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**AUTHORITY**

AFWL ltr 30 Nov 1971

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WORLD, A SUBROUTINE FOR DIGITAL PLOTTING OF CONTINENTAL OUTLINES AND GEOGRAPHICAL DATA

Robert E. Wiley
Capt USAF

TECHNICAL REPORT NO. AFWL-TR-69-126
October 1969

AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base
New Mexico

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FOREWORD

This research was performed under Program Element 61102H, Project 5710, Subtask PA051, and was funded by the Defense Atomic Support Agency (DASA).

Inclusive dates of research were July 1968 to December 1968. The report was submitted 6 October 1969 by the Air Force Weapons Laboratory Project Officer, Captain Robert E. Wiley (WLTH).

The latitude-longitude data defining the continental outlines was obtained from the National Center for Atmospheric Research along with a sample program for plotting the modified mercator map. Subroutine ELIM is the only routine which remains essentially unchanged from the NCAR version.

Information in this report is embargoed under the U.S. Export Control Act of 1949, administered by the Department of Commerce. This report may be released by departments or agencies of the U.S. Government to departments or agencies of foreign governments with which the United States has defense treaty commitments, subject to approval of AFWL (WLTH).

This report has been reviewed and is approved.

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ABSTRACT
(Distribution Limitation Statement No. 2)

WORLD is a general-use computer subroutine which draws maps containing continental outlines and overlays data on the map. Projection of maps may be modified mercator, equidistant polar, or hemispherical.
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SECTION I
INTRODUCTION

Frequently one generates or obtains data which readily lends itself to plots that emphasize the positional relationship between the data and the earth. Generally this means that one must plot the data on a standard map of the earth (e.g., Calcomp paper W2), and be limited by the fixed scale, or draw a simple grid labeling the latitudes and longitudes and neglect the geographical features of continents, etc. Use of subroutine WORLD allows one to draw a map of reasonable size of any section of the earth (excluding the polar regions) and plot data on this map. The projection of the plot may be either modified mercator, equal-distance polar, or hemispherical. Hemisphere projections may be done as if viewed from any point above the earth.
SECTION II

HOW TO USE THE ROUTINE

The calling statement for WORLD is as follows:

CALL WORLD (XLONG, YLAT, N, XSIZE, YSIZE, XEAST, XWEST, YNORTH, YSOUTH, MAP, IPLOT, IEND, IXAX, IX, IYAX, IY, ITLE, IT, LABEL, IL) where

XLONG     The array containing the logitude data. The data must be in degrees, but may be in the range 0° to 360° or -180° to +180° (- indicates west longitude and + east)

YLAT      The array containing the latitude data. The data must be in degrees and in the range -90° to +90° (- indicates south latitudes and + north)

N        The number of data points in the arrays XLONG and YLAT. If N = 0 no data will be plotted, although any operations specified by other parameters will be performed.

XSIZE     The length of the longitude axis in inches.

YSIZE     The length of the latitude axis in inches. For polar or hemispherical projection YSIZE is the diameter of the map.

XEAST     The longitude of the eastern boundary of the map. Units must be consistent with definition of XLONG. Not used for polar map. For MAP=5, longitude of viewing position.

XWEST     The longitude of the western boundary of the map. Units must be consistent with definition of XLONG. Not used for polar map. For MAP=5, latitude of viewing position.

YNORTH    The northern boundary of the map. Units must be consistent with the definition of YLAT. Boundary of north polar map.

YSOUTH    The southern boundary of the map. Units must be consistent with the definition of YLAT. Boundary of south polar map.
MAP Indicates the type of projection. The values which MAP may have and what each indicates are

1. Modified mercator projection
2. Hemisphere viewed from above the equator
3. North polar projection
4. South polar projection
5. Hemisphere but viewed from some point other than the equator. Viewing position specified by XEAST and XWEST.

ILOT An indicator which allows the user to reuse the mapping region defined in the previous call to the subroutine. ILOT = 0 indicates that a new mapping region and/or a new scale is being defined with this call; therefore a new map is needed. ILOT = 1 indicates that the same region as the previous call is being used, but that a new map of the region is desired. (This value of ILOT should be used only after a call defining IEND = 0. See below.) Any other definition of ILOT indicates that this call defines new data which is to be plotted over the data plotted in the previous call.

