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PROCEDURES TO CONFIGURE SHARED WORK AREAS FOR THE ARC/INFO GIS

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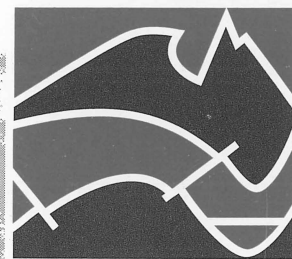
by

Andrew Tucker, Peter Miller & Ross Brodie



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PROCEDURES TO CONFIGURE SHARED WORK AREAS FOR THE ARC/INFO GIS

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*Procedures to Configure Shared Work Areas for the
ARC/INFO GIS*

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Andrew Tucker, Peter Miller, Ross Brodie

Australian Geological Survey Organisation
Environmental Geoscience and Groundwater Program

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources: Hon. David Beddall, MP

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Abstract

The reasons for adopting a structured, consistent approach to sharing spatially distributed data are delineated in this document.

Procedures that can be used to share data and programs developed for ESRI's ARC/INFO geographical information system are described. The automated generation of directory structures to hold the data and programs (called a "shared work area") is also described.

The role of a shared work area data administrator is discussed, and the tasks that must be undertaken to create and maintain an ARC/INFO shared work area.

The information that may be required to describe a geological or hydrogeological dataset is outlined, along with a template text file to hold this information.

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1) Introduction:

Projects in the Environmental Geoscience and Groundwater Program (EGG) of the Australian Geological Survey organisation (AGSO) are making increasing use of the corporate ARC/INFO Geographic Information System (GIS) facility. Some of these EGG projects need to store and manage ARC/INFO data sets so that current versions of data sets are accessible to all members of the project. There is also a requirement to archive and control access to these data sets.

The first section of this document describes why it is important to share and manage GIS data sets. Subsequent sections describe procedures for establishing and accessing shared ARC/INFO work areas under the UNIX operating system.

Note that in this document, we use "shared" to mean, at most, simultaneous read access to a data set.

2) Sharing GIS Data Sets:

2.1) Accessing GIS Data Sets:

Access to GIS data sets is critical for many projects within AGSO. Increasingly, data sets required for scientific investigations are becoming available in digital/GIS compatible formats. These data sets not only reduce the time and cost of scientific investigations, but also greatly enhance the quality, usefulness and presentation of the project results. Clients are also beginning to request information in digital form for input into their own GIS or database platforms.

Inappropriate access to data sets must be prevented. Data sets that are being prepared may not necessarily be suitable for general distribution. The access to information based on confidential or sensitive data must also be controlled.

Access to data sets should be grantable at different levels; to individuals, to all members of a project/program or to all members of an organisation. Modifications to shared data sets must also be controlled so that the changes to data sets can be monitored and reviewed.

2.2) Data Set Versions:

Many data sets need to be continually updated, and utility programs will need to be modified to meet new user requirements. GIS data set users should be freed from the need to copy and maintain shared data sets, and be confident that they are using the most current version.

2.3) Efficient Use of Resources:

It is inappropriate to maintain multiple copies of identical GIS data sets: many GIS data sets are very large and disk space is always finite. It is also inappropriate to spend time and resources developing data sets and utility programs that already exist.

Duplication of computationally intensive data processing can be reduced through the appropriate use of shared data sets.

2.4) Descriptions of GIS Data Sets:

Appropriate and informed use and distribution of GIS data sets is only possible if the data sets are adequately described and catalogued. Modifications made to data sets should also be documented, and this documentation should be made available to users of these data sets.

2.5) Communication between Data Set Developers and Users:

Communication between data set developers and users is essential if products are to be useful for users, and to ensure that any inaccuracies or errors in data sets discovered by data set users can be corrected by the custodians.

Mechanisms to notify users of the availability of new and updated data sets should also be established.

2.6) Summary:

- . We must control access to shared data sets: wherever possible GIS users should have access to the data sets they need, but inappropriate access to data should be prevented.
- . We must ensure that users have access to current releases of data and utility programs.
- . We must ensure that efficient use is made of GIS data, and computer and human resources.
- . We must ensure that users have access to descriptions of shared GIS data sets.
- . We must ensure that communication exists between GIS data set developers and users.

The remainder of this document describes a partial solution to these issues for the ARC/INFO GIS and the UNIX operating system. This solution is called "shared work areas".

3) Shared Data Sets for the ARC/INFO GIS and Environmental Geoscience and Groundwater Program:

A consistent approach to sharing data sets would be of great benefit to those projects within AGSO's Environmental Geoscience and Groundwater (EGG) Program that use GIS. Shared ARC/INFO work areas would greatly assist long term data management and project coordination.

The Great Artesian Basin Project is currently using a shared work area to hold ARC/INFO coverages, projection files and ARC AML files that are being developed for a hydrogeological model of the Great Artesian Basin. Because some data sets are derived from data made available only to this project, security has been implemented to control access to the data sets held in the shared work area.

The Murray Basin Project is using a shared work area to hold GIS data that is being converted from a CAD/CAM system to the ARC/INFO GIS.

At the program level, a shared work area could hold, for example, coverages that make up the digital version of the hydrogeological map of Australia, as this data set should be accessible to several projects within the EGG Program. Other national coverages such as soil, vegetation and land use classifications would also be of common use.

There are data sets that should be made available to many projects within AGSO. The coverages making up the 1:2,500,000 geological map of Australia would be an example of a data set of use to all programs within the organisation. Also, access to a national coverage of cultural details such as topography, drainage, state boundaries, and 1:100 000 and 1:250 000 scale basemaps would be convenient for many AGSO ARC/INFO users. The ARC/INFO projection files for all the AMG zones within Australia would also be useful, as would the AGSO cartographic symbol sets and common map elements such as the AGSO logo, standard north arrow and scale bars. General purpose ARC/INFO AML (or program) files used to develop point coverages from location data held in Oracle databases (Tucker, 1993) could also reside in a shared AGSO work area.

The shared work areas need not necessarily be hierarchical (i.e. organisation above program above project), as it may be appropriate to allow users from different programs to access a shared work area. For example, cartographers at the AGSO Cartographic Services Unit may need access to a project's shared work area as well as members of the project.

