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GUIDELINES FOR USE OF ADSARC AND MOSSARC COMMANDS OF ARC/INFO (REV 6.1.1)

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

Award of the ALMRS/Modernization contract makes available powerful new tools for resource management, including very fast workstations and the ARC/INFO GIS with its graphical user interface and its integrated capability to use a variety of relational database management systems, including INFORMIX.

Efforts are underway by the GIS Data Transition Project to provide any additional necessary tools in support of the conversion of existing GIS data to the new platform. These include a file manager system for cataloging GIS data and for tracking the transfer process and conversion tools such as guidelines, AML (Arc Macro Language) programs, and data translators. However, these tools are still being developed, and they will only become available incrementally over the next several months.

State offices will be receiving pilot workstations for familiarization. In addition, some states have requirements for obtaining additional workstations and have funding available for their purchase. Therefore, there is a need for immediate conversion guidance for using existing data translators.

1.2 Goal

The purpose of this user guide to provide a reference source for those field offices which need to begin immediate conversion of ADS and MOSS data to ARC/INFO rev 6.1.1 using its two data translators, ADSARC and MOSSARC. These available translators have serious deficiencies which have important consequences for the usefulness of converted data. However, knowledge of these limitations can be the basis for addressing the inadequacies in other ways or for restricting the applications using the data.

Four topics will be discussed in this guide:

- issues and strategies,
- planning,
- procedures, and
- limitations and concerns.

2 ISSUES AND STRATEGIES

There are five key concerns which need to be addressed in regard to converting ADS and MOSS data to ARC, using the existing translators:

- shortage of translators,
- inadequancy of translators,
- differences in GIS architecture,
- differences in operating system, and
- scale of effort.

2.1 Shortage of Translators

ARC provides only two translators for direct conversion from ADS and MOSS data: ADSARC and MOSSARC. No ARC translators are available for MAPS data or for plotfiles. The existing MOSS family (ADS, MOSS, MAPS, and COS) offers no translators into ARC formats.

2.2 Inadequacy of Translators

The existing ARC/INFO translators (MOSSARC and ADSARC) appear to handle coordinates, labels, and feature numbers acceptably. In addition, ADSARC also appears to handle MBR, border, registration, and projection data adequately.

The principal limitation of MOSSARC data conversion is that it is based upon the MOSS export file format. Feature number, subject value, and coordinates are the only data which are directly converted. All other data in the MOSS map is lost unless some other way can be found to handle it. No automated ways currently exist, but a goal of the GIS Data Transition Project is to develop conversion tools which will move the remaining data to ARC/INFO.

The principal limitation of ADSARC data conversion is that it is oriented to line map data only. Symbol data is completely ignored, and only the raw lines and the attributes for the polygons are converted. The polygons must be reconstructed in ARC/INFO. Conversion of ADS symbol data and use of closed-line (.C) polygon information are expected to be available in ARC/INFO rev 7.0. At that time, the GIS Data Transition Project will evaluate the revised ADSARC translator and update this User Guide.

Neither of these translators address the transfer of text information, multiple attributes, meta-data, or cartographic information (such as markers, line styles, polygon shades, and text fonts).

2.3 Differences in GIS Architecture

The architecture of ARC is radically different from that of MOSS or ADS. The primary difference is the integrated handling of spatial features and their associated attributes. Whereas multiple attributes and lookup tables are extensions or add-ons in MOSS and ADS, they are central to the design and use of ARC/INFO.

Another important difference involves the way cartographic information is presented. MOSS and ADS store cartographic information (such as line style, color, font, and text orientation) with the features themselves. ARC stores them in lookup tables and activates them in a series of sequential operations.

Finally, ARC makes no provision for the storage and maintenance of meta-data, such as description, creator, or source. MOSS and ADS meta-data is lost in the conversion process.

These are just a few of the important differences. The key point is simply to recognize that moving to ARC will require a major cognitive reorientation in how do get things done using GIS. It should not be underestimated.

2.4 Differences in Operating Systems

The shift from PRIMOS to UNIX will be very difficult, since they are very different operating systems. Different commands will have to be learned to accomplish similar things, and whole new concepts like piping and redirection will have to be mastered. There are other important differences in security, system administration, and available utilities. For example, UNIX includes many standard utilities for text editing, text processing, managing information, electronic mail, networking, performing calculations, and developing programs. Many of these utilities are quite different from the ones provided by PRIMOS.

A major conceptual reorientation will be required in moving from centralized PRIME minicomputers to networked UNIX workstations. Online storage will be distributed around the network rather being consolidated at a single site.

Finally, the X Windows environment can accomplish similar types of work quite differently from the way they would be done on the PRIME. For example, on the PRIME it is necessary to submit a job in batch if there is a need to continue doing interactive work from the same terminal while a job is processing. In X Windows an additional window can be opened for interactive work while other windows continue processing previous commands.

2.5 Scale of Effort

Many field offices have vast amounts of GIS data. Converting this data in its entirety is no small undertaking. What is reasonably simple and straightforward for a single map may rapidly become cumbersome and complex for projects which involve large numbers of interrelated maps. Conversion efforts by the Oregon State Office and others show that the major barrier encountered is often the poor quality of the existing data.

