KANSAS GEOLOGICAL SURVEY
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WHEAT SOURCE CODE

by

G. Pouch

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Open-file Report

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Source Code for WHTGCTP: WHEAT General Cartographic Transformation Package Program

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Abstract

This report describes the workings of WHTGCTP, a user-friendly program that converts coordinates from one projection system to another. WHTGCTP is an event-driven program written in Visual Basic 3.0 Professional and is essentially a "wrapper" around the conversion routines in the General Cartographic Transformation Package library, which is here used as a Windows Dynamic Link Library. WHTGCTP was originally designed to be used with WHEAT, a set of computer-based mapping programs for Windows, but can be readily adapted to work with other file formats.

Unlike most graphical user interface programs, WHTGCTP is intended to be used rarely, so the program leads the user through the transformation process. WHTGCTP intentionally makes defining coordinate systems difficult for the user, to discourage use of too many coordinate systems.

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Introduction

was designed to be used with WHEAT, an open, user-friendly, electronic mapping package developed at KGS (Pouch, 1994, 1995, 1996a, 1996b). WHEAT uses coordinates stored in a database. WHEAT assumes that the coordinates of geographic features are in an isotropic, right-handed coordinate system, such as Universal Transverse Mercator or State Plane Coordinates systems.

Which fields are used as coordinates is determined at run-time based on user selections; this allows multiple coordinate systems in a single table. (The designation of fields is based on Structured Query Language statements that define the data for a particular theme.)

Overview of GCTP

The GCTP is a Fortran library of projection routines for a wide selection of map coordinate systems. (Elassal, 1987). WHTGCTP uses a copy of GCTP obtained over the internet from the USGS at charon.er.usgs.gov: this may not correspond exactly to the original GCTP, although it does seem to project coordinates properly. The "internet" copy is included in this document. The coordinate systems used in GCTP are explained in Elassal (1987) and Pouch (1996c). An excellent overview of map projection systems is available as Snyder (1982).

In WHTGCTP1, the GCTP library of routines has been compiled into a 16-bit Windows Dynamic Link Library (DLL) using Microsoft Fortran 5.1. This is compiled and linked to make a DLL using the following batch job (dllmake.bat)

```
fl  /c /Aw /Gw /4Yd /4I4 /4Nb  /FPc /G2   %1.for
link  %1.obj, %1.dll , nul, /NOD ldllfew.lib, %1.def
```

This implementation of GCTP does not allow the direct use of State Plane Coordinates: See subroutine PJ02Z0 in GCTP0001.FOR if you wish to try fixing this. I am not certain whether the files FILE1.ORI and FILE2.ORI contain correct projection parameters for the various State Plane Coordinate zones, nor is it clear where a DLL will try reading from, nor do the READs seem to make sense. Good luck.

Overview of WHTGCTP

WHTGCTP is essentially a graphical user-interface wrapper around a dynamic link library (DLL). Before anything else can be done, the user must open two PRJ files that define the projection systems. (See on-line help and the WHTGCTP1 User's Manual.) These contains all the information necessary to define the projection to GCTP. At any time, the user is allowed to open new PRJ files, thus re-defining the input and output systems for subsequent transformations.

Once the input and output projection systems are defined, the user can interactively enter point locations (very unlikely), or choose one of the other tabs to project coordinate pairs in either X,Y point or coordinate chain format.

A typical session would be as follows.

1. User starts WHTGCTP from Program Manager.
2. WHTGCTP checks command line for PRJ files (routine ParseCommandLine). If it finds the files, it opens them. If not, it prompts the user for input and output projection files (SetCaptions). Nothing much can happen until both files are opened.
3. Ideally, the user would open a database at this point (routine mfOpenDB). Even I forget to do this. Usually, I click on one of the tabs: this checks to see if a database is open. If not, it prompts the user. Once a database is opened, WHTGCTP lists all of the tables/queries in the Table/Query comboboxes on the X,Y and XYChain tabs.
4. With a database open, the use clicks on either the X,Y points or XYChains tab. If there is no table/query yet selected, WHTGCTP sets focus to the Table/Query list and sends itself an ALT-DOWN to get the user to select a table or query. (Routines cmdPoints_Click and cmdBLOBs_Click) The cool tabbed interface is done with three three-D command buttons, three three-D panels, and use of Z-Order.
5. Once a query is selected, WHTGCTP looks at the field names for the current query (routines SetQuery_Points and SetQuery_BLOBs). It tries to match up fields needed with fields available using substring matching.
6. The user can accept WHTGCTP's guesses or override them by selecting fields from the comboboxes. The user can also enter new output field names in the comboboxes.
7. Eventually, the user realizes he/she must click on the command button. When this happens,

   a) WHTGCTP examines the output field names, and creates the output fields if necessary;
   b) loops through the records in the recordset
   c) writes an entry in the table ztblWHEAT_LOG
   d) tells the user that it is done.
8. The user can now select another table or query and project that, leave the program, or choose one of the other tabs.

For each record, WHTGCTP

1) reads the point(s) using standard Visual Basic database handling techniques. (Points are either from two fields for points/text or one field containing XYChains using BLOB2RealPoints for lines/polygons.)
2) projects each point using the GCTP routine GTRNZ0
3) stores the output points in the table using standard techniques. For lines/polygons, they are stored in a single XYChain using RealPoints2BLOB to convert an array of RealPoints to a string containing the array.

Although event-driven programs are easy to use, they are not easy to document, so only a brief overview is given. The reader is advised to get the program, open it in the Visual Basic design environment, and single-step through the program to get an idea of how it works.

Using the GCTP Dynamic Link Library from Other Programs

The DLL GCTP0001.DLL can be directly accessed by other programs. For Visual Basic derived programming environments like MS Access and MS Excel, include the following declarations in your program, and call the routines with **`Call GTRNZ0(dblIn, JCoordSysIn(1), SetupCoordSysIn(1), dblOut, JCoordSysOut(1), SetupCoordSysOut(1), j0, jFlag)`**.

```
Option Explicit
Type typDblePoint
   X As Double
   Y As Double
End Type
Type typRealPoint
   X As Single
   Y As Single
End Type

Global Const OneDegreeInRadians = .01745329251994
Global Const OneRadianInDegrees = 57.29577951308

'GCTP Main routine, calls other routines as appropriate
Declare Sub GTRNZ0 Lib "GCTP0001.DLL" (DblCoordIn As typDblePoint,
   JCoordSysIn As Long, SetupCoordSysIn As Double, DblCoordOut As
   typDblePoint, JCoordSysOut As Long, SetupCoordSysOut As Double, jZero
   As Long, jFlag As Long)

Global Const J0Zero = 0&
Dim CoordSysIn(1 To 13) As Double, CoordSysOut(1 To 13) As Double
Global flgInitialized As Long, j0 As Long, jFlag As Long
Global dblPoint1 As typDblePoint, dblPoint2 As typDblePoint
```

References

Elassal, Atef A., 1987, General Cartographic Transformation Package (GCTP), Version II, NOAA Technical Report NOS 124 CGS 9, 23 pp.

Pouch, G.W., 1994, User's Guide to WHEAT : the Windows-based Hydrogeologic Exploration and Analysis Toolkit, Open File Report 94-51, Kansas Geological Survey, 28 pages.

Pouch, G.W, 1995, *Source code WHEAT EMAPKGS2 2.0*, Open File Report 95-65, Kansas Geological Survey, 678 pages.

Pouch, G.W, 1996a, *How to Use WHEAT Electronic Mapper 2.0: EMAPKGS2*, Open File Report 95-64, Kansas Geological Survey, 10 pages.

Pouch, G.W., 1996b, *WHEAT Software Development Toolkit*, Open File Report 96-??, Kansas Geological Survey, ?? pages.

Pouch, G.W., 1996c, *User's Manual for WHTGCTP1: A User-Friendly Map-Coordinate Projection Program*, Open File Report 96-14, Kansas Geological Survey, 38 pages.

Snyder, John P., 1982, *Map Projections Used by U.S. Geological Survey*, Bulletin 1532, United States Geological Survey, 313 pages.

VB CROSS REFERENCE - TABLE OF CONTENTS

For file: WHTGCTP1.MAK
4/1/96 3:46:00 PM

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Source Listing
PRJALL01.FRM (illustration) 1
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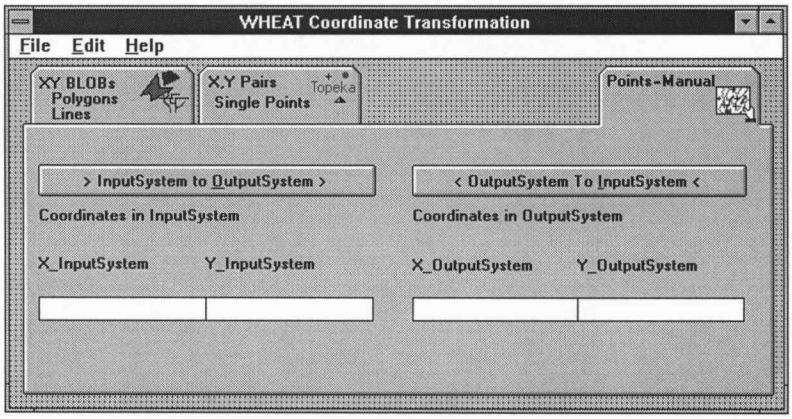
XYBLOB01.BAS: (declarations) 36


