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MAP MAKER

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MAP MAKER

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ABSTRACT

Described is application of the MAP MAKER program for PCs to produce maps of user defined areas and projections, for insertion in word processor documents. A graphics package can be used as an intermediate process, with all the advantages so implied. Options include map delimitation by latitude and longitude, level of detail, creation of reduced data set files to speed map production, some point annotation capability and gridding. A number of data sets provided with the program are also described.

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INTRODUCTION

In late 1990 a need was demonstrated for computer generated maps that could be inserted into word processor documents. Although a number of mapping programs were available, none seemed able to produce output for a word processor or graphics package of user selected areas and projections. Consequently, a simple system was produced to create maps from an existing database, with output primarily for a graphics package of the type to provide links to word processors. Many graphics packages can provide that link, and some word processors can read the mapping program output directly. Although limited, this system worked, provided professional editing and annotating facilities and was popular with its users.

Following requests from DGMSC, the JEPS and DCOORD areas, as well as other comments, it was decided to improve the mapping program. This working paper gives details of the enhanced package and its use. Annex A lists the enhancements from version 1 to 2. Altogether the system represents nearly three months programming effort.

So that they may be used as a reference, the options and file selection sections have been organized primarily to coincide with the program.

PREAMBLE

Like the original, the upgraded program is called MAP MAKER, and is accessed through the file PHYSMAP.EXE. Provision of a suitable graphics package and word processing package are the responsibility of the user. Suitable graphics packages include Harvard Graphics, Draw Gallery, Applause and Corel Draw. Suitable word processors include Microsoft Word version 5 or later and Word Perfect. Neither list is complete, and users should check their own packages. To make use of MAP MAKER output, a package should either be able to accept CGM metafiles directly, or have a linked utility program that will convert such files to its own format. The graphics packages mentioned and both Word for Windows and Word Perfect will accept CGM metafiles in one of these ways. This document was produced using Word 5 with illustrations in HPGL format files from Draw Gallery, originally produced using MAP MAKER mostly at resolution 2.

Commonly, computer pictures are stored and manipulated using either a pixel based or a vector based methodology. Within each are many variants, but essentially pixel based forms simply work with the status of each pixel on the screen - its colour, brightness and so on. Vector based pictures define a form of line (straight, curved, closed etc), and points that define important features of the line such as the ends. The quality of output generally depends on the output device with vector pictures, but on the screen in use

at the time of production for pixel pictures. MAP MAKER uses the vector form with straight lines between points. This includes output for the graphics program, so pixel based packages (Paintbrush etc) are not appropriate.

In general MAP MAKER has been written to be user friendly, and can be run with minimal background knowledge or preparation. Nevertheless it has its limitations because of the time and resources available for its production. Particularly included in the limitations of the system provided is the accuracy of the database for very small areas and for fine details. For example Australian rivers include only the Murray-Darling complex. MAP MAKER itself is not restricted in this way, and users may choose to provide a more detailed database.

The system used for transferring data from MAP MAKER to the Graphics package is an evolving standard and is not totally defined. Because of this there can be some variations between packages text size and colour which can create output problems. In particular users should be aware that they may need to modify background and line colours to obtain a suitable output. Generally black lines on a white background will be satisfactory.

SYSTEM OVERVIEW

MAP MAKER is a program written in Turbo Pascal for the PC. It produces maps from data files and may output them in several ways. Output options include CGM metafiles for input to a graphics program, which in turn can produce files to be read by a word processor. It is not intended to be an alternative to conventional cartographics for other purposes.

Geographic locations demanded by MAP MAKER from text based files are represented using degrees and decimal fractions of a degree rather than minutes and seconds. Latitudes south of the equator and longitudes west of Greenwich are expressed as negative numbers.

PROJECTIONS

Four projections have been included. Some reasons for choosing a particular projection are in the options section, and include computing time, ability to map the poles, common practice and reasonable accuracy with respect to distances.

OUTPUT

Maps can be produced for any area, in one of four projections, and with or without a grid. They can be output to any combination of the screen, a metafile, and two types of

disk file (types RDF and SCN). Important features are:-

- (a) from the screen the map can be output to a printer via the Print Scrn key provided that this facility has been enabled on the computer. Although not necessary, it is recommended that output to the screen always be selected, allowing immediate confirmation of correct selections etc.
- (b) Metafile output can be read by a graphics package and treated as a normal graphics picture. This includes alteration of the map, annotation and addition of other maps, symbols etc.
- (c) One type of disk file (RDF) is for use at another time by MAP MAKER. It holds map data specifically tailored by and for the user, generally of a particular area. Its purpose is to reduce computing time and user inputs.
- (d) Another type of disk file (SCN) may be used to reproduce the screen at another time. This is without regard to the new choices of geographical location, scaling or projection. It may be used as a base map to which other elements may be added, or to produce some special effects. It can also save time.

INPUT

Input is needed by MAP MAKER both as map data and to define various options. The options may be read from a file of preset values or entered from the keyboard.

Map data may be read from files holding data in one of three forms for geographic locations, or holding screen locations. Geographic points are identified by their latitudes and longitudes in files that have:

- (a) ASCII format (MP1 files);
- (b) binary format (PNT files) with the data based on a large CIA data base;
- (c) binary format (RDF files), being reduced data form files created by MAP MAKER.

Files with screen points (SCN files) identify computer screen positions in binary format. Several files and file types can be used in one application of MAP MAKER to produce the desired output.

Data in ASCII format can be read and modified by most word processors, but binary forms require a computer program. The different file types are identified by their file name extent (MP1, PNT etc).

The contents of each file is indicated by its name, but general organization depends on file type. Mostly the PNT database is more complete and reliable, but is slower because

its files are less well organized than the MPI database and it has more points. Users may wish to create their own RDF files from the supplied material, to save time when producing several maps from one general area. RDF files for the Australia-SE Asia region and for the world at lesser levels of detail are supplied.

Options include selection of the area to be mapped, the resolution of the mapping (that is, what minimum spacing is required between plotted points) the resolution below which islands will not be plotted, map projection and whether grid lines are required. To save the labour of retyping entries that do not change, almost all options can be preset in PRESETS.MAP or some other presets file. Presets files can be manipulated by MAP MAKER or by a word processor.

SETTING UP

The programs and data files are provided in a compressed form on floppy disks. The system will run from floppies or a hard drive, but there may be space problems running from 360K floppies only.

First set up the directory for the system if required; \MAPS on C: or D: is suggested. Copy the compressed files into the directory or floppy and then execute them from that directory by typing their names. They will de-compress themselves, after which the compressed files can be deleted to save space.

Because of differing standards (e.g. EGA, VGA), screen representations of maps may be distorted. This can be corrected by the first parameter in the PRESETS file, the pixel aspect ratio (PXLASPRAT). For a VGA screen the value 1.0 is probably appropriate, and for an EGA screen 1.25. The value can be adjusted on a trial and error basis using the file CIRCLE.MP1 which draws a circle around the north pole. It can be used with the azimuthal equidistant projection centred at 90N and any longitude, using a range of 60 nmiles. PXLASPRAT cannot be altered from MAP MAKER and must be modified in the presets file using an editor or word processor. It should be used in all presets files. If the Print Scrn key is to be used, a different PXLASPRAT value may be needed. These changes have no effect on the data written to the CGM file for the graphics program.