4) Implementing Shared Work Areas for ARC/INFO Data Sets and UNIX Workstations:

At present, ARC/INFO does not implement any form of security for its spatial data sets (though INFO does have password control): ARC/INFO relies solely on the host operating system for security. UNIX allows the owner of a file to control read, write and execute access at three levels; the owner, the other members of groups of which the owner is a member, and to all other users. It is not possible (with current versions of UNIX) to grant access to a file or directory to a specific user other than the owner, or to groups that the owner of the file is not a member of.

It is possible to create shared work areas for each project to hold data that will be shared by those working on the project. A shared work area can be set up for ARC/INFO geo-data sets common to a project, a program, or to all AGSO ARC/INFO users. A UNIX group can also be created, with a membership made up solely of those users who wish to access the shared data.

A GIS data administrator may be appointed for each shared work area, and the UNIX ownership of all files in the directory vested in that person. The GIS data administrator is the only individual with write access to the shared work area directories, and is responsible for updating data sets, ensuring that documentation standards are maintained, that security is implemented correctly, and that users who may need to access the data are informed of the availability of data sets. The GIS data administrator would also be responsible for archiving to tape media those data sets that no longer need to be stored on disk. The GIS data administrator would have a separate account that would only be used when maintaining the shared GIS data.

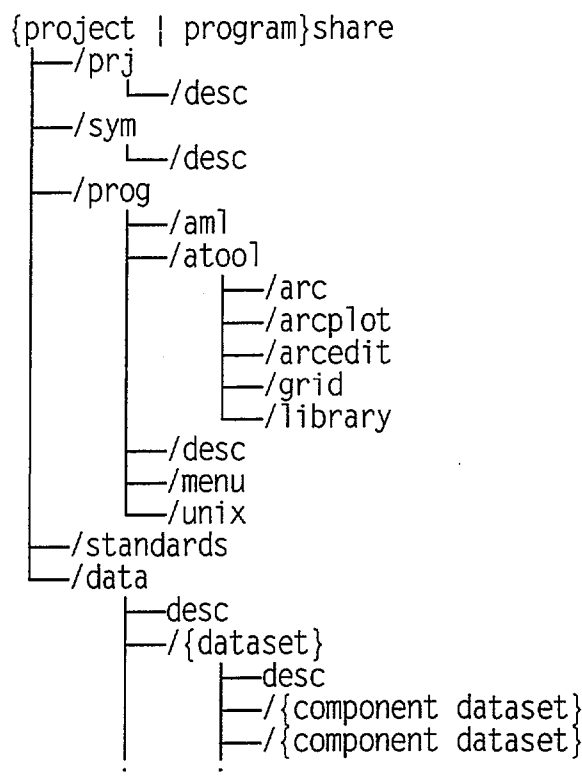
A member of a project would be a logical choice for administration of that project's shared data sets.

Each shared work area includes directories for ARC/INFO projection files, symbol sets, and ATOOL commands and AML's common to users accessing the data in the shared work area. UNIX environment variables are initialised to point to shared work areas, and these variables can be used within ARC to specify the location of the shared data sets.

When large, complex data sets are to be shared, the use of ARC/INFO libraries should be considered. However, ARC/INFO libraries suffer from the same security deficiencies as ARC/INFO coverages, and do not at present support ARC/INFO grids.

4.1) A Shared Work Area Directory Structure:

The directory structure for shared ARC/INFO data and programs (modified from Gallagher, 1992) could be:



{project}: main directory of the shared work area.

{project}/prj: ARC/INFO projection files.

{project}/prj/desc: help files for ARC/INFO projection files.

{project}/sym: ARC/INFO symbol sets.

{project}/sym/desc: help files for ARC/INFO symbol sets.

{project}/prog:

{project}/prog/aml: aml's not specific to any ARC/INFO module. This directory can be added to the ARC/INFO aml path variable (&amlpath)

{project}/prog/atool: atool amls. This directory can be added to the ARC/INFO atool path variable (&atool) .

{project}/prog/atool/arc: atool amls executable from arc.

{project}/prog/atool/arcplot: atool amls executable from arcplot.

{project}/prog/atool/arcedit: atool amls executable from arcedit.

{project}/prog/atool/grid: atool amls executable from grid.

{project}/prog/atool/library: atool amls executable from library.

{project}/prog/desc: help files for aml and atool commands

{project}/prog/menu: ARC/INFO menu files. This directory should be added to the ARC/INFO menu path variable (&menupath).

{project}/prog/unix: executables and shell scripts that can be run from the UNIX command line. This directory can be added to the UNIX path environment variable.

{project}/standards: text files describing standards for data and programs held in the shared work area.

{project}/data: shared ARC/INFO geodata.

{project}/data/desc: descriptions of shared ARC/INFO geodata sets as text files.

{project}/data/{dataset}: ARC/INFO data for a data set. This directory may also

need to be defined as an ARC/INFO workspace.

{project}/data/{dataset}/desc: a text file containing a description of the data set.

{project}/data/{dataset}/{component dataset}: a directory containing an ARC/INFO geo data set.

A detailed description of a typical ARC/INFO coverage directory structure (corresponding to the directory {project}/data in the list above) is shown in Musto (1990).

4.2) Shell environment variables for Shared Work Areas:

UNIX shell variables can be used from within ARC/INFO to specify the location of symbol sets, projection files and ARC/INFO data workspace. For example, for the Great Artesian Basin (GAB) shared work area, the following UNIX shell variables are defined:

GAB : defined as the location of the gabshare directory.

GABS : defined as the location of the shared symbol sets directory. For example, to load a line symbol set from the Great Artesian Basin shared work area, the following command could be used:

```
arcplot>lineset $GABS/plotter8
```

GABP : defined as the location of the shared projection files directory. To specify a projection file held in the shared work area, the following command could be used:

```
arc>project cover gridg grida $GABP/alb2127.prj
```

GABD : defined as the location of the shared data set directory. For example, to copy a TIN from the shared data set directory, the following command would be useful:

```
arc>copy $GABD/anytin updanytin
```

4.3) ARC/INFO Pathnames and Variables:

The atool, menu, and aml path variables (defined with the &atool, &menupath and &amlpath ARC/INFO commands respectively) can be defined in an AML to free users from typing full pathnames for AML programs held in a shared work area. Unfortunately, there is no ARC/INFO path variable for text or help files. There are two ways around this deficiency: putting help files into ARC/INFO menus and displaying these as forms from within AML based applications, or defining a variable to hold the location of help files. The first method has the disadvantages of a requirement to modify text help files to convert them into ARC menus, and only a limited amount of available text display. The second method has the disadvantage of not being a true path specification: only one directory can be specified in the

AML variable.

