telephone Service	4,300
Reproduction Equipment Rental	3,800
Dues and Subscriptions	200
TOTAL	$80,000

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A more serious question arises regarding the use of monies from the cooperative fire control fund and the timber suspense fund. Arizona Revised Statutes section 35-173, subsection C requires a budget unit to receive the approval of the assistant director for finance to "transfer funds from one class or subclass to another" or to "transfer funds between and within programs if funds are appropriated to the budget unit by programs". Since no approval was received from the assistant director for finance, the use of monies from the two previously named funds for the September and December equipment rental payments would appear to violate Arizona Revised Statutes section 35-173 and constitute a class 1 misdemeanor under Arizona Revised Statutes section 35-197. While monies are not appropriated to these two funds, funds are appropriated to the land department by program and so we believe that Arizona Revised Statutes section 35-173 is applicable.

The use of the cooperative fire control monies also appears to violate Arizona Revised Statutes section 37-624 which prescribes that the fund is to be used "for the purpose of fire protection".

Monies in the timber account, as authorized in Arizona Revised Statutes section 37-482, may be used only for legitimate expenses connected with the sale of the timber. It is unclear whether rent for the IRD equipment would be a legitimate expense. See 72 Op. Atty. Gen. 8-L(1972)

5. The state accounting manual specifically requires data processing equipment lease agreements to be approved by the data processing division and the attorney general. This procedure appears to contemplate the existence of a written agreement evidencing the lease. Additionally Arizona Revised Statutes section 35-151 requires encumbrance documents to be issued by budget units to cover all state obligations. The division of finance is required to examine such documents to determine if the proposed expenditure is for a valid public purpose. Failure to have a written rental agreement would severely handicap the finance division's ability to determine the validity of an expenditure. Additionally, the lack of a written agreement, considering the amount of monies involved, is an

example of extremely poor business practice. Public authorities have a duty to act in good faith and in the best interests of the govermental agency involved. Hertz Drive-Ur-Self System v. Tucson Airport Authority, 81 Ariz. 80, 85, 299 P.2d 1071, 1074 (1956). In this instance, that duty would seem to require a written rental agreement for the computer equipment.

We are unable to determine the propriety of using a lease-purchase agreement rather than a rental agreement under the stated fact situation. A lease-purchase agreement in many instances is more favorable and advantageous for the state.

It is unclear whether the rental of the computer equipment should have been competitively bid. Arizona Revised Statutes section 41-730 refers to purchases in excess of five thousand dollars per transaction. Certainly, for a fiscal year, the rent for the equipment would exceed five thousand dollars; however, we are unable to determine if the computer equipment rental could be characterized as a "purchase of contractual services" under section 41-730.

6. While the descriptions on the claims and invoices you provided to us certainly are brief, we are unable to determine if they are in violation of any statute, regulation or procedure.

7. An intentional improper classification of an expenditure on an encumbrance document would appear to subject a person to the civil liability provisions of Arizona Revised Statutes sections 35-154 and 35-196 and the criminal provisions of section 35-197.

cc: Gerald A. Silva
Performance Audit Manager

APPENDIX XII

FEBURARY 20, 1980,
LEGISLATIVE COUNCIL MEMORANDUM

ARIZONA LEGISLATIVE COUNCIL

MEMO

February 20, 1980

TO: Douglas R. Norton, Auditor General

FROM: Arizona Legislative Council

RE: Request for Research and Statutory Interpretation (O-80-3)

This is in response to a request submitted on your behalf by Gerald A. Silva in a memo dated January 29, 1980. No input was received from the Attorney General concerning this request.

QUESTIONS PRESENTED:

1. Does Arizona Revised Statutes title 37, chapter 1.2 mandate that an information data bank be developed that is: a) a statewide natural resources information system that should consider in its design and contain in its storage the data needed by all agencies with resource management responsibilities or b) a system designed for State Land Department needs that other agencies may use for their own responsibilities?

2. Does Arizona Revised Statutes section 37-173 mandate that the entire "information data bank" be computerized (as opposed to a manual system) or do the statutes require that computer compositing techniques be used only in the development of the "information data bank"?