RUNNING MAP MAKER

From the directory where MAP MAKER is stored, on the DOS prompt type PHYSMAP to begin. Alternatively use an applications manager or a utilities shell such as PCTOOLS, XTREE, or the DOS shell. Depending on the values in the presets file and the options selected, MAP MAKER will ask a number of questions. The last of these will always be the data files to be used. Any files entered will be added to the list started in the presets file, but if no file is selected (i.e. the 'enter' key pressed with nothing on the

line), the mapping process then will begin.

When mapping has finished a copy can be sent to the printer and MAP MAKER then re-run or stopped. To obtain a hard copy of the screen on the printer, the 'Print scrn' key can be pressed. To re-run type r then Enter, and to terminate just press Enter.

To stop MAP MAKER while choosing options, before mapping has begun the control key and c should be pressed (together).

All latitudes and longitudes entered should be in degrees and decimal degrees, South and West being negative, while North and East are positive.

OPTIONS

With three exceptions, individual options can be selected from either the keyboard or the presets file. The exceptions are the choice of presets file, the pixel aspect ratio mentioned in the setting up section and the re-run facility. Mostly MAP MAKER only asks for a keyboard response for options that are relevant (through previous choices). In the options description, an indication as to whether the information must be supplied (M) or is dependant on other choices (D) is given. Options are detailed in the same order as MAP MAKER asks for them and as in the presets file. In summary they are:

- (a) presets file identification;
- (b) pixel aspect ratio;
- (c) presets file modifier;
- (d) output form(s) required;
- (e) resolution;
- (f) small object relative resolution;
- (g) equivalent screen size;
- (h) metafile name for map output;
- (i) screen file name for map output;
- (j) raw data file name for map output;
- (k) map projection type;
- (l) map area selection type;
- (m) the point about which the map should be centred;
- (n) the range from the centre to the northernmost map limit;
- (o) the focal point of the map;
- (p) the four corners or else the bounds of the map;

- (q) standard parallels for the simple conic projection;
- (r) grid lines option;
- (s) first grid latitude and longitude, and increments;
- (t) map data files to use;
- (u) terminate or re-run MAP MAKER options.

When MAP MAKER starts, it first asks for the essential identification elements of the presets file, which is immediately read. When information is needed about an option it only asks for a keyboard input if the preset value is 0 (or null for file names).

Presets File Identification (M)

An entry of the form X.XXX or no entry at all (followed by the return key) is expected. Any of the Xs may be omitted but not the dot, although on a null entry '.MAP' is assumed. The file name read by MAP MAKER begins with 'PRESETS' and has the entry added to it. Thus files such as PRESETS.NUL (enter .NUL) can be readily accessed. Note that using the .NUL file will allow it to be overwritten should presets file modification be selected.

Pixel Aspect Ratio (M)

This depends on the screen attached to the computer, and must be correct for undistorted pictures to appear on the screen (and printer via the Print Scrn key). It may not be input from the keyboard but must be modified in the presets file using a text file editor. For an EGA screen a typical value would be 1.25, and for a VGA screen 1.0.

Presets file modifier (M)

The presets file can be modified from MAP MAKER, although in general it is best to use a word processor. When it has been modified by the program, the old set of choices are kept in the file PRESETS.OLD (accomplished by renaming the .MAP file). The choices available in the presets file are:

- 0 - keyboard entry;
- m - all relevant presets file entries may be modified, according to the values typed in from the keyboard;
- d - no modifications, and do not ask for this option from the keyboard;

From the keyboard there are the following additional options:

- y - yes modify all presets file entries relevant to the range of choices made, but leave a 0 in this option (i.e. ask this question again on the next run);

- l - limited modification - modify those entries that currently have a 0 in them, apart from this option (i.e. ask this question again on the next run);
- n - no do not modify the presets file at all;
- d - as for d above - that is, do not modify any of the presets file except for this option (i.e. do not ask this question again);
- a - yes, modify all relevant presets file entries - do not ask this question again;
- s - as for l above, but do not ask this question again.

Directing output (M)

The choices are not mutually exclusive, and they indicate that output should be directed to:

- 1 - the screen;
- 2 - a metafile;
- 4 - a disk file (SCN file) that can be used by a later run of MAP MAKER to reconstruct the screen;
- 8 - a disk file (RDF file) that will hold a reduced data set;

To choose more than one, the relevant values should be added - for example 15 will choose

all four ($15=1+2+4+8$), and 3 will choose the screen and a metafile. It is recommended that:

- (a) the screen always be included so that an immediate visual check of the map can be made (choice 1); and
- (b) RDF files be created (choice 8) from the CIA based data (the PNT files) covering a little more than the area of most interest. This will save considerable amounts of computing time as the basic PNT files are usually world wide, and MAP MAKER has to reject data outside the area of interest. If special runs are done to create RDF files, the lat-long option with finest relevant resolutions should be chosen. RDF files of Australia and SE Asia are provided with the system.

Resolution R (M)

This is the plotting accuracy of map data. Essentially MAP MAKER estimates the distance on the screen from the last point plotted to the current one, and plots only if it is greater than the resolution value. The resolution value can range from negative values upwards, and can be fractional. Negative values and 0 will include every point in the data set, 0.1 gives a high resolution map, and 5 is coarse but adequate. Values over 30 usually produce recognizable if crude outlines. In the presets file, a negative value such as -1 can be used to include all points. When producing metafiles and other

disk files, larger resolutions generate smaller files. This is important if a metafile is too large to be read in to a graphics program, when a coarser resolution should be tried.

Small object resolution S (M)

MAP MAKER will only plot small objects (islands or short line segments) if there is a point estimated to be distant at least R/S from the first point. That is, this parameter gives the relative resolution of small objects. It allows reduction in delays due to many small islands being plotted with coarser resolutions. When S is 0 or less all small objects will be plotted. A generally acceptable value is 10, and will normally include most objects that are not single points. It has no effect when resolution R is 0 or less.

Equivalent screen size (D)

If the output screen is not selected, maximum x and y values are needed. Typical values for an EGA screen are 511 and 349.

Metafile name for map output (D)

Once metafile output has been selected MAP MAKER needs to know where to store the output data in graphics package readable form. This file is the crucial link between MAP MAKER and the graphics package. The name has .CGM automatically added to it. If a path is not included then the file is put in the same

directory as MAP MAKER. As an example, a:map will put the CGM output into the file MAP.CGM on a floppy disk on the a: drive.

Screen file name for map output (D)

If screen file output has been selected this option is needed. The form is as for metafiles, but .SCN is automatically added to the name. Thus MAP will produce MAP.SCN.

Raw data file name for map output (D)

If the culled raw data option has been selected the name of the RDF output file is needed. MAP MAKER automatically adds .RDF to the name you choose. Only the data that are used to create plot points on the screen are sent to this file. That is area selected, files used and resolution values all affect the contents of this file.

Map projection type (M)

Because the world is curved, nearly as a sphere, it is necessary to distort the map of an area for it to be flat. The distortions available are called projections, and there are many of them to cover the various uses of maps. MAP MAKER provides four projections that cover most requirements for illustrative maps, and they are:

- 1 - the Plate Carrée projection, producing a map with latitudes in the y direction and longitudes in the x direction. It is the fastest to compute, and so is often best when producing RDF files. However with coarser resolutions another projection may be more appropriate if the difference between this and the chosen projection is significant at the edges of the map. At and near the equator Plate Carrée is very little different to most of the other projections, but is not a good representation beyond 30 or 40 degrees from the equator. Figure 1 illustrates this projection.