Laborious examination and correction of the data in MOSS and ADS may be required, before the data is usable in ARC. Although ARC has very powerful tools for editing data (such as ARCEDIT), they are quite different from the corresponding tools in MOSS and ADS. Use of familiar tools and familiar names may yield higher productivity and may aid in recalling important information about the source, reliability, and problems associated with specific data

3 PLANNING

There are seven issues which require careful planning:

- resource requirements,
- theme standardization,
- directory structures,
- AMLs,
- conversion of directories,
- quality control, and
- progress tracking.

3.1 Resource Requirements

It is important in undertaking an effort of this magnitude to try to estimate the resources that will be required. This includes disk storage, CPU usage, and people. Unfortunately, we have very little experience as a basis for such estimates. However, we will try to provide initial estimation factors based upon the experience of the Oregon State Office in their ADS-to-ARC conversion efforts and upon test runs by the Data Transition staff.

Disk space requirements for ADS data on the workstation should be only about 75% of the space requirements on the PRIME, unless it is desired to maintain a backup copy of the data as it was before topological processing by ARC/INFO. (In general, this should not be necessary, since testing has shown that ARC/INFO results are sufficiently accurate and reliable.) This includes storing the data at double-precision on the workstation. Also, we assume, at present, that MOSS data has similar requirements. If ORACLE tables need to be moved, one should estimate their space requirements as the same on both platforms.

CPU timing estimates are not yet available.

Requirements for personnel are heavily dependent upon the nature of the specific data. Oregon found that 3 people working full-time could convert 50 townships of ADS data with 8 themes in one week. This included all aspects of the conversion process, including error correction.

3.2 Theme Standardization

It is highly advantageous to standardize the names of menus prior to converting the data. ADSARC uses the mapname to create a directory (workspace) and under that creates a subdirectory (coverage) with the menu name (truncated to six positions, if necessary). If a map library manager, like ARC LIBRARIAN or ARCSTORM, will be used to manage the data, standard coverage (menu) names need to be used consistently for maps in the library. If standard menu names are not used, the coverages will have to be renamed in ARC. Once ARC LIBRARIAN has been evaluated, more information will be forthcoming.

There is another problem with using ADS menu names for the naming of ARC coverages. ADS supports the combination of different data types under a single ADS menu. However, ARC does not allow mixing point, line, and polygon data in the same coverage. In fact, it is strongly recommended that each type of data (point, line, and polygon) be kept in separate coverages.

Since ADS menus can reference symbol, line, and polygon data, slightly changed versions of the menu name are necessary to identify both the source menu and its data type. Since ADSARC truncates the menu name to six letters, it will be necessary to rename the resulting coverage anyhow. One way to accomplish this would be to slightly vary the theme names, such as by appending a suffix to the menu name to identify the data type. ARC allows up to 13 characters for a coverage name.

Identifying and using standardized map and theme names is especially critical in regard to MOSS data which has no requirements for theme reference (like menu name in ADS) and, if a theme reference is included, usually consists of very compact and obscure abbreviations due to mapname length limitations.

3.3 Directory Structures

Directory structures are central to operation of ARC/INFO. Systematic naming allows the use of map library managers like ARC LIBRARIAN or ARCSTORM. A special consideration for ARC LIBRARIAN is to define a set of tiles (polygons which completely partition a spatial area). Each tile becomes a workspace (directory) with a specific spatial extent (such as township or quad). Relevant coverages (subdirectories) are created immediately under each spatial-extent directory. Note that this could conflict with the standard project structure of MOSS and ADS, if projects overlap spatially.

Existing ADS file names are constructed from the mapname, menu name, and data type. This usually suggests where their data should reside in ARC after translation. The mapname suggests the spatial-extent directory. The menu name suggests the type of coverage (subdirectory). Finally, many users track the data-type by adding a standard suffix to the coverage name. This shift in directory structures is likely to be confusing to ADS users. Instead of a single project directory with all files (including different menu names and different data types) for a given mapname, the project would be the high level directory, each mapname would be a separate subdirectory (workspace) under the project directory, and each menu name and data type would be separate subdirectories (coverages) under its specific mapname directory (workspace).

This can make navigating around ARC/INFO directories and data files very confusing. The work area used during an ARC/INFO session is a workspace, which is "a directory containing a logical collection of geographic data sets and supporting data files...Workspaces contain coverages, grids, tins, a local INFO database and other supporting files." (Environmental Research Systems Institute, 1991, p. 5-2) The ADS mapname is used by ADSARC to create a workspace of the same name (without the "ADS." prefix). Initially, after running ADSARC, one is at the project directory level, and one must change to the mapname workspace (subdirectory) to access the coverages created by the command.

Existing MOSS files have no MOSS-based limitations which link names to content. However, many sites have naming conventions which combine map name and theme. Unfortunately, limits on MOSS mapname length often make these references very cryptic. Where they do exist, they should be used similarly to the suggestions for ADS files.