WHEAT Coordinate Transformation
File Edit Help
XY BLOBs
Polygons
Lines
X,Y Pairs
Single Points
Topeka
Points-Manual
> InputSystem to OutputSystem >
< OutputSystem To InputSystem <
Coordinates in InputSystem
Coordinates in OutputSystem
X_InputSystem
Y_InputSystem
X_OutputSystem
Y_OutputSystem

```
VERSION 2.00
Begin Form frmProjection_BOTH
   BackColor       =   &H00C0C0C0&
   Caption         =   "WHEAT Coordinate Transformation"
   ClientHeight    =   4095
   ClientLeft      =   735
   ClientTop       =   1695
   ClientWidth     =   8970
   Height          =   4785
   Icon            =   PRJALL01.FRX:0000
   Left            =   675
   LinkTopic       =   "Form1"
   ScaleHeight     =   273
   ScaleMode       =   3  'Pixel
   ScaleWidth      =   598
   Top             =   1065
   Width           =   9090
   Begin SSRibbon cmdManual
      AutoSize        =   1  'Adjust Picture Size To Button
      BackColor       =   &H00C0C0C0&
      BevelWidth      =   0
      Height          =   720
      Left            =   6825
      Outline         =   0   'False
      PictureDn       =   PRJALL01.FRX:0302
      PictureDnChange =   1  'Dither 'PictureUp' Bitmap
      PictureUp       =   PRJALL01.FRX:0F7C
      Top             =   75
      Value           =   -1  'True
      Width           =   1920
   End
   Begin SSRibbon cmdBLOBs
      AutoSize        =   1  'Adjust Picture Size To Button
      BackColor       =   &H00C0C0C0&
      BevelWidth      =   0
      Height          =   720
      Left            =   240
      Outline         =   0   'False
      PictureDn       =   PRJALL01.FRX:1BF6
      PictureDnChange =   1  'Dither 'PictureUp' Bitmap
      PictureUp       =   PRJALL01.FRX:2870
      Top             =   75
      Width           =   1920
   End
   Begin SSRibbon cmdPoints
      AutoSize        =   1  'Adjust Picture Size To Button
      BackColor       =   &H00C0C0C0&
      BevelWidth      =   0
      Height          =   720
      Left            =   2175
      Outline         =   0   'False
      PictureDn       =   PRJALL01.FRX:34EA
      PictureDnChange =   1  'Dither 'PictureUp' Bitmap
      PictureUp       =   PRJALL01.FRX:4164
      Top             =   75
      Width           =   1920
   End
   Begin SSPanel pnlManualEntry
```

```
   59|        BackColor       =   &H00C0C0C0&
   60|        BevelWidth      =   2
   61|        Font3D          =   0  'None
   62|        Height          =   3200
   63|        Left            =   150
   64|        Outline         =   -1  'True
   65|        TabIndex        =   43
   66|        Top             =   750
   67|        Width           =   8715
   68|        Begin TextBox txtJunk
   69|           Height          =   315
   70|           Left            =   15000
   71|           TabIndex        =   41
   72|           Text            =   "This could be scrapped"
   73|           Top             =   2520
   74|           Width           =   615
   75|        End
   76|        Begin TextBox txtYOutSys
   77|           FontBold        =   0   'False
   78|           FontItalic      =   0   'False
   79|           FontName        =   "MS Sans Serif"
   80|           FontSize        =   8.25
   81|           FontStrikethru  =   0   'False
   82|           FontUnderline   =   0   'False
   83|           Height          =   285
   84|           Left            =   6420
   85|           TabIndex        =   37
   86|           Top             =   2040
   87|           Width           =   1950
   88|        End
   89|        Begin TextBox txtXOutSys
   90|           FontBold        =   0   'False
   91|           FontItalic      =   0   'False
   92|           FontName        =   "MS Sans Serif"
   93|           FontSize        =   8.25
   94|           FontStrikethru  =   0   'False
   95|           FontUnderline   =   0   'False
   96|           Height          =   285
   97|           Left            =   4500
   98|           TabIndex        =   36
   99|           Top             =   2040
  100|           Width           =   1950
  101|        End
  102|        Begin TextBox txtYInSys
  103|           FontBold        =   0   'False
  104|           FontItalic      =   0   'False
  105|           FontName        =   "MS Sans Serif"
  106|           FontSize        =   8.25
  107|           FontStrikethru  =   0   'False
  108|           FontUnderline   =   0   'False
  109|           Height          =   285
  110|           Left            =   2100
  111|           TabIndex        =   35
  112|           Top             =   2040
  113|           Width           =   1950
  114|        End
  115|        Begin TextBox txtXInSys
  116|           FontBold        =   0   'False
```

```
117|           FontItalic      =   0   'False
118|           FontName        =   "MS Sans Serif"
119|           FontSize        =   8.25
120|           FontStrikethru  =   0   'False
121|           FontUnderline   =   0   'False
122|           Height          =   285
123|           Left            =   180
124|           TabIndex        =   34
125|           Top             =   2040
126|           Width           =   1950
127|        End
128|        Begin CommandButton cmdOut2In_MANUAL
129|           Caption         =   "< OutputSystem To &InputSystem <"
130|           Enabled         =   0   'False
131|           Height          =   375
132|           Left            =   4500
133|           TabIndex        =   33
134|           Top             =   480
135|           Width           =   3900
136|        End
137|        Begin CommandButton cmdIn2Out_Manual
138|           Caption         =   "> InputSystem to &OutputSystem >"
139|           Enabled         =   0   'False
140|           Height          =   375
141|           Left            =   180
142|           TabIndex        =   32
143|           Top             =   480
144|           Width           =   3900
145|        End
146|        Begin Label zlblYOUT_Manual
147|           BackStyle       =   0  'Transparent
148|           Caption         =   "Y_OutputSystem"
149|           Height          =   195
150|           Left            =   6420
151|           TabIndex        =   40
152|           Top             =   1560
153|           Width           =   1815
154|        End
155|        Begin Label zlblXOUT_MANUAL
156|           BackStyle       =   0  'Transparent
157|           Caption         =   "X_OutputSystem"
158|           Height          =   195
159|           Left            =   4500
160|           TabIndex        =   42
161|           Top             =   1560
162|           Width           =   1815
163|        End
164|        Begin Label zlblYIN_MANUAL
165|           BackStyle       =   0  'Transparent
166|           Caption         =   "Y_InputSystem"
167|           Height          =   195
168|           Left            =   2100
169|           TabIndex        =   39
170|           Top             =   1550
171|           Width           =   1875
172|        End
173|        Begin Label zlblXIN_MANUAL
174|           BackStyle       =   0  'Transparent
```

```
175|          Caption          =   "X_InputSystem"
176|          Height           =   255
177|          Left             =   180
178|          TabIndex         =   38
179|          Top              =   1550
180|          Width            =   1635
181|       End
182|       Begin Label zlblOUT_MANUAL
183|          BackStyle        =   0  'Transparent
184|          Caption          =   "Coordinates in OutputSystem"
185|          Height           =   375
186|          Left             =   4500
187|          TabIndex         =   31
188|          Top              =   980
189|          Width            =   3975
190|       End
191|       Begin Label zlblIN_MANUAL
192|          BackStyle        =   0  'Transparent
193|          Caption          =   "Coordinates in InputSystem"
194|          Height           =   495
195|          Left             =   180
196|          TabIndex         =   30
197|          Top              =   980
198|          Width            =   3975
199|       End
200|    End
201|    Begin SSPanel pnlBLOBs
202|       BackColor        =   &H00C0C0C0&
203|       BevelWidth       =   2
204|       Font3D           =   0  'None
205|       Height           =   3200
206|       Left             =   150
207|       Outline          =   -1  'True
208|       TabIndex         =   15
209|       Top              =   750
210|       Width            =   8715
211|       Begin PictureBox picGray
212|          BackColor        =   &H00C0C0C0&
213|          BorderStyle      =   0  'None
214|          Height           =   300
215|          Index            =   1
216|          Left             =   8120
217|          ScaleHeight      =   300
218|          ScaleWidth       =   105
219|          TabIndex         =   25
220|          Top              =   1680
221|          Width            =   100
222|       End
223|       Begin PictureBox picGray
224|          BackColor        =   &H00C0C0C0&
225|          BorderStyle      =   0  'None
226|          Height           =   300
227|          Index            =   0
228|          Left             =   3800
229|          ScaleHeight      =   300
230|          ScaleWidth       =   105
231|          TabIndex         =   24
232|          Top              =   1680
```

```
233|          Width           =   100
234|       End
235|       Begin Data Dat_BLOBS
236|          Caption         =   "Move record "
237|          Connect         =   ""
238|          DatabaseName    =   ""
239|          Exclusive       =   0   'False
240|          Height          =   270
241|          Left            =   9120
242|          Options         =   0
243|          ReadOnly        =   0   'False
244|          RecordSource    =   ""
245|          Top             =   1200
246|          Width           =   2445
247|       End
248|       Begin ComboBox cmbQTList_BLOBS
249|          Height          =   300
250|          Left            =   90
251|          Sorted          =   -1  'True
252|          Style           =   2  'Dropdown List
253|          TabIndex        =   21
254|          Top             =   120
255|          Width           =   8535
256|       End
257|       Begin CommonDialog CMDialog1
258|          Left            =   9120
259|          Top             =   4320
260|       End
261|       Begin ComboBox cmbXY_In_BLOBS
262|          Height          =   300
263|          Left            =   180
264|          TabIndex        =   20
265|          Text            =   "XYChain_In"
266|          Top             =   1680
267|          Width           =   3968
268|       End
269|       Begin ComboBox cmbXY_Out_BLOBS
270|          Height          =   300
271|          Left            =   4500
272|          TabIndex        =   19
273|          Text            =   "XYChain_Out"
274|          Top             =   1680
275|          Width           =   3968
276|       End
277|       Begin CommandButton cmdIn2Out_BLOBS
278|          Caption         =   "> InputSystem to &OutputSystem >"
279|          Enabled         =   0   'False
280|          Height          =   375
281|          Left            =   180
282|          TabIndex        =   18
283|          Top             =   480
284|          Width           =   3900
285|       End
286|       Begin PictureBox picPercentDoneHost
287|          Height          =   255
288|          Left            =   180
289|          ScaleHeight     =   1
290|          ScaleMode       =   0  'User
```

```
291|          ScaleWidth      =   96.546
292|          TabIndex        =   16
293|          Top             =   2800
294|          Width           =   8415
295|          Begin PictureBox picPercentDone
296|             BackColor       =   &H00FF0000&
297|             BorderStyle     =   0  'None
298|             Height          =   225
299|             Left            =   0
300|             ScaleHeight     =   225
301|             ScaleWidth      =   15
302|             TabIndex        =   17
303|             Top             =   0
304|             Width           =   15
305|          End
306|       End
307|       Begin Label zlblBLOB_In
308|          BackStyle       =   0  'Transparent
309|          Caption         =   "Binary Large OBject (BLOB) field
   containing coordinates in INPUT system"
310|          Height          =   495
311|          Left            =   180
312|          TabIndex        =   23
313|          Top             =   1200
314|          Width           =   3975
315|       End
316|       Begin Label zlblBLOBS_Out
317|          BackStyle       =   0  'Transparent
318|          Caption         =   "Binary Large OBject (BLOB) field
   containing coordinates in OUTPUT system"
319|          Height          =   420
320|          Left            =   4500
321|          TabIndex        =   22
322|          Top             =   1200
323|          Width           =   3975
324|       End
325|    End
326|    Begin SSPanel pnlSinglePoints
327|       BackColor       =   &H00C0C0C0&
328|       BevelWidth      =   2
329|       Font3D          =   0  'None
330|       Height          =   3200
331|       Left            =   150
332|       Outline         =   -1  'True
333|       TabIndex        =   0
334|       Top             =   750
335|       Width           =   8715
336|       Begin PictureBox picGray
337|          BackColor       =   &H00C0C0C0&
338|          BorderStyle     =   0  'None
339|          Height          =   300
340|          Index           =   5
341|          Left            =   8120
342|          ScaleHeight     =   300
343|          ScaleWidth      =   105
344|          TabIndex        =   29
345|          Top             =   1680
346|          Width           =   100
```

```
347|        End
348|        Begin PictureBox picGray
349|           BackColor       =   &H00C0C0C0&
350|           BorderStyle     =   0  'None
351|           Height          =   300
352|           Index           =   4
353|           Left            =   8120
354|           ScaleHeight     =   300
355|           ScaleWidth      =   105
356|           TabIndex        =   28
357|           Top             =   2340
358|           Width           =   100
359|        End
360|        Begin PictureBox picGray
361|           BackColor       =   &H00C0C0C0&
362|           BorderStyle     =   0  'None
363|           Height          =   300
364|           Index           =   3
365|           Left            =   3800
366|           ScaleHeight     =   300
367|           ScaleWidth      =   105
368|           TabIndex        =   27
369|           Top             =   2340
370|           Width           =   100
371|        End
372|        Begin PictureBox picGray
373|           BackColor       =   &H00C0C0C0&
374|           BorderStyle     =   0  'None
375|           Height          =   300
376|           Index           =   2
377|           Left            =   3800
378|           ScaleHeight     =   300
379|           ScaleWidth      =   105
380|           TabIndex        =   26
381|           Top             =   1680
382|           Width           =   100
383|        End
384|        Begin Data Dat_Points
385|           Caption         =   "Move record "
386|           Connect         =   ""
387|           DatabaseName    =   ""
388|           Exclusive       =   0   'False
389|           Height          =   270
390|           Left            =   9120
391|           Options         =   0
392|           ReadOnly        =   0   'False
393|           RecordSource    =   ""
394|           Top             =   1200
395|           Width           =   2445
396|        End
397|        Begin ComboBox cmbQTList_Points
398|           Height          =   300
399|           Left            =   90
400|           Sorted          =   -1  'True
401|           Style           =   2  'Dropdown List
402|           TabIndex        =   8
403|           Top             =   120
404|           Width           =   8535
```

```
405|        End
406|        Begin ComboBox cmbXY_In_Points
407|           Height          =   300
408|           Index           =   0
409|           Left            =   180
410|           TabIndex        =   7
411|           Text            =   "X_In"
412|           Top             =   1680
413|           Width           =   3968
414|        End
415|        Begin ComboBox cmbXY_Out_Points
416|           Height          =   300
417|           Index           =   0
418|           Left            =   4500
419|           TabIndex        =   6
420|           Text            =   "X_Out"
421|           Top             =   1680
422|           Width           =   3968
423|        End
424|        Begin CommandButton cmdIn2Out_Points
425|           Caption         =   "> InputSystem to &OutputSystem >"
426|           Enabled         =   0   'False
427|           Height          =   375
428|           Left            =   180
429|           TabIndex        =   5
430|           Top             =   480
431|           Width           =   3900
432|        End
433|        Begin PictureBox picPercentDoneHost_Points
434|           Height          =   255
435|           Left            =   120
436|           ScaleHeight     =   1
437|           ScaleMode       =   0  'User