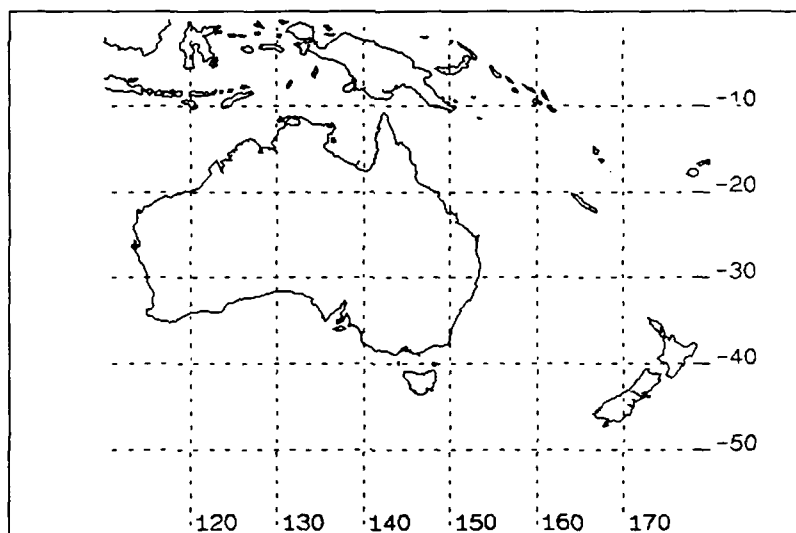


FIGURE 1. THE PLATE CARREE PROJECTION (ANZ)

- 2 - The azimuthal equidistant projection, in which distances from a focal point are all proportional to the shortest (great circle) distance. Angles about the focus also represent the direction of the great circle between the focus and any point on the map. It is good for looking at aircraft and radio wave situations for example. It is the only projection for maps involving polar regions. In all but one of the map area selection choices, the focus is assumed to be at the centre of the map. Figure 2 illustrates this projection.

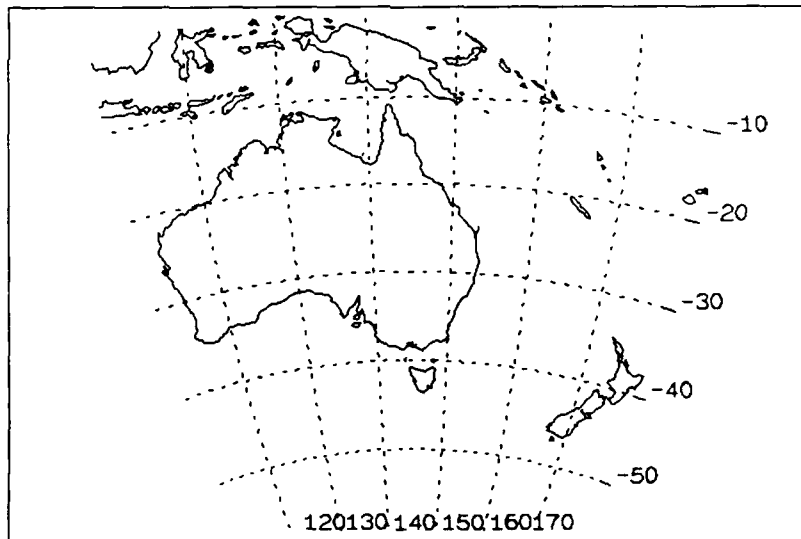


FIGURE 2. THE AZIMUTHAL EQUIDISTANT PROJECTION

- 3 - The Mercator projection - a map that is similar to the Plate Carrée, except that longitudes are stretched with increasing distance from the equator. It is a commonly used projection in atlases and shows small shapes accurately. It can also be used for rhumb line navigation. Figure 3 illustrates this projection.

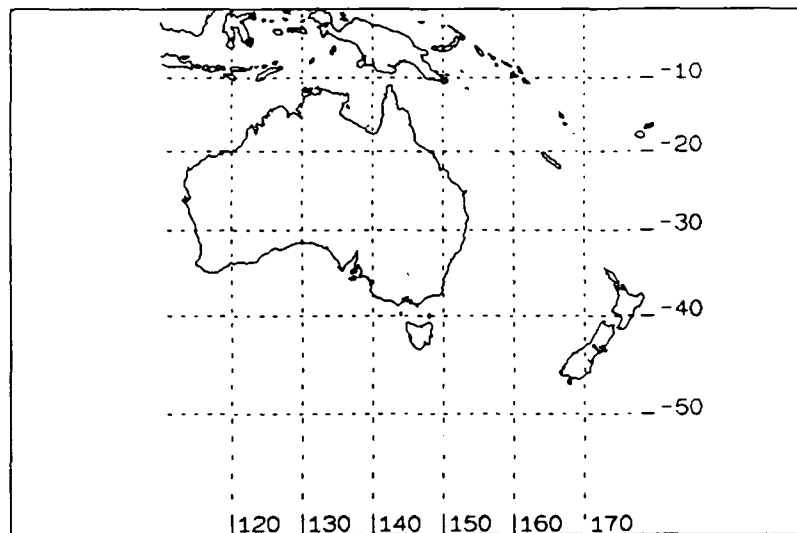


FIGURE 3. THE MERCATOR PROJECTION

- 4 - The simple conic or equidistant conic projection - a map in which lines of longitude draw closer together toward the poles, and lines of latitude are arcs of circles. With this projection distances

are usually only a few percent in error, depending on the area covered and the location of the parallels at which there is no error. There may be distortions of shape for larger area maps. It is a fairly common projection and is recommended for general purposes, particularly for smaller areas, but not for those that cross the equator. It requires two standard parallels to be defined (below). MAP MAKER will make recommendations, but any reasonable values can be chosen - even both the same. Figure 4 illustrates this projection.

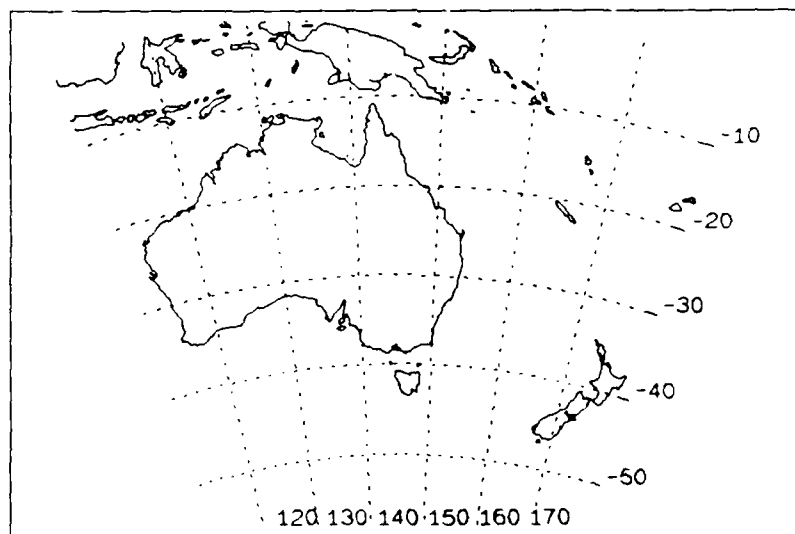


FIGURE 4. THE SIMPLE CONIC PROJECTION

Map area selection type (M)

This option defines how the mapped area is to be described - details of the area itself are demanded later. As a general rule it is best to expect a little imprecision in the limits of the map - for example mapping may not extend all the way to all corners. A larger area than is actually needed should be defined when creating RDF (user defined) files.