3. Does "coordinate those activities of State government agencies and State political subdivisions with respect to any utilization by them" of NASA Landsat program mean that all agencies and subdivisions must utilize or notify the Division for each use of Landsat? If not, what activity does the word coordinate require?

ANSWERS:

1. It is a clear rule of statutory interpretation that the word "shall" normally implies that to accomplish the purpose of the provision someone must act. Dickerson, Legislative Drafting section 6.6. See Sutherland, Statutory Construction, Vol. 1A, 4th Ed. On the other hand, the term "may" is used to confer a right, privilege or power. Dickerson, Legislative Drafting section 7.4. See Sutherland, Statutory Construction, Vol. 1A, 4th Ed. Applying these simple rules to the provisions of Arizona Revised Statutes title 37, chapter 1.2, sections 37-173 and 37-174, it is clear that the state land department is required to develop an information data bank for its own use which other political subdivisions of this state may use for their own related purposes.

Among other things, Arizona Revised Statutes section 37-173 requires the resources division to "1. Provide an information data bank for the state land department. . ." (emphasis added). However, Arizona Revised Statutes section 37-174 allows the resources division to establish a liaison relationship with political subdivisions of this state for purposes of making available resource information. If the resources division enters into such a liaison relationship, and to the extent the relationship involves

making available resource information, the resources division would have to obtain and store that information.

2. Arizona Revised Statutes section 37-173 states that "/t/he resources division shall: 1. Provide an information data bank for the state land department by computer compositing the data from remote sensing technology with other technical information and the geographical base resulting from the Arizona orthophotoquad program. . .". If language is plain and unambiguous it must be given effect. Sutherland, Statutory Construction section 46.04, 4th Ed. Generally, the test of whether a statute is clear and unambiguous is whether the statute is not contradicted by other language in the same act. A review of Arizona Revised Statutes title 37, chapter 2.1 disclosed no contrary language to indicate that the legislature intended that the resources division computerize only part of the information data bank. Therefore, the only reasonable conclusion that can be drawn from Arizona Revised Statutes section 37-137 is that the division has been mandated to computer composite all the data for the information data bank.

3. Under both statutory and case law the terminology used in a statute is given the ordinary and common meaning unless legislative intent is to the contrary. Ross v. Industrial Commission, 112 Ariz. 253, 540 P. 2d 1234 (1975); Arizona Revised Statutes section 1-213. In seeking such a plain meaning, Webster's Third New International Dictionary states that "coordinate" means to bring into a common action, movement or condition: regulate and combine in harmonious action.

Coordinating those activities with respect to the use by state agencies or political subdivisions of certain information would seem to imply that the legislature intended the resources division to be the central point from which the agencies and subdivisions would draw their information. The test as to what side effects should be held to flow from a statute by way of inference is that the statute embrace such consequential applications and effects as are necessary, essential, natural or proper. Sutherland, Statutory Construction, section 55.03, 4th Ed. Thus, requiring an agency or political subdivision of this state to use or notify the division of each use of Landsat would be a proper procedure pursuant to legislative mandate. If this procedure is unnecessary or impractical, Arizona Revised Statutes section 37-173, paragraph 6 should be amended to more closely parallel the practical use of the Landsat program.

CONCLUSION:

1. Title 37, chapter 1.2, Arizona Revised Statutes, requires that the resources division develop an information data bank for the state land department that other political subdivisions of this state may use.

2. Arizona Revised Statutes section 37-173 requires that the entire information data bank be computerized.

3. Requiring an agency or political subdivision of this state to use or notify the resources division of each use of Landsat would be a proper procedure pursuant to Arizona Revised Statutes section 37-173, paragraph 6.

cc: Gerald A. Silva
Performance Audit Manager

APPENDIX XIII

NOVEMBER 26, 1979, LETTER TO THE
STATE AUTOMATION DIRECTOR
FROM THE STATE LAND DEPARTMENT

Bruce Babbitt
Governor

Arizona
State Land Department
1624 WEST ADAMS
PHOENIX, ARIZONA 85007

Joe T. Fallini
Commissioner

November 26, 1979

Mr. Jack Stanton
State Automation Director
Data Processing Division
Department of Administration
State Capitol, West Wing
Phoenix, Arizona 85007

Dear Mr. Stanton:

The Arizona State Land Department, Information Resources Division is required to provide a computer information data bank of natural resources which can be used by various divisions within the Department, including the field offices.