4.4) Initialising AML Variables for Shared Work Areas:

Ideally, it should be possible to initialise the AML path variables with a single ARC/INFO command. It is possible to initialise AML path variables in modified ARC/INFO station files. This presents some difficulties during upgrades of the ESRI software, as these files must be copied into the station directory of the new version of ARC/INFO. The modifications must also be placed in every station file that is likely to be used by ARC/INFO users. If more than one shared work area is to be set up, it will be difficult to prevent all ARC/INFO users having their AML variables initialised for all shared work areas.

ARC/INFO GIS users may wish to access data in several shared work areas during a single ARC/INFO session. Therefore, the UNIX environment variables used to hold paths to directories within a shared work area should be unique.

An ARC/INFO AML file called "share.aml", which initialises AML path variables for any number of shared ARC/INFO work areas, is described in the following section.

4.5) Automating Shared Work Area Creation:

Much of the directory structure for a shared work area will be common to all shared work areas. It is preferable that a standard approach be taken to initialising UNIX and AML variables, to prevent conflicts and incompatibilities arising when GIS users wish to access more than one shared work area concurrently. It is therefore appropriate to generate the shared work area directory structure and configuration files with a UNIX shell script. A shell script, called "arcshare", that undertakes these tasks is described and listed in appendix i). This script file also creates a UNIX shell script to initialise environment variables holding the paths of some of the shared work area directories (section 4.2), and also creates an AML program file to initialise the AML path variables (section 4.3 and 4.4).

4.5.1) Initialising UNIX Environment Variables for Shared Work Areas:

The shell script initialising all the UNIX environment variables for each shared work area is placed in the {project}/prog/unix directory during initialisation of the shared work area. This script file can be executed (with the C shell source command) from the .cshrc file at the start of a user's UNIX session. If an ARC/INFO user wishes to access more than one shared work area, the order in which the shared work areas are searched for executable files is the same as that in which the configuration shell scripts are called from the .cshrc file.

For example, the c shell script created during initialisation of the GAB shared work area is called cshrc-gab, and is placed in the \$GAB/prog/unix directory. The following command was added to each GAB shared work area user's .cshrc file:

```
source /mnt/gaba/gab/prog/unix/cshrc-gab
```

This shell script also adds the \$GAB/prog/unix directory to the UNIX path variable.

4.5.2) Initialising Shared Work Area AML Path Variables:

When the shared work area is created with the "arcshare" shell script, and when the UNIX and ARC/INFO configuration files are set up for each user, the user can initialise AML, menu and atool path variables by typing a single command at the ARC, ARCEDIT, ARCPLOT or GRID prompt.

The following example would set up AML path variables for the environmental geoscience and groundwater shared work area, the Murray Basin shared work area, and the Great Artesian Basin shared work area:

```
ARC> share egg mb gab
```

The locations of the shared work area directories are added to the AML path variables in the order in which they appear on the "share" command line. The AML path variables are not reset before the shared work areas are appended to them.

The AML, menu and atool path variable may be reset to a null state by typing the following command:

```
ARC>share -none
```

The usage of the share command, and the current AML, menu and atool path variable values, can be viewed by typing:

```
ARC> share
```

The share command may be included in a user's ".arc" file in their home directory to save them the inconvenience of typing it each time they start ARC/INFO.

The share command runs an AML file created during the initialisation of the shared work area. This AML file should be copied from the {project}/prog/aml directory to the \$ARCHOME/share.cfg directory by the data administrator after the shared work area has been created.

For example, after the GAB shared work area was create, the following command was used to copy the AML path configuration aml to the share.cfg directory:

```
master@zircon: cp $GAB/prog/aml/gab.aml $ARCHOME/share.cfg
```

The system administrator should run this copy command.

5) The Role of the GIS Data Administrator:

The role of the GIS data administrator is similar to the role of the database administrator described by Kucka (1992). However, given that the shared data areas will be implemented mostly at the project level, it is appropriate for the role of the GIS data administrator to be more extensive than that described by Kucka for a database administrator.

The GIS data administrator for a project should be responsible for:

- . copying the data sets and programs into the shared work area,
- . updating a log file when new or updated data sets are copied to the shared work area (the log file is called "shareadm.log", and is created by the "arcshare" script described in appendix i),
- . updating the index files that contain a one line description of the data sets and programs in the shared work area (refer to section 7.2),
- . ensuring that UNIX file permissions are set appropriately so that all members of the shared work area group can access the shared data sets, and that the file permissions are set to prevent inappropriate access to the data sets,
- . archiving the data sets, aml files, symbol sets and projection files,
- . ensuring that documentation describing each of the data sets is maintained,
- . assisting in the dissemination of information about the data sets to interested parties.

6) Creating A Shared ARC/INFO Work Area:

After the GIS data administrator is appointed, the administrator should follow these procedures to create a shared work area:

- i) ask the UNIX system administrator to create a UNIX group that includes all users of the shared work area (including the GIS data administrator). The group name should not conflict with any other UNIX group. A new account for the GIS data administrator of the shared work area should also be created, and the .cshrc file modified to allow the GIS data administrator to use ARC/INFO.
- ii) estimate the storage required by the shared work area, and ensure that there is sufficient space available in the file system hosting the shared work area. The GIS data administrator should log on as the shared work area data administrator, and create the shared work area with the UNIX shell script "arcshare" (appendix i). The data administrator should be familiar with UNIX file permissions, the use of the UNIX "umask" variable, and be able to check that file permissions in the shared work area are set appropriately¹.
- iii) the UNIX shell script created by "arcshare" should be "sourced" from each user's ".cshrc" file (section 4.5).
- iv) ask the UNIX system administrator to copy the AML configuration file created by "arcshare" into a common shared work area configuration ARC/INFO directory (currently \$ARCHOME/share.cfg). This AML configuration file is initially held in the prog/aml directory of the shared work area. The ownership of this configuration file should be vested in the GIS database administrator, so that it can be updated to reflect changes in the locations of the shared work area directories. The group of the file should be the same as the group of the GIS data administrator.
- v) copy initial data sets, AML's, projection files and symbol sets into the shared work area, and update the administrator's log and data set descriptions.
- vii) describe the procedures for accessing data, AML's, projection files and symbol sets to members of the shared work area.