Care should be taken for maps that have boundaries near a pole. In particular the Conic and Mercator projections will cause MAP MAKER to fail with centre and range selection (option 3) if the upper or lower limit crosses itself (i.e. parts of the world are mapped twice). Choices allow the region mapped to be defined by:

- 1 - the lines of limiting latitude and longitude. In the simple conic projection these bounds will probably leave unmapped areas in the upper or lower corners.
- 2 - The four corners of a box.
- 3 - A centre point and a range from it to the northernmost boundary. The other boundaries, to the S, E and W are determined by the screen dimensions and the projection selected. For maps including polar regions this option or the next one is required, in conjunction with the equidistant azimuthal projection.

- 4 - This choice is only available in the azimuthal equidistant projection and is similar to 3 but with the focus offset from the centre.

The centre point of the map (D)

Used with map area selection choice 3 or 4, the latitude and longitude of the centre point of the map should be given using degrees and decimals of a degree. A dot marks this point both on the screen and in metafiles.

Range (D).

This is the distance in nautical miles from the centre point to the northernmost limit of the map. MAP MAKER assumes that one degree of latitude is 60 n miles.

The focal point of the map (D)

Only demanded with map area selection choice 4, it is the point from which all map distances are proportional to ground distances. Its latitude and longitude should be given using degrees and decimals of a degree. A dot marks this point.

Map corners or bounds (D)

This information is demanded following map area selection options 1 and 2. In the corners case (option 2) it is assumed that four are given as latitude and longitude pairs in clockwise order starting at the top left. (i.e. TL, TR, BR, BL). In the bounds case

(option 1), input from the presets file uses the top left and bottom right corners, and ignores the other two corners. For keyboard entry of the bounds, input should be northernmost, southernmost latitudes then leftmost and rightmost longitudes.

As usual, input should be in degrees and decimals of a degree. For the four corners option, there is no requirement to keep the corners regular. It is even possible to define a triangle by allowing two adjacent corners to cross over. In box and bounds cases, the maximum right bound may be less than the minimum left bound, in which case the rest of the world will be mapped. Bounds of -30 and -30.1 will map all longitudes other than those between -30.1 and -30 for example.

Simple Conic standard parallels (D)

Simple Conic projections use two standard parallels where mapping error is zero. The error increases with distance from them (not uniformly). Typically, errors should be no more than a few percent. Professional cartographers sometimes use set values for standard parallels, depending on nationality and area. MAP MAKER will recommend values based on the bounds of the map that will keep the maximum error fairly small. To accept these values simply press Enter, otherwise use your own - either through the presets file or the keyboard. A single standard parallel may be chosen by using the same value twice.

If the map crosses the equator (not recommended) it is possible for the best parallels to be the same magnitude, but on opposite sides of the equator. In this instance the program will fail to produce a reliable result. Thus different parallels that are the same distance from the equator must not be used.

Grid lines option (M)

Dashed grid lines can be superimposed on the map. Each dash is a line or object in the output, so graphics programs with a limit to the number of objects may have a problem with this option. The choices are:

- y - yes, grid the map and use computer generated positions for the latitudes and longitudes. This is not the best option since the computer can fail to select good grid values of latitude and longitude.
 - c - yes, grid the map, but choose the first line position and the interval between grid lines. This is the recommended option because it most accurately reflects user needs.
 - 0 - presets file only, call for a keyboard entry.
- all other choices - no gridding.

Grid start values and increments (D)

When the c gridding option is selected MAP MAKER needs a starting latitude and longitude and their increments. If the first latitude and longitude are outside the map limits MAP MAKER adds increments to the initial value until a line lies inside the map boundaries. The increments operate in an Easterly and a Southerly direction. As usual use degrees and decimals.

Map data files to use (M)

There can be any number of files chosen as source files for the mapping data. After one has been processed, MAP MAKER looks for the next and so on until there are no more. It stores the list of files to be used before it starts processing so some can be input from the presets file and more from the keyboard. Non-existent files are ignored, and either file names or built-in cyphers can be used. Only one file name or one cypher is allowed per line, and the last line must be empty to for MAP MAKER to stop asking for file names. There are several ways of specifying files:

- (a) A built in identification system of a two or three digit cypher, used to give access to files provided with the system. It comprises a number, a letter and possibly a number. Details are in the file selection section.

(b) File names may be typed but must include any paths required and the extent .MP1, .PNT, .RDF or .SCN. If none is specified, .RDF is assumed. Files with any other extent are expected to have the MP1 file structure and naming convention.

(c) The double quote or ditto cypher (") can be used to repeat the last fully typed keyboard entry. Because MAP MAKER ignores files that it cannot find, an entry can be any convenient sequence, and subsequent entries can then use the ditto. It can only be used as the first character on a line. For example data files abc0.mpl, abc1.mpl etc could be entered as:

abc

"0.mpl

"1.mpl

That is, the first line puts abc into the ditto cypher and the following lines use it. The file entry is repeated in full along with the number of files input, so if there is any doubt about the contents of the cypher it can be readily reviewed.

Terminate or re-run MAP MAKER (M)

If the presets file has been modified and saved, MAP MAKER says so and allows a restart, (hit the r key), a stop (use Control C) or a continuation (any other key).

After the maps have been drawn, MAP MAKER waits for input, but does not indicate that it is finished (so that the Print Scrn key will produce a clean copy). At this point typing

an r followed by the Enter key will cause a restart, while just the Enter key will terminate the run.

PRESETS FILES

The presets file must be in the same directory as MAP MAKER, and have the form PRESETSX.XXX (X is any letter or number, or may be omitted). It is identified at the first option. Provided with the program files are the presets files .NUL, .MAP and .OLD (i.e. PRESETS.NUL etc). To avoid its possible corruption, it is recommended that the .NUL file be used as a master reference, and copied to a new file name. When no file is identified, .MAP is used.

If the option to replace values in the file is chosen, then the old file has its extent changed to 'OLD'. For example PRESETSG.ULF would become PRESETSG.OLD with the new presets in the .ULF file.

The contents and structure of these files is generally as in the options section. Modification using a word processor is recommended, but it can be done using MAP MAKER options. A zero entry (or a null one for file names) will require a keyboard entry if the option is relevant. A typical file is shown in Appendix B.

MAP DATA FILES

There are a number of different data sources acceptable to MAP MAKER. The oldest and probably least accurate are files ending in .MP1. They are also the easiest to access (since they are in ASCII) and are the best organized. The newest are the .PNT files, and are the most accurate and comprehensive but have the poorest organization. Neither source can be considered totally complete and fully accurate, although they are reasonable for mapping at national levels.

Other files (.RDF and .SCN) are taken from these data sources. The RDF files can be used to save time when producing many maps from one general area, or when producing very large area maps. The SCN files can be used for producing base maps to which other material is added at a later time.

MP1 FILES

These files mostly come from the computer shareware "The World Digitized", copyright 1986 John B. Allison. Not all the material in the shareware has been reproduced, and the original material can be obtained from the ACT PC Users Group or John B. Allison. Copying is authorized by including the COPYING file (located with the MP1 files) as indicated in the following abstract:

"Making Backups:

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The world is represented by perhaps 100,000 points. In addition to this database, there are files for Kamaria, some Australian islands and some territorial baselines that were created either by scanning an outline, or a document holding a list of points. There is also one small file holding a few Australian city names and locations which is used to identify specific points with a mark and

identifying text. They can all be read and edited, using a word processor.