Existing projects can be moved over to ARC/INFO in a straightforward way. However, conversion to a quad-based (or other spatial-extent-based) map-naming system establishes the foundation for conversion to a map library manager, which is essential for administering and using extensive map holdings.

3.4 AMLs

ARC was originally developed on the PRIME. One feature that ESRI took along with them to new platforms was CPL (Command Procedure Language), renamed as AML (ARC Macro Language). AML provides an easy-to-use method for saving and automatically issuing a series of commands to accomplish tasks in ARC/INFO. While AML runs only under ARC and not from the UNIX command line, it is a complete implementation and extension of CPL with minor syntactical changes. Experienced users of CPL will readily be able to adapt to AML.

While AMLs offer great potential for automating data conversion on a large scale, they can be very dangerous if misused. Data problems are highly likely in any largescale conversion. AMLs must continually check for error conditions and provide logic for dealing with them in an appropriate fashion. The AMLs should keep a log of all operations, including file names, directory names, commands, and results. These logs must be scanned, either manually or automatically, to recognize unforeseen conditions and to identify trends in data errors.

It is also very important to thoroughly document AMLs in the code itself. As the conversion proceeds and unanticipated errors are encountered, this will be invaluable in modifying the AML code to handle the new set of conditions.

3.5 Conversion of Directories

MOSS and ADS data directories are named for projects. If the project naming structure is retained, conversion of entire directories at the same time is more straightforward. However, such an approach can conflict with necessary ARC LIBRARIAN directory structures, closing off its enormous convenience for managing extensive map data holdings. Developing a unified spatial framework across all projects of interest is crucial, prior to doing any directory conversions, if the ultimate use of ARC LIBRARIAN is the goal. It is strongly recommended that ARC LIBRARIAN or its successor ARCSTORM be used wherever possible.

While converting a directory at a time is a unit of work convenient for managing the overall conversion effort, a considerable amount of front-end work will be required to properly identify the proper target directories for the converted data, as outlined in 3.3. The time and effort required to do this right should not be underestimated.

The File Manager System produced by the Data Transition Project has been designed to facilitate the large-scale conversion of MOSS and ADS data. It inventories GIS holdings and helps track the data conversion process.

3.6 Quality Control

The data to be converted will be quite uneven in quality. Data problems are to be expected. A set of procedures need to be developed to ensure that as many data problems as possible can be identified and corrected.

3.7 Progress Tracking

The scale of the conversion effort dictates keeping systematic records to identify:

- which files are targeted for conversion,
- which have begun to be converted,
- which have encountered errors, and
- which have been successfully converted.

It is highly recommended that progress tracking be implemented using the File Manager System or some other automated system.

4 PROCEDURES

4.1 General Procedures

Six key steps can be identified for data conversion:

- data preparation,
- data staging,
- data transfer,
- data conversion,
- quality control, and
- data certification.

4.1.1 Data Preparation

This involves:

- identifying the directories and files that will be converted,
- entering them into a progress tracking system,
- ensuring that they are actually available and readable, and
- designating the target directory names for each file.

With MOSS data, it also includes using the MOSS EXPORT command to convert the existing MOSS map into the format expected by the MOSSARC command.

A serious barrier to conversion of ADS data is that ADSARC does not translate symbol data. One way of converting ADS symbol data is to first convert the point data into a MOSS file using the ADS ADS2MOSS command. Then, the resulting MOSS file can be exported and converted using MOSSARC. However, the restrictions of MOSSARC make this a less than desirable alternative. Other alternatives, such as ADS.PTSTOMC, have similar limitations. This lack of conversion capability for ADS symbol data is expected to be corrected in ARC/INFO rev 7.0.

4.1.2 Data Staging

It is recommended that a staging area be used rather than attempting to transfer the data from the ADS and MOSS directories, since the whole set of ADS and MOSS files will not usually be transferred.

The MOSS export files created in the Data Preparation step (4.1.1) should be moved to a MOSS staging area.

The required subset of ADS files should be moved to an ADS staging area.

The ADSARC command requires the following files:

ads.<u>mapname</u>,
<u>mapname</u>.border,
<u>mapname</u>.menus,
<u>mapname</u>.<u>menu</u>.L and
<u>mapname</u>.<u>menu</u>.A.

If no attribute file is present, a warning will be given, but the command will still process the available data properly.

The ADSARC command uses the raw line (.L) file. With polygon data, the closed line (.C) file represents the data after it has been topologically cleaned with ADS CLOSURE and POLYGON commands. For polygon data, these closed line (.C) files should be moved instead of the corresponding raw line (.L) files. After movement to the staging area, the closed line (.C) files should be renamed to raw line (.L) files. It is important to do this copying and renaming only in the staging area, since the raw-line data will be destroyed. Ability to use of closed-line (.C) polygon information is expected to be available in ARC/INFO rev 7.0.

Another difficulty is that ADSARC brings over the full line file, including deleted lines. These deleted lines need to be eliminated in ADS using ADS.RESEQUENCE to avoid considerable manual effort in ARC to eliminate them.