438|           ScaleWidth      =   97.237
439|           TabIndex        =   3
440|           Top             =   2760
441|           Width           =   8475
442|           Begin PictureBox picPercentDone_Points
443|              BackColor       =   &H00FF0000&
444|              BorderStyle     =   0  'None
445|              Height          =   225
446|              Left            =   0
447|              ScaleHeight     =   225
448|              ScaleWidth      =   15
449|              TabIndex        =   4
450|              Top             =   0
451|              Width           =   15
452|           End
453|        End
454|        Begin ComboBox cmbXY_In_Points
455|           Height          =   300
456|           Index           =   1
457|           Left            =   180
458|           TabIndex        =   2
459|           Text            =   "Y_In"
460|           Top             =   2340
461|           Width           =   3968
462|        End
```

```
463|        Begin ComboBox cmbXY_Out_Points
464|           Height          =   300
465|           Index           =   1
466|           Left            =   4500
467|           TabIndex        =   1
468|           Text            =   "Y_Out"
469|           Top             =   2340
470|           Width           =   3968
471|        End
472|        Begin Label zlbl_PointIn
473|           BackStyle       =   0  'Transparent
474|           Caption         =   "Fields containing coordinates in
     Input coordinates"
475|           Height          =   495
476|           Left            =   180
477|           TabIndex        =   14
478|           Top             =   1000
479|           Width           =   3968
480|        End
481|        Begin Label zlblOutFields_Points
482|           BackStyle       =   0  'Transparent
483|           Caption         =   "Fields to get output coordinates"
484|           Height          =   375
485|           Left            =   4500
486|           TabIndex        =   13
487|           Top             =   1000
488|           Width           =   3968
489|        End
490|        Begin Label zlblXIn_Points
491|           BackStyle       =   0  'Transparent
492|           Caption         =   "X_In"
493|           Height          =   255
494|           Left            =   180
495|           TabIndex        =   12
496|           Top             =   1440
497|           Width           =   3968
498|        End
499|        Begin Label zlblYIn_Points
500|           BackStyle       =   0  'Transparent
501|           Caption         =   "Y_In"
502|           Height          =   255
503|           Left            =   180
504|           TabIndex        =   11
505|           Top             =   2100
506|           Width           =   3975
507|        End
508|        Begin Label zlblXOut_POINTS
509|           BackStyle       =   0  'Transparent
510|           Caption         =   "X_Out"
511|           Height          =   255
512|           Left            =   4500
513|           TabIndex        =   10
514|           Top             =   1440
515|           Width           =   3975
516|        End
517|        Begin Label zlblYOUT_Points
518|           BackStyle       =   0  'Transparent
519|           Caption         =   "Y_Out"
```

```
520|          Height          =   255
521|          Left            =   4500
522|          TabIndex        =   9
523|          Top             =   2100
524|          Width           =   3975
525|       End
526|    End
527|    Begin Menu zzzzFile
528|       Caption         =   "&File"
529|       Begin Menu mfOpenDB
530|          Caption         =   "Open &Database..."
531|       End
532|       Begin Menu mfCloseDatabase
533|          Caption         =   "&Close Database"
534|       End
535|       Begin Menu zzzzz1
536|          Caption         =   "-"
537|       End
538|       Begin Menu mfOpenInputPrjctn
539|          Caption         =   "Open &Input Projection File.."
540|       End
541|       Begin Menu mfOpenOutputPrjctn
542|          Caption         =   "Open &Output Projection File.."
543|       End
544|       Begin Menu zzzzz2
545|          Caption         =   "-"
546|       End
547|       Begin Menu mfExit
548|          Caption         =   "E&xit"
549|       End
550|    End
551|    Begin Menu zzMnuEdit
552|       Caption         =   "&Edit"
553|       Begin Menu meCopy
554|          Caption         =   "&Copy"
555|          Shortcut        =   ^{INSERT}
556|       End
557|       Begin Menu mePaste
558|          Caption         =   "&Paste"
559|          Shortcut        =   +{INSERT}
560|       End
561|    End
562|    Begin Menu mnuHelp
563|       Caption         =   "&Help"
564|    End
565| End
566| Option Explicit
567|
568| Dim DBName As String' May want to change scope of this later.
569| Dim intCoordinateField As Long
570| Dim XYBlob As String
571| Dim DataPt() As RealPoint
572|
573| Dim TabChar As String * 1, CR  As String * 1, CRLF  As String *
    2
574|
575| Dim nFields As Long, n As Long
576|
```

```
577| Dim DB As Database, tblLineData As table
578| Dim snpQTList As Snapshot, dnsCurrentQT As Dynaset
579|
580|
581| Dim SepName(0 To 20) As String, SepChar(0 To 20) As String
582| Const X_INDEX = 0
583| Const Y_INDEX = 1
584|
585| Dim jUTMZone As Long
586|
587| Const WHITE = 16777215
588|
589| Dim JCoordSysIn(1 To 3) As Long, SetupCoordSysIn(1 To 13) As
    Double, strPRJIn As String, strINSuffix As String
590| Dim JCoordSysOut(1 To 3) As Long, SetupCoordSysOut(1 To 13) As
    Double, strPRJOut As String, strOUTSuffix As String
591|
592| Dim strInputProjectionHistory As String,
    strOutputProjectionHistory As String
593|
594| Sub cmbQTList_BLOBS_Click ()
595|     Dim Temp As String
596|     Temp = cmbQTList_BLOBs
597|     Call SetQuery_BLOBS(Temp)
598|
599| End Sub
600|
601| Sub cmbQTList_Points_Click ()
602| Dim Temp As String
603| Temp = cmbQTList_Points
604| Call SetQuery_Points(Temp)
605|
606| End Sub
607|
608| Sub cmdBLOBs_Click (Value As Integer)
609|     If DBName = "" Then
610|         Call GripeNoDatabase
611|         'Exit Sub
612|     End If
613|
614|
615|     Value = True
616|     pnlBLOBS.ZOrder
617|     cmdBLOBS.ZOrder
618|     zzMnuEdit.Enabled = False
619|    If cmbQTList_BLOBs.ListIndex = -1 Then
620|       cmbQTList_BLOBs.SetFocus
621|       SendKeys "%{DOWN}"
622|    End If
623|
624|
625| End Sub
626|
627| Sub cmdIn2Out_BLOBS_Click ()
628| On Error Resume Next
629| If strPRJIn = "" Then GripeNoInputProjection: Exit Sub
630| If strPRJOut = "" Then GripeNoOutputProjection: Exit Sub
631|
```

```
632|
633| If cmbXY_In_BLOBS.ListIndex = -1 Then
634|     MsgBox "That field does not exist in the present
    query/table, so you can't very well convert FROM it, now can
    you?"
635|     Exit Sub
636|   End If
637|
638|
639| Dim name_BLOB_In As String, name_BLOB_Out As String
640| name_BLOB_In = cmbXY_In_BLOBS.Text
641|
642| If (cmbXY_Out_BLOBs.ListIndex = -1) Or
    (cmbXY_Out_BLOBs.ListIndex = cmbXY_Out_BLOBs.ListCount - 1) Then
643|     Dim strSourceTable As String
644|     strSourceTable =
    dat_BLOBs.Recordset.Fields(name_BLOB_In).SourceTable
645|     If Trim$(cmbXY_Out_BLOBs.Text) = "" Then
646|         name_BLOB_Out = "XY_Out"
647|        Else
648|         name_BLOB_Out = Trim$(cmbXY_Out_BLOBs.Text)
649|     End If
650|     Dim nfldBLOB_Out As New field
651|     nfldBLOB_Out.Name = name_BLOB_Out: nfldBLOB_Out.Type =
    DB_LONGBINARY
652|     Dim Temp As String
653|     Temp = dat_BLOBs.RecordSource
654|     dat_BLOBs.RecordSource = "": dat_BLOBs.Refresh
655|     'Professional Edition of VB 3.0 only allows this addition of
    a field
656|     DB.TableDefs(strSourceTable).Fields.Append nfldBLOB_Out
657|     dat_BLOBs.RecordSource = Temp: dat_BLOBs.Refresh
658|    Else
659|     name_BLOB_Out = cmbXY_Out_BLOBs.Text
660| End If
661|
662|
663|
664| 'CopyXYFromBLOBToMemo name_BLOB_In, name_BLOB_Out, XYDelim,
    PairDelim, Me.Dat_BLOBS.Recordset
665| Dim nR As Long, nRecs As Long', Temp As String
666| dat_BLOBs.Recordset.MoveFirst : dat_BLOBs.Recordset.MoveLast :
    dat_BLOBs.Recordset.MoveFirst
667| nRecs = dat_BLOBs.Recordset.RecordCount
668| For nR = 1 To nRecs
669|
670|     picPercentDone.Width = nR / nRecs * 100
671|     DoEvents
672|     Temp = dat_BLOBs.Recordset(name_BLOB_In)
673|     dat_BLOBs.Recordset.Edit
674|     dat_BLOBs.Recordset(name_BLOB_Out) = gctp_ProjectBLOB(Temp,
    JCoordSysIn(), SetupCoordSysIn(), JCoordSysOut(),
    SetupCoordSysOut())
675|     dat_BLOBs.Recordset.Update
676|     dat_BLOBs.Recordset.MoveNext
677| Next nR
678|
679| 'Add a log entry.
```

```
680| Dim strInput As String, strOutput As String
681|   strInput = "XYChains from field [" & name_BLOB_In & "] in
    table [" & dat_BLOBs.RecordSource & "]" & CRLF &
    strInputProjectionHistory
682|   strOutput = "XYChains to field [" & name_BLOB_Out & "] in
    table [" & dat_BLOBs.RecordSource & "]" & CRLF &
    strOutputProjectionHistory
683| Call WheatLog_AddEntry(DBName, strInput, strOutput, "WhtGCTP
    WHEAT General Cartographic Transformation Package", "")
684|
685|
686|   MSGDoneProjecting
687| End Sub
688|
689| Sub cmdIn2Out_Manual_Click ()
690| If strPRJIn = "" Then GripeNoInputProjection: Exit Sub
691| If strPRJOut = "" Then GripeNoOutputProjection: Exit Sub
692|
693|        Dim dblIn As typDblePoint, dblOut As typDblePoint
694|        dblIn.X = Val(txtXInSys.Text)
695|        dblIn.Y = Val(txtYInSys.Text)
696|
697|  On Error Resume Next
698|
699|    Call GTRNZ0(dblIn, JCoordSysIn(1), SetupCoordSysIn(1),
    dblOut, JCoordSysOut(1), SetupCoordSysOut(1), j0, jFlag)
700|
701|        txtXOutSys = Format$(dblOut.X, "0")
702|        txtYOutSys = Format$(dblOut.Y, "0")
703|
704| End Sub
705|
706| Sub cmdIn2Out_Points_Click ()
707|
708| Dim Temp As String
709| If strPRJIn = "" Then GripeNoInputProjection: Exit Sub
710| If strPRJOut = "" Then GripeNoOutputProjection: Exit Sub
711| On Error Resume Next
712|
713|
714|
715| 'Make sure the fields the user wants to project FROM exist.
716| If (cmbXY_In_Points(X_INDEX).ListIndex = -1) Or
    (cmbXY_In_Points(Y_INDEX).ListIndex = -1) Then
717|     MsgBox "That field does not exist in the present
    query/table, so you can't very well convert FROM it, now can
    you?"
718|     Exit Sub
719| End If
720|
721| Dim name_XOut As String, name_XIn As String
722| Dim name_YOut  As String, name_YIn As String
723| name_XIn = cmbXY_In_Points(X_INDEX).Text
724| name_YIn = cmbXY_In_Points(Y_INDEX).Text
725|
726| Dim Temp1 As Integer, Temp2 As Integer
727| Temp1 = cmbXY_Out_Points(X_INDEX).ListIndex < 0
728| Temp2 = cmbXY_Out_Points(Y_INDEX).ListIndex < 0
```

```
729|
730| If Temp1 Xor Temp2 Then
731|      Beep
732|      MsgBox "Either select two NEW fields to put data into, or
   two OLD fields to put data into, but not one old and one new."
733|      Exit Sub
734| End If
735|
736| If (cmbXY_Out_Points(X_INDEX).ListIndex = -1) Or
   (cmbXY_Out_Points(X_INDEX).ListIndex =
   cmbXY_Out_Points(X_INDEX).ListCount - 1) Then
737|     Dim strSourceTable As String
738|     'Put the output coordinates in the same table as the input
   coordinates
739|     strSourceTable =
   Dat_Points.Recordset.Fields(name_XIn).SourceTable
740|     If Trim$(cmbXY_Out_Points(X_INDEX).Text) = "" Then
741|         name_XOut = "X_Out"
742|        Else
743|         name_XOut = Trim$(cmbXY_Out_Points(X_INDEX).Text)
744|     End If
745|     If Trim$(cmbXY_Out_Points(Y_INDEX).Text) = "" Then
746|         name_YOut = "Y_Out"
747|        Else
748|         name_YOut = Trim$(cmbXY_Out_Points(Y_INDEX).Text)
749|     End If
750|
751|
752|     Dim nfldX_Out As New field, nfldY_Out As New field
753|     nfldX_Out.Name = name_XOut: nfldX_Out.Type = DB_SINGLE
754|     nfldY_Out.Name = name_YOut: nfldY_Out.Type = DB_SINGLE
755|
756|     Temp = Dat_Points.RecordSource
757|     Dat_Points.RecordSource = "": Dat_Points.Refresh
758|     'Professional Edition of VB 3.0 only allows this addition of
   a field
759|     DB.TableDefs(strSourceTable).Fields.Append nfldX_Out
760|     DB.TableDefs(strSourceTable).Fields.Append nfldY_Out
761|     Dat_Points.RecordSource = Temp: Dat_Points.Refresh
762|    Else
763|     name_XOut = cmbXY_Out_Points(X_INDEX).Text
764|     name_YOut = cmbXY_Out_Points(Y_INDEX).Text
765| End If
766|
767|
768| Dim nR As Long, nRecs As Long', Temp As String
769| Dat_Points.Recordset.MoveFirst : Dat_Points.Recordset.MoveLast :
   Dat_Points.Recordset.MoveFirst
770| nRecs = Dat_Points.Recordset.RecordCount
771| Dim dblIn As typDblePoint, dblOut As typDblePoint
772| For nR = 1 To nRecs
773|     picPercentDone_Points.Width = nR / nRecs * 100
774|     DoEvents
775|
776|     dblIn.X = Dat_Points.Recordset(name_XIn)
777|     dblIn.Y = Dat_Points.Recordset(name_YIn)
778|   Call GTRNZ0(dblIn, JCoordSysIn(1), SetupCoordSysIn(1), dblOut,
   JCoordSysOut(1), SetupCoordSysOut(1), j0, jFlag)
```

```
779|      Dat_Points.Recordset.Edit
780|      Dat_Points.Recordset(name_XOut) = dblOut.X
781|      Dat_Points.Recordset(name_YOut) = dblOut.Y
782|      Dat_Points.Recordset.Update
783|      Dat_Points.Recordset.MoveNext
784| Next nR
785|
786|
787|
788| MSGDoneProjecting
789|
790|
791| 'Add a log entry.
792| Dim strInput As String, strOutput As String
793|   strInput = "X,Y Pairs from fields [" & name_XIn & "] , [" &
    name_YIn & "] in table [" & Dat_Points.RecordSource & "]" & CRLF
    & strInputProjectionHistory
794|   strOutput = "X,Y Pairs to fields [" & name_XOut & "] , [" &
    name_YOut & "] in table [" & Dat_Points.RecordSource & "]" &
    CRLF & strInputProjectionHistory
795| Call WheatLog_AddEntry(DBName, strInput, strOutput, "WhtGCTP
    WHEAT General Cartographic Transformation Package", "")
796|
797|
798|
799| End Sub
800|
801| Sub cmdMANUAL_Click (Value As Integer)
802|      Value = True
803|      pnlManualEntry.ZOrder
804|      cmdManual.ZOrder
805|      zzMnuEdit.Enabled = True
806| End Sub
807|
808| Sub cmdOut2In_MANUAL_Click ()
809|
810|
811| If strPRJIn = "" Then GripeNoInputProjection: Exit Sub
812| If strPRJOut = "" Then GripeNoOutputProjection: Exit Sub
813| On Error Resume Next
814|        Dim dblIn As typDblePoint, dblOut As typDblePoint
815|        dblIn.X = Val(txtXOutSys.Text)
816|        dblIn.Y = Val(txtYOutSys.Text)
817|
818|
819|    Call GTRNZ0(dblIn, JCoordSysOut(1), SetupCoordSysOut(1),
    dblOut, JCoordSysIn(1), SetupCoordSysIn(1), j0, jFlag)
820|
821|         txtXInSys.Text = Format$(dblIn.X, "0")
822|         txtYInSys.Text = Format$(dblIn.Y, "0")
823|
824| End Sub
825|
826| Sub cmdPoints_Click (Value As Integer)
827|      If DBName = "" Then
828|          Call GripeNoDatabase
829|          'Exit Sub
830|      End If
```

```
831|
832|
833|     Value = True
834|     zzMnuEdit.Enabled = False
835|     pnlSinglePoints.ZOrder
836|     cmdPoints.ZOrder
837|     If cmbQTList_Points.ListIndex = -1 Then
838|        cmbQTList_Points.SetFocus
839|        SendKeys "%{DOWN}"
840|     End If
841|
842| End Sub
843|
844| Sub EnableButtons (Value As Long)
845|   Me!cmdIn2Out_Manual.Enabled = Value
846|   Me!cmdOut2In_MANUAL.Enabled = Value
847|   Me!cmdIn2Out_BLOBS.Enabled = Value
848|   Me!cmdIn2Out_Points.Enabled = Value
849|
850| End Sub
851|
852| Sub Form_Load ()
853|         CR = Chr$(13)
854|         TabChar = Chr$(9)
855|         CRLF = Chr$(13) & Chr$(10)
856|         ReDim DataPts(1 To 1)
857|
858|   strINSuffix = "No input system defined"
859|   strOUTSuffix = "No output system defined"
860|
861| 'Maybe read the command line and parse for input projection,
    output projection, and a database name????
862|   ParseCommandLine
863|
864|   Call SetCaptions(strINSuffix, strOUTSuffix) 'Automatically
    fling the user at the define input projection menu
865| End Sub
866|
867| Sub GripeNoDatabase ()
868|     Call cmdMANUAL_Click(0)
869|     cmdManual = True
870|     Beep
871|     MsgBox "You cannot use this program to project coordinates
    stored in a database until you have opened a database."
872|     SendKeys "%F"
873|     SendKeys "d"
874| End Sub
875|
876| Sub GripeNoInputProjection ()
877|    Beep
878|    MsgBox "You cannot project points until you have opened a
    file containing a definition of the input projection."
879|     SendKeys "%F"
880|     SendKeys "i"
881|
882| End Sub
883|
884| Sub GripeNoOutputProjection ()
```

```
885|    Beep
886|    MsgBox "You cannot project points until you have opened a
    file containing a definition of the output projection."
887|     SendKeys "%F"
888|     SendKeys "o"
889|
890| End Sub
891|
892| Sub ListQrysTblsInComboBox (DBIn As Database, ComboOut As
    ComboBox)
893| ' this subroutine lists all queries and tables in a database
894| '    in a combobox, for later user selection.
895|     ComboOut.Clear
896|     Dim DB_SYSTEMOBJECT As Long
897|     DB_SYSTEMOBJECT = &H80000002
898|
899|     Dim snpQTList As Snapshot 'declared locally so it goes away
900|     Set snpQTList = DBIn.ListTables()
901|
902|     Dim QTName As String
903|     snpQTList.MoveFirst
904|     Do Until snpQTList.EOF 'For each Table and query
905|         If Not ((snpQTList("Attributes") And DB_SYSTEMOBJECT) <>
    0) And (snpQTList("Attributes") < 6) Then
906|           'Exclude system objects from list of tables and
    queries presented to user