¹The "arcshare" script sets up file permissions so that only the data administrator has 'write' permission in the shared work area. Members of the same UNIX group have only 'read' permission to the shared work area. Other users of the system have no permissions to the shared work area. Therefore, by default, only the data administrator can modify the data and programs. Other members of the group can read the data and execute programs, but will not be able to use an ARC/INFO workspace in the shared work area as their current workspace because ARC/INFO will not be able to create a log file in that workspace.

7) Documenting GIS Data Sets:

7.1) GIS Data Set Descriptions:

At the simplest level, an ASCII text file can be used to describe each GIS dataset. These text files can then be included in the appropriate description directory in the shared work area. The following information, based on the input requirements for the FINDAR directory system (Shelley, 1992), can be incorporated into the documentation. Descriptions useful for datasets used in groundwater numerical modelling are included in this list:

Identification:

Title:	Name of data set
Full Name:	Descriptive name
Description:	Abstract or short description of data set
Purpose:	Reason for compilation of the data set
Reference(s):	Published reference(s) containing data set
Owner Organisation:	Organisation responsible for compilation
Owner Branch:	Branch within organisation responsible for compilation
Owner Project:	Component project responsible for compilation
Other Organisations:	Other participating organisations
Authors/Collators:	Person(s) responsible for compilation
Copy?:	Is this a copy?
Identification Comments:	Comments concerning identification

Spatial Identity:

Spatial Feature(s):	Type(s) of spatial features (point, node, arc, polygon, annotation, grid, tin)
Projection Type:	Cartographic projection used
Projection File:	File containing projection details (.prj)
Coordinate Units:	Units used for spatial coordinates
Grid Size:	Number of rows and columns
Cell Size:	Dimensions of grid cell
Grid Type:	Floating Point/Integer
Spatial Id Comments:	Comments on spatial identity

Data Items:

Point Attributes (PAT):	Description of attributes assigned to point features	
Name Definition	Description	Resolution
Node Attributes (NAT):	Description of attributes assigned to nodes of lines	
Name Definition	Description	Resolution
Arc Attributes (AAT):	Description of attributes assigned to line features	
Name Definition	Description	Resolution
Polygon Attributes (PAT):	Description of attributes assigned to polygon features	
Name Definition	Description	Resolution
Grid Attributes (VAT):	Description of attributes assigned to grid cells	
Name Definition	Description	Resolution
Annotation Attributes	Description of annotation	
Data Relates:	Linkages with other datasets	
Data Comments:	Comments on data attributes	

Spatial Coverage:

General Area: Geological province or basin/groundwater basin/geographic area of data set

Onshore/Offshore:

Spatial Description: Description of spatial extent of dataset

Future Spatial Coverage: Possible extensions to spatial extent of dataset

Spatial Cov Comments: Comments on spatial coverage

Temporal Coverage:

Time variant: Yes/No

Time span: Interval of time to which the data applies

Predictive: Yes/No

Temporal Cov Comments:

Dataset Information:

Data Form: GIS coverage/grid/tin/table

Working Media: Magnetic disc/paper

Digital Data?: Extent of digital format (complete, partial, none)

Software: ARC/INFO,ERMapper

Hardware: Sun/PC

Available Formats: ARC/INFO export, dxf, igds, dlg3, ascii

This Format:

Size: approximate size of dataset

Dataset Comments:

Hydrogeological Model Information:

Calibrated?: Calibrated/uncalibrated data

Continuous?: Continuous/discretized over model grid

I/O Status: model input or input/output or output

Hard Copy:

Available: Yes/No

Paper Size: A0-A4

Scale: Presentation scale

Location: Storage location for hardcopies

Reference Number:

Data Currency:

Custodian Organisation: Organisation responsible for maintaining data

Custodian: Position or person responsible for data maintenance

Data Status: Planned, in progress, completed, obsolete

Date Commenced: Commencement of compilation

Date Completed: Completion of final product

Update Frequency: How often data will be updated

Future Proposals: possible extensions to dataset

Archive: Record of data archive - tape number, format, date

Currency Comments:

Availability:

Access: Level of access to data set

Output Product(s): Types of available products

Charges:
Supplier: Name & organisation of supplier
Postal Address:
Phone:
Fax:

Keywords:
Keywords:

Comments:
Comments:

Lineage/Quality:

Primary Data:	Principal factual source(s) used in compilation		
Collection Method(s):	Methods used in collecting primary data		
Source datasets:	Datasets used in derivation		
Positional Accuracy:	Indication of degree of accuracy in position of features		
Compilation Base:	Base map/dataset used for compilation		
Compilation Scale:			
Compilation Media:	Matt, paper		
Attribute Accuracy:	Indication of accuracy of attributes		
Logical Consistency:	Checks taken to ensure data is logical		
Data Quality Comments:	Comments on data quality		
Processing History:	Summary of stages of compilation and processing		
Date	Author	Process	Purpose

For a particular project, a template textfile can be set up with default entries, simplifying documentation to entering information unique to each dataset. An example of dataset documentation based on this layout is presented in appendix iii).

ARC/INFO commands such as "describe", "log" and "items" are particularly useful in compiling some of the background information relating to a dataset.

7.2) Maintaining Brief Descriptions of GIS Data Sets and Programs:

Experience with prototype shared work areas indicated that it can be useful to maintain a one line description of each of the data sets and programs in text files. Some of the maintenance of these files (called "INDEX" files) can be automated.

The C shell script "make INDEX" searches the files in the "prj" (projection file) directory, the standards directory and the sub-directories beneath the "prog" (program) directory (with the exception of the prog/UNIX directory) for lines that contain the character string "/*###". These lines are then added to a file called INDEX in that directory. "make INDEX" does not attempt to produce INDEX files in the GIS dataset directories, or in the prog/UNIX directory: INDEX files for these directories must be maintained manually. Appendix iv) contains a listing of this script file.

The C shell script "list_INDEX" searches the directory structure beneath the home directory of the shared work area and displays the contents of any INDEX files to the screen. The output of the script may be directed to a file. A listing of the "list_INDEX" shell script is shown in appendix v).

Note: both shell scripts must be run from the home directory of the shared work area - not the home directory of the shared work area data administrator.