The World Data Files

They are in a number of categories in two principal divisions. One class of division is the continent or major land mass, and the other is type of feature - coastlines, islands, lakes, national boundaries and cities. File names reflect these divisions, and comprise a 1 to 3 letter sequence identifying the continent, followed by a digit for the feature type, then .MP1 to complete the name. Table 1 illustrates the file naming structure, but N America essentially means Canada, and S America includes Mexico. As an example, the Australian coastline file name is AU0.MP1. Not all areas have all features - in particular, only Australia has a city file, and the Pacific has only an island file. The EEZ files (including territorial baselines) have been numbered 6 rather than 5 to allow room for any river files that might be created. At the moment EEZ files only cover Australian and Vietnamese territorial limits, and may not be perfectly accurate.

TABLE 1. MP1 FILE NAME STRUCTURE

Area	Name	Feature	Ident No
Africa	AF	Coastlines	0
Antarctica	AN	Islands	1
Asia	AS	Lakes	2
Australia	AU	National	
Europe	E	boundaries	3
Greenland	GR	Cities	4
N. America	NA	EEZs etc	6
Pacific	PA		
S. America	SA		
USA	USA		
Kamaria	KAM		

The lines of an MP1 file

They are latitude and longitude as degrees and decimals of a degree, separated by a space and then comments (or more data in a city file). Empty lines signify the end of some sort of object (an island, a lake, a stretch of coastline etc). MAP MAKER will generally attempt to close objects from coastline, island and lake files if the start point is close to the finish point and the whole of the object is in the map. National boundary, city and EEZ files (with names ending in 3, 4 and 6) are not so treated.

City files

They are used to mark points on the map with crosses and optionally some text - usually one or two letters per point. A City file should not be used as the first file read because it will annotate the centre point. The very first line indicates the size of the mark locating the exact point and may take any value. Otherwise, each line has a location, the letter l, r or n to indicate whether the text should be to the left or right of the location point or whether there should be no text, then a short abbreviation of the city name (usually one or two letters) and finally the full name. Elements on one line need a space to separate them. A typical line is:

-35.33 149.1 1 C Canberra

Figure 5 shows the current City file, combined with the mainland and islands RDF files for Australasia and SE Asia, bounded for our region. City files may also be used for marking tracks, as shown in figure 11 in the section on marking ship tracks.

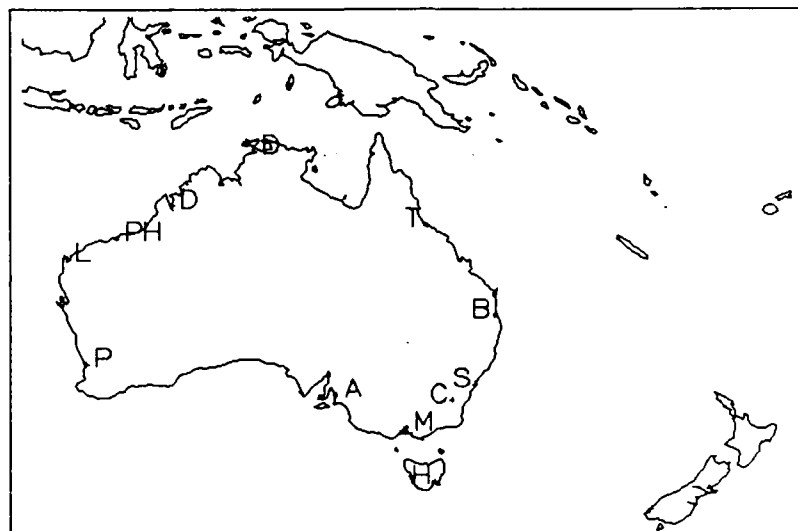


FIGURE 5. AUSTRALIAN CITIES

Kamaria

Files are divided into the main island (a coastline file) and the other principal islands (an islands file) and are illustrated in figure 6. Because it is a fictional nation, its 'true' location can vary. There are two ways to handle relocation:

- (a) produce a metafile with the islands in their current locations, and then use the graphics package to move them as required;

- (b) run a separate program that will produce new files with the required location.

Program NEWKAM.EXE has been included for solution (b). It asks for the name of the file (symbolized by ~), (no extent) and adds '.MP1'. It also asks for the new location, which it assumes to be the position of the first point in the file. It renames the existing file to be ~.OLD and leaves the new file in ~.MP1.

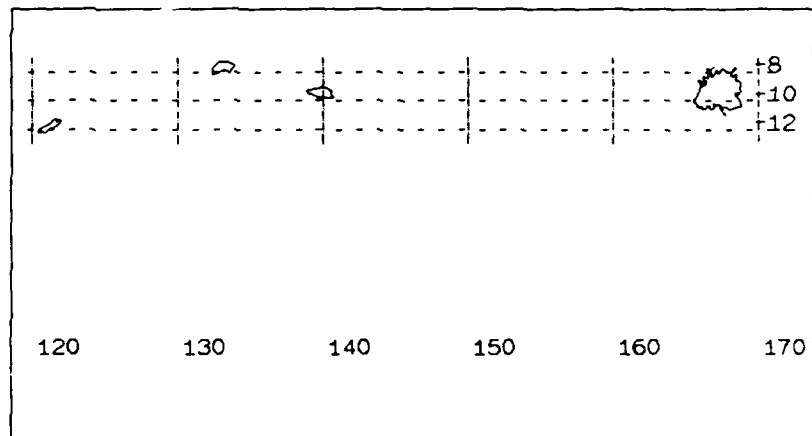


FIGURE 6. KAMARIA

Other files

Files have been produced for Christmas, Cocos and Keeling islands, because they are not included in the PNT database. Originally they were not in the MP1 database but were added some months ago at a low level of detail. Very detailed versions have been combined into one file named XCK.MP1.

New MP1 files

These can be produced by

- (a) typing a list of latitudes and longitudes using a word processor and saving as an unformatted file with line feeds.
- (b) Using a scanner to read a printed list of latitudes and longitudes. It may be necessary to edit the file to remove extraneous material, and it may be necessary to convert minutes and seconds to decimal degrees with a small program.
- (c) Using a scanner to copy a map or map outline. The result can then be put through the Corel Draw trace facility (or similar) which will convert it to a series of line segments. These in turn can be output in HPGL form. Included in the system is HP2LL.EXE which will convert an HPGL file to MP1 form. It uses the first pair of points to define latitudes and longitudes, so the original map must include two known points. A line must be drawn between them in Corel Draw and then

the original points deleted. This line must be the first thing to be output so it must be at the back of the Corel draw picture. Experience indicates that some cleaning up of the original scanned image may well be necessary before satisfactory trace results can occur.

PNT FILES

These files are copies of the Fred Pospeschil data base Plot Micro World Data Bank. If copied they need an acknowledgement (such as this) and may be given but not sold. They have been extracted from a CIA data base of around 6 million points, and hold about 180,000 points. Ultimately it is hoped that the whole of the original database will become available, although no time frame has been indicated.

Data are organized into features only, so much time can be spent in rejecting unwanted points when mapping small areas. This problem can be reduced when a variety of maps from a general area are needed, by creating an RDF file for the region of interest. Table 2 lists the file names and area. File contents are in binary, and can be read by a Pascal or Fortran program, but not a text editor. Each datum consists of a code number, a latitude and a longitude. The three numbers are 16 bit signed integers, with locations in whole minutes. There is no line feed separating one datum from the next.