Under the present goals and objectives of the Land Department it is important that such a system provide near real-time information related to the fields of natural resources to improve the Department's ability to manage the 9.5 million acres of Trust lands.

I have designated Mike Castro to represent the Department on the interim executive committee of the Governor's State Data Coordination Network.

The inter-department review committee has recommended the following system items be replaced during FY 80-81.

A. The present Nova 800 computer be replaced for the following reasons:

1) Multiple users input-output (Phoenix based or field office based) cannot access to the system during normal working hours.

2) No communication additions can be made to provide direct field office input or output.

3) The computer maintenance is being phased out because it is considered obsolete by the manufacture.

4) The present operating software does not provide time sharing, multiple language use of the system.

5) Programming activities cannot be conducted while a single in-house is operating the system.

B. The following equipment has been recommended as the most cost effective, non-disruptive replacement to the present operation system.

1) Data General Eclipse S/130 Computer which will eliminate all of the problems mentioned above.

2) Floating Point Board be provided to support Fortran language users with high speed math use for forestry management modeling, range management modeling, agriculture management modeling, water management modeling, engineering and mapping producing activities.

3) Tape drive unit (800/1600 selectable) which was recommended by your staff's April 1978 survey of requirements.

4) Dasher-terminal to be used as a master terminal to the system.

C. The benefits of this system for the Department and others are as follows:

1) 40% savings in man hours related to the range inventory process which are to be inspected once a year, 5 FTE range managers provide the Department with the proper information required for billing, carrying capabilities, and land management.

2) Geographical inventory is ongoing in forestry for the protection of life, property and natural resources from the threat of damaging wildfires, 46,000 acres of fire damage during 1979. Special models of fuel type, fire danger, weather, topography, fire suppression forces needed and equipment services in an emergency condition must be reported in real-time.

3) The use of the agriculture inventory against a use-report will provide the Department with audit capabilities never used before. The satelite image used with the present equipment will provide a checking method to verify our agriculture leases.

4) Mapping requirements will improve 20% by increased volume which will provide great availability of plat maps used by control audit and review personnel.

5) Other agencies are preparing to access the system for information such as the Game and Fish Department, graphical analysis of the Kaibab National Forest for data overlays of animal locations in a form of UTM coordinates, deer densities, elevation zones, vegetation types. Parks and Recreation want a geographical data base of the parks, vegetation types, trails. Water Commission has proposed a geographical mapping data base for the flood-early warning system which will also be used by Emergency Services. A recent request by the Governor to support the inventory and mapping needs of the Arizona Natural Heritage Program.

We hope this request meets your review and approval requirements. Please call me if you have any additional questions.

Sincerely,

Joe T. Fallini

Joe T. Fallini
Commissioner

JTF:rm

APPENDIX XIV

MARCH 4, 1980,
LEGISLATIVE COUNCIL MEMORANDUM

ARIZONA LEGISLATIVE COUNCIL

MEMO

March 4, 1980

TO: Douglas R. Norton, Auditor General

FROM: Arizona Legislative Council

RE: Request for Research and Statutory Interpretation (0-80-9)

This is in response to a request submitted on your behalf by Gerald A. Silva in a memo dated February 26, 1980. No input was received from the Attorney General concerning this request.

QUESTIONS PRESENTED:

1(a). In Arizona Revised Statutes section 37-174, what does political subdivisions mean?

(b). Does it (political subdivisions) include state agencies?

2. If "political subdivisions" does not include state agencies, does the Information Resources Division have the authority to develop a computer composited information data bank that includes the wants or needs or data of other state agencies, commissions, boards or departments?

ANSWERS:

1(a). Arizona Revised Statutes section 37-174, paragraph 1 states:

> The resources division may:
> 1. Establish a liaison relationship with political subdivisions of this state for purposes of collecting, compiling, processing and making available resource information. (Emphasis added.)

The legislature has not defined "political subdivision".

Under both statutory and case law the terminology used in a statute is to be given its ordinary and common meaning unless legislative intent is to the contrary, Ross v. Industrial Commission, 112 Ariz. 253, 540 P. 2d. 1234 (1975); Arizona Revised Statutes section 1-213.