7.3) Maintaining Documentation Describing Standards:

Standards or conventions relevant to the data and programs in the shared work area may be saved as text files in the "standards" directory. For example, if GIS data set file name conventions are to be followed, the extensions and their meanings would be included in a suitable named text file in the "standards" directory. This directory can also be used to hold template files for AML and ARC menu files, projection files and GIS data set description files.

8) Discussion:

This document delineates some of the advantages of using shared work areas for GIS data, and describes procedures for creating a shared ARC/INFO work area. These procedures have been semi-automated with UNIX shell scripts and ARC/INFO AML files. The role of the GIS data administrator has also been described.

The advantages of these procedures are:

- . they provide a consistent directory structure that can be used for all EGG shared ARC/INFO work areas,
- . they allow an ARC/INFO GIS user to access several shared work areas simultaneously,
- . security for data sets is relatively easy to implement, and is effected by a single individual (the GIS data administrator),
- . they provide a framework to assist GIS users to access current releases of data and utility programs,
- . they provide a consistent method of sharing data sets, reducing the likelihood of multiple identical copies of GIS data sets,
- . they provide a framework to assist GIS data set documentation,
- . they may be integrated into GIS data set quality assurance procedures

There is a need for a means of aiding the creation and maintenance of descriptions of spatial data sets. The development of a metadatabase that records data set descriptions, data quality and data set development histories would be of considerable assistance to the users of shared work areas. Such a metadatabase system has been described by Doig (1993), who also expresses the hope that GIS and RDBMS vendors will provide the functionality required to fully integrate metadata into data information systems.

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References:

- Doig, J., 1993, *Metadata System Integration: The Technical Key to Accessable GIS*, Proceedings of the 13th Annual ESRI User Conference, Palm Springs California, May 1993
- Environmental Systems Research Institutes, Inc., 1991, *Using Map Libraries: Spatial Database Management and LIBRARIAN Command References*, ESRI, Redlands, USA
- Gallagher, R., 1992, *Results from GIS Development Contract 17 September 1991 - 16 April 1992*, BMR Record 1992/63
- Kucka, M., 1992, *Dual Oracle Database Environment and Change Control Management*, BMR Record 1992/85
- Musto, I.P., 1990, *Project Standards & System Procedures for the Use of Geographical Information Systems*, Unpublished Report, National Resource Information Centre, Canberra, ACT, Australia.
- Shelley, E.P., 1992, *Access to Data Through FINDAR*, BMR Record 1992/27, Geographic Information Systems, Cartographic and Data Standards, Workshop Proceedings, pp.235-244
- Tucker, A.G., 1993, *Procedures to Access Point Spatial and Attribute Data in an Oracle Database from within the ARC/INFO GIS*, AGSO Record 1993/73

Appendix i) "arcshare": A UNIX Shell Script to Initialise a Shared Work Area:

"arcshare" is a UNIX Bourne shell script that creates a shared work area. The script requires that two parameters be specified on the command line:

- i) the fully qualified filename (and path) of the directory to contain the shared work area. This directory should not already exist.
- ii) the group name of the group which is to be allowed to access the data. This group must already exist, and the GIS data administrator running "arcshare" should be a member of the group. The group name will also be used to identify the ARC/INFO AML file that initialises AML path variables for users.

The "arcshare" script performs the following tasks:

- i) checks the user specified command line arguments,
- ii) builds the directory structure specified in the body of this record,
- iii) assigns owner, group and others' access to files and directories within the shared work area,
- iv) builds Bourne and C shell scripts to initialise UNIX environment variables for the directories within the shared work area. The c shell script file should be run from each user's .cshrc file with the "source" statement. These files have the name of the shared work area group appended to their file name, and are placed in the "unix" directory of the shared work area,
- v) creates an administrators log file in the main directory of the shared work area. This file initially only contains the date and time the shared directory was created, and is called "shareadm.log",
- vi) builds an ARC AML file to initialise the ARC/INFO path variables. This file has a base name the same as the group of the shared work area, and has an extension of ".aml".


```

#!/bin/sh
#####
#
# name: arcshare
# by: AGTucker
# date: 26/3/93
#
# function: to create a directory structure for a shared arc/info
#           work area
#
#####
#
# input arguments:
# 1: share_name: the name and path of the shared directory
# 2: share_group: the name of the group who will access the data
#
#####
#
# check the number of input arguments
#
check_args ()
{
if [ $# != 2 ]
then
    echo Usage: arcshare shared_directory_name group_name
    exit 1
fi
}
#
#####
#
# create each of the required directories, set group-ids, and access
#
create_dirs ()
{
# start with the main shared directory
mkdir $1
if [ $? != 0 ]
then
    echo Error: unable to create shared directory $1
    exit 1
fi
#
# set the group of the directory
chgrp $2 $1
if [ $? != 0 ]
then
    echo Error: unable to set group of $1 to $2
    rmdir $1
    exit 1
fi
#
# create the prj directory, the symbol set directory, and the program directory
mkdir $1/prj $1/sym $1/prog $1/prog/aml $1/prog/atool
mkdir $1/prog/atool/arc $1/prog/atool/arcplot $1/prog/atool/arccedit
mkdir $1/prog/desc $1/prog/menu $1/prog/unix
}
#####
#
# set access and groups for all sub-directories in the shared work area
#
set_access ()
{
chmod -R o= $1
chmod -R g=rx $1
chmod -R u=rwx $1
chgrp -R $2 $1
}
#
#####
#