IEND The plot advance control. IEND = 0 will plot the data for this call and advance the plotter to the origin of the next plot. Distance between plots = 4.0 inches. Any other definition of IEND will not terminate the plot and subsequent calls to the subroutine will cause the new data to be plotted over the older data.

IXAX Contains the longitude axis label in Hollerith format. Unused if no label desired.

IX Number of characters in IXAX. Must = 0 is no longitude label is desired or for polar projection.

IYAX Contains the latitude axis label in Hollerith format. Unused if no label desired.

IY Number of characters in IYAX. Must = 0 if no latitude label is desired for polar projection.

ITLE Contains the plot title in Hollerith format. Unused if no label desired.
IT

Number of characters in ITLE. Must = 0 if no plot title is desired.

LABEL

Contains any identification which the user wishes to apply to this set of data. The identifier must be in Hollerith format. It will be positioned above and along the line beginning with the first point inside the mapping region.

IL

The number of characters in LABEL. Must = 0 if no data identification is desired.

NOTE 1:
The user must make provision for a physical TAPE3, EF20, 1/2 inch, 556 BPI.

NOTE 2:
For the special case of using WORLD with Calcomp W2 paper, use the following parameters: XSIZE = 9.0, YSIZE = 18.0, XEAST = 360.0, XWEST = 0, YNORTH = 90.0, MAP = 1, IPLOT = 2. Other parameters may be set as appropriate.

Considerable effort has been expended to make subroutine WORLD as general as the average programmer may need. If problems do occur or if help is needed on very specific problems, contact Captain Wiley, WLTH, AFWL.
SECTION III
GENERAL COMMENTS TO THE USER

The WORLD package consists of a main routine, WORLD, and 11 supporting routines. All control of the supporting routines is determined by the calling parameters of WORLD. WORLD has the following capabilities:

1. To draw a map of any specified region and label it as desired.
2. To draw a map and overlay data.
3. To overlay several sets of data on same map.
4. To ignore all data falling outside the specified map region.
5. To do any of above in mercator, polar, or hemispherical projection.

There are some limitations on the use of this routine. Although the calling sequence specifies both XSIZE and YSIZE, one or the other is always ignored. If YSIZE is 10.0 inches or less, then XSIZE will be adjusted to ensure that the latitude and longitude scaling factors are equal. If YSIZE is greater than 10.0 inches, but XSIZE is 10.0 inches or less, then YSIZE will be adjusted to ensure that the scaling factors remain equal. (This will result in a reorientation of the axes and the values of XSIZE and YSIZE will be switched, which may cause problems in the calling program.) If both XSIZE and YSIZE are greater than 10.0 inches, the size is incompatible with the Calcomp plotter; therefore WORLD will print an error message and stop execution. Even though the range of all longitudes can be -180 to +180 when calling WORLD, the returned values will be between 0 and 360, as will be all longitude labels on the plot. In addition, the YLAT array will be altered when doing polar projections. When MAP = 5, XWEST, XEAST, XLONG, and YLAT are all changed to the new, rotated coordinate system.

Features of mercator maps include a boundary around the map with tick marks every inch on all four sides, latitude values defined at each tick mark along the left edge with longitude values defined along the bottom, and any labels which the user provides. Polar projections will have the diameter of YSIZE. Quadrant longitudes will be drawn and labeled. North polar maps have 0° longitude at the bottom while south polar maps have 0° longitude at the top. Latitude circles will be drawn and labeled every inch from pole to boundary.
It must be pointed out to the user that each call to the routine which specifies that a new region is to be mapped involves rewinding a tape, reading that tape, and sorting the data. Therefore, one should use care in defining the calling parameters so that unnecessary tape handling can be avoided. Remember that one can change the scaling (i.e., the size) without doing any tape handling as long as the map region remains constant. (HINT: Copying the physical tape to a disk TAPE3 will reduce the tape handling problem.)

Each of the major subroutines is briefly described below:

**SCALE**
Uses the calling parameters XEAST, XWEST, YNORTH, YSOUTH and MAP to fit the map into the area specified by YSIZE and/or XSIZE and set scaling factors for other subroutines.