4.1.3 Data Transfer

It is necessary to get the data files from the PRIME to the RS/6000. Currently the only feasible option is to establish a communications link between the PRIME and the RS/6000. Then, it is very convenient to use FTP to move the data between the two computers.

4.1.4 Data Conversion

It is strongly recommended that conversion and quality control be done in a special holding area on the RS/6000. Only after passing quality control should the files be moved to their actual target locations.

Three important issues in data conversion are selection of desired precision, choice of tolerances, and changes in topology of MOSS features.

A key initial issue is selecting numeric precision. ARC treats both ADS and MOSS data as single-precision rather than double-precision. However, MOSS export files have enough significant digits to require double-precision. On the other hand, while ADS coordinates are in map-inches and require only single-precision, the registration points have enough significant digits to require double-precision. It is recommended that double-precision be used for all ADS and MOSS data. Since precision is always reduced to the lowest common level when features from different coverages are combined, precision will be unnecessarily lost otherwise. An additional premium on disk space is required for double-precision (typically an additional 20-30 percent of space), but the additional operational complexity of tracking and maintaining two different coverage precisions, coupled with the chances for inadvertent error, outweigh that additional cost.

Another key decision for data conversion is choosing fuzzy and dangle tolerances for the ARC CLEAN command. A fuzzy tolerance defines "the smallest distance between all arc coordinates" (Environmental Research Systems Institute, 1991, p. G-20). It resolves "inexact intersection locations due to limited arithmetic precision of computers" (Environmental Research Systems Institute, 1991, p. G-20). In short, it controls when close coordinates should be snapped to the same coordinate. A dangle tolerance identifies the minimum length allowed for resolving a line which slightly undershoots or overshoots another line to which it is supposed to connect. Oregon used different tolerances for different types of coverage, with smaller tolerances for more precise coordinates like the land grid and larger tolerances for less precise coordinates like hydrography. "Fuzzy creep", minor shifting in coordinate values, commonly occurs as a result of the application of the fuzzy tolerance value were found. However, these shifts were found to be within acceptable ranges.

Oregon also tested for "repeated fuzzy creep", the potential for continued migration of coordinate values within a given coverage as a result of repetitive topological restructuring using the ARC CLEAN command. Their testing, while limited, did not uncover any problem with repeated fuzzy creep.

A final difficult issue derives from changes in topology as a result of the ARC CLEAN command. MOSS features have no defined topological relationship to each other. When the topology is established and corrected by ARC CLEAN, a given MOSS feature (line or polygon) may disappear or break into several smaller features. This can create problems with attribute records. With line and polygon data, it indicates errors in the topology of the source data.

It is recommended that file location and item name for labels be standardized for both MOSS and ADS data conversions. MOSSARC places subject labels in the feature attribute tables in an item named "DATA". On the other hand, ADSARC puts line and attribute labels in the corresponding feature lookup table (.ACODE or .PCODE) in an item named "LABEL". It is suggested that all labels be located in the feature attribute table, and all be place in an item named "LABEL". This requires moving the ADS feature lookup table (.ACODE or .PCODE) label information to the corresponding feature attribute table (.AAT or .PAT). It also requires renaming the MOSS feature attribute table item from "DATA" to "LABEL".

4.1.5 Quality Control

Quality control should involve several steps:

- ensuring that the AMLs successfully completed,
- correcting any error conditions identified by the AMLs,
- using ARC commands to identify label errors and node errors (typically included in the AMLs),
- visually inspecting each map to ensure that it appears correct (typically plotted by the AMLs),
- insisting upon correction or a waiver for every error,
- transferring the approved files to their target directories, and
- cleaning up by removing the intermediate coverages from the holding area.

4.1.6 Data Certification

The data owner should officially certify the acceptability of the converted data, and the data will be designated master data with corresponding access and security controls.

4.2 ADS to ARC

4.2.1 Comments

The ADSARC command will look for data files for each menu listed in the mapname.menus file. A warning will be given for each menu without data files. However, this will not affect processing for the data which is present. However, if an error is found in the input data, all created coverages will be deleted as part of recovery. The erroneous data must be corrected or eliminated before ADSARC will complete successfully.

Deleted lines must be removed from ADS line files prior to conversion. This can be accomplished by running ADS.RESEQUENCE.

The only conversion limit identified with ADSARC is its inability to handle lines with more than 1028 coordinates. It treats this as an error condition and eliminates all coverages created before encountering the error. If this error is encountered, the problematic line will need to be split or weeded in ADS before ADSARC can be successfully run.

After the ADS data has been translated to ARC/INFO, the label information must be transferred to the feature attribute table prior to running CLEAN to create correct topology. Since ADSARC does not create feature attribute tables, they must first be constructed using the BUILD command (with line data) or the CLEAN command (with polygon data). Then, the labels can be moved from the feature lookup tables (.ACODE and .PCODE) to the feature attribute tables (.AAT and .PAT). When the CLEAN command is used to create correct topology, changed features will reflect these initial values.