```

```

# build a Bourne and c shell script to set the environment variables for directory
# pathnames
#
build_init_script ()
{
# c shell script
# write describing the purpose of this file
echo "# csh variable definitions for $2 shared arcinfo work area" > $1/prog/unix/cshrc-$2
#
# write line setting the variable for the 'home' share directory
echo "setenv $2 $1" >> $1/prog/unix/cshrc-$2
#
# write line setting the variable for the shared arc/info workspace
echo "setenv ${2}d $1/data" >> $1/prog/unix/cshrc-$2
#
# write line setting the variable for the shared arc/info projection files
echo "setenv ${2}p $1/prj" >> $1/prog/unix/cshrc-$2
#
# write line setting the variable for the shared arc/info symbol sets
echo "setenv ${2}s $1/sym" >> $1/prog/unix/cshrc-$2
#
# write adding the UNIX script/bin directory to the path
echo "set path = ( \ $path $1/prog/unix )" >> $1/prog/unix/cshrc-$2
#
# bourne shell script
# write describing the purpose of this file
echo "# sh variable definitions for $2 shared arcinfo work area" > $1/prog/unix/profile-$2
#
# write line setting the variable for the 'home' share directory
echo "$2=$1" >> $1/prog/unix/profile-$2
#
# write line setting the variable for the shared arc/info workspace
echo "${2}d=$1/data" >> $1/prog/unix/profile-$2
#
# write line setting the variable for the shared arc/info projection files
echo "${2}p=$1/prj" >> $1/prog/unix/profile-$2
#
# write line setting the variable for the shared arc/info symbol sets
echo "${2}s=$1/sym" >> $1/prog/unix/profile-$2
#
# write line to export all the new variables
echo "export $2 ${2}d ${2}p ${2}s" >> $1/prog/unix/profile-$2
#
# write adding the UNIX script/bin directory to the path
echo "PATH=\$PATH:$1/prog/unix" >> $1/prog/unix/profile-$2
}
#
#####
#
# set up an admin log file
#
init_admin_log ()
{
echo "arc/info shared work area created:" `date` > $1/shareadm.log
}
#
#####
#
# set up an aml file to add the aml, menu and atool directories to the
# arc path variables
#
build_init_aml ()
{
echo "/* path definitions for $2 shared work area" > $1/prog/aml/$2.aml
echo "&atool [unquote [show &atool]] $1/prog/atool" >> $1/prog/aml/$2.aml
echo "&menupath [unquote [show &menupath]] $1/prog/menu" >> $1/prog/aml/$2.aml
echo "&amlpath [unquote [show &amlpath]] $1/prog/aml" >> $1/prog/aml/$2.aml
}
#
#####
#

```

```

# create an arc/info workspace in the data directory
#
create_arc_workspace ()
{
cd $1
$ARCHOME/programs/arc "cw $1/data"
mkdir $1/data/desc
}
#
#####
#
# main flow of control
#
# set up the variables for the sub-directory
share_dir=$1
export share_dir
share_grp=$2
export share_grp
#
# check the input arguments
check_args $1 $2
#
# create required sub-directories
create_dirs $share_dir $share_grp
#
# build a script file to set up environment variables
build_init_script $share_dir $share_grp
#
# build an ARC aml file to set ARC path variables
build_init_aml $share_dir $share_grp
#
# create an ARC workspace to hold data files
create_arc_workspace $share_dir $share_grp
#
# initialise an admin log
init_admin_log $share_dir $share_grp
#
# set accesses to all files and sub-directories
set_access $share_dir $share_grp
#
# clear off
exit
#
#####
#

```

Appendix ii) "share": An ARC AML to Initialise ARC/INFO Path Variables:

The "share" aml calls ARC AML files that initialise ARC AML path variables for shared work areas. Any reasonable number of shared work areas may be initialised with a single call to this AML.

```
*****
/*
/* name: share.aml
/* by: AGTucker
/* date: 16/4/93
/*
/* function: call aml configuration files to set up ARC paths to shared
/*           program areas
/*
/* notes:
/*   i)      this routine assumes the existence of a shared work area
/*   ii)     the shared work area is identified by the name of the group
/*           that accesses the data
/*   iii)    that a configuration file identified by the name of the group
/*           /name of the shared work area exists in a directory, along with
/*           all other shared directories. The location of this directory is
/*           held in the variable "share_cfg".
/*
/* arguments:
/*   1-n: name(s) of the shared work area(s)
/*
*****
/*
/* put all the arguments into a single variable
&args share_list:rest
/*
/* define the name of the directory holding the shared work area
&s share_cfg = ~tucker/work/sharetest/
/*
/* if no arguments are supplied, print a usage message, and display
/* current values of ARC path variables
&if [null %share_list%] &then &do
  &call share usage
  &type amlpath = [show &amlpath]
  &type menupath = [show &menupath]
  &type atool = [show &atool]
  &type
  &return
&end
/*
/* if the argument is -none, reset the aml, menu and atool paths
&if [lower %share_list%] = -none &then &do
  &s old_msg_state = [show &messages]
  &messages &off &all
  &amlpath 1234z
  &menupath 1234z
  &atool 1234z
  &messages %old_msg_state%
  &return
&end
/*
/* have a go at calling the configuration file for each specified shared
/* work area
&do share_one &list [unquote %share_list%]
/*
/* run the configuration aml
&if [exists %share_cfg%%share_one%.aml -file] &then &do
  &r %share_cfg%%share_one%
  &end
&else &do
```

```

        &type ERROR: configuration file does not exist for shared work area: %share_one%
    &end
&end
/*
/* clear off
&return
/*
/*****
/*
&routine share_usage
/*
/* display a usage message for the share aml
&type USAGE: share <shared work area name> {shared work area name} ...
&type      to add shared work areas to ARC aml, menu, and atool paths
&type
&type USAGE: share -none
&type      to clear ARC aml, menu and atool paths
&type
/*
/* clear off
&return
/*
/*****
/*

```

Appendix iii) Example ASCII Textfile Documentation of an ARC/INFO data set:

At the simplest level, documentation of ARC/INFO datasets can be stored in an ASCII textfile. The following example is loosely based on the database attributes for the FINDAR database directory system. Many data sets within a particular project will have common elements in their documentation, thereby a template textfile can be created, copied and the remaining distinct features of each dataset recorded.

```
mbshare/data/ana/desc/tpa_sy.txt
created: 15/10/92
*****
                        DETAILS OF DATA PACKAGE
*****
>>>>>>>IDENTIFICATION
>>TITLE:                TPA SY
>>FULL NAME:            SALINITY/YIELD OF PLIOCENE SANDS AQUIFER - ANA BRANCH SI 54-7
>>DESCRIPTION:          MAPPING OF SALINITY/YIELD CLASSES FOR THE PLIOCENE SANDS AQUIFER ON THE ANA BRANCH
                        1:250 000 MAPSHEET SI 54-7
>>PURPOSE:              HYDROGEOLOGICAL MAPPING FOR LAND AND WATER MANAGEMENT, PARTICULARLY SALINISATION AND
                        WATER LOGGING
>>REFERENCE(S):         BRODIE, R. (AGSO) 1992 - ANABRANCH HYDROGEOLOGICAL MAP (1:250 000 SCALE) AUSTRALIAN
                        GEOLOGICAL SURVEY ORGANISATION, CANBERRA, AUSTRALIA
                        FED/AGSO AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION
>>OWNER ORGANIS.:       EGG - ENVIRONMENTAL GEOSCIENCE AND GROUNDWATER
>>OWNER BRANCH:         MURRAY BASIN MAPPING
>>OWNER PROJECT:        STATE/NSWDWR NEW SOUTH WALES DEPARTMENT OF WATER RESOURCES
>>OTHER ORGANISATIONS:  BRODIE, R (AGSO)
>>AUTHORS/COLLATORS:    NO
>>COPY?:               NO
>>I.D. COMMENTS:        ISSUED UNDER THE AUTHORITY OF THE MINISTER FOR PRIMARY INDUSTRY AND ENERGY, CHAIRMAN OF THE
                        MURRAY-DARLING BASIN MINISTERIAL COUNCIL. COORDINATED BY THE WORKING GROUP OF THE MURRAY-
                        DARLING BASIN COMMISSION
*****
>>>>>>>SPATIAL IDENTITY
>>SPATIAL FEATURES:     ARCS, POLYGONS
>>PROJECTION TYPE:      AUSTRALIAN MAP GRID ZONE 54
>>PROJECTION FILE:
>>COORDINATE UNITS:     METRES
>>GRID SIZE:
>>CELL SIZE:
>>GRID TYPE:
>>SPATIAL ID COMMENTS:
*****
>>>>>>>DATA ITEMS
>>POINT ATTRIBUTES:
>>NODE ATTRIBUTES:
>>ARC ATTRIBUTES:       SALT 4.5.B GROUNDWATER SALINITY, MG/L TDS
                        YIELD 8.12.F.1 SUSTAINABLE BORE YIELD, L/S
>>POLYGON ATTRIBUTES:   SY 2 4 B INTEGER REPRESENTATION OF SALINITY/YIELD MATRIX
                        SALINITY:
                        1 = <500 MG/L
                        2 = 500-1000 MG/L
                        3 = 1000 - 1500 MG/L
                        4 = 1500 - 3000 MG/L
                        5 = 3000 - 7000 MG/L
                        6 = 7000 - 14000 MG/L
                        7 = 14000 - 35000 MG/L
                        8 = 35000 - 100000 MG/L
                        9 = >100000 MG/L
                        YIELD:
                        1 = <0.5 L/S
                        2 = 0.5-5 L/S
                        3 = 5-50 L/S
                        4 = >50 L/S
>>GRID ATTRIBUTES:
>>ANNOTATION ATTRIBUTES: ANNO.SY LABELS OF SALINITY/YIELD CLASSES
>>DATA RELATES:
>>DATA COMMENTS:        SY VALUES CORRESPOND TO SALINITY/YIELD MATRIX ON MAP FACE.
*****
>>>>>>>SPATIAL COVERAGE
>>GENERAL AREA:         WESTERN NSW, MURRAY BASIN, SOUTHEAST AUSTRALIA
>>ONSHORE/OFFSHORE:     ONSHORE
>>SPATIAL DESCRIPTION:  ANABRANCH 1:250 000 SI 54-7
>>FUTURE SPATIAL COVERAGE:COMPONENT OF 1:250 000 MURRAY BASIN HYDROGEOLOGICAL MAP SERIES
>>SPATIAL COV COMMENTS:
*****
>>>>>>>TEMPORAL COVERAGE
>>TIME VARIANT:         YES
```

>>TIME SPAN: 1992
>>PREDICTIVE:
>>TEMPORAL COV COMMENTS:

>>>>>>>DATASET INFORMATION

>>DATA FORM: GIS COVERAGE
>>WORKING MEDIA: MAGNETIC DISK
>>DIGITAL DATA?: COMPLETELY
>>SOFTWARE: ARC/INFO
>>HARDWARE: SUN
>>AVAILABLE FORMATS: ARC/INFO EXPORT, DXF, IGDS, DLG3, ASCII
>>THIS FORMAT: ARC/INFO EXPORT
>>SIZE: 10 KILOBYTES
>>DATASET COMMENTS:

>>>>>>>MODEL STATUS

>>CALIBRATED?:
>>CONTINUOUS?:
>>STATUS:
>>CONTROL PARAMETERS:
>>MODEL COMMENTS:

>>>>>>>HARD COPY

>>AVAILABLE: YES, PUBLISHED MAP
>>PAPER SIZE: A0
>>SCALE: 250000
>>LOCATION: AGSO SALES CENTRE
>>REFERENCE NUMBER:

>>>>>>> DATA CURRENCY

>>CUSTODIAN: AGSO AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION
>>CUSTODIAN POSITION: HEAD OF PROGRAM, ENVIRONMENTAL GEOSCIENCE AND GROUNDWATER
>>DATA STATUS: IN PROGRESS
>>DATE COMMENCED: JUNE 1992
>>DATE COMPLETED: TO BE PUBLISHED JUNE 1993
>>UPDATE FREQUENCY:
>>FUTURE PROPOSALS:
>>ARCHIVE:
>>CURRENCY COMMENTS:

>>>>>>>AVAILABILITY

>>ACCESS: PUBLIC
>>OUTPUT PRODUCTS: PUBLISHED MAP
DIGITAL DATA
>>CHARGES: \$25 FOR MAP
>>SUPPLIER: SALES CENTRE
AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION
ANZAC EAST BUILDING, CNR CONSTITUTION AVE & ANZAC PDE
PARKES ACT 2600
>>POSTAL ADDRESS: GPO BOX 378 CANBERRA ACT 2601
>>PHONE: 61 06 249 9111
>>FAX: 61 06 249 9999

>>>>>>>KEYWORDS

KEYWORDS: GROUNDWATER, SALINITY, AQUIFER YIELD, PARILLA SANDS, PLIOCENE, MURRAY BASIN

>>>>>>> COMMENTS

TPA SY shows the salinity/yield characteristics of the Pliocene Sands aquifer, which consists of the Loxton-Parilla Sands in the ANA BRANCH mapsheet. The salinity/yield attribute is based on the matrix defined for the mapping. Aquifer yield is calculated on the basis of the maximum sustainable extraction rate from fully penetrating bores, with screens in every sand bed. The Pliocene Sands maybe confined by fine-grained lacustrine sediments of the Quaternary Blanchetown Clay. Although the water-table is within the Blanchetown Clay in these areas, it is not regarded as a regional water-bearing aquifer. Over the Neckarboo Ridge in the southeast corner of the mapsheet, the Pliocene Sands becomes unsaturated and the watertable lies in the Upper Renmark Group aquifer. The map is dominated by high (> 35000 mg/l) groundwater salinities, particularly in the western half. The Pliocene Sands aquifer may be stratified, with salinity increasing with depth. A fresh to brackish groundwater aureole surrounds the Darling and Murray rivers, and to a lesser extent, the Darling Anabranch and Lake Victoria. The extent of river leakage to the shallow aquifer would depend on the flood regime and flow regulation.