In seeking such an ordinary and common meaning the dictionary defines a "political unit" as a "unit of territory defined by boundaries set by political authority and usually having a separate political organization".[1] (Emphasis added.)

[1] Webster's Third New International Dictionary.

We believe that "political subdivision" as used in section 37-174, paragraph 1, Arizona Revised Statutes, has the same ordinary and common meaning as the dictionary meaning of "political unit" and means a political unit or subdivision with defined geographical boundaries.

It is also a rule of statutory construction that, in the absence of a manifested intent to the contrary or other overriding evidence of a different meaning, legal terms in a statute are presumed to have been used in their legal sense, SUTHERLAND, STATUTES AND STATUTORY CONSTRUCTION section 4730 (1973).

The Arizona Supreme Court has interpreted "political subdivision" to include counties, cities, towns, school districts and irrigation, power, electrical, agricultural improvement, drainage and flood control districts, Hernandez v. Frohmiller, 68 Ariz. 242, 204 P. 2d 854 (1949).

Both the ordinary, common meaning and the legal meaning of "political subdivision" indicate the legislature's intent to use the term to mean a unit or subdivision of the state defined by geographical boundaries set by political authority and having a separate political organization. Counties, cities, towns and school districts are examples of political subdivisions.

Political subdivision implies a governmental unit which is established by the will of the voters, administered by an elected board and is self-financing.

1(b). The legislature has not defined "state agency". The common and ordinary meaning of "agency" as defined in the dictionary is "the department or other administrative unit of a government".[2] (Emphasis added.)

From the above definition it is clear that "political subdivision" and "state agency" are mutually exclusive terms.

That the legislature did not intend to include state agencies within the meaning of political subdivision is further evidenced by Arizona Revised Statutes section 37-173, paragraph 6 which was enacted by the same act as section 37-174, Arizona Revised Statutes. Section 37-173, paragraph 6, Arizona Revised Statutes, states:

> The resources division shall . . .
> 6. Coordinate the activities of state government agencies and state political subdivisions. (Emphasis added.)

In reading together sections 37-173 and 37-174, Arizona Revised Statutes, it is clear that the legislature did not intend state agencies to be included in the meaning of political subdivisions in section 37-174 or the legislature would have added that term.

[2] Ibid.

In construing the meaning of a statute the intent of the legislature must be found in the language of the statute, Automatic Registering Machine Co. v. Pima County, 36 Ariz. 367, 285 P. 1034 (1930).

Courts will not read into a statute something which is not within the manifested intention of the legislature as gathered from the statute itself, Town of Scottsdale v. State ex rel. Pickrell, 98 Ariz 382, 405 P. 2d 871 (1965).

In construing a statute it is presumed that what the legislature means, it will say, Padilla v. Industrial Commission, 113 Ariz. 104, 546 P. 2d 1135 (1976).

We presume that if the legislature intended to include state agencies in section 37-174, Arizona Revised Statutes, it would have included the term "state agencies". Under this strict interpretation of the statute it appears that the intent of the legislature was to authorize the resources division to establish liaison relationships with political subdivisions of the state only and not to authorize liaison relationships with state agencies under section 37-174, Arizona Revised Statutes. However it is also possible that state agencies were not included in this provision because the legislature deemed that state agencies have an implied statutory authority to deal with one another whereas statutory authority is needed for dealings with other governmental units. Under such an interpretation the resources division could be deemed to have inherent powers to form liaison relationships with other state agencies.

2. In determining the authority of the resources division to develop a computer composited information data bank the pertinent statute is section 37-173, Arizona Revised Statutes, which provides:

> 37-173. Duties
> The resources division shall:
> 1. Provide an information data bank for the state land department by computer compositing the data from remote sensing technology with other technical information and the geographical base resulting from the Arizona orthophotoquad program.
> 2. Provide current information regarding revenue producing activities and monitor changes over time by remote sensing techniques.
> 3. Produce maps and inventories at standard scales for any area defined by its designated geographical, governmental or jurisdicational boundaries to include combinations of data elements.
> 4. Provide maps, aerial photographs and other remote sensing techniques related to state trust lands to assist in the valuation process by determining location and description of the following classes of property:
> (a) Producing mines, personal property used in such mines, improvements to such mines and mills and smelters operated in conjunction with such mines.