907|           QTName = snpQTList("Name")
908|           ComboOut.AddItem QTName
909|         End If
910|         snpQTList.MoveNext
911|     Loop
912|     snpQTList.Close
913|     Set snpQTList = Nothing
914| End Sub
915|
916| Sub meCopy_Click ()
917| clipboard.Clear
918| Dim strClipOut As String
919|
920| If (activecontrol Is txtXInSys) Or (activecontrol Is txtYInSys)
    Then
921|    strClipOut = txtXInSys & TabChar & txtYInSys & CRLF
922| End If
923|
924|
925| If (activecontrol Is txtXOutSys) Or (activecontrol Is
    txtYOutSys) Then
926|    strClipOut = txtXOutSys & TabChar & txtYOutSys & CRLF
927| End If
928| clipboard.SetText strClipOut
929|
930|
931|
932| End Sub
933|
934| Sub mePaste_Click ()
935|    If TypeOf activecontrol Is TextBox Then
936|      'do nothing
```

```
 937|     Else
 938|       Exit Sub
 939|    End If
 940|
 941| Dim strClipIn As String, str1 As String, str2 As String, T1 As
     Long, T2 As Long
 942|    strClipIn = clipboard.GetText()
 943|    T1 = InStr(strClipIn, TabChar)
 944|    If T1 = 0 Then
 945|         activecontrol = strClipIn
 946|         Exit Sub
 947|    End If
 948|    str1 = Left$(strClipIn, T1 - 1)
 949|    T2 = InStr(strClipIn, CRLF)
 950|    If T2 = 0 Then T2 = InStr(strClipIn, Chr$(10))
 951|    If T2 = 0 Then T2 = InStr(strClipIn, Chr$(13))
 952|    If T2 = 0 Then T2 = Len(strClipIn) + 1
 953|    str2 = Mid$(strClipIn, T1 + 1, T2 - T1 - 1)
 954|
 955| If (activecontrol Is txtXInSys) Or (activecontrol Is txtYInSys)
     Then
 956|     txtXInSys = str1
 957|     txtYInSys = str2
 958| End If
 959|
 960|
 961| If (activecontrol Is txtXOutSys) Or (activecontrol Is
     txtYOutSys) Then
 962|    txtXOutSys = str1
 963|    txtYOutSys = str2
 964| End If
 965|
 966|
 967| End Sub
 968|
 969| Sub mfCloseDatabase_Click ()
 970|  On Error Resume Next
 971|  DB.Close
 972|   DBName = ""
 973|   Me.Caption = "WHEAT Coordinate Transformation " & "NO DATABASE
     OPEN"
 974|  Set DB = Nothing
 975|   Dat_Points.Recordset.Close
 976|   dat_BLOBs.Recordset.Close
 977|   cmbQTList_BLOBs.Clear
 978|   cmbQTList_Points.Clear
 979|   cmbXY_In_BLOBS.Clear
 980|   cmbXY_In_Points(X_INDEX).Clear :
     cmbXY_In_Points(Y_INDEX).Clear
 981|   cmbXY_Out_BLOBs.Clear
 982|   cmbXY_Out_Points(X_INDEX).Clear :
     cmbXY_Out_Points(Y_INDEX).Clear
 983|
 984|
 985|
 986| End Sub
 987|
 988| Sub mfExit_Click ()
```

```
 989|  End
 990| End Sub
 991|
 992| Sub mfOpenDB_Click ()
 993| On Error GoTo ERRmfOpenDB
 994| CMDialog1.DialogTitle = "Database to Open"
 995| CMDialog1.Filter = "MS Access Databases|*.mdb"
 996| CMDialog1.Flags = OFN_FILEMUSTEXIST
 997| CMDialog1.Filename = "*.mdb"
 998| CMDialog1.Action = 1
 999| CMDialog1.CancelError = True
1000| Dim Temp As String
1001|
1002| Temp = CMDialog1.Filename
1003| If Len(Temp) = 0 Then 'the user did not enter a file name
1004|     Else
1005|      DBName = Temp
1006|      Call OpenMyDB(DBName)
1007|
1008| End If
1009| Exit Sub
1010| ERRmfOpenDB:
1011|  Select Case Err
1012|    Case Else
1013|    Exit Sub
1014|    Resume
1015|  End Select
1016| End Sub
1017|
1018| Sub mfOpenInputPrjctn_Click ()
1019| On Error Resume Next
1020| CMDialog1.DialogTitle = "INPUT Projection File to Open"
1021| CMDialog1.Filter = "Projection files|*.prj"
1022| CMDialog1.Filename = "*.prj"
1023| CMDialog1.Flags = OFN_FILEMUSTEXIST
1024| CMDialog1.CancelError = True
1025| CMDialog1.Action = 1
1026|
1027|
1028| Dim Temp As String
1029| If Err <> 0 Then Exit Sub
1030|
1031| Temp = CMDialog1.Filename
1032|
1033| If Len(Temp) = 0 Then 'the user did not enter a file name
1034|     Else 'Open the input projection system
1035|      strPRJIn = Temp
1036|      Call OpenInputProjection(strPRJIn)
1037| End If
1038|
1039| Exit Sub
1040|
1041|
1042|
1043| End Sub
1044|
1045| Sub mfOpenOutputPrjctn_Click ()
1046|
```

```
1047| On Error Resume Next
1048| CMDialog1.DialogTitle = "OUTPUT Projection File to Open"
1049| CMDialog1.Filter = "Projection files|*.prj"
1050| CMDialog1.Filename = "*.prj"
1051| CMDialog1.CancelError = True
1052| CMDialog1.Flags = OFN_FILEMUSTEXIST
1053| CMDialog1.Action = 1
1054|
1055| If Err <> 0 Then Exit Sub
1056|
1057| Dim Temp As String
1058|
1059| Temp = CMDialog1.Filename
1060| If Len(Temp) = 0 Then 'the user did not enter a file name
1061|     Else 'Open the Output projection system
1062|      strPRJOut = Temp
1063|      Call OpenOutputProjection(strPRJOut)
1064| End If
1065| End Sub
1066|
1067| Sub mnuHelp_Click ()
1068|      SendKeys "{F1}"
1069| End Sub
1070|
1071| Sub MSGDoneProjecting ()
1072|
1073| Beep
1074| MsgBox "Done projecting coordinates."
1075| Me!picPercentDone_Points.Width = 0
1076|
1077| End Sub
1078|
1079| Sub OpenInputProjection (strPRJIn As String)
1080| 'open and read an input projection file
1081| On Error GoTo ERROpenInputPrjctn
1082| ' A valid PRJ file is layed out as follows.
1083| '  1) comment line or blank line at top
1084| '  2) Suffix/name for coordinate system
1085| '  3) number of coordinate system
1086| '  4) zone number (1 to 60 for UTM, > 60 for all others)
1087| '  5) Unit codes  feet=1, meters=2, seconds=3, decdeg=4, packed
      dddmmss.ssss=5
1088| '  6-18) 13 parameters defining the projection.  They must
      always be present.
1089|       Dim Temp As String
1090|
1091|       Open strPRJIn For Input As 1
1092|       Line Input #1, Temp 'Skip the first line.  Treat it as a
      comment.
1093|       Line Input #1, Temp 'Read in the  strINSuffix
1094|       For n = 1 To Len(Temp)
1095|         If Mid$(Temp, n, 1) = " " Then Mid$(Temp, n, 1) = "_"
1096|       Next n
1097|       strINSuffix = "_" & Temp
1098|        'Define the coordinate system and zone number
1099|       Line Input #1, Temp: JCoordSysIn(1) = Val(Temp)
1100|       Line Input #1, Temp: JCoordSysIn(2) = Val(Temp)
1101|       Line Input #1, Temp: JCoordSysIn(3) = Val(Temp)
```

```
1102|          'For systems other than UTM, make sure the zone number
    is > 60
1103|       If (JCoordSysIn(1) <> 1) And (JCoordSysIn(2) < 60) Then
    JCoordSysIn(2) = 100
1104|        'Projection parameters
1105|       For n = 1 To 13
1106|          Line Input #1, Temp: SetupCoordSysIn(n) = Val(Temp)
1107|       Next n
1108|
1109|
1110|    Close 1
1111|    DoEvents
1112|  'Read the whole file in for auditing purposes.
1113|    Open strPRJIn For Binary As 1
1114|       strInputProjectionHistory = Input$(LOF(1), #1)
1115|    Close 1
1116|
1117|   Call SetCaptions(strINSuffix, strOUTSuffix)
1118|  Exit Sub
1119| ERROpenInputPrjctn:
1120|
1121|  Select Case Err
1122|    Case Else
1123|       Close 1
1124|       strINSuffix = "No input system defined"
1125|       Call EnableButtons(False)
1126|       Beep
1127|       MsgBox "That projection file was somehow defective.
    Please examine it and try again." & CRLF & "Error #" & Err &
    CRLF & Error & CRLF & "Input projection file " & strPRJIn
1128|       Exit Sub
1129|       Resume
1130|  End Select
1131|
1132| End Sub
1133|
1134| Sub OpenMyDB (DBName As String)
1135|      '  Open an MSAccess database for non-exclusive, read-write
    access.
1136|      On Error GoTo ERROpenMyDB
1137|      Set DB = OpenDatabase(DBName, False, False, "") 'Open the
    desired database
1138|      Dat_Points.DatabaseName = DBName
1139|      Me.Caption = "WHEAT Coordinate Transformation " & DBName
1140|      dat_BLOBs.DatabaseName = DBName
1141|      Call ListQrysTblsInComboBox(DB, cmbQTList_BLOBs)
1142|      Call ListQrysTblsInComboBox(DB, cmbQTList_Points)
1143|      If cmdPoints.Value = True Then
1144|          cmbQTList_Points.SetFocus
1145|          SendKeys "%{DOWN}"
1146|      End If
1147|      If cmdBLOBS.Value = True Then
1148|          cmbQTList_BLOBs.SetFocus
1149|          SendKeys "%{DOWN}"
1150|     End If
1151| Exit Sub
1152| ERROpenMyDB:
1153| Select Case Err
```

```
 1154|  Case Else
 1155|   MsgBox "Error #" & Err & " occurred trying to open the
      database " & DBName & CRLF & Error
 1156|   Err = 0
 1157|   Exit Sub
 1158|   Resume
 1159| End Select
 1160| End Sub
 1161|
 1162| Sub OpenOutputProjection (strPRJOut As String)
 1163| 'Open and read an OUTPUT projection file
 1164|
 1165| On Error GoTo ERROpenOUTPrjctn
 1166|
 1167|
 1168| ' A valid PRJ file is layed out as follows.
 1169| '  1) comment line or blank line at top
 1170| '  2) the projection suffix
 1171| '  3) number of coordinate system
 1172| '  4) zone number (1 to 60 for UTM, > 60 for all others)
 1173| '  5) Unit codes  feet=1, meters=2, seconds=3, decdeg=4, packed
      dddmmss.ssss=5
 1174| '  6-18) 13 parameters defining the projection.  They must
      always be present.
 1175|       Dim Temp As String
 1176|
 1177|       Open strPRJOut For Input As 1
 1178|       Input #1, Temp 'Skip the first line.  Treat it as a
      comment.
 1179|       Line Input #1, Temp 'Read in the  strINSuffix
 1180|       For n = 1 To Len(Temp)
 1181|         If Mid$(Temp, n, 1) = " " Then Mid$(Temp, n, 1) = "_"
 1182|       Next n
 1183|       strOUTSuffix = "_" & Temp
 1184|        'Define the coordinate system and zone number
 1185|       Line Input #1, Temp: JCoordSysOut(1) = Val(Temp)
 1186|       Line Input #1, Temp: JCoordSysOut(2) = Val(Temp)
 1187|       Line Input #1, Temp: JCoordSysOut(3) = Val(Temp)
 1188|         'For systems other than UTM, make sure the zone number
      is > 60
 1189|       If (JCoordSysOut(1) <> 1) And (JCoordSysOut(2) < 60) Then
      JCoordSysOut(2) = 101
 1190|        'Projection parameters
 1191|       For n = 1 To 13
 1192|          Line Input #1, Temp: SetupCoordSysOut(n) = Val(Temp)
 1193|       Next n
 1194|
 1195|    Close 1
 1196|    DoEvents
 1197|  'Read the whole file in for auditing purposes.
 1198|    Open strPRJOut For Binary As 1
 1199|       strOutputProjectionHistory = Input$(LOF(1), #1)
 1200|    Close 1
 1201|
 1202|   Call SetCaptions(strINSuffix, strOUTSuffix)
 1203|
 1204| Exit Sub
 1205| ERROpenOUTPrjctn:
```

```
 1206|  Select Case Err
 1207|    Case Else
 1208|       Close 1
 1209|       strINSuffix = "No input system defined"
 1210|       Call EnableButtons(False)
 1211|       Beep
 1212|       MsgBox "That projection file was somehow defective.
      Please examine it and try again." & CRLF & "Error #" & Err &
      CRLF & Error & CRLF & "Ouput projection " & strPRJOut
 1213|       Exit Sub
 1214|       Resume
 1215|  End Select
 1216|
 1217|
 1218|
 1219| End Sub
 1220|
 1221| Sub ParseCommandLine ()
 1222| Dim Temp As String
 1223|   Dim Temp2 As String, n As Long, m As Long, nLoc As Long
 1224|
 1225|
 1226|   Temp = UCase$(Command$)
 1227|   If Temp = "" Then Exit Sub
 1228|   nLoc = (InStr(Temp, "IN="))
 1229|   If nLoc <> 0 Then
 1230|      Temp2 = Mid$(Temp, nLoc) & " "
 1231|      nLoc = InStr(Temp2, " ")
 1232|      strPRJIn = Mid$(Temp2, 4, nLoc - 4)
 1233|      'Open the input projection file
 1234|      Call OpenInputProjection(strPRJIn)
 1235|   End If
 1236|
 1237|   nLoc = (InStr(Temp, "OUT="))
 1238|   If nLoc <> 0 Then
 1239|      Temp2 = Mid$(Temp, nLoc) & " "
 1240|      nLoc = InStr(Temp2, " ")
 1241|      strPRJOut = Mid$(Temp2, 5, nLoc - 5)
 1242|      'Open the output projection file
 1243|      Call OpenOutputProjection(strPRJOut)
 1244|   End If
 1245|
 1246|   nLoc = (InStr(Temp, "DB="))
 1247|   If nLoc <> 0 Then
 1248|      Temp2 = Mid$(Temp, nLoc) & " "
 1249|      nLoc = InStr(Temp2, " ")
 1250|      DBName = Mid$(Temp2, 4, nLoc - 4)
 1251|      'Open the database
 1252|      Call OpenMyDB(DBName)
 1253|   End If
 1254|
 1255|
 1256| End Sub
 1257|
 1258| Sub SetCaptions (strINSuffix As String, strOUTSuffix As String)
 1259|     If strINSuffix = "No input system defined" Then SendKeys
      "%F": SendKeys "I": Exit Sub
 1260|     If strOUTSuffix = "No output system defined" Then SendKeys
```

```
      "%F": SendKeys "O": Exit Sub
 1261| '' This subroutine will change the captions on all the buttons
      and
 1262| ''   label to indicate the user's input projection systems.
 1263| ''   User gets to choose the name
 1264|
 1265|   Me!cmdIn2Out_Manual.Caption = "&> " & strINSuffix & " to " &
      strOUTSuffix & ">"
 1266|   Me!cmdOut2In_MANUAL.Caption = "&<" & strOUTSuffix & " to " &
      strINSuffix & "<"
 1267|   'Me!cmdIn2Out_Manual.Enabled = True
 1268|   'Me!cmdOut2In_MANUAL.Enabled = True
 1269|
 1270|   Me!zlblIN_MANUAL.Caption = "Coordinates in " & strINSuffix
 1271|   Me!zlblXIN_MANUAL.Caption = "X" & strINSuffix
 1272|   Me!zlblYIN_MANUAL.Caption = "Y" & strINSuffix
 1273|   Me!zlblOUT_MANUAL.Caption = "Coordinates in " & strOUTSuffix
 1274|   Me!zlblXOUT_MANUAL.Caption = "X" & strOUTSuffix
 1275|   Me!zlblYOUT_Manual.Caption = "Y" & strOUTSuffix
 1276|
 1277|
 1278|
 1279|   Me!cmdIn2Out_BLOBS.Caption = "&> " & strINSuffix & " to " &
      strOUTSuffix & ">"
 1280|   'Me!cmdIn2Out_BLOBS.Enabled = True
 1281|   Me!zlblBLOB_In.Caption = "BLOB field containing input XY Chain
      in " & strINSuffix & " coordinates"
 1282|   Me!zlblBLOBS_Out.Caption = "BLOB field to receive output XY
      Chain in " & strOUTSuffix & " coordinates"
 1283|
 1284|   Me!zlbl_PointIn.Caption = "Fields containing input " &
      strINSuffix & " coordinates"
 1285|   Me!zlblOutFields_Points.Caption = "Fields to get " &
      strOUTSuffix & " output coordinates"
 1286|   Me!zlblXIn_Points.Caption = "X" & strINSuffix
 1287|   Me!zlblYIn_Points.Caption = "Y" & strINSuffix
 1288|   Me!zlblXOut_POINTS.Caption = "X" & strOUTSuffix
 1289|   Me!zlblYOUT_Points.Caption = "Y" & strOUTSuffix
 1290|   Me!cmdIn2Out_Points.Caption = "&> " & strINSuffix & " to " &
      strOUTSuffix & " >"
 1291|   'Me!cmdIn2Out_Points.Enabled = True
 1292|   Call EnableButtons(True)
 1293| End Sub
 1294|
 1295| Sub SetQuery_BLOBS (strTblQrySQL As String)
 1296| 'This subroutine sets the data control to the desired TaBLe,
      QueRY, or SQL string,
 1297| ' then sets the labels for the attribute grid.
 1298| On Error GoTo ERRSetQuery_BLOBS
 1299| Set dnsCurrentQT = DB.CreateDynaset(strTblQrySQL)
 1300| nFields = dnsCurrentQT.Fields.Count
 1301| dnsCurrentQT.Close
 1302| Set dnsCurrentQT = Nothing
 1303| dat_BLOBs.RecordSource = strTblQrySQL
 1304|         'nFields = Dat_BLOBS.Recordset.Fields.Count
 1305| dat_BLOBs.Refresh
 1306| intCoordinateField = 0
 1307| Dim FieldName As String
```

```
1308| nFields = dat_BLOBs.Recordset.Fields.Count
1309|
1310| cmbXY_In_BLOBS.Clear : cmbXY_Out_BLOBs.Clear
1311| For n = 0 To nFields - 1
1312|     If (dat_BLOBs.Recordset.Fields(n).Type = DB_LONGBINARY) Then
1313|        cmbXY_In_BLOBS.AddItem dat_BLOBs.Recordset.Fields(n).Name
1314|     End If
1315|     If (dat_BLOBs.Recordset.Fields(n).Type = DB_LONGBINARY) Then
1316|        cmbXY_Out_BLOBs.AddItem
    dat_BLOBs.Recordset.Fields(n).Name
1317|     End If
1318| Next n
1319|
1320| If cmbXY_In_BLOBS.ListCount = 0 Then
1321|   Beep
1322|   MsgBox "That query or table does not contain a BLOB field.
    Please choose another table/query or modify the field names to
    include UTM or LatLong as appropriate."
1323|       cmbQTList_BLOBs.SetFocus
1324|       SendKeys "%{DOWN}"
1325|
1326|   Exit Sub
1327| End If
1328|
1329| If cmbXY_In_BLOBS.ListCount > 0 Then
1330|     cmbXY_In_BLOBS.ListIndex = 0
1331| End If
1332|     cmbXY_Out_BLOBs.AddItem "XYChain" & strOUTSuffix
1333|     cmbXY_Out_BLOBs.ListIndex = cmbXY_Out_BLOBs.ListCount - 1
1334|
1335|
1336| Exit Sub
1337|
1338| ERRSetQuery_BLOBS:
1339| If Err = 3061 Then
1340|     MsgBox "You tried selecting a parameter query, and this
    application doesn't do those.  Sorry!"
1341|     Err = 0
1342|     Exit Sub
1343| End If
1344|
1345| MsgBox "Error number " & Err & " occurred in SetQuery_BLOBS." &
    CRLF & Error
1346| Err = 0
1347| Exit Sub
1348| Resume
1349| 'Dat_BLOBS.Recordset.MoveFirst
1350| 'Eliminated the above line so empty tables wouldn't
1351| '  cause it to freak out.
1352| End Sub
1353|
1354| Sub SetQuery_Points (strTblQrySQL As String)
1355| 'This subroutine sets the data control to the desired TaBLe,
    QueRY, or SQL string,
1356| ' then sets the labels for the attribute grid.
1357| On Error GoTo ERRSetQuery
1358| Set dnsCurrentQT = DB.CreateDynaset(strTblQrySQL)
1359| nFields = dnsCurrentQT.Fields.Count
```

```
1360| dnsCurrentQT.Close
1361| Set dnsCurrentQT = Nothing
1362| Dat_Points.RecordSource = strTblQrySQL
1363|         'nFields = Dat_Points.Recordset.Fields.Count
1364| Dat_Points.Refresh
1365| intCoordinateField = 0
1366| Dim FieldName As String, uFieldName As String
1367| nFields = Dat_Points.Recordset.Fields.Count
1368| Dim intHasX As Integer, intHasY As Integer   ', intHasUTM As
    Integer, intHasLL As Integer
1369| cmbXY_In_Points(X_INDEX).Clear : cmbXY_In_Points(Y_INDEX).Clear
1370| cmbXY_Out_Points(X_INDEX).Clear :
    cmbXY_Out_Points(Y_INDEX).Clear
1371|
1372| For n = 0 To nFields - 1
1373|     If ((Dat_Points.Recordset.Fields(n).Type = DB_SINGLE) Or
    (Dat_Points.Recordset.Fields(n).Type = DB_DOUBLE)) Then   '
    field might contain coordinates
1374|       intHasX = False: intHasY = False    ': intHasUTM = False:
    intHasLL = False
1375|       FieldName = Dat_Points.Recordset.Fields(n).Name:
    uFieldName = UCase$(FieldName)
1376|
1377|       intHasX = intHasX Or InStr(uFieldName, "X_") <> 0
1378|       intHasX = intHasX Or InStr(uFieldName, "EAST") <> 0