>>>>>>>LINEAGE/ QUALITY

>>PRIMARY DATA: WATER BORES (NSW DWR), OBSERVATION BORES (NSW DWR/AGSO), PETROLEUM WELLS (AGSO)
>>COLLECTION METHOD(S): SALINITY BASED ON QUALITATIVE ESTIMATES AT TIME OF DRILLING, FIELD TDS, LAB TDS
YIELD BASED ON PUMP TESTS, BAIL TESTS, LITHOLOGICAL LOGS
>>PRECISION: SINGLE
>>SOURCE DATASETS:
>>POSITIONAL ACCURACY: 1KM TO 10KM? FOR HYDROGEOLOGICAL PARAMETERS
>>COMPILATION BASE : 1: 250 000 SCALE INTERNATIONAL MAP OF THE WORLD TOPO SERIES, AUSLIG
>>COMPILATION SCALE: 1:250 000
>>COMPILATION MEDIA: MATT DRAFTING FILM
>>ATTRIBUTE ACCURACY:

>>LOGICAL CONSISTENCY: COMPARISON WITH JOINING MAPSHEETS AND SALINITY/YIELD OF CONNECTED AQUIFER LAYERS
>>DATA QUALITY COMMENTS: RELIABILITY DIAGRAM AVAILABLE AS COVERAGE RELIAB
>>PROCESSING HISTORY: BOREHOLE DATA INCORPORATED INTO ORACLE DATABASE
MAP COMPILATION USING ARC/INFO GIS TOOLS
TOPOLOGY AND ATTRIBUTE BUILDING
IGDS CONVERSION FOR MAP PUBLISHING WITH INTERGRAPH CAD/CAM

Appendix iv) "make_INDEX": A UNIX Shell Script to build INDEX Files:

The "make_INDEX" shell script file searches for lines containing the character string `"/*###"` in text files, and copies the lines to an INDEX file in the same directory. All directories in the shared work area are searched, with the exception of the `prog/UNIX` directory and the data directory and all sub-directories below it. This script must be run from the home directory of the shared work area.

```
#!/bin/csh
##/* build INDEX files for non-data directories in shared work area
#####
#
# name: make_INDEX
# by: AGTucker
# date: 6/8/93
#
# function: to build INDEX files in directories where ever possible
#           to describe the contents of those directories
#
# notes: the files searched for notes must preface comments
#         destined for the INDEX file with a special character
#         sequence that identifies the lines to be included.
#
#         the directories in which INDEX's will be built, and the
#         INDEX identifying strings are:
#
#         {project}/prj                /*##
#         {project}/prog/aml           /*##
#         {project}/prog/atool/arc /*##
#         {project}/prog/atool/arcedit /*##
#         {project}/prog/atool/arcplot /*##
#         {project}/prog/atool/grid    /*##
#         {project}/prog/atool/menu    /*##
#         {project}/standards/        /*##
#
#         This file must be run from top directory of the shared
#         work area (e.g. ~mba/mb for the murray basin
#         shared work area).
#
#         The shareadm.log file will be updated by this program
#
#         Any existing INDEX files will be deleted
#
#####
#
# projection files
cd prj
echo generated automatically - do not edit >INDEX
grep '/*###' *.prj | sed 's/\/*\#\\#/' >>INDEX
cd ..
#
# aml files
cd prog/aml
echo generated automatically - do not edit >INDEX
grep '/*###' *.aml | sed 's/\/*\#\\#/' >>INDEX
cd ../..
#
# atool arc amls
cd prog/atool/arc
echo generated automatically - do not edit >INDEX
grep '/*###' *.aml | sed 's/\/*\#\\#/' >>INDEX
cd ../../..
#
# atool arcedit amls
cd prog/atool/arcedit
echo generated automatically - do not edit >INDEX
grep '/*###' *.aml | sed 's/\/*\#\\#/' >>INDEX
cd ../../..
#
# atool arcplot amls
cd prog/atool/arcplot
echo generated automatically - do not edit >INDEX
grep '/*###' *.aml | sed 's/\/*\#\\#/' >>INDEX
```

```

cd ../../..
#
# atool grid amls
cd prog/atool/grid
echo generated automatically - do not edit >INDEX
grep '/*##' *.aml | sed 's/\\/*\\#\\#/' >>INDEX
cd ../../..
#
# menu files
cd prog/menu
echo generated automatically - do not edit >INDEX
grep '/*##' *.menu | sed 's/\\/*\\#\\#/' >>INDEX
cd ../../..
#
# standards descriptions files
cd standards
echo generated automatically - do not edit >INDEX
grep '/*##' *.std | sed 's/\\/*\\#\\#/' >>INDEX
cd ..
#
# update the shared work area GIS administrator log file
echo 'date '+%d/%m/%y %H:%M:%S' \ ':projection and aml/menu/atool INDEX files recreated with make_index'
>>shareadm.log
#
# clear off
exit
#
#####
#

```

Appendix v) "list_INDEX": A UNIX Shell Script to Display INDEX Files:

The "list_INDEX" shell script file searches all directories in the shared work area for files called "INDEX". When a file called "INDEX" is found, it is listed on the display. The output of the "list_INDEX" script may be redirected to a file. This script must be run from the home directory of the shared work area.

```
#!/bin/csh
##/* lists all INDEX files below the current directory
#####
#
# name: list_INDEX
# by: AGTucker
# date: 6/8/93
#
# function: to list all INDEX files below the current directory
#
# arguments:
#
#####
#
# put up a header
echo "INDEX description files for the ARC/INFO share work area:"
echo " " $PWD
echo
#
# list all INDEX files
find . -name INDEX -print -exec more {} \; -exec echo \;
#
# clear off
exit
#
#####
#
```