**DRAW**
Plots the continental outlines in the desired projection.

**ELIM**
Eliminates all continental areas outside of map region.

**MPLOT2**
Scales and plots the user's data over the world map.

**TITLE**
Draws boundaries and labels plots.

**VIEW**
Transforms the continental outline and plot data to the proper viewing angle.

The normal starting point for all plots except Calcomp W2 is 1/2 inch from the right edge of the Calcomp paper. For W2, the zero point is -90° latitude and 0° longitude (i.e., the crosshairs must be at -90° latitude and 20° longitude).

Subroutine WORLD is used in conjunction with any of the Calcomp plot packages or simulation routines.

**ERROR MESSAGES**

**SIZE IS INCOMPATIBLE WITH CALCOMP PAPER SIZE.**

**XSIZE = XX.XX**

**YSIZE = XX.XX**

occurs whenever both XSIZE and YSIZE are greater than 10.7 inches.
SAMPLE PLOTS
Figure 1. Modified Mercator

CALL WORLD (DUM, DUM, 0., 6., 135., 355., 90., -90., 1, 0, 0,
99LONGITUDE, 9, 99LATITUDE, 8, 169TEST OF MERCATOR, 16, DUM, 0)
Figure 2. Hemisphere

CALL WORLD (DUM, DUM, 0, 6., 6., 155., 355., 90., -90., 2, 0, 0,
DUM, 0, DUM, 0, 18HTEST OF HEMISPHERE, 18, DUM, 0)
Figure 3. North Polar

CALL WORLD (DUM, DUM, 0, 6., 6., DUM, DUM, 0., DUM, 3, 0, 0, DUM, 0, DUM, 0, 19HTEST OF NORTH POLAR, 19, DUM, 0)
Figure 4. South Polar

CALL WORLD (DUM, DUM, 0, 6., 6., DUM, DUM, DUM, 0., 4, 0, 0, DUM, 0, DUM, 0, 19, TEST OF SOUTH POLAR, 19, DUM, 0)
Figure 5. Hemisphere (Off-Equator View)

CALL WORLD (DUM, DUM, 0, 6., 6., 250., 45., 90., -90., 5, 0, 0, 0.0, 0, DUM, 0, DUM, 0, 24HTEST OF OFF-EQUATOR VIEW, 24, DUM, 0)
Figure 6. Data Plot

CALL WORLD (XLONG, YLAT, N, 6., 6., 360., 180., 90., -90., 1, 0, 0,
9HLONGITUDE, 9, 8HLATITUDE, 8, 22HSATELLITE GROUND TRACK, 22,
6HPASS 1, 6)
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SUBROUTINE WORLD (XLONG, YLAT, N, VE17F, VE17F, YEACT, YNORTH, YEQUA)

COMMON XFACTOR, XFACTOR, YEAC, YEAD, VE17F, YE17F, XDIS, YC7, YC7

COMMON XPLAT, YPLAT, XPLAT, YPLAT

DIMENSION XLONG(1), YLAT(1)

YC7, YC7

COMMON X, Y, N, N, N

IF (IPLOT, NEQO) GO TO 1

CALL SCALE (XLONG, YLAT, N, VE17F, VE17F, YEACT, YNORTH, YEQUA, XPLAT, YPLAT)

1: IF (IPLOT, NEQO) GO TO 1

CALL TITLE (IXAX, IXAX, ITLE, IXAX, ITLE)

IF (IPLOT, NEQO) GO TO 2

CALL DOWM (IPLOT)

2: IF (IPLOT, NEQO) GO TO 3

CALL WPL (XLONG, YLAT, N, LABEL, IL)

3: IF (IPLOT, NEQO) RETURN

CALL PLOT (YI7F, 0, 0, 0, 0)

RETURN

END
SUBROUTINE SCALE (YV, NV, V4, V5, V6, V7, YWEST, YMO, YOUTH, MAD, SCL)

CALL XSLMADD, SPLIT, MAD, DECREASE, DOT
CALL XSCKEY, YV, NV, YVE, Y6, Y7, Y8
CALL XSCKEY, YWEST, YVE, Y6, Y7, Y8, YVE, Y7, Y6