1379|
1380|       intHasY = intHasY Or InStr(uFieldName, "Y_") <> 0
1381|       intHasY = intHasY Or InStr(uFieldName, "NORT") <> 0
1382|
1383|
1384|
1385|       If (intHasX) Then cmbXY_Out_Points(X_INDEX).AddItem
    FieldName
1386|       If (intHasY) Then cmbXY_Out_Points(Y_INDEX).AddItem
    FieldName
1387|
1388|       If (intHasX) Then cmbXY_In_Points(X_INDEX).AddItem
    FieldName
1389|       If (intHasY) Then cmbXY_In_Points(Y_INDEX).AddItem
    FieldName
1390|
1391|     End If
1392|
1393| Next n
1394|
1395|
1396| If cmbXY_In_Points(X_INDEX).ListCount = 0 Then
1397|   Beep
1398|   MsgBox "That query or table does not contain any suitable
    coordinate fields.  Please choose another table/query or modify
    the field names to include X_ and Y_ as appropriate."
1399|   cmbQTList_Points.SetFocus
1400|   SendKeys "%{DOWN}"
1401|   Exit Sub
1402| End If
1403|
1404| If cmbXY_In_Points(X_INDEX).ListCount > 0 Then
1405|     cmbXY_In_Points(X_INDEX).ListIndex = 0
```

```
1406| End If
1407| If cmbXY_In_Points(Y_INDEX).ListCount > 0 Then
1408|     cmbXY_In_Points(Y_INDEX).ListIndex = 0
1409| End If
1410|
1411|
1412|    cmbXY_Out_Points(X_INDEX).AddItem "X" & strOUTSuffix
1413|    cmbXY_Out_Points(X_INDEX).ListIndex =
     cmbXY_Out_Points(X_INDEX).ListCount - 1
1414|
1415|    cmbXY_Out_Points(Y_INDEX).AddItem "Y" & strOUTSuffix
1416|    cmbXY_Out_Points(Y_INDEX).ListIndex =
     cmbXY_Out_Points(Y_INDEX).ListCount - 1
1417|
1418|
1419| Exit Sub
1420|
1421| ERRSetQuery:
1422| If Err = 3061 Then
1423|     MsgBox "You tried selecting a parameter query, and this
     application doesn't do those.  Sorry!"
1424|     Err = 0
1425|     Exit Sub
1426| End If
1427|
1428| MsgBox "Error number " & Err & " occurred in SetQuery." & CRLF &
     Error
1429| Err = 0
1430| Exit Sub
1431| Resume
1432| 'Dat_Points.Recordset.MoveFirst
1433| 'Eliminated the above line so empty tables wouldn't
1434| '  cause it to freak out.
1435| End Sub
1436|
1437| Sub txtJunk_GotFocus ()
1438|    cmdIn2Out_Manual.SetFocus
1439| End Sub
1440|
```

```
 1| Option Explicit
 2| Type typDblePoint
 3|    X As Double
 4|    Y As Double
 5| End Type
 6| Type typRealPoint
 7|    X As Single
 8|    Y As Single
 9| End Type
10|
11|
12|
13|
14| Global Const OneDegreeInRadians = .01745329251994
15| Global Const OneRadianInDegrees = 57.29577951308
16|
17|
18| 'GCTP Main routine, calls other routines as appropriate
19| Declare Sub GTRNZ0 Lib "GCTP0001.DLL" (DblCoordIn As
    typDblePoint, JCoordSysIn As Long, SetupCoordSysIn As Double,
    DblCoordOut As typDblePoint, JCoordSysOut As Long,
    SetupCoordSysOut As Double, jZero As Long, jFlag As Long)
20|
21| 'Initialization routine for UTM
22| Declare Sub IS01Z0 Lib "GCTP0001.DLL" (jZone As Long,
    SetupCoordSys As Double, jZero As Long, jFlag As Long)
23| 'Forward UTM transformation            Lat Long Radians     ->
    UTM Meters
24| Declare Sub PF01Z0 Lib "GCTP0001.DLL" (DblCoordIn As
    typDblePoint, DblCoordOut As typDblePoint, jFlag As Long)
25| 'Inverse UTM                          UTM Meters           ->
    Lat Long Radians
26| Declare Sub PI01Z0 Lib "GCTP0001.DLL" (DblCoordIn As
    typDblePoint, DblCoordOut As typDblePoint, jFlag As Long)
27|
28|
29| Global Const J0Zero = 0&
30| Dim CoordSysIn(1 To 13) As Double, CoordSysOut(1 To 13) As
    Double
31| Global flgInitialized As Long, j0 As Long, jFlag As Long
32| Global dblPoint1 As typDblePoint, dblPoint2 As typDblePoint
33|
34|
35|
36|   'Declare Function ClipLineToPolygon Lib "WhtGeom1.DLL" (P1 As
    RealPoint, P2 As RealPoint, nPts As Long, Poly As RealPoint,
    Crossings As RealPoint) As Long
37|
38| Function DecDegToDMS (ByVal DecDegIn As Single) As String
39|      Dim strDeg As String, strMin As String, strSec As String
40|      Dim Temp1 As Single, Temp2 As Single
41|      strDeg = "": strMin = "": strSec = ""
42|      Temp1 = Fix(DecDegIn)
43|      strDeg = Format(Temp1)
44|      Temp1 = Abs(DecDegIn - Temp1)
45|
46|
47|      Temp1 = 60 * Temp1
```

```
 48|      Temp2 = Fix(Temp1)
 49|      strMin = Format$(Temp2, "00")
 50|
 51|      Temp2 = 60 * (Temp1 - Temp2)
 52|      strSec = Format$(Temp2, "00.#")
 53|
 54|      DecDegToDMS = strDeg & " " & strMin & " " & strSec
 55| End Function
 56|
 57| Function DMSToDecDeg (ByVal DMSIn As String) As Single
 58|    Dim a As Single, b As Single, c As Single
 59|     Dim str1 As String, str2 As String, str3 As String
 60|     Dim Loc1 As Integer, Loc2 As Integer, Loc3 As Integer
 61|     Dim Sign As Integer
 62|     DMSIn = Trim$(DMSIn)
 63|     Loc1 = InStr(DMSIn, " ")
 64|     If Loc1 = 0 Then  'If there are no spaces, just degrees. So
    skip out now
 65|         DMSToDecDeg = Val(DMSIn)
 66|         Exit Function
 67|     End If
 68|
 69|     str1 = Trim$(Mid$(DMSIn, 1, Loc1))'Get the degrees
 70|     a = Val(str1)
 71|     Sign = Sgn(a)
 72|
 73|     str2 = Trim$(Mid$(DMSIn, Loc1))
 74|     Loc2 = InStr(str2, " ")
 75|     If Loc2 = 0 Then   'Just degrees and minutes, so skip out
    now.
 76|        b = Val(str2) / 60#
 77|        DMSToDecDeg = a + Sign * b
 78|        Exit Function
 79|     End If
 80|      str3 = Trim$(Mid$(str2, Loc2))
 81|      str2 = Left$(str2, Loc2)
 82|
 83|     b = Val(str2) / 60#
 84|
 85|     c = Val(str3) / 3600#
 86|     DMSToDecDeg = a + Sign * b + Sign * c
 87| End Function
 88|
 89| Sub gctp_COMMENTS ()
 90|  'This module contains definitions and helper routines for
 91|  ' use with the GCTP Map Projection package.
 92|  ' Source code for GCTP comes from USGS and NOAA
 93|  '  See NOAA Technical Report NOS 124 CGS9
 94|  ' General Cartographic Transformation Package (GCTP), Version
    II
 95|  '  by Atef A. Elassal
 96| 'Slightly modified by Greg Pouch at KGS 9/27/94 and 11/1/94
 97| '   to get the SPCZ routines to read properly.
 98| ' Compiled and linked as a Windows DLL by Greg Pouch 95 03 02
 99| ' Calling routines and declare statements  95 03 02
100|
101|
102| End Sub
```

```
103|
104| Sub gctp_DConvertDecDegToUTM (DblLatLongIn As typDblePoint,
   DblUTMOut As typDblePoint, jZone As Long)
105| '' Takes Double Points and converts from Lat Long in Decimal
   Degrees to UTM Meters
106|     Dim dblTemp As typDblePoint
107|     j0 = J0Zero
108|     dblTemp.X = DblLatLongIn.X * OneDegreeInRadians
109|     dblTemp.Y = DblLatLongIn.Y * OneDegreeInRadians
110|     Call IS01Z0(jZone, CoordSysIn(1), j0, jFlag)
111|     Call PF01Z0(dblTemp, DblUTMOut, jFlag)
112| End Sub
113|
114| Sub gctp_DConvertUTMToDecDeg (DblUTMIn As typDblePoint,
   DblLatLongOut As typDblePoint, jZone As Long)
115| ''Takes Double Points to convert from UTM to Lat Long.
116|     j0 = J0Zero
117|     Call IS01Z0(jZone, CoordSysIn(1), j0, jFlag)
118|     Call PI01Z0(DblUTMIn, DblLatLongOut, jFlag)
119|     DblLatLongOut.X = DblLatLongOut.X * OneRadianInDegrees
120|     DblLatLongOut.Y = DblLatLongOut.Y * OneRadianInDegrees
121| End Sub
122|
123| Function gctp_ProjectBLOB (XYBLOBIn As String, JCoordSysIn() As
   Long, SetupCoordSysIn() As Double, JCoordSysOut() As Long,
   SetupCoordSysOut() As Double) As String
124|
125|
126|     Dim nP As Long, nPoints As Long
127|     Dim dblIn As typDblePoint, dblOut As typDblePoint
128|
129|     nPoints = Len(XYBLOBIn) \ 8
130|     ReDim XYCoords(1 To 1) As RealPoint
131|     Call BLOB2RealPoints(XYBLOBIn, XYCoords())
132|
133|     For nP = 1 To nPoints
134|         dblIn.X = XYCoords(nP).X: dblIn.Y = XYCoords(nP).Y
135|         Call GTRNZ0(dblIn, JCoordSysIn(1), SetupCoordSysIn(1),
   dblOut, JCoordSysOut(1), SetupCoordSysOut(1), j0, jFlag)
136|
137|         XYCoords(nP).X = dblOut.X: XYCoords(nP).Y = dblOut.Y
138|     Next nP
139|    gctp_ProjectBLOB = RealPoints2BLOB(XYCoords())
140|
141| End Function
142|
143| Function gctp_ProjectBLOBLLToUTM14 (XYBLOBIn As String) As
   String
144|     Dim nP As Long, nPoints As Long
145|     Dim dblIn As typDblePoint, dblOut As typDblePoint
146|
147|     nPoints = Len(XYBLOBIn) \ 8
148|     ReDim XYCoords(1 To 1) As RealPoint
149|     Call BLOB2RealPoints(XYBLOBIn, XYCoords())
150|
151|     For nP = 1 To nPoints
152|         dblIn.X = XYCoords(nP).X: dblIn.Y = XYCoords(nP).Y
153|         Call gctp_DConvertDecDegToUTM(dblIn, dblOut, 14&)
```

```
154|          XYCoords(nP).X = dblOut.X: XYCoords(nP).Y = dblOut.Y
155|      Next nP
156|     gctp_ProjectBLOBLLToUTM14 = RealPoints2BLOB(XYCoords())
157| End Function
158|
159| Function gctp_ProjectBLOBLLToUTMnn (XYBLOBIn As String, jZone As
   Long) As String
160|      Dim nP As Long, nPoints As Long
161|      Dim dblIn As typDblePoint, dblOut As typDblePoint
162|
163|      nPoints = Len(XYBLOBIn) \ 8
164|      ReDim XYCoords(1 To 1) As RealPoint
165|      Call BLOB2RealPoints(XYBLOBIn, XYCoords())
166|
167|      For nP = 1 To nPoints
168|          dblIn.X = XYCoords(nP).X: dblIn.Y = XYCoords(nP).Y
169|          Call gctp_DConvertDecDegToUTM(dblIn, dblOut, jZone)
170|          XYCoords(nP).X = dblOut.X: XYCoords(nP).Y = dblOut.Y
171|      Next nP
172|     gctp_ProjectBLOBLLToUTMnn = RealPoints2BLOB(XYCoords())
173|
174| End Function
175|
176| Function gctp_ProjectBLOBUTM14ToLL (XYBLOBIn As String) As
   String
177|      Dim nP As Long, nPoints As Long
178|      Dim dblIn As typDblePoint, dblOut As typDblePoint
179|
180|      nPoints = Len(XYBLOBIn) \ 8
181|      ReDim XYCoords(1 To 1) As RealPoint
182|      Call BLOB2RealPoints(XYBLOBIn, XYCoords())
183|
184|      For nP = 1 To nPoints
185|          dblIn.X = XYCoords(nP).X: dblIn.Y = XYCoords(nP).Y
186|          Call gctp_DConvertUTMToDecDeg(dblIn, dblOut, 14&)
187|          XYCoords(nP).X = dblOut.X: XYCoords(nP).Y = dblOut.Y
188|      Next nP
189|     gctp_ProjectBLOBUTM14ToLL = RealPoints2BLOB(XYCoords())
190|
191| End Function
192|
193| Function gctp_ProjectBLOBUTMnnToLL (XYBLOBIn As String, jZone As
   Long) As String
194|      Dim nP As Long, nPoints As Long
195|      Dim dblIn As typDblePoint, dblOut As typDblePoint
196|
197|      nPoints = Len(XYBLOBIn) \ 8
198|      ReDim XYCoords(1 To 1) As RealPoint
199|      Call BLOB2RealPoints(XYBLOBIn, XYCoords())
200|
201|      For nP = 1 To nPoints
202|          dblIn.X = XYCoords(nP).X: dblIn.Y = XYCoords(nP).Y
203|          Call gctp_DConvertUTMToDecDeg(dblIn, dblOut, jZone)
204|          XYCoords(nP).X = dblOut.X: XYCoords(nP).Y = dblOut.Y
205|      Next nP
206|     gctp_ProjectBLOBUTMnnToLL = RealPoints2BLOB(XYCoords())
207|
208| End Function
```

```
209|
210| Sub gctp_SConvertDecDegToUTM (sngLatLongIn As typRealPoint,
   sngUTMOut As typRealPoint, jZone As Long)
211| ''Takes Real Points to convert from Lat Long to  UTM.
212|      dblPoint1.X = sngLatLongIn.X: dblPoint1.Y = sngLatLongIn.Y
213|      Call gctp_DConvertUTMToDecDeg(dblPoint1, dblPoint2, jZone)
214|      sngUTMOut.X = dblPoint2.X: sngUTMOut.Y = dblPoint2.Y
215| End Sub
216|
217| Sub gctp_SConvertUTMToDecDeg (sngUTMIn As typRealPoint,
   sngLatLongOut As typRealPoint, jZone As Long)
218| ''Takes Real Points to convert from UTM to Lat Long.
219|      dblPoint1.X = sngUTMIn.X: dblPoint1.Y = sngUTMIn.Y
220|      Call gctp_DConvertUTMToDecDeg(dblPoint1, dblPoint2, jZone)
221|      sngLatLongOut.X = dblPoint2.X: sngLatLongOut.Y =
   dblPoint2.Y
222| End Sub
223|
224| Sub zzzGTRNZ0 ()
225| '*
   ************************************************************
   *******GCTP0197
226| '* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A.
   ELASSAL **GCTP0198
227| '* ** GCTP/II                VERSION 1.0.2          SEPTEMBER
   1,1986 **GCTP0199
228| '*
   ************************************************************
   *******GCTP0200
229| '      SUBROUTINE GTRNZ0 (CRDIN,INDEF,TPARIN,CRDIO,IODEF,TPARIO,
   GCTP0201
230| '     .                   IPFILE,IFLG)
   GCTP0202
231| 'CRDIN  Input coordinates as a pair of real*8s
232| 'INDEF  Integer*4 3-element array defining input coordianate
   system
233| 'TPARIN  Thirteen Parameters real*8 defining input coordinate
   system
234| 'CRDIO  Output coordinates as a pair of real*8s
235| 'IODEF  Integer*4 3-element array defining output coordianate
   system
236| 'TPARIO Thirteen Parameters real*8 defining input coordinate
   system
237| 'IPFILE SET TO ZERO, pass as an integer*4
238| 'IFLG   Return code.  Zero is good, other numbers indicate a
   problem.
239|
240| '*
   GCTP0203
241| '* GENERAL PROGRAM FOR TRANSFORMATION BETWEEN VARIOUS REFERENCE
   SYSTEMS  GCTP0204
242| '*
   GCTP0205
243| '* INPUT
   ************************************************************
   GCTP0206
244| '* CRDIN    : COORDINATES IN INPUT SYSTEM (2 DP WORDS ARRAY).
   GCTP0207
```

```
'* INDEF(1) : CODE NUMBER OF INPUT COORDINATE SYSTEM (INTEGER).
GCTP0208
'*               =  0 , GEOGRAPHIC
GCTP0209
'*               =  1 , U T M
GCTP0210
'*               =  2 , STATE PLANE
GCTP0211
'*               =  3 , ALBERS CONICAL EQUAL-AREA
GCTP0212
'*               =  4 , LAMBERT CONFORMAL CONIC
GCTP0213
'*               =  5 , MERCATOR
GCTP0214
'*               =  6 , POLAR STEREOGRAPHIC
GCTP0215
'*               =  7 , POLYCONIC
GCTP0216
'*'               =  8 , EQUIDISTANT CONIC
GCTP0217
'*               =  9 , TRANSVERSE MERCATOR
GCTP0218
'*               = 10 , STEREOGRAPHIC
GCTP0219
'*               = 11 , LAMBERT AZIMUTHAL EQUAL-AREA
GCTP0220
'*               = 12 , AZIMUTHAL EQUIDISTANT
GCTP0221
'*               = 13 , GNOMONIC
GCTP0222
'*'               = 14 , ORTHOGRAPHIC
GCTP0223
'*               = 15 , GENERAL VERTICAL NEAR-SIDE PERSPECTIVE
GCTP0224
'*               = 16 , SINUSOIDAL
GCTP0225
'*               = 17 , EQUIRECTANGULAR
GCTP0226
'*               = 18 , MILLER CYLINDRICAL
GCTP0227
'*               = 19 , VAN DER GRINTEN I
GCTP0228
'*               = 20 , OBLIQUE MERCATOR (HOTINE)
GCTP0229
'* INDEF(2) : CODE NUMBER OF INPUT COORDINATE ZONE (INTEGER).
GCTP0230
'* TPARIN   : PARAMETERS OF INPUT REFERENCE SYSTEM (15 DP WORDS
ARRAY).  GCTP0231
'* INDEF(3) : CODE NUMBER OF UNITS OF MEASURE FOR INPUT COORDS
(INTEGER).GCTP0232
'*               = 0 , RADIANS.
GCTP0233
'*               = 1 , FEET.
GCTP0234
'*               = 2 , METERS.
GCTP0235
'*               = 3 , SECONDS OF ARC.
GCTP0236
```

```
274| '*                = 4 , DEGREES OF ARC.
   GCTP0237
275| '*                = 5 , PACKED DMS.
   GCTP0238
276| '* IODEF(1) : CODE NUMBER OF OUTPUT COORDINATE SYSTEM (INTEGER).
   GCTP0239
277| '* IODEF(2) : CODE NUMBER OF OUTPUT COORDINATE ZONE (INTEGER).
   GCTP0240
278| '* TPARIO   : PARAMETERS OF OUTPUT REFERENCE SYSTEM (15 DP WORDS
   ARRAY). GCTP0241
279| '* IODEF(3) : CODE NUMBER OF UNITS OF MEASURE FOR OUTPUT COORDS
   (INTEGER)GCTP0242
280| '* IPFILE   : LOGICAL NUMBER OF FILE FOR MESSAGES.
   GCTP0243
281| '*
   GCTP0244
282| '* OUTPUT
   ************************************************************
   GCTP0245
283| '* CRDIO    : COORDINATES IN OUTPUT REFERENCE SYSTEM (2 DP WORDS
   ARRAY). GCTP0246
284| '* IFLG     : RETURN FLAG (INTEGER).
   GCTP0247
285| '*              = 0 , SUCCESSFUL TRANSFORMATION.
   GCTP0248
286| '*              = I , UNSUCCESSFUL TRANSFORMATION. ERROR CODE
   = I.     GCTP0249
287| '*
   GCTP0250
288| '      IMPLICIT REAL*8 (A-H,O-Z)
289|
290| End Sub
291|
```

```
 1| Option Explicit
 2|
 3| Global TabChar  As String, CR  As String, CRLF   As String
 4|
 5| Type RealPoint
 6|     X As Single
 7|     Y As Single
 8| End Type
 9| Type String8
10|     f As String * 8
11| End Type
12| Dim RlPt As RealPoint
13| Dim S8 As String8
14| 'File Open/Save Dialog Flags
15| Global Const OFN_READONLY = &H1&
16| Global Const OFN_OVERWRITEPROMPT = &H2&
17| Global Const OFN_HIDEREADONLY = &H4&
18| Global Const OFN_NOCHANGEDIR = &H8&
19| Global Const OFN_SHOWHELP = &H10&
20| Global Const OFN_NOVALIDATE = &H100&
21| Global Const OFN_ALLOWMULTISELECT = &H200&
22| Global Const OFN_EXTENSIONDIFFERENT = &H400&
23| Global Const OFN_PATHMUSTEXIST = &H800&
24| Global Const OFN_FILEMUSTEXIST = &H1000&
25| Global Const OFN_CREATEPROMPT = &H2000&
26| Global Const OFN_SHAREAWARE = &H4000&
27| Global Const OFN_NOREADONLYRETURN = &H8000&
28|
29| ' Field Data Types
30| Global Const DB_BOOLEAN = 1
31| Global Const DB_BYTE = 2
32| Global Const DB_INTEGER = 3
33| Global Const DB_LONG = 4
34| Global Const DB_CURRENCY = 5
35| Global Const DB_SINGLE = 6
36| Global Const DB_DOUBLE = 7
37| Global Const DB_DATE = 8
38| Global Const DB_TEXT = 10
39| Global Const DB_LONGBINARY = 11
40| Global Const DB_MEMO = 12
41|
42| Sub BLOB2RealPoints (BLOBin As String, DataPts() As RealPoint)
43| Dim n As Long, nPoints As Long, NPos As Long
44| nPoints = Len(BLOBin) / 8 '8 Bytes to a RealPoint
45| Dim NStart As Long
46| 'We will append datapoints to the end of the current array.
47| ' This way, we can have an unlimited number (kind of) of points
48| ' in a line.  Before starting to fill this array using
49| ' this subroutine, you should redim it to contain zero points
50| If LBound(DataPts) <> UBound(DataPts) Then
51|     NStart = UBound(DataPts) + 1
52|     ReDim Preserve DataPts(1 To UBound(DataPts) + nPoints)
53|   Else
54|     NStart = 1
55|     ReDim Preserve DataPts(1 To nPoints)
56| End If
57|
58| 'ReDim Preserve DataPts(1 To UBound(DataPts) + NPoints)
```

```
 59| NPos = 1  'NPos will keep track of where in the BLOB we are
 60| For n = NStart To UBound(DataPts)