(b) Producing oil, gas and geothermal resource interests.

(c) Gas, water and electric utilities and pipelines.

(d) Community antenna television systems and microwave services.

(e) Forestry management lands requiring burn permits.

(f) Real and personal property of railroad companies.

(g) Standing timber.

(h) Water ditches constructed for mining, manufacturing or irrigating purposes.

(i) Improvements on unpatented land, mining claims or state land.

5. Function as the Arizona affiliate office for the national cartographic information center, with support from the United States geological survey, to access archived maps and imagery data sources to assist the mapping, inventorying and data handling segments of the division.

6. Coordinate those activities of state government agencies and state political subdivisions with respect to any utilization by them of the national aeronautics and space administration, earth resources satellite program, Landsat, in discharging their responsibilities in the fields of agriculture, wildlife, forestry, land, mineral, water and other resource management.

The only stated authority of the resources division concerning other state agencies is the duty prescribed by paragraph 6 of the above statute to "/c/oordinate those activities of state government agencies . . . ."

Under both statutory and case law the terminology used in a statute is given the ordinary and common meaning unless the legislative intent is contrary, Ross v. Industrial Commission, 112 Ariz. 253, 540 P. 2d 1234 (1975); Arizona Revised Statutes section 1-213.

The legislature has not defined "coordinate".

The dictionary meaning of "coordinate" is "to bring into a common action, movement, or condition; i.e., to regulate and combine in harmonious action."[3]

The legislature has not defined "activities".

The dictionary meaning of "activity" is "an organizational unit for performing a specific function; duties or functions."[4]

[3] Ibid.
[4] Ibid.

The utilization of "national aeronautics and space administration, earth resources satellite program, Landsat" are apparently synonomous terms for the land satellite program. (Landsat)

Coordinating those activities with respect to the use by state agencies of Landsat information would seem to imply that the legislature intended the resources division to be the central information depository for the dissemination of Landsat data.

The authority of the resources division relating to the purpose for which the information data bank is to be developed is clearly stated in paragraph 1 of the above statutory provision which states in pertinent part that the resources division shall "provide an information data bank for the state land department." (Emphasis added.) It is clear from the above language that the legislature intended the data bank to be developed to meet the needs of the state land department.

Courts will not read into a statute something which is not within the manifested intention of the legislature as gathered from the statute itself, Town of Scottsdale v. State ex rel. Pickrell, 98 Ariz. 382, 405 P. 2d 871 (1965).

We presume that if the legislature intended the data bank be developed to meet other state agencies' needs it would have so stated.

It would appear that under section 37-173, Arizona Revised Statutes, the legislature intended that other state agencies may have access to the data bank to assist them in discharging certain specified agency responsibilities, and the resources division is responsible for coordinating the dissemination of information from the data bank to these agencies.

Under paragraph 4 of section 37-174, Arizona Revised Statutes, the resources division may "utilize the advice and services of all . . . state . . . agencies." This provision would certainly authorize the division to collect the data of other state agencies.

CONCLUSIONS:

1(a). "Political subdivision" means a subdivision of the state which is defined by geographical boundaries set by political authority and having a separate political organization.

1(b). It is not clear whether the legislature did not include state agencies in section 37-174, Arizona Revised Statutes, because it intended to explicitly exclude state agencies or because it deemed that there already was an inherent implied power to form liaison relationships with other state agencies.

2. The information resources division does not have authority to develop a computer composited information data bank which includes data for the use of other state agencies or which is designed to meet their needs, except if such data overlaps with data relevant to the needs of the state land department.

RECOMMENDATION:

Since an administrator may otherwise be subjected to an infinite variety of issues is seeking to draw a line between unauthorized relationships on one hand and merely inappropriately directed ones on the other, if the legislature intends the data bank to include information useful to state agencies other than the state land department, Arizona Revised Statutes section 37-173 should be amended. The statute should expressly state the types of additional information which may be collected, the specific needs of other identified state agencies for which data may be collected and the financial or other arrangements which would apply to such a liaison.

The statute should also be amended to state the priorities for information to be collected by the resources division. The existing statute provides no guideline for the resolution of competing information demands nor method for allocating services among competing clients.

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