YHIE IS IN INCHES, REFERS TO THE LATITUDE DIRECTION IF LESS THAN
10 INCHES, IF MORE THAN 10 INCHES AND YHIE LESS THAN 10 INCHES, SCL
THEY DEFINE DETERMINES THE SIZE OF THE MAP, IF BOTH YHIE AND
YHIE ARE GREATER THAN 10 INCHES THEN THE ERROR EXIT IS TAKEN.
YHIE IS A SHIFTER ON MAP FOR POLAR PROJECTION.
YHIE IS IN INCHES, REFERS TO THE LONGITUDE DIRECTION NORMALLY.
SEE YHIE FOR SPECIAL CASES.
YVE, YWEST, YOUTH ARE IN DEGREES AND DEFINE BOUNDARIES
OF MAP.

LOGICAL DECREASE
LOGICAL SPLIT
INTEGER DOT
DECREASE = .FALSE.
IF (YHIE,GT,10.0) GO TO 1
GO TO 2
1 IF (YHIE,GT,10.0) GO TO 12
DECREASE = .TRUE.
YHIE = YHIE
YWEST = YWEST
YOUTH = YOUTH
DATA (IF (SPLIT,EQ,0) CALL VIEW (YWEST, YMO, Y7, Y6, Y5, SCL)
SPLIT = .FALSE.
GO TO (37, 36, 35, 34)
SPLIT = .TRUE.
37 (YWEST, LT, 10) MAD
IF (YWEST, LT, 10) YWEST = YWEST + 1
IF (YWEST, LT, 10) YWEST = YWEST + 1
IF (YWEST, LT, 10) YWEST = YWEST + 1
YWEST = YWEST
YVE = YVE
YWEST = YWEST
IF (YWEST, LT, 10) GO TO 2
YWEST = YWEST + 1
SPLIT = .TRUE.
4 CONTINUE
YVE = YVE + 1
YWEST = YWEST + 1
YVE = YVE + 1
IF (DECREASE, EQ, 1) A
YWEST = YWEST
YMO = YMO + 1
CONTINUE
YVE = YVE + 1
YVE = YVE + 1
YVE = YVE + 1
YMO = YMO + 1
17
SUBROUTINE POLFOR

THE ROUTINE PLOTTES THE ORIGI MAD

COMMON /SEQ,MD, /SEQ1,M
COMMON /FACT1,XFAC,YFAC,VZERO,YZERO,XM1,Y1ZEN
DATA RAN/47,2057789131/;DAT1/4017243/
GO TO (1,12,2,11), MAD
1 JUMP
[X1=X*FACT1*Y1ZEN+001]
IF ((V2-VZERO-1CM1)*LT.001) YNO=1YN
GO A 15B,15Y
YNO=10
PH16n
CONTINUE
GO 1 1S1,16A
Y2=YFAC(YV1)YNO=7YFAC=001
Y2=YFAC(YM1)YNO=1YFAC=001
IF (1,1201) CALL PLOT (XX,YY,2)
CALL PLOT (YY,YY,2)
PH16B1+4DAN
2 CONTINUE
CALL PLOT (YY,YY,2)
IF (MAP,FO,6) GO TO 8
CALL NUMBER =XYY-1,07,001/XX/XX+10+14HFR,1)
GO TO 8
4 CALL NUMBER =YY+1,07,001/YY+10+14HFR,1)
IF (JUMP,FO,1) GO TO 7
5 CONTINUE
JUMP
XX+1=XX+YEAF
GO TO 2
7 IF (MAP,FO,6) GO TO 8
CALL NUMBER =07,001/XX/XX+10+14HFR,1)
GO TO 8
8 CALL NUMBER =07,001/YY+10+14HFR,1)
9 CALL PLOT =07,001/YY+10+14HFR,1)
GO TO 8
10 CALL NUMBER =07,001/YY+10+14HFR,1)
11 CALL PLOT =07,001/YY+10+14HFR,1)
GO TO 8
12 CALL NUMBER =07,001/YY+10+14HFR,1)
13 CALL PLOT =07,001/YY+10+14HFR,1)
RETURN
ZERO=VS17ES,6
PH16n
GO 17 1=1760
Y2=YFAC(YV1)YNO=7YFAC=001
Y2=YFAC(YM1)YNO=1YFAC=001
IF (1,1201) CALL PLOT (YY,YY,2)
CALL PLOT (YY,YY,2)
PH16B1+4DAN
19 CONTINUE
CALL PLOT (YY,YY,2)
RETURN
END