 61|     S8.f = Mid$(BLOBin, NPos, 8)
 62|     LSet RlPt = S8
 63|     DataPts(n) = RlPt
 64|     NPos = NPos + 8
 65| Next n
 66| End Sub
 67|
 68| Sub BLOB2XYPairsInSnglArray (BLOBin As String, sngXYData() As
     Single)
 69| '' Take XY Chains stored in a WHEAT format XYBLOB and put them
     into
 70| '' a one-based, two-dimensional array.
 71| '' sngXYData() must be a dimensionable array
 72| ''  Point nPt will be X=sngXYData(nPt,1), Y=sngXYData(nPt,1)
 73|
 74|
 75| Dim n As Long, nPoints As Long, NPos As Long
 76| nPoints = Len(BLOBin) / 8 '8 Bytes to a RealPoint
 77|
 78| ReDim sngXYData(1 To nPoints, 1 To 2)
 79| NPos = 1  'NPos will keep track of where in the BLOB we are
 80| For n = 1 To nPoints
 81|     S8.f = Mid$(BLOBin, NPos, 8)
 82|     LSet RlPt = S8
 83|     sngXYData(n, 1) = RlPt.X
 84|     sngXYData(n, 2) = RlPt.Y
 85|     NPos = NPos + 8
 86| Next n
 87|
 88| End Sub
 89|
 90| Function RealPoints2BLOB (DataPts() As RealPoint) As String
 91| Dim n As Long
 92| Dim BigTemp  As String
 93| BigTemp = ""
 94| For n = LBound(DataPts) To UBound(DataPts)
 95|     RlPt = DataPts(n)
 96|     LSet S8 = RlPt
 97|     BigTemp = BigTemp & S8.f
 98| Next n
 99| RealPoints2BLOB = BigTemp
100| End Function
101|
102| Sub WheatLog_AddEntry (DBName As String, strInputs As String,
     strOutputs As String, strProgName As String, strUserName As
     String)
103| '''Call WheatLog_AddEntry
     (DBName,strInputs,strOutputs,strProgName, strUserName)
104| '' Adds an entry to the WheatLog Table.
105| Dim DB As Database
106| 'Dim strInputs As String, strOutputs As String, strProgName As
     String, strUserName As String
107| 'call WheatLog_AddEntry (DBName , strInputs, strOutputs ,
     strProgName , strUserName )
108| On Error Resume Next
109| Dim tbl As Table
```

```
110|
111| Set DB = OpenDatabase(DBName, False, False)
112| Set tbl = DB.OpenTable("ztblWHEAT_LOG")
113|  If Err <> 0 Then
114|    Call WheatLog_DefineTable(DB)
115|    DB.Close
116|    Set DB = OpenDatabase(DBName, False, False)
117|    Set tbl = DB.OpenTable("ztblWHEAT_LOG")
118|  End If
119|  Err = 0
120|
121|  tbl.AddNew
122|    tbl("Inputs") = strInputs
123|    tbl("Outputs") = strOutputs
124|    tbl("ProgramName") = strProgName
125|    tbl("UserName") = strUserName
126|    tbl("TimeStamp") = Now
127|  tbl.Update
128| '    "WHEAT_Log_SerialNumber" Serial number not set.
129|    tbl.Close : Set tbl = Nothing
130|    DB.Close : Set DB = Nothing
131|
132| End Sub
133|
134| Sub WheatLog_DefineTable (DBIn As Database)
135| On Error GoTo ERRDefine_ztblWHEATLOG
136| 'GWPouch 940830
137| 'Defines a table store program log entries
138|
139|
140| Dim NewTable As New tabledef
141| NewTable.Name = "ztblWHEAT_LOG"
142|
143| Dim nfSerial As New field
144| nfSerial.Type = DB_LONG
145| nfSerial.Name = "SerialNumber"
146| nfSerial.Attributes = 49'Auto-increment, fixed width, updateable
147| NewTable.Fields.Append nfSerial
148|
149| Dim nfWhen As New field
150| nfWhen.Type = DB_DATE
151| nfWhen.Name = "TimeStamp"
152| NewTable.Fields.Append nfWhen
153|
154| Dim nfInputs As New field
155| nfInputs.Type = DB_MEMO
156| nfInputs.Name = "Inputs"
157| NewTable.Fields.Append nfInputs
158|
159| Dim nfOutputs As New field
160| nfOutputs.Type = DB_MEMO
161| nfOutputs.Name = "Outputs"
162| NewTable.Fields.Append nfOutputs
163|
164| Dim nfProgramName As New field
165| nfProgramName.Type = DB_TEXT
166| nfProgramName.Size = 255
167| nfProgramName.Name = "ProgramName"
```

```
168| NewTable.Fields.Append nfProgramName
169|
170| Dim nfUserName As New field
171| nfUserName.Type = DB_TEXT
172| nfUserName.Size = 255
173| nfUserName.Name = "UserName"
174| NewTable.Fields.Append nfUserName
175|
176|
177|
178|
179| DBIn.TableDefs.Append NewTable
180|
181| Exit Sub
182|
183|
184| ERRDefine_ztblWHEATLOG:
185| Select Case Err
186|  Case 3010 'Table of that name already exists
187|     Err = 0
188|     Exit Sub
189|     Resume
190|  Case 3125
191|     'TableOutName = InputBox$(TableOutName & " is not a valid
    name.  Please choose a new one.", "Saving Contours to Table",
    TableOutName)
192|     'NewTable.Name = TableOutName
193|     'Resume
194|  Case Else
195|     MsgBox "Error #" & Err & " occured in WheatLog_DefineTable."
    & CRLF & Error
196|     Err = 0
197|     Exit Sub
198|     Resume
199| End Select
200|
201|
202|
203| End Sub
204|
205| Function XYPairsInSnglArray2BLOB (sngXYData() As Single) As
    String
206| '' Take XY Chains stored in a two-dimensional real*4 array and
    put them
207| '' into aWHEAT format XYBLOB
208| ''  Point nPt will be X=sngXYData(nPt,X_INDEX),
    Y=sngXYData(nPt,Y_INDEX)
209| Dim X_INDEX As Long, Y_INDEX As Long, nPt As Long
210| Dim nFirst As Long, nLast As Long
211| nFirst = LBound(sngXYData, 1): nLast = UBound(sngXYData, 1)
212| X_INDEX = LBound(sngXYData, 2): Y_INDEX = UBound(sngXYData, 2)
213| If Y_INDEX - X_INDEX > 1 Then Exit Function
214| Dim BigTemp  As String
215| BigTemp = ""
216| For nPt = nFirst To nLast
217|     RlPt.X = sngXYData(nPt, X_INDEX): RlPt.Y = sngXYData(nPt,
    Y_INDEX)
218|     LSet S8 = RlPt
```

```
219|     BigTemp = BigTemp & S8.f
220| Next nPt
221| XYPairsInSnglArray2BLOB = BigTemp
222|
223| End Function
224|
```

```
* ***********************************************************************GCTP0001
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0002
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0003
* ***********************************************************************GCTP0004
      DOUBLE PRECISION FUNCTION ADJLZ0 (LON)                             GCTP0005
*                                                                        GCTP0006
* FUNCTION TO ADJUST LONGITUDE ANGLE TO MODULE 180 DEGREES.              GCTP0007
*                                                                        GCTP0008
      IMPLICIT REAL*8 (A-Z)                                              GCTP0009
      DATA TWO,PI /2.0D0,3.14159265358979323846D0/                       GCTP0010
*                                                                        GCTP0011
  020 ADJLZ0 = LON                                                       GCTP0012
      IF (DABS(LON) .LE. PI) RETURN                                      GCTP0013
      TWOPI = TWO * PI                                                   GCTP0014
      LON = LON - DSIGN (TWOPI,LON)                                      GCTP0015
      GO TO 020                                                          GCTP0016
*                                                                        GCTP0017
      END                                                                GCTP0018
* ***********************************************************************GCTP0020
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0021
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0022
* ***********************************************************************GCTP0023
      DOUBLE PRECISION FUNCTION ASINZ0 (CON)                             GCTP0024
*                                                                        GCTP0025
* THIS FUNCTION ADJUSTS FOR ROUND-OFF ERRORS IN COMPUTING ARCSINE        GCTP0026
*                                                                        GCTP0027
      IMPLICIT REAL*8 (A-Z)                                              GCTP0028
      DATA ONE /1.0D0/                                                   GCTP0029
*                                                                        GCTP0030
      IF (ABS(CON) .GT. ONE) THEN                                        GCTP0031
       CON = DSIGN (ONE,CON)                                             GCTP0032
       ENDIF                                                             GCTP0033
      ASINZ0 = DASIN (CON)                                               GCTP0034
      RETURN                                                             GCTP0035
*                                                                        GCTP0036
      END                                                                GCTP0037
* ***********************************************************************GCTP0039
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0040
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0041
* ***********************************************************************GCTP0042
      BLOCK DATA                                                         GCTP0043
*                                                                        GCTP0044
* INITIALIZATION OF ELLIPSOID TO CLARK'S 1866 PARAMETERS.                GCTP0045
*                                                                        GCTP0046
      IMPLICIT REAL*8 (A-Z)                                              GCTP0047
*                                                                        GCTP0048
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                      GCTP0049
      COMMON /SPHRZ0/ AZZ                                                GCTP0050
*                                                                        GCTP0051
      DATA AZ  /0.6378206400000000D+07/                                  GCTP0052
      DATA EZ  /0.8227185422300323D-01/                                  GCTP0053
      DATA ESZ /0.6768657997291094D-02/                                  GCTP0054
      DATA E0Z /0.9983056818784341D+00/                                  GCTP0055
      DATA E1Z /0.2542555507651308D-02/                                  GCTP0056
      DATA E2Z /0.2698084527466011D-05/                                  GCTP0057
      DATA E3Z /0.3533088739635530D-08/                                  GCTP0058
      DATA E4Z /0.1003939903560134D+01/                                  GCTP0059
*                                                                        GCTP0060
      DATA AZZ /0.6370997000000000D+07/                                  GCTP0061
*                                                                        GCTP0062
*                                                                        GCTP0063
      END                                                                GCTP0064
* ***********************************************************************GCTP0111
```

```
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0112
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0113
* ***********************************************************************GCTP0114
      DOUBLE PRECISION FUNCTION E0FNZ0 (ECCNTS)                          GCTP0115
*                                                                        GCTP0116
* FUNCTION TO COMPUTE CONSTANT (E0).                                     GCTP0117
*                                                                        GCTP0118
      IMPLICIT REAL*8 (A-Z)                                              GCTP0119
      DATA QUART,ONE,ONEQ,THREE,SIXT /0.25D0,1.0D0,1.25D0,3.0D0,16.0D0/ GCTP0120
*                                                                        GCTP0121
      E0FNZ0 = ONE - QUART * ECCNTS * (ONE + ECCNTS / SIXT *             GCTP0122
     .         (THREE + ONEQ * ECCNTS))                                  GCTP0123
*                                                                        GCTP0124
      RETURN                                                             GCTP0125
      END                                                                GCTP0126
* ***********************************************************************GCTP0128
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0129
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0130
* ***********************************************************************GCTP0131
      DOUBLE PRECISION FUNCTION E1FNZ0 (ECCNTS)                          GCTP0132
*                                                                        GCTP0133
* FUNCTION TO COMPUTE CONSTANT (E1).                                     GCTP0134
*                                                                        GCTP0135
      IMPLICIT REAL*8 (A-Z)                                              GCTP0136
      DATA CON1,CON2,CON3 /0.375D0,0.25D0,0.46875D0/                     GCTP0137
      DATA ONE /1.0D0/                                                   GCTP0138
*                                                                        GCTP0139
      E1FNZ0 = CON1 * ECCNTS * (ONE + CON2 * ECCNTS *                    GCTP0140
     .         (ONE + CON3 * ECCNTS))                                    GCTP0141
*                                                                        GCTP0142
      RETURN                                                             GCTP0143
      END                                                                GCTP0144
* ***********************************************************************GCTP0146
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0147
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0148
* ***********************************************************************GCTP0149
      DOUBLE PRECISION FUNCTION E2FNZ0 (ECCNTS)                          GCTP0150
*                                                                        GCTP0151
* FUNCTION TO COMPUTE CONSTANT (E2).                                     GCTP0152
*                                                                        GCTP0153
      IMPLICIT REAL*8 (A-Z)                                              GCTP0154
      DATA CON1,CON2 /0.05859375D0,0.75D0/                               GCTP0155
      DATA ONE /1.0D0/                                                   GCTP0156
*                                                                        GCTP0157
      E2FNZ0 = CON1 * ECCNTS * ECCNTS * (ONE + CON2 * ECCNTS)            GCTP0158
*                                                                        GCTP0159
      RETURN                                                             GCTP0160
      END                                                                GCTP0161
* ***********************************************************************GCTP0163
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0164
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0165
* ***********************************************************************GCTP0166
      DOUBLE PRECISION FUNCTION E3FNZ0 (ECCNTS)                          GCTP0167
*                                                                        GCTP0168
* FUNCTION TO COMPUTE CONSTANT (E3).                                     GCTP0169
*                                                                        GCTP0170
      IMPLICIT REAL*8 (A-Z)                                              GCTP0171
      DATA CON /0.113932291666667D-01/                                   GCTP0172
*                                                                        GCTP0173
      E3FNZ0 = CON * (ECCNTS**3)                                         GCTP0174
*                                                                        GCTP0175
      RETURN                                                             GCTP0176
      END                                                                GCTP0177
* ***********************************************************************GCTP0179
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* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0180
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0181
* ***********************************************************************GCTP0182
      DOUBLE PRECISION FUNCTION E4FNZ0 (ECCENT)                          GCTP0183
*                                                                        GCTP0184
* FUNCTION TO COMPUTE CONSTANT (E4).                                     GCTP0185
*                                                                        GCTP0186
      IMPLICIT REAL*8 (A-Z)                                              GCTP0187
      DATA ONE /1.0D0/                                                   GCTP0188
*                                                                        GCTP0189
      CON = ONE + ECCENT                                                 GCTP0190
      COM = ONE - ECCENT                                                 GCTP0191
      E4FNZ0 = DSQRT ((CON ** CON) * (COM ** COM))                       GCTP0192
*                                                                        GCTP0193
      RETURN                                                             GCTP0194
      END                                                                GCTP0195
* ***********************************************************************GCTP0197
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0198
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0199
* ***********************************************************************GCTP0200
      SUBROUTINE GTRNZ0 (CRDIN,INDEF,TPARIN,CRDIO,IODEF,TPARIO,          GCTP0201
     .                   IPFILE,IFLG)                                    GCTP0202
*                                                                        GCTP0203
* GENERAL PROGRAM FOR TRANSFORMATION BETWEEN VARIOUS REFERENCE SYSTEMS   GCTP0204