4.2.4 Data Conversion Procedures

The following procedures assume basic familiarity with ARC/INFO commands. For more complete information on a specific command, please see the ARC Command References manual.

The command sequence for accomplishing ADS to ARC conversion is as follows:

1. After logging onto the RS/6000, change to the area where the ADS data has been transferred. Then go into ARC/INFO. $ **arc**
2. Set precision to double. Arc: **precision double**
3. Run ADSARC command. A workspace (directory) will be created, containing ARC coverages for each theme found in the ADS .<u>menus</u> file and whose data was exported to the RS/6000. <u>example</u>: Arc: **adsarc *ads.mapname output_workspace*** adsarc ads.s15w06 s15w06

4. Attach to the workspace that was created in the previous step. Arc: **workspace *output_workspace***	<u>example</u>: workspace s15w06
5. If the coverage is line data, go to step 6. If the coverage is polygon data, go to step 10.	
6. For a line coverage, create a feature attribute table. Arc: **build *input_coverage* line**	<u>example</u>: build hydrol line
7. Create field in ARC/INFO arc attribute table to add ADS label attributes for line label information. Arc: **additem *input_coverage*.aat *input_coverage*.aat label 52 52 c**	<u>example</u>: additem hydrol.aat hydrol.aat label 52 52 c

8. From ARC, enter INFO. Within INFO, move the label data from the .ACODE table (created from the ADS raw line labels) to the ARC/INFO arc attribute table. (Type in upper case while in INFO, since INFO is case sensitive.)

	example:
Arc: **info**	info
ENTER USER NAME> **ARC**	ARC
ENTER COMMAND> **SELECT *INPUT_COVERAGE*.ACODE**	SELECT HYDROL.ACODE
ENTER COMMAND> **RELATE *INPUT_COVERAGE*.AAT BY *INPUT_COVERAGE*-ID**	RELATE HYDROL.AAT BY HYDROL-ID
ENTER COMMAND> **MOVE LABEL TO $1LABEL**	MOVE LABEL TO $1LABEL
ENTER COMMAND> **Q STOP**	Q STOP

9. Create topologically-correct line coverage. For recommended tolerances, see Appendix A. Conversion is complete. Go to step 13.

	example:
Arc: **clean *input_coverage* *output_coverage* *dangle_length* *fuzzy_tolerance* line**	clean hydrol hydrolcl 1.0 2.0 line

10. For a polygon coverage, create fields in the ARC/INFO polygon attribute table to add ADS attribute information.	
	<u>example</u>:
Arc: **additem** ***input_coverage*.pat** ***input_coverage*.pat label 52 52 c**	additem landli.pat landli.pat label 52 52 c
Arc: **additem** ***input_coverage*.pat** ***input_coverage*.pat angle 4 8 f 2**	additem landli.pat landli.pat angle 4 8 f 2

11. From ARC, enter INFO. Within INFO, move the label and angle data from the .PCODE table (created from the ADS attribute file) to the ARC/INFO polygon attribute table. (Type in upper case while in INFO, since INFO is case sensitive.)	
	<u>example</u>:
Arc: **info**	info
ENTER USER NAME> **ARC**	ARC
ENTER COMMAND> **SELECT** ***INPUT_COVERAGE*.PCODE**	SELECT LANDLI.PCODE
ENTER COMMAND> **RELATE** ***INPUT_COVERAGE*.PAT BY** ***INPUT_COVERAGE*-ID**	RELATE LANDLI.PAT BY LANDLI-ID
ENTER COMMAND> **MOVE LABEL TO $1LABEL**	MOVE LABEL TO $1LABEL
ENTER COMMAND> **MOVE ANGLE TO $1ANGLE**	MOVE ANGLE TO $1ANGLE
ENTER COMMAND> **Q STOP**	Q STOP

12. Create topologically-correct polygon coverage. The CLEAN command creates a new coverage into which it copies the existing information, including the polygon attribute table, projection, etc. This is a good opportunity to use a standard name for the new coverage. For recommended tolerances, see Appendix A. Conversion is complete.

	example:
Arc: **clean** ***input_coverage output_coverage dangle_length fuzzy_tolerance*** **poly**	clean landli landlicp 0 0.06 poly

13. This completes the ADS to ARC conversion. Exit ARC.

Arc: **quit**

4.3 MOSS to ARC

4.3.1 Comments

A number of problems arise because MOSSARC uses MOSS export files rather than the full map files. Three important types of missing data include projection, registration, and attribute placement.

MOSS export files do not include projection information. The appropriate projection information must be manually obtained using MOSS and entered manually in ARC using the PROJECT or PROJECTDEFINE command.

MOSS export files do not have registration points. Spatial reference in MOSS is accomplished by the use of a minimum bounding rectangle (MBR). During conversion, ARC creates four tics at the corners of the coverage boundary. This boundary coordinate file (BND) can be considered equivalent to the MBR. Tics created during the conversion process are located at the corners of the BND and unsuitable for registration purposes in ARC/INFO.