PLG 1
PLG 2
PLG 3
PLG 4
PLG 5
PLG 6
PLG 7
PLG 8
PLG 9
PLG 10
PLG 11
PLG 12
PLG 13
PLG 14
PLG 15
PLG 16
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PLG 52
PLG 53
PLG 54
PLG 55
PLG 56
PLG 57
PLG 58
PLG 59
SUBROUTINE HOLDOT (X,Y,XLHOLD,YLHOLD)

THIS ROUTINE TAKES ARRAYS OF LATITUDE AND LONGITUDE AND PLOTS THE
DATA ON A MAP DRAWN BY WORML

X = LATITUDE (DEGREES, 0 TO +90, OR -100 TO 180)
Y = LONGITUDE (DEGREES, +NORTH, =SOUTH)
NUMBER OF DATA POINTS

COMMON ZEREX, ZEREX, ZEREX, ZEREX, ZEREX, ZEREX
COMMON XHOLD, YHOLD, YHOLD, YHOLD, YHOLD, YHOLD
COMMON YFINAL, SPLIT, MAP, NUEREF, DOT

LOGICAL SPLIT
LOGICAL SPLIT

INTEGER X(1), Y(1)
DATA X(1), Y(1)
VUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVUVU

1 IF (Y(J)+LT;Y(J)) Y(J)=Y(J)+720
2 IF (NOT=EQL) GO TO 20
3 DO 1 J=1,N
4 IF (Y(J)+LT;Y(J)) Y(J)=Y(J)+720
5 IF (SPLIT) =.E.
6 IF (Y(J)+LT;Y(J)) Y(J)=Y(J)+720
7 IF (Y(J)+LT;Y(J)) Y(J)=Y(J)+720
8 IF (Y(J)+LT;Y(J)) Y(J)=Y(J)+720
9 IF (Y(J)+LT;Y(J)) Y(J)=Y(J)+720
10 CONTINUE
11 GO TO 10}

NOT REPRODUCIBLE
NOT REPRODUCIBLE

VXX*YX(X(J4);Y(J4))
Vy*YH(Y(J4))

11 VXX*AY((VY-VY)/(VY-VY))85T
IF (1L<EN I) GO TO 1F
CALL CVRRL (XX0,OR/VX0,OR07/L4FL,VY01L)
CALL PLOT (XX,VY,1)
JPLT+0
IF (J+EN 1) JPLTEN
GO TO 16
16 CONTINUE
JPLT+1
RETURN
14 CONTINUE
JLP2+J+2
DO 28 J=J1,N
IF (Y(1)>LT,0) X(Y(1)+RAN)<0
IF (SNLIT 19,16
16 CONTINUE
IF (X(1)>LT.X/60) X(1)+RAN0
CONTINUE
IF (X(1)+LT.XWEST0,0,X(1)+CT.XWEST) GO TO 24
IF (Y(1)+LT,YOUTH0,0,Y(1)+CT.YNORTH) GO TO 24
IF (1.LT.JP2) GO TO 17
17 CONTINUE
IF (ARK(X(1)-Y(1)-1).CT.XRAY) GO TO 30
19 CONTINUE
IF (JPLT+NF,0) CALL ENDPLOT (X,Y:1+JPLT+J)
CONTINUE
GO TO (10,21), MAP
10 VY=Y(1)+VPAC-YZPRO
XX=X(1)+VPAC-XZPRO
IF (DPVPRSF vs22
20 TEP=XX
XX=VY+0.5VZPNOVRPLFP 
VY=TEMP
GO TO 28
21 XX=XXH(X(1),Y(1))
YY=VYH(Y(1))
22 CALL PLOT (XX,YY,P)
NUM0+1
JPLTEN
GO TO 28
27 JPLT+9
CALL ENGPLOT (X,Y:1+JPLT+J)
JPLT+0
GO TO 18
24 JPLT+P
IF (NUM+EN,0) CALL ENGPLOT (X,Y:1+JPLT+J)
NUM+NUM+1
JPLT+1
CONTINUE
CALL PLOT (XX,YY,3)
OPTION
CONTINUE
JPLT+1
FACT+1+0
DO 30 J=1,N
IF (MAP+EN,4) GO TO 27