*                                                                        GCTP0205
* INPUT ************************************************************** GCTP0206
* CRDIN    : COORDINATES IN INPUT SYSTEM (2 DP WORDS ARRAY).             GCTP0207
* INDEF(1) : CODE NUMBER OF INPUT COORDINATE SYSTEM (INTEGER).           GCTP0208
*               =  0 , GEOGRAPHIC                                        GCTP0209
*               =  1 , U T M                                             GCTP0210
*               =  2 , STATE PLANE                                       GCTP0211
*               =  3 , ALBERS CONICAL EQUAL-AREA                         GCTP0212
*               =  4 , LAMBERT CONFORMAL CONIC                           GCTP0213
*               =  5 , MERCATOR                                          GCTP0214
*               =  6 , POLAR STEREOGRAPHIC                               GCTP0215
*               =  7 , POLYCONIC                                         GCTP0216
*               =  8 , EQUIDISTANT CONIC                                 GCTP0217
*               =  9 , TRANSVERSE MERCATOR                               GCTP0218
*               = 10 , STEREOGRAPHIC                                     GCTP0219
*               = 11 , LAMBERT AZIMUTHAL EQUAL-AREA                      GCTP0220
*               = 12 , AZIMUTHAL EQUIDISTANT                             GCTP0221
*               = 13 , GNOMONIC                                          GCTP0222
*               = 14 , ORTHOGRAPHIC                                      GCTP0223
*               = 15 , GENERAL VERTICAL NEAR-SIDE PERSPECTIVE            GCTP0224
*               = 16 , SINUSOIDAL                                        GCTP0225
*               = 17 , EQUIRECTANGULAR                                   GCTP0226
*               = 18 , MILLER CYLINDRICAL                                GCTP0227
*               = 19 , VAN DER GRINTEN I                                 GCTP0228
*               = 20 , OBLIQUE MERCATOR (HOTINE)                         GCTP0229
* INDEF(2) : CODE NUMBER OF INPUT COORDINATE ZONE (INTEGER).             GCTP0230
* TPARIN   : PARAMETERS OF INPUT REFERENCE SYSTEM (15 DP WORDS ARRAY).   GCTP0231
* INDEF(3) : CODE NUMBER OF UNITS OF MEASURE FOR INPUT COORDS (INTEGER).GCTP0232
*               = 0 , RADIANS.                                           GCTP0233
*               = 1 , FEET.                                              GCTP0234
*               = 2 , METERS.                                            GCTP0235
*               = 3 , SECONDS OF ARC.                                    GCTP0236
*               = 4 , DEGREES OF ARC.                                    GCTP0237
*               = 5 , PACKED DMS.                                        GCTP0238
* IODEF(1) : CODE NUMBER OF OUTPUT COORDINATE SYSTEM (INTEGER).          GCTP0239
* IODEF(2) : CODE NUMBER OF OUTPUT COORDINATE ZONE (INTEGER).            GCTP0240
* TPARIO   : PARAMETERS OF OUTPUT REFERENCE SYSTEM (15 DP WORDS ARRAY). GCTP0241
* IODEF(3) : CODE NUMBER OF UNITS OF MEASURE FOR OUTPUT COORDS (INTEGER)GCTP0242
* IPFILE   : LOGICAL NUMBER OF FILE FOR MESSAGES.                        GCTP0243
*                                                                        GCTP0244
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* OUTPUT ************************************************************ GCTP0245
* CRDIO    : COORDINATES IN OUTPUT REFERENCE SYSTEM (2 DP WORDS ARRAY). GCTP0246
* IFLG     : RETURN FLAG (INTEGER).                                    GCTP0247
*              = 0 , SUCCESSFUL TRANSFORMATION.                        GCTP0248
*              = I , UNSUCCESSFUL TRANSFORMATION. ERROR CODE   = I.     GCTP0249
*                                                                      GCTP0250
      IMPLICIT REAL*8 (A-H,O-Z)                                       GCTP0251
      INTEGER*4 SYSUNT(21),INDEF(3),IODEF(3)                          GCTP0252
      DIMENSION CRDIN(1),CRDIO(1),TPARIN(1),TPARIO(1),COORD(2)        GCTP0253
      DATA SYSUNT / 0 , 20*2 /                                        GCTP0254
      DATA MAXUNT,MAXSYS / 5 , 20 /                                   GCTP0255
      DATA ZERO /0.0D0/                                               GCTP0256
*                                                                     GCTP0257
* CHECK VALIDITY OF CODES FOR UNITS OF MEASURE AND REFERENCE SYSTEMS. GCTP0258
*                                                                     GCTP0259
      IF (INDEF(1).GE.0 .AND. INDEF(1).LE.MAXSYS) GO TO 020           GCTP0260
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) INDEF(1)                 GCTP0261
 2000 FORMAT (' ILLEGAL SOURCE REFERENCE SYSTEM CODE = ',I6)          GCTP0262
      IFLG = 1                                                        GCTP0263
      RETURN                                                          GCTP0264
  020 IF (IODEF(1).GE.0 .AND. IODEF(1).LE.MAXSYS) GO TO 040           GCTP0265
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) IODEF(1)                 GCTP0266
 2010 FORMAT (' ILLEGAL TARGET REFERENCE SYSTEM CODE = ',I6)          GCTP0267
      IFLG = 2                                                        GCTP0268
      RETURN                                                          GCTP0269
  040 IF (INDEF(3).GE.0 .AND. INDEF(3).LE.MAXUNT) GO TO 060           GCTP0270
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020) INDEF(3)                 GCTP0271
 2020 FORMAT (' ILLEGAL SOURCE UNIT CODE = ',I6)                      GCTP0272
      IFLG = 3                                                        GCTP0273
      RETURN                                                          GCTP0274
  060 IF (IODEF(3).GE.0 .AND. IODEF(3).LE.MAXUNT) GO TO 080           GCTP0275
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030) IODEF(3)                 GCTP0276
 2030 FORMAT (' ILLEGAL TARGET UNIT CODE = ',I6)                      GCTP0277
      IFLG = 4                                                        GCTP0278
      RETURN                                                          GCTP0279
*                                                                     GCTP0280
* CHECK CONSISTANCY BETEEN UNITS OF MEASURE AND REFERENCE SYSTEM.     GCTP0281
*                                                                     GCTP0282
  080 IUNIT = SYSUNT(INDEF(1) + 1)                                    GCTP0283
      DO 100 I = 1,2                                                  GCTP0284
      CALL UNITZ0 (CRDIN(I),INDEF(3),COORD(I),IUNIT,IPFILE,IFLG)      GCTP0285
      IF (IFLG .NE. 0) RETURN                                         GCTP0286
  100 CONTINUE                                                        GCTP0287
      IUNIT = SYSUNT(IODEF(1) + 1)                                    GCTP0288
      CALL UNITZ0 (ZERO,IUNIT,CRDIO,IODEF(3),IPFILE,IFLG)             GCTP0289
      IF (IFLG .NE. 0) RETURN                                         GCTP0290
      IF (INDEF(1).NE.IODEF(1) .OR. INDEF(2).NE.IODEF(2)) GO TO 140   GCTP0291
      DO 120 I = 1,2                                                  GCTP0292
      CALL UNITZ0 (CRDIN(I),INDEF(3),CRDIO(I),IODEF(3),IPFILE,IFLG)   GCTP0293
      IF (IFLG .NE. 0) RETURN                                         GCTP0294
  120 CONTINUE                                                        GCTP0295
      RETURN                                                          GCTP0296
*                                                                     GCTP0297
* COMPUTE TRANSFORMED COORDINATES AND ADJUST THEIR UNITS.             GCTP0298
*                                                                     GCTP0299
  140 IF (INDEF(1) .EQ. 0) GO TO 520                                  GCTP0300
      IF (INDEF(2).GT.60 .OR. INDEF(1).EQ.1) GO TO 200                GCTP0301
      IF (IPFILE .NE. 0) WRITE (IPFILE,2040) INDEF(2)                 GCTP0302
 2040 FORMAT (' ILLEGAL SOURCE ZONE NUMBER = ',I6)                    GCTP0303
      IFLG = 5                                                        GCTP0304
      RETURN                                                          GCTP0305
*                                                                     GCTP0306
* INVERSE TRANSFORMATION.                                             GCTP0307
*                                                                     GCTP0308
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200 GO TO (210,220,230,240,250,260,270,280,290,300,                    GCTP0309
   .       310,320,330,340,350,360,370,380,390,400) , INDEF(1)         GCTP0310
210 CALL IS01Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0311
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0312
    CALL PI01Z0 (COORD,CRDIO,IFLG)                                     GCTP0313
    GO TO 500                                                          GCTP0314
220 CALL IS02Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0315
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0316
    CALL PI02Z0 (COORD,CRDIO,IFLG)                                     GCTP0317
    GO TO 500                                                          GCTP0318
230 CALL IS03Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0319
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0320
    CALL PI03Z0 (COORD,CRDIO,IFLG)                                     GCTP0321
    GO TO 500                                                          GCTP0322
240 CALL IS04Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0323
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0324
    CALL PI04Z0 (COORD,CRDIO,IFLG)                                     GCTP0325
    GO TO 500                                                          GCTP0326
250 CALL IS05Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0327
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0328
    CALL PI05Z0 (COORD,CRDIO,IFLG)                                     GCTP0329
    GO TO 500                                                          GCTP0330
260 CALL IS06Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0331
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0332
    CALL PI06Z0 (COORD,CRDIO,IFLG)                                     GCTP0333
    GO TO 500                                                          GCTP0334
270 CALL IS07Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0335
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0336
    CALL PI07Z0 (COORD,CRDIO,IFLG)                                     GCTP0337
    GO TO 500                                                          GCTP0338
280 CALL IS08Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0339
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0340
    CALL PI08Z0 (COORD,CRDIO,IFLG)                                     GCTP0341
    GO TO 500                                                          GCTP0342
290 CALL IS09Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0343
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0344
    CALL PI09Z0 (COORD,CRDIO,IFLG)                                     GCTP0345
    GO TO 500                                                          GCTP0346
300 CALL IS10Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0347
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0348
    CALL PI10Z0 (COORD,CRDIO,IFLG)                                     GCTP0349
    GO TO 500                                                          GCTP0350
310 CALL IS11Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0351
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0352
    CALL PI11Z0 (COORD,CRDIO,IFLG)                                     GCTP0353
    GO TO 500                                                          GCTP0354
320 CALL IS12Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0355
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0356
    CALL PI12Z0 (COORD,CRDIO,IFLG)                                     GCTP0357
    GO TO 500                                                          GCTP0358
330 CALL IS13Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0359
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0360
    CALL PI13Z0 (COORD,CRDIO,IFLG)                                     GCTP0361
    GO TO 500                                                          GCTP0362
340 CALL IS14Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0363
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0364
    CALL PI14Z0 (COORD,CRDIO,IFLG)                                     GCTP0365
    GO TO 500                                                          GCTP0366
350 CALL IS15Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0367
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0368
    CALL PI15Z0 (COORD,CRDIO,IFLG)                                     GCTP0369
    GO TO 500                                                          GCTP0370
360 CALL IS16Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                          GCTP0371
    IF (IFLG .NE. 0) GO TO 500                                         GCTP0372
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      CALL PI16Z0 (COORD,CRDIO,IFLG)                                    GCTP0373
      GO TO 500                                                         GCTP0374
  370 CALL IS17Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                         GCTP0375
      IF (IFLG .NE. 0) GO TO 500                                        GCTP0376
      CALL PI17Z0 (COORD,CRDIO,IFLG)                                    GCTP0377
      GO TO 500                                                         GCTP0378
  380 CALL IS18Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                         GCTP0379
      IF (IFLG .NE. 0) GO TO 500                                        GCTP0380
      CALL PI18Z0 (COORD,CRDIO,IFLG)                                    GCTP0381
      GO TO 500                                                         GCTP0382
  390 CALL IS19Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                         GCTP0383
      IF (IFLG .NE. 0) GO TO 500                                        GCTP0384
      CALL PI19Z0 (COORD,CRDIO,IFLG)                                    GCTP0385
      GO TO 500                                                         GCTP0386
  400 CALL IS20Z0 (INDEF(2),TPARIN,IPFILE,IFLG)                         GCTP0387
      IF (IFLG .NE. 0) GO TO 500                                        GCTP0388
      CALL PI20Z0 (COORD,CRDIO,IFLG)                                    GCTP0389
  500 IF (IFLG .NE. 0) RETURN                                           GCTP0390
      IF (IODEF(1) .EQ. 0) GO TO 920                                    GCTP0391
      COORD(1) = CRDIO(1)                                               GCTP0392
      COORD(2) = CRDIO(2)                                               GCTP0393
  520 IF (IODEF(2).GT.60 .OR. IODEF(1).EQ.1) GO TO 540                  GCTP0394
      IF (IPFILE .NE. 0) WRITE (IPFILE,2050) IODEF(2)                   GCTP0395
 2050 FORMAT (' ILLEGAL TARGET ZONE NUMBER = ',I6)                      GCTP0396
      IFLG = 6                                                          GCTP0397
      RETURN                                                            GCTP0398
*                                                                       GCTP0399
* FORWARD TRANSFORMATION.                                              GCTP0400
*                                                                       GCTP0401
  540 GO TO (610,620,630,640,650,660,670,680,690,700,                   GCTP0402
     .       710,720,730,740,750,760,770,780,790,800) , IODEF(1)        GCTP0403
  610 CALL IS01Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0404
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0405
      CALL PF01Z0 (COORD,CRDIO,IFLG)                                    GCTP0406
      GO TO 900                                                         GCTP0407
  620 CALL IS02Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0408
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0409
      CALL PF02Z0 (COORD,CRDIO,IFLG)                                    GCTP0410
      GO TO 900                                                         GCTP0411
  630 CALL IS03Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0412
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0413
      CALL PF03Z0 (COORD,CRDIO,IFLG)                                    GCTP0414
      GO TO 900                                                         GCTP0415
  640 CALL IS04Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0416
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0417
      CALL PF04Z0 (COORD,CRDIO,IFLG)                                    GCTP0418
      GO TO 900                                                         GCTP0419
  650 CALL IS05Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0420
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0421
      CALL PF05Z0 (COORD,CRDIO,IFLG)                                    GCTP0422