TABLE 2. PNT FILE NAME STRUCTURE

File Name	Comments
COAST1.PNT	Coastline of Europe & Asia. Remaining world coastline
COAST2.PNT	
ISLAND.PNT	
LAKE.PNT	
COUNTRY.PNT	National Boundaries. Only the Murray-Darling for Australia.
RIVER.PNT	

In contrast to MP1 files, outlines are not normally complete units, but are line segments that happen to have coincident ends. In some cases adjoining segments come from well separated parts of the file.

RDF FILES

The acronym RDF stands for 'reduced data form'. Created by abstraction from MP1, PNT and RDF files, this type of file can reduce the time and effort needed to produce maps. They hold a record of those points that were chosen for plotting to the screen, so depend on resolution, area selected, projection and specific mapping files used, but not the type of source files (except type SCN which are excluded).

Each datum is stored in binary and consists of a latitude and a longitude in whole minutes, as 16 bit signed integers. The start of each object or line segment is identified by having 10800 added to the latitude. This number is twice the minutes of polar latitudes, so is always identifiable. No line feed separates one datum from the next. This form was chosen to minimize computing time and file space occupied. A text editor can not be used with these files.

Files of SE Asia and Australia have been provided with the system. They were created from PNT files plus the Christmas Cocos and Keeling islands MP1 file, and are bounded by 30N, 60S, 60E and 180W. They can be accessed through the cypher system (area u) and are called AUSEAn.RDF where n is a digit in the range 0 to 6 (not 4) and follows the feature numbering system of MP1 files (table 1). Figure 7 illustrates the complete set of these files except for the EEZ file drawn on one map.

Also provided are two sets of the World, produced using resolutions of 0.5 and 2. They contain about 15% and 5% of the original PNT files respectively. As with the AUSEA files they are named WMHn.RDF and WM2n.RDF and can be accessed using cyphers v and w.

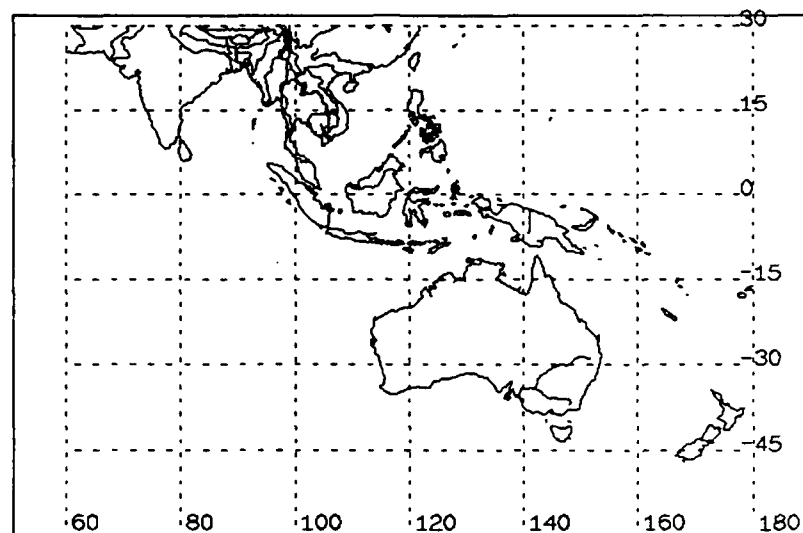


FIGURE 7. AUSTRALASIA AND SE ASIA RDF DATA.

SCN FILES

These files hold the screen location of each plotted point and reproduce material very quickly. To be accurate, the original conditions of map area and projection must be repeated. The resolution parameter affects their output.

An SCN file might be used when a base map is needed to which a variety of other elements can be added. Special effects may be created by varying conditions from the original - for example outlines within outlines as illustrated in figure 8. Metafiles produced by MAP MAKER will include input from these files.

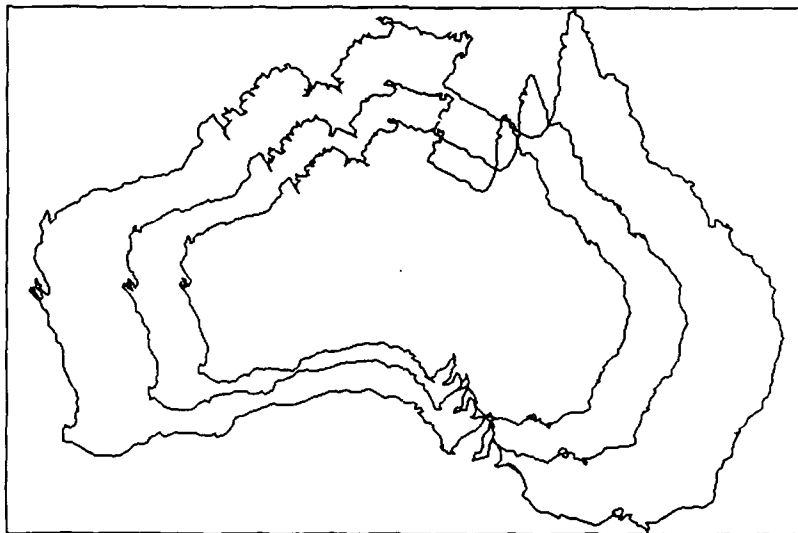


FIGURE 8. AN SCN SPECIAL EFFECT.

SELECTION OF FILES

Both to keep the system as accessible as possible, and to save the author learning time, neither the Windows nor the Turbo Vision operating systems were used. Access to basic files has been built in using a cypher system, and users can also enter file names directly. There can be any number of files specified as source files for the mapping data. Files can be identified from both the presets file and the keyboard. Non-existent files are ignored, and only one file name or one cypher is allowed per line. THE LAST LINE MUST BE EMPTY. That is, following the last file the Enter key must be pressed again.

FILE CYPHERS

The built in identification system allows a two or three digit cypher to be used for MP1 and PNT files. It is made up as a number, a letter and possibly a number. Table 3 shows the range of choices that can be made. The first digit, (from the first column), identifies the feature. Next a letter (from column two) specifies the continental region for MP1 files, or that it is a PNT or RDF file. The final digit (from column three) identifies the path to the file. A choice of zero or the omission of the digit selects the 'current' directory where MAP MAKER is held. For example the coastline of Australia can be selected by 1d if it is in the current directory. There are two coastline features

because of the PNT file structure. SELECTING COASTLINE 1 FOR MP1 FILES WILL NOT GIVE AN MP1 COASTLINE FILE. Selecting 9 or s will give all the features files or all the areas files, or both (Kamaria excluded).

TABLE 3. FILE NAME CYPHER CREATION

Number-Feature	Letter - Area	Path- Path
0 Coastline 1	a Africa	none none
1 Coastline 2	b Antarctica	0 none
2 Islands	c Asia	1 a:
3 Lakes	d Australia	2 b:
4 National boundaries	e Europe	3 c:\maps\
5 Cities	f Greenland	4 d:\maps\
6 Rivers	g N. America	
7 EEZs etc.	h Pacific	
	i S. America	
	j USA	
	k Kamaria	
9 ALL OF 0-6	s ALL OF a-j (MP1 files)	
	t PNT files	
	u Australia & SE Asia(RDF)	
	v World res .5	
	w World res 2	

FILE NAMES

Names may be typed in and may include any path required. The extender (.MP1, .PNT, .RDF or .SCN) should be included, but MAP MAKER will add '.RDF' if it is omitted (dot as well). Other extenders are acceptable and will be treated as .MP1 files. MAP MAKER also allows the use of the double quote or ditto cypher (") to repeat the last fully typed entry. Because files that can't be found are ignored, an entry can be any convenient sequence, and subsequent entries can then use the ditto. The ditto can only be used as the first character of a name. An example is given in the options, map data files section. The contents of the ditto will be replaced whenever the first character on the line is not a digit or a ditto.