24
IF (Y(J) LT YNORTH) GO TO 30
Y(J) = CO - Y(J)
GO TO 20

27 FACT = 1.0
IF (Y(J) GT YSOUTH) GO TO 30
Y(J) = Y(J) + 0.0

28
XY = SIN(X(J) + RAD) * Y(J) * YFAC * YZPD
YY = FOC(X(J) + RAD) * Y(J) * YFAC * YFAT * YZPD

30
YY = ATAN((YY + YY) / (XX - YY)) * 67.3
IF (IL = 0.0) GO TO 20
CALL SYMBOL (XX, YY, OR, OT, LABEL, YY, IL)

20 CALL PLOT (XX, YY, 0)
JPLT = 0
GO TO 31
30 CONTINUE
RETURN
21 CONTINUE
J = J + 1
IF (J = AT N) RETURN
GO TO 17
IF ("20") GO TO 32
Y(J) = CO - Y(J)
GO TO 33

32 IF (Y(J) LT YNORTH) GO TO 34
IF (Y(J) LT 0.0) X(J) = X(J) + 360
YY = COS(X(J) + RAD) * Y(J) * YFAC * YFAT * YZPD

34 XX = NV(X(J) + RAD) * Y(J) * YFAC * YFAT * YZPD
IF (JPLT = 0) CALL PLOT (XX, YY, 0)
CALL PLOT (XX, YY, 0)
JPLT = 0
GO TO 36
36 CONTINUE
CALL PLOT (XX, YY, 0)
RETURN
END
SUBROUTINE DGOPLOT (XY, JJ, JFAC, JFFAC, YFAC, JFREQ, JFFREQ, YFREQ, JFREV, JFFREV, YFREV)

IF (YYFAC < 0) THEN
    IF (YYFREV < 0) THEN
        IF (YYFREV > 0) THEN
            YYFREV = -YYFREV
        END IF
    END IF
    IF (YYFREV > 0) THEN
        YYFREV = -YYFREV
    END IF
END IF

IF (YYFAC > 0) THEN
    IF (YYFREV > 0) THEN
        YYFREV = -YYFREV
    END IF
    IF (YYFREV < 0) THEN
        YYFREV = -YYFREV
    END IF
END IF

DX = X - XX
DY = Y - YY

IF (DX < 0) THEN
    DX = -DX
    YYFAC = -YYFAC
END IF

IF (DY < 0) THEN
    DY = -DY
    YYFREV = -YYFREV
END IF

IF (YYFAC < 0) THEN
    YYFAC = -YYFAC
    YYFREV = -YYFREV
END IF

IF (DY < 0) THEN
    YYFREV = -YYFREV
END IF

FINISH

END SUBROUTINE
```
1  IF (DEVERSE) 19,19
   TEMO=VV
   YVE=VV$V@AC-V7E0A
   VV=TEMO
   CONTINUE
14  YX=XY(YEST,1VIN)
   VV=VY(VIN)
15  CALL PLOT (VV,YY,3)
   YVE=VY(J)+VEAC-Y7E0A
   YVE=VY(J)+VEAC-Y7E0A
   IF (MAP=LT,2) GO TO 27
   YX=XY(Y,1Y(J))
   YV=XY(V(J))
   GO TO 27
16  YINAY(Y,J4)+(YEST-J(J))/((Y(K)-Y(Y(J)))/(Y(K)-Y(J)))
   GO TO (17,20) MOD
17  YVE=XY(VEAC-Y7E0A
   YVE=XY(VEAC-Y7E0A
   IF (DEVERSE) 19,19
   TEMO=VV
   YVE=VV$V@AC-V7E0A
   VV=TEMO
18  CONTINUE
   GO TO 21
21  YX=XY(YEST,1VIN)
   VV=VY(VIN)
22  CALL PLOT (VV,YY,3)
   YVE=VY(J)+VEAC-Y7E0A
   YVE=VY(J)+VEAC-Y7E0A
   IF (MAP=LT,2) GO TO 27
   YX=XY(Y,J),Y(J)
   YV=XY(V(J))
   GO TO 27
23  YINAY(Y,J4)+(YEST-J(J))/((Y(K)-Y(Y(J)))/(Y(K)-Y(J)))
   GO TO (23,20) MOD
24  YVE=XY(VEAC-Y7E0A
   YVE=
   IF (DEVERSE) 24,26
25  TEMO=VV
   YVE=VV$V@AC-V7E0A
   VV=TEMO
   GO TO 24
26  YX=XY(YIN,YERUY)
   VV=XY(YIN)
27  CALL PLOT (XX,YY,3)
   YVE=VY(J)+VEAC-Y7E0A
   YVE=VY(J)+VEAC-Y7E0A
   IF (MAP=LT,2) GO TO 27
   YX=XY(Y,J),Y(J)
   YV=XY(V(J))
28  GO TO (28,10) MOD
29  IF (DEVERSE) 29,30
30  TEV=XY
```
"SUBROUTINE TITLE (XAXIS,YAXIS,PLTLE,NBX,NEY,NPY,NOT)"