      GO TO 900                                                         GCTP0423
  660 CALL IS06Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0424
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0425
      CALL PF06Z0 (COORD,CRDIO,IFLG)                                    GCTP0426
      GO TO 900                                                         GCTP0427
  670 CALL IS07Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0428
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0429
      CALL PF07Z0 (COORD,CRDIO,IFLG)                                    GCTP0430
      GO TO 900                                                         GCTP0431
  680 CALL IS08Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0432
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0433
      CALL PF08Z0 (COORD,CRDIO,IFLG)                                    GCTP0434
      GO TO 900                                                         GCTP0435
  690 CALL IS09Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0436
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      IF (IFLG .NE. 0) GO TO 900                                        GCTP0437
      CALL PF09Z0 (COORD,CRDIO,IFLG)                                    GCTP0438
      GO TO 900                                                         GCTP0439
  700 CALL IS10Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0440
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0441
      CALL PF10Z0 (COORD,CRDIO,IFLG)                                    GCTP0442
      GO TO 900                                                         GCTP0443
  710 CALL IS11Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0444
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0445
      CALL PF11Z0 (COORD,CRDIO,IFLG)                                    GCTP0446
      GO TO 900                                                         GCTP0447
  720 CALL IS12Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0448
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0449
      CALL PF12Z0 (COORD,CRDIO,IFLG)                                    GCTP0450
      GO TO 900                                                         GCTP0451
  730 CALL IS13Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0452
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0453
      CALL PF13Z0 (COORD,CRDIO,IFLG)                                    GCTP0454
      GO TO 900                                                         GCTP0455
  740 CALL IS14Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0456
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0457
      CALL PF14Z0 (COORD,CRDIO,IFLG)                                    GCTP0458
      GO TO 900                                                         GCTP0459
  750 CALL IS15Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0460
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0461
      CALL PF15Z0 (COORD,CRDIO,IFLG)                                    GCTP0462
      GO TO 900                                                         GCTP0463
  760 CALL IS16Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0464
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0465
      CALL PF16Z0 (COORD,CRDIO,IFLG)                                    GCTP0466
      GO TO 900                                                         GCTP0467
  770 CALL IS17Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0468
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0469
      CALL PF17Z0 (COORD,CRDIO,IFLG)                                    GCTP0470
      GO TO 900                                                         GCTP0471
  780 CALL IS18Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0472
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0473
      CALL PF18Z0 (COORD,CRDIO,IFLG)                                    GCTP0474
      GO TO 900                                                         GCTP0475
  790 CALL IS19Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0476
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0477
      CALL PF19Z0 (COORD,CRDIO,IFLG)                                    GCTP0478
      GO TO 900                                                         GCTP0479
  800 CALL IS20Z0 (IODEF(2),TPARIO,IPFILE,IFLG)                         GCTP0480
      IF (IFLG .NE. 0) GO TO 900                                        GCTP0481
      CALL PF20Z0 (COORD,CRDIO,IFLG)                                    GCTP0482
  900 IF (IFLG .NE. 0) RETURN                                           GCTP0483
  920 DO 940 I = 1,2                                                    GCTP0484
      CALL UNITZ0 (CRDIO(I),IUNIT,CRDIO(I),IODEF(3),IPFILE,IFLG)        GCTP0485
      IF (IFLG .NE. 0) RETURN                                           GCTP0486
  940 CONTINUE                                                          GCTP0487
*                                                                       GCTP0488
      RETURN                                                            GCTP0489
      END                                                               GCTP0490
* ***********************************************************************GCTP0066
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0067
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0068
* ***********************************************************************GCTP0069
      SUBROUTINE DMSLZ0 (ANG,IUNIT,DMS,IPFILE,IFLG)                     GCTP0070
*                                                                       GCTP0071
* SUBROUTINE TO CONVERT ANGLE TO DISPLAY DMS                            GCTP0072
*                                                                       GCTP0073
      IMPLICIT REAL*8 (A-H,O-Z)                                         GCTP0074
      CHARACTER*16 DMS                                                  GCTP0075
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      CHARACTER*1 SIGN                                                  GCTP0076
      INTEGER*4 ISEC,IDEG,IMIN                                          GCTP0077
      DATA ZERO /0.0D0/                                                 GCTP0078
*                                                                       GCTP0079
* DETERMINE THE SIGN OF ANGLE                                          GCTP0080
*                                                                       GCTP0081
      IFLG = 0                                                          GCTP0082
      SIGN = ' '                                                        GCTP0083
      IF (ANG .LT. ZERO) SIGN = '-'                                     GCTP0084
*                                                                       GCTP0085
* CONVERT ANGLE TO SECONDS OF ARC                                      GCTP0086
*                                                                       GCTP0087
      IOUNT = 3                                                         GCTP0088
      SEC = ABS(ANG)                                                    GCTP0089
      CALL UNITZ0 (SEC,IUNIT,SEC,IOUNT,IPFILE,IFLG)                     GCTP0090
      IF (IFLG .NE. 0) RETURN                                           GCTP0091
      SEC = SEC - MOD (SEC,0.0001D0)                                    GCTP0092
      ISEC = SEC                                                        GCTP0093
*                                                                       GCTP0094
* COMPUTE DEGREES, MINUTES,AND SECONDS PARTS OF ANGLE                  GCTP0095
*                                                                       GCTP0096
      IDEG = ISEC / 3600                                                GCTP0097
      ISEC = MOD (ISEC,3600)                                            GCTP0098
      IMIN = ISEC / 60                                                  GCTP0099
      ISEC = MOD (ISEC,60)                                              GCTP0100
      SEC = SEC - IDEG * 3600 - IMIN * 60 - ISEC                        GCTP0101
*                                                                       GCTP0102
* FORM DMS CHARACTER FIELD                                             GCTP0103
*                                                                       GCTP0104
      WRITE (DMS,1000) SIGN,IDEG,IMIN,ISEC,SEC                          GCTP0105
 1000 FORMAT (1X,A1,I3.3,2(I3.2),F5.4)                                  GCTP0106
*                                                                       GCTP0107
      RETURN                                                            GCTP0108
      END                                                               GCTP0109
* ********************************************************************GCTP0492
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0493
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0494
* ********************************************************************GCTP0495
      DOUBLE PRECISION FUNCTION MLFNZ0 (E0,E1,E2,E3,PHI)                GCTP0496
*                                                                       GCTP0497
* FUNCTION TO COMPUTE CONSTANT (M).                                    GCTP0498
*                                                                       GCTP0499
      IMPLICIT REAL*8 (A-Z)                                             GCTP0500
      DATA TWO,FOUR,SIX /2.0D0,4.0D0,6.0D0/                             GCTP0501
*                                                                       GCTP0502
      MLFNZ0 = E0 * PHI - E1 * DSIN (TWO * PHI) +                       GCTP0503
     .         E2 * DSIN (FOUR * PHI) - E3 * DSIN (SIX * PHI)           GCTP0504
*                                                                       GCTP0505
      RETURN                                                            GCTP0506
      END                                                               GCTP0507
* ********************************************************************GCTP0509
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0510
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0511
* ********************************************************************GCTP0512
      DOUBLE PRECISION FUNCTION MSFNZ0 (ECCENT,SINPHI,COSPHI)           GCTP0513
*                                                                       GCTP0514
* FUNCTION TO COMPUTE CONSTANT (SMALL M).                              GCTP0515
*                                                                       GCTP0516
      IMPLICIT REAL*8 (A-Z)                                             GCTP0517
      DATA ONE /1.0D0/                                                  GCTP0518
*                                                                       GCTP0519
      CON = ECCENT * SINPHI                                             GCTP0520
      MSFNZ0 = COSPHI / DSQRT (ONE - CON * CON)                         GCTP0521
*                                                                       GCTP0522
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      RETURN                                                            GCTP0523
      END                                                               GCTP0524
* ********************************************************************GCTP0526
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0527
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0528
* ********************************************************************GCTP0529
      DOUBLE PRECISION FUNCTION PAKSZ0 (ANG,IPFILE,IFLG)                GCTP0530
*                                                                       GCTP0531
* FUNCTION TO CONVERT DMS PACKED ANGLE INTO SECONDS OF ARC.             GCTP0532
*                                                                       GCTP0533
      IMPLICIT REAL*8 (A-H,M-Z)                                         GCTP0534
      DIMENSION CODE(2)                                                 GCTP0535
      DATA CODE /10000.0D0,100.0D0/                                     GCTP0536
      DATA ZERO,ONE /0.0D0,1.0D0/                                       GCTP0537
      DATA C1,C2 /3600.0D0,60.0D0/                                      GCTP0538
*                                                                       GCTP0539
* SEPERATE DEGREE FIELD.                                                GCTP0540
*                                                                       GCTP0541
      IFLG = 0                                                          GCTP0542
      FACTOR = ONE                                                      GCTP0543
      IF (ANG .LT. ZERO) FACTOR = - ONE                                 GCTP0544
      SEC = DABS(ANG)                                                   GCTP0545
      TMP = CODE(1)                                                     GCTP0546
      I = SEC / TMP                                                     GCTP0547
      IF (I .GT. 360) GO TO 020                                         GCTP0548
      DEG = I                                                           GCTP0549
*                                                                       GCTP0550
* SEPERATE MINUTES FIELD.                                               GCTP0551
*                                                                       GCTP0552
      SEC = SEC - DEG * TMP                                             GCTP0553
      TMP = CODE(2)                                                     GCTP0554
      I = SEC / TMP                                                     GCTP0555
      IF (I .GT. 60) GO TO 020                                          GCTP0556
      MIN = I                                                           GCTP0557
*                                                                       GCTP0558
* SEPERATE SECONDS FIELD.                                               GCTP0559
*                                                                       GCTP0560
      SEC = SEC - MIN * TMP                                             GCTP0561
      IF (SEC .GT. C2) GO TO 020                                        GCTP0562
      SEC = FACTOR * (DEG * C1 + MIN * C2 + SEC)                        GCTP0563
      GO TO 040                                                         GCTP0564
*                                                                       GCTP0565
* ERROR DETECTED IN DMS FORM.                                           GCTP0566
*                                                                       GCTP0567
  020 IF (IPFILE .NE. 0) WRITE (IPFILE,2000) ANG                        GCTP0568
 2000 FORMAT (' ILLEGAL PACKED DMS FIELD = ',F15.3)                     GCTP0569
      IFLG = 10                                                         GCTP0570
      RETURN                                                            GCTP0571
*                                                                       GCTP0572
  040 PAKSZ0 = SEC                                                      GCTP0573
*                                                                       GCTP0574
      RETURN                                                            GCTP0575
      END                                                               GCTP0576
* ********************************************************************GCTP0578
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0579
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0580
* ********************************************************************GCTP0581
      DOUBLE PRECISION FUNCTION PHI1Z0 (ECCENT,QS,IPFILE,IFLG)          GCTP0582
*                                                                       GCTP0583
* FUNCTION TO COMPUTE LATITUDE ANGLE (PHI-1).                           GCTP0584
*                                                                       GCTP0585
      IMPLICIT REAL*8 (A-Z)                                             GCTP0586
      INTEGER*4 II,NIT,IPFILE,IFLG                                      GCTP0587
      DATA HALF,ONE /0.5D0,1.0D0/                                       GCTP0588
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      DATA EPSLN,TOL,NIT /1.0D-7,1.0D-10,15/                            GCTP0589
*                                                                       GCTP0590
      PHI1Z0 = ASINZ0 (HALF * QS)                                       GCTP0591
      IF (ECCENT .LT. EPSLN) RETURN                                     GCTP0592
*                                                                       GCTP0593
      ECCNTS = ECCENT * ECCENT                                          GCTP0594
      PHI = PHI1Z0                                                      GCTP0595
      DO 020 II = 1,NIT                                                 GCTP0596
      SINPI = DSIN (PHI)                                                GCTP0597
      COSPI = DCOS (PHI)                                                GCTP0598
      CON = ECCENT * SINPI                                              GCTP0599
      COM = ONE - CON * CON                                             GCTP0600
      DPHI = HALF * COM * COM / COSPI * (QS / (