MAP PRESENTATION

When there are many features on a map it may be desirable to differentiate between them. This can be achieved in the graphics package using the various line types available. To simplify this process the user may choose to produce a different map for each feature, then modify all elements in individual maps and superimpose them in the graphics package. To help with registration, a small dot has been put at the centre of the map, and at the focus if it is different. The graphics package may also be used to convert lines into outlines which can then be shaded

or coloured internally. Figure 9 illustrates a few of the things that can be done, but is in no way comprehensive.

β

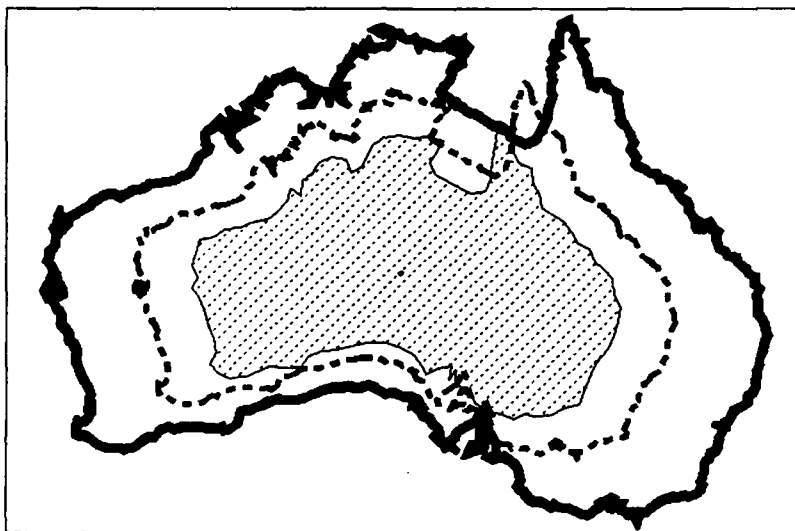


FIGURE 9. USING GRAPHICS PACKAGE FEATURES.

Sometimes it is useful to show one area of the world alongside another with which the reader is likely to be familiar. This can be done by using the graphics package facilities, and 'towing' one to the other, but it may be difficult if the areas are a long way apart, or very different in size etc. Using MAP MAKER it can be achieved in a number of ways. For example, produce separate RDF files of the areas, then use one of them to generate an SCN

file which can then be used with the other RDF file. The map centre and range method for defining areas to be plotted can be used for the last two runs of MAP MAKER keeping the same range value so that the scales are the same. Alternatively, the same latitude range can be used with a bounds defined area. Figure 10 illustrates this.

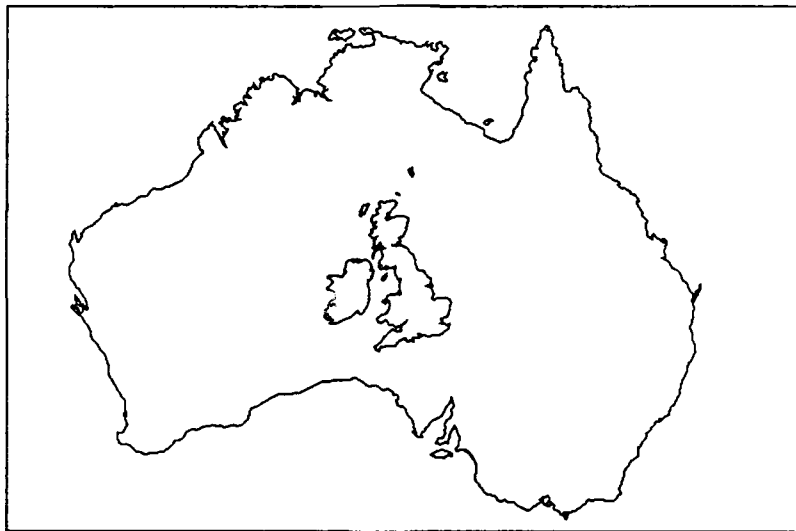


FIGURE 10. MAINLAND AUSTRALIA AND UK AREA.

LOCATING SHIPS AND OTHER FEATURES

The facilities for cities can also be used to locate ships etc (see Map Data Files - MP1 files - City files section). One line in the file is needed per mark, and if only a point is to be marked the 'n' option should be used. The size of the marking point is controlled by the first line of the file, but can be varied or replaced in the graphics package. Figure 11 illustrates two tracks, A having all points labelled and marker size 2 while B only has the first and last points labelled, and uses a marker size 1.

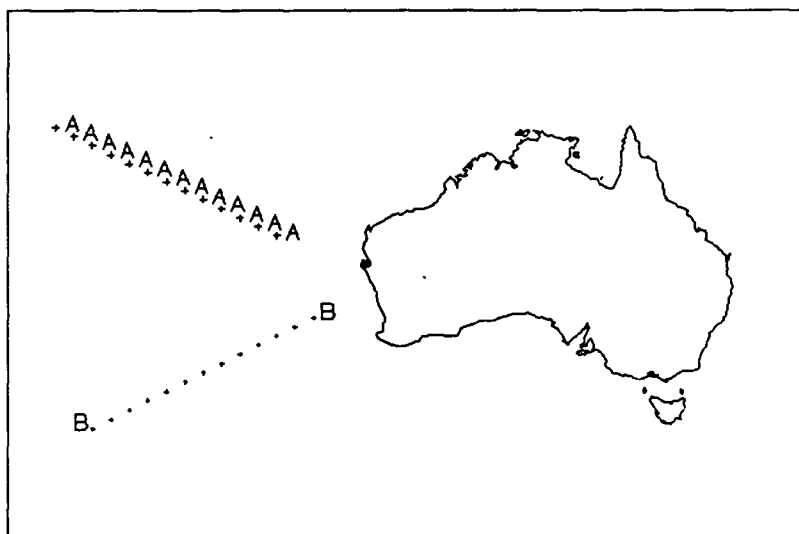


FIGURE 11. SHIP TRACKS.

DIFFICULTIES

Common sources of difficulty are due to:

- (a) not having the map data file available - e.g. still compressed, in the wrong directory, etc;
- (b) not putting a '.' when identifying the presets file;
- (c) using a City file as the first to be plotted;
- (d) failing to finish an MP1 file with a blank line;
- (e) failing to put something in every element of a City file line;
- (f) not using map definition options 1 or 2 (bounds or box corners) when close to a pole;
- (g) using standard parallels for a simple conic projection that are of similar magnitude;
- (h) wrong choice of options such as line and background colours in the graphics package, so that the lines do not print or are faint;
- (i) using too fine a resolution for the capabilities of the graphics package - for example in total points that it can read,

or the number of points that it can accept in a feature that needs to be treated as one objects;

- (j) program failures - try again with some other range of choices, file contents, file order ... or as an last resort contact the author who will probably be at a loss as to what to do next as well!

ACKNOWLEDGEMENTS

1. Plot Micro World Data Bank II Data, (PLOTMWDB). Fred Pospeschil, 3108 Jackson St, Bellevue, NE 68005, USA.
2. "The World Digitized", copyright 1986 John B. Allison. Dept. PC SIG, 166 Shady Lane, Apollo, PA 15613.
3. Map Projections:- A Working Manual. John P Snyder. U.S. Geological Survey Professional Paper 1395; U.S. Government Printing Office, Washington, 1987.