MOSS data in export files consists of simple closed polygons with unplaced subjects. ARC creates label points at the centroid of the input polygon. With complex topology, labels can end up in the wrong place, causing some polygons to have multiple labels while other polygons have none.

4.3.2 Data Conversion Procedures

The command sequence for accomplishing MOSS to ARC conversion is as follows:

1. After logging onto the RS/6000, change to the area where the MOSS export files have been transferred. Then go into ARC/INFO. $ **arc**
2. Set precision to double. Arc: **precision double**
3. If the coverage is point data, go to step 4. If the coverage is line data, go to step 5. If the coverage is polygon data, go to step 9.
4. For a point coverage, use the MOSSARC command to convert MOSS export file into an ARC point file. This is a good opportunity to use a standard name for the new coverage. Conversion is complete. Go to step 9. example: Arc: **mossarc *input_moss_file* *output_coverage* point** — mossarc raswolfrg raptor point
5. For a line coverage, use the MOSSARC command to convert MOSS export file into ARC line data. example: Arc: **mossarc *input_moss_file* *output_coverage* line** — mossarc plnwolfrg pipe line

6. Create topologically-correct line coverage. This is a good opportunity to use a standard name for the new coverage. For recommended tolerances, see Appendix A. Conversion is complete. Go to step 9. example: Arc: **clean *input_coverage output_coverage dangle_length fuzzy_tolerance* line** — clean pipe pipecl 1.0 2.0 line
7. For a polygon coverage, use MOSSARC command to convert MOSS export file into ARC polygon data. example: Arc: **mossarc *input_moss_file output_coverage* poly** — mossarc plswolfrg plss poly
8. Create topologically-correct polygon coverage. This is a good opportunity to select a standard name for the new coverage. For recommended tolerances, see Appendix A. Conversion is complete. example: Arc: **clean *input_coverage output_coverage dangle_length fuzzy_tolerance* poly** — clean plss plsscp 0 0.06 poly
9. This completes the ADS to ARC conversion. Exit ARC. Arc: **quit**

5 LIMITATIONS AND CONCERNS

There are four important areas of limitation or concern:

- incorrect source data,
- lack of standardization,
- unconverted data, and
- loss of meta-data.

5.1 Incorrect Source Data

ADSARC and MOSSARC do a good job of converting features and their coordinates and labels. However, poor source data can cause serious problems when ARC tries to correct the poor data. In large measure, this is due to ARC's use of tolerances for closing features, eliminating duplication, and dropping dangling lines. Proper specification of tolerances often requires knowledge of the specific map data and an iterated process of trial-and-error. It is highly recommended that the source data be of the highest possible quality prior to conversion. Oregon found that most identified errors were "a result of data problems in the source ADS files and did not relate to the conversion process....Detected errors that were the result of existing problems in ADS included multiple label points, missing labels, gaps, and dangles that exceeded the dangle tolerances used" (Wickwire and Vu, 1993, p. 4) If the master data will be maintained on the RS/6000, ARCEDIT is available for correcting the identified problems in ARC/INFO. Otherwise, the data should be corrected on the PRIME, then transferred and converted again.

Another concern is lack of edgematching in the source data. ARC can handle small differences during the clean process using fuzzy tolerance settings. However, large differences cannot be handled with increased tolerance settings without causing undesirable coordinate movement. If the source data has already been edgematched in ADS, automated procedures in ARC/INFO can resolve discrepancies (from map-inches conversions, etc.) using the EDGEMATCH command in ARCEDIT.

Some coverages, like soils, are often impossible to edgematch across county boundaries, due to differences in classification methods. DEM data can produce coverages that are too dense for reasonable edgematching. Oregon noted, "Edgematching errors were encountered between townships for several themes within the converted test block. These edgematch errors, on the order of 1-2 meters, also exist in both ADS and MOSS" (Wickwire and Vu, 1993, p. 4) The indicated ADS and MOSS data was not correctly edgematched prior to conversion. Edgematching is required for implementing a tile system in ARC LIBRARIAN. However, LIBRARIAN does not perform this function.

5.2 Lack of Standardization

It should be emphasized again that lack of standardization for file and theme names on the PRIME should not be carried over to the RS/6000, if at all possible. Conversion to ARC requires creating workspaces and coverages. This presents an opportunity to ensure that these names reflect spatial extents and themes, respectively. This lays the foundation for use of a map library manager, like ARC LIBRARIAN or ARCSTORM.

5.3 Unconverted Data

Since neither of these translators address the transfer of text information, multiple attributes, meta-data, or cartographic information (such as markers, line styles, polygon shades, and text fonts), alternative methods need to be developed to get this data from MOSS and ADS into ARC.

Some of this data, like multiple attributes, can be extracted in a relatively straightforward fashion, then transferred and imported into INFORMIX for use by ARC. On the other hand, cartographic information cannot be extracted without writing special programs and cannot be readily used (since ARC accomplishes cartographic assignment in a very different manner).

The loss of this data may or may not be acceptable. Tools will be produced by the GIS Data Transition Project to transfer this data. Conversion may have to wait for their availability.