* C
* THIS SUBROUTINE LABELS THE AXES AND TOP OF THE PLOT AS WELL AS
* DRAWING THE BOUNDARIES.
* C
* DIMENSION XAXIS(1), YAXIS(1), PLTLE(1)
* COMMON /SCLMAP/ SPLIT,MAP,REVERSE
* COMMON /FACTOR/ XFACE,YFACE,XFAC,YFAC,YDIS,YSIDE,XSIZE
* LOGICAL DEVERSE
* INTERFACE XAXIS,YAXIS,PLTLE
* S12F,47
* C
* PLOT XAXIS LABEL
* IF (NBX.EQ.0) GO TO 1
* CALL POIT (NAX,0,NF,XS12F,XSIZE)
* IF (DEVERSE) 1,2
* 1 CALL SYMVAL (-33,F,517F,YAXIS,00,NAY)
* GO TO 3
* C CONTINUE
* 2 CALL SYMVAL (01,F,517F,YAXIS,00,NAY)
* IF (NBX.EQ.0) GO TO 4
* CALL POIT (NPY,0,NF1,XS12F,XSIZE)
* IF (DEVERSE) 4,5
* 4 CALL SYMVAL (01,F,517F,YAXIS,00,NAY)
* GO TO 3
* C CONTINUE
* 5 CALL SYMVAL (-36,F,517F,YAXIS,00,NAY)
* IF (NBX.EQ.0) GO TO 7
* S12F,14
* CALL POIT (NPT,0,NF,XS12F,XSIZE)
* IF (DEVERSE) 7,8
* 7 CALL SYMVAL (XS12F,15,YS12F,01,F,517F,PLTLE,-30,NAT)
* GO TO 6
* C CONTINUE
* 8 CALL SYMVAL (01,F,517F,YS12F,15,S12F,PLTLE,00,NAT)
* CONTINUE
* GO TO (12,17,11,11), MAP
* CALL POLEFB
* C RETURN
* C DRAW BORDER
* 12 IF (NXY.EQ.0001) RETURN
* CALL PLOT (00,0,13)
* IF (NBX.EQ.0 AND NPY.EQ.0 AND NAT.EQ.0) RETURN
* XFAC=1/YFACE
* DO 15 I=1,15
* XSAMP=(I*XFAC)*XPER,3AD01
* CALL PLOT (X-10,15)
* CALL PLOT (X+10,15)
* IF (DEVERSE) 14,17
* 14 CONTINUE
* CALL MINREP (X,-24,-2,0,07,XS12F,47,01)
* CONTINUE
* 15 CALL PLOT (X+0,3)
* IF CONTINUE
NOT REPRODUCIBLE

```
SUMMARY TF=200.04 (YV1,YV2,YV3,YV4,YV5,YV6,YV7) TF=1
  YV1=1, YV2=2, YV3=3, YV4=4, YV5=5, YV6=6, YV7=7

COMMON /A/ A(100)

1 IF (A(l),GO TO 100), ANGO (YV1), YV2, YV3, YV4, YV5, YV6, YV7)
  GO TO 1
  2 CONTINUE
  3 OPTION

TF= 20
```
WORLD is a general-use computer subroutine which draws maps containing continental outlines and overlays data on the map. Projection of maps may be modified mercator, equidistant polar, or hemispherical.
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