ANNEX A

IMPROVEMENTS OF VERSION 2 OVER VERSION 1

1. Ability to select the presets file (option a).
2. Ability to modify the presets file through the program (option c).
3. Addition of Screen Files (options d, i).
4. Resolution methodology - smaller numbers are now required to achieve a similar result (option e).
5. Ability to reject small objects and lines, using the resolution reduction factor (option f).
6. Change in format of the reduced data files to the RDF structure.
7. Addition of the no annotation feature (n) to city files.
8. Addition of marker size control to city files.
9. Addition of the Mercator and Simple Conic projections (options k and others).

10. Addition of Bounds to the map limits (options l and others).
11. Improved handling of map limits - thin wide maps and narrow tall maps can now be specified, as can triangular and irregular quadrilateral limits (options l and others).
12. Gridding can be put on the maps (options r, s).
13. A better database is available (.PNT files).
14. A marked improvement in production speed.
15. The program re-start facility (option u).
16. Provision of Australia-SE Asia regional data files.
17. Provision of coarser resolution maps.
18. Provision of Kamaria etc.

ANNEX B

PRESETS FILE LAYOUT

MAP MAKER Presets file. Generally use 0 for manual (keyboard) input.

```
1.25  pxtasprat:- pixel aspect ratio
0      modify this file 0-manual; m=yes, d=no
0      output form 1=screen 2=metafile 4=screen file 8=RDF file.
Add to mix
0      resolution required for map output. .1 fine, 5 OK
0      resolution reduction factor that allows small objects to
      be plotted.
0 0    max x and y on screen. NEXT 3 LINES META, SCREEN, RAW
FILE IDs
```

```
0 map type 1=lat-long, 2=Equal distance, 3=Mercator, 4=S.Conic
0 map type 2. 1=Bounds 2=Box 3=Centre 4=Centre & focus
0 0 map centre lat & long
```

0 map range - centre to y limit in n miles
0 0 map focus lat & long (both maptypes 1 & 2 as 2)
0 0 0 0 0 0 lats & longs of bounding map box
0 0 standard parallels for the simple conic projection
0 gridded - 0=keyboard input y=yes c=choose grid values n=no
0 0 0 0 Grid lat1 and increment, long1 and increment

Above lines are file identifications for input data files. THE LAST ONE MUST BE EMPTY.

ANNEX C

FILES SUPPLIED

The system is provided on a number of disks containing compressed (archived) files. They are self-unarchiving, and are activated by executing them. Archive files have been kept small enough to fit on to 360K disks, but will expand by a factor of up to three, so the total space occupied including the original file will increase substantially. Many users will not need all files, and it is not necessary to expand all files. The following tables identify the archive files, approximate sizes and summarize their contents. The compressed files occupy just over 2Mbytes, and when fully expanded fill about 6.5Mbytes (including the original files).

TABLE C-1. ARCHIVE FILES

Name	Size	Comments
AEMPL.EXE	346,518	MP1 files begin-
XMP1.EXE	308,425	ning in A and E
COUIRPNT.EXE	329,580	Other MP1 files
		Country, Island
		& River PNT files
CSTLSPNT.EXE	342,214	Coast, Lake &
		State PNT files
RDF.EXE	245,355	RDF files AUSEA,WM
MAPFXES.EXE	169,517	EXE, TPU etc
MAPPROGS.COM	31,294	Source programs
MAPDOC.EXE	285,861	Documentation

TABLE C-2. TOTAL SPACE USED BY FILES

Type of file	Size
Archive	2,058,764
MP1	1,794,250
PNT	1,068,408
RDF	290,258
EXE, TPU etc	310,909
Program	88,977
Documentation & figures	882,659

TABLE C-3. MP1 FILES

Name	Ext	Size	Name	Ext	Size
AF0	MP1	38,857	KAM1	MP1	55,954
AF1	MP1	30,009	E0	MP1	117,029
AF2	MP1	18,157	E1	MP1	102,572
AF3	MP1	70,086	E2	MP1	33,773
AN0	MP1	43,909	E3	MP1	27,150
AN1	MP1	8,019	GR0	MP1	86,013
AS0	MP1	121,197	GR1	MP1	33,846
AS1	MP1	137,894	NA0	MP1	126,967
AS2	MP1	17,587	NA1	MP1	284,124
AS3	MP1	42,449	SA0	MP1	86,135
AS6	MP1	234	SA1	MP1	66,126
AU0	MP1	34,360	SA2	MP1	2,142
AU1	MP1	27,552	SA3	MP1	28,440
AU2	MP1	10,235	USA0	MP1	24,425
AU4	MP1	328	USA1	MP1	3,605
AU6	MP1	10,137	XCK1	MP1	23,096
KAM0	MP1	64,332	PA1	MP1	17,511

TABLE C-4. PNT FILES

Name	Ext	Size	Name	Ext	Size
COAST1	PNT	192,000	LAKE	PNT	90,708
COAST2	PNT	257,802	RIVER	PNT	169,164
COUNTRY	PNT	134,154	STATE	PNT	13,554
ISLAND	PNT	211,026			

TABLE C-5. RDF FILES

Name	Ext	Size	Name	Ext	Size
AUSEA0	RDF	37,704	WMH2	RDF	11,188
AUSEA1	RDF	59,700	WMH3	RDF	19,388
AUSEA2	RDF	8	WMH5	RDF	24,360
AUSEA3	RDF	13,448	WM20	RDF	12,052
AUSEA5	RDF	14,512	WM21	RDF	7,548
AUSEA6	RDF	2,768	WM22	RDF	2,856
WMH0	RDF	50,292	WM23	RDF	6,876
WMH1	RDF	26,440	WM25	RDF	7,112

TABLE C-6. EXE, TPU ETC FILES

Name	Ext	Size	Name	Ext	Size
BSLNCNV	EXE	6,112	PHMRV	TPU	4,960
EGAVGA	BGI	5,554	PHMSEL	TPU	31,168
GRAPH	TPU	32,336	PHMUBL	TPU	8,160
HP2LL	EXE	45,072	PHYSMAP	EXE	70,896
MATHFUNC	TPU	5,600	PRESETS	BAK	1,066
METAHEAD	CGM	513	PRESETS	MAP	1,063
NEWKAM	EXE	7,216	PRESETS	NUL	1,029
PHMCNV	TPU	5,040	PRESETS	OLD	946
PHMINP	TPU	15,888	TURBO	TPL	45,344
PHMOP	TPU	22,944			

TABLE C-7. PROGRAM FILES

Name	Ext	Size	Name	Ext	Size
BSLNCNV	PAS	1,607	PHMOP	PAS	18,854
MATHFUNC	PAS	3,369	PHMRV	PAS	3,810
NEWKAM	PAS	1,762	PHMSEL	PAS	18,727
PHYSMAP	PAS	1,597	PHMUBL	PAS	5,920
PHMAPIDS	PAS	2,963	CLEANMP1	PAS	1,984
PHMCNV	PAS	4,215	HP2LL	FOR	8,562
PHMINP	PAS	15,607			

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16. Abstract Described is application of the MAP MAKER program for PCs to produce maps of user defined areas and projections, for insertion in word processor documents. A graphics package can be used as an intermediate process, with all the advantages so implied. Options include map delimitation by latitude and longitude, level of detail, creation of reduced data set files to speed map production, some point annotation capability and gridding. A number of data sets provided with the program are also described.	