5.4 Loss of Meta-Data

The most immediate meta-data that will be lost is that contained in the headers in MOSS and the ADS.mapname file in ADS. There is no defined location for this information in ARC. In addition, FGDC (Federal Geographic Data Committee) has mandated the collection and maintenance of an extensive list of meta-data elements. While some of this is just not available, pieces are already stored in MOSS and ADS files. Other data can be remembered or reconstructed based upon project, personnel, and personal experience. This latter data may prove impossible to gather once the specific PRIME contexts of MOSS and ADS are lost.

5.5 Precision Limitations

It is recommended that all coordinates in ARC be maintained in double precision. MOSS export files maintain double precision. However, ADS data maintains only single precision, except for the registration points. To keep from losing precision, it is probably best to keep all data as double precision.

6 CONCLUSION

There are serious limitations to attempting to move MOSS and ADS data to ARC using only the existing translators. However, if the limits are recognized and good procedures are followed, useful data can be made available in ARC.

APPENDIX A: SUGGESTED TOLERANCES

Source: Environmental Systems Research, 1991, p. A-8.

TABLE

These fuzzy tolerances are calculated as follows:

(scale / number of inches per coverage unit) * 0.0002

APPENDIX B: REFERENCES

Environmental Systems Research Institute, Inc., 1991, ARC/INFO Data Model, Concepts, & Key Terms: Redlands, California, Environmental Systems Research Institute, Inc.

Wickwire, D., and Vu, H., 1993, Experience Report ADS to Arc/Info Conversion: Portland, Oregon, Oregon State Office, Bureau of Land Management, May 27, 1993.

11-16-93 01:28p Directory C:\JOE\PROJECT*.*
Free: 46,049,280

.	Current	<Dir>			..	Parent	<Dir>		
ADSDATA	.	<Dir>	07-07-93	11:13a	AMLNERC	.	<Dir>	08-03-93	07:43a
AMLOSO	.	<Dir>	08-03-93	07:43a	3-1	.	9,283	03-23-93	09:13a
3-1-1	.	12,305	03-23-93	09:12a	3-2-1	.	10,876	03-23-93	09:07a
3-2-11	.	11,583	03-23-93	09:56a	3-2-2	.	9,698	03-23-93	09:51a
3-2-6	.	10,497	03-23-93	10:04a	3-2-9	.	10,236	03-23-93	10:05a
4-93	.PR	4,565	04-22-93	02:22p	ADSDATA	.WP5	64,759	07-20-93	03:06p
ADSDATA2	.WP5	68,950	07-20-93	03:22p	ADSDATAS	.WP5	91,221	10-21-93	02:49p
ADSREV8	.TXT	28,313	03-16-93	12:56p	ADSREV8	.WP5	28,161	03-16-93	12:58p
ALTI	.WPM	76	04-20-93	09:50a	ALTO	.WPM	87	10-27-93	09:44a
ALTP	.WPM	88	03-10-93	11:46a	ALTS	.WPM	547	07-21-93	09:05a
ALTT	.WPM	77	11-01-93	07:53a	ARCDATA	.WP5	48,532	07-20-93	07:51a
ARCDATAS	.WP5	91,053	10-21-93	03:25p	ARCINSTS	.WP5	5,283	05-28-93	02:48p
ARCTIME	.WP5	3,609	05-28-93	03:34p	BRDUP	.WP5	38,149	07-12-93	01:03p
BRSTD	.WP5	38,674	07-14-93	01:03p	BRTRN	.WP5	19,423	08-17-93	11:11a
CFC	.WP5	1,891	10-18-93	01:12p	CHARTER	.	53,037	12-17-92	05:51p
CROSS	.C	30,001	08-17-93	07:41a	DTRNSLTR	.TO2	16,726	06-21-93	11:57a
DUP	.TO	17,598	01-27-93	03:34p	DUP1LTRC	.WP5	4,179	05-18-93	12:28p
DUP1LTRJ	.WP5	3,641	05-18-93	11:11a	DUPADS	.WP5	22,862	03-17-93	09:46a
DUPDOC	.WP5	5,213	08-25-93	04:35p	DUPDOCF	.WP5	3,861	02-23-93	03:51a
DUPDOCS	.WP5	5,101	02-23-93	05:52a	DUPDOCT	.WP5	5,085	03-08-93	05:27p
DUPDOCT2	.BK	2,992	08-26-93	10:26a	DUPDOCX	.WP5	5,153	08-26-93	06:28a
DUPERR1	.WP5	2,894	08-12-93	12:49p	DUPERR2	.WP5	1,625	08-27-93	11:28a
DUPERR3	.WP5	998	09-10-93	03:51p	DUPERR4	.WP5	9,884	10-08-93	01:11p
DUPERR5	.WP5	10,305	10-26-93	03:05p	DUPERRS	.WP5	6,564	03-18-93	09:50a
DUPPREA	.WP5	150,706	03-10-93	11:46a	DUPSRS	.WP5	28,437	08-26-93	12:03p
DUPSRSB	.WP5	37,446	03-04-93	10:32a	DUPTO	.WP5	18,718	02-17-93	05:21p
DUPUAT	.WP5	4,921	01-21-93	01:14a	FILES	.DOC	51,166	08-25-93	07:46p
FMS	.TOC	19,228	06-24-93	11:47a	FMSCLASS	.WP5	2,198	09-20-93	10:57a
FREDUP	.WP5	4,572	04-07-93	07:42a	GISLAND	.WP5	27,611	10-12-93	02:13p
GISPLN	.JOE	209,486	06-10-93	03:41p	GISPMB	.LST	2,686	03-24-93	09:18a
IBM{WP}	.FRS	4,146	10-18-93	10:26a	IDSADS	.WP5	2,298	10-21-93	11:37a
IDSARC	.WP5	4,398	10-21-93	03:09p	IDSMOSS	.WP5	5,103	08-27-93	12:52p
IOMRET	.WP5	1,677	08-23-93	09:52a	LOGA2D	.WP5	6,160	04-13-93	03:00p
LOGDUP	.WP5	9,239	04-02-93	02:47p	LOGMAC	.WP5	1,911	03-11-93	03:39p
LOGSTD	.WP5	2,534	07-02-93	11:12a	LOGTRN	.WP5	5,964	08-10-93	11:16a
MOSDATAS	.WP5	118,867	10-21-93	04:17p	MOSS	.TAB	27,808	04-26-93	09:21a
MOSSDATA	.OLD	59,833	07-19-93	07:33a	MOSSDATA	.WP5	76,861	07-20-93	02:43p
NOTEBOOK	.WP5	4,032	06-24-93	08:20a	NOTEDUP	.WP5	73,701	07-13-93	10:11a
NOTESTD	.WP5	47,601	08-10-93	11:42a	NOTETRN	.WP5	54,998	08-10-93	11:36a
SCALE	.WP5	7,699	07-08-93	08:38a	SDDDUP1	.WP5	18,830	03-18-93	09:14a
SP2	.	7,833	10-08-93	09:00a	SRSA2D	.WP5	42,332	05-27-93	02:45p
SRSDUP	.WP5	38,158	04-07-93	03:19p	SRSDUPN1	.WP5	3,182	03-19-93	01:01p
SRSDUPSY	.WP5	28,761	03-17-93	03:07p	SRSFMS	.WP5	106,401	09-24-93	03:53p
SRSFMSIO	.WP5	158,727	09-28-93	08:01a	SRSSTD	.WP5	39,250	06-21-93	03:20p
STAT0721	.WP5	6,040	07-21-93	01:50p	STATPMB	.WP5	5,486	04-08-93	09:47a
STDDUP	.WP5	100,910	04-06-93	10:01a	STDRES	.WP5	32,600	05-03-93	02:04p
STDTABLE	.WP5	27,445	04-06-93	10:01a	STPDUP	.WP5	59,682	04-02-93	02:19p
STRDUP	.WP5	8,498	11-03-93	10:52a	SUNDIAL	.WP5	3,751	07-08-93	08:25a
SWJUST	.WP5	4,492	04-22-93	02:31p	TOOLS	.TOC	20,737	06-28-93	01:12p
TRAINDB	.WP5	2,900	11-04-93	10:14a	TRANSTD	.WP5	3,156	06-16-93	07:59a

TRFADS .WP5	2,910	08-03-93	10:04a		TRFARC .WP5	3,679	08-06-93	08:44a
TRFMOSS .WP5	7,376	08-03-93	11:01a		TRNANAL .BK	63,827	10-28-93	03:53p
TRNANAL .WP5	77,999	11-02-93	11:07a		TRNGUIDE.WP5	69,659	11-15-93	11:11a
TRNRPTS .WP5	4,265	10-07-93	08:09a		TRNSTAT .WP5	32,962	07-02-93	12:16p
TRNSTRAM.WP5	49,805	11-15-93	11:08a		TRNSUMT .ASC	1,763	10-08-93	08:53a
TRNSUMT .WP5	10,610	I0-05-93	12:38p		TSURVEY .WP5	59,380	11-08-93	04:28p
UATA2DCH.WP5	4,572	03-29-93	12:13p		UATA2DSL.WP5	4,678	03-29-93	12:10p
UATDUPDP.WP5	4,905	01-21-93	08:13p		UATDUPJN.WP5	4,921	01-21-93	01:14a
WBS3 .WP5	17,676	03-26-93	11:42a		WBSA2D .WP5	2,933	03-29-93	09:59a
WBSA2DB .WP5	7,990	03-29-93	10:54a		WBSA2DNH.WP5	4,035	03-29-93	10:36a
WBSDUP .WP5	5,616	03-26-93	02:26p		WBSDUPB .WP5	12,602	03-29-93	09:56a
WBSDUPNH.WP5	5,963	03-29-93	08:42a		WBSDUPNT.WP5	6,021	03-29-93	09:00a
WBSDUPT .WP5	12,038	03-26-93	02:37p		WENDYST .WP5	2,234	08-27-93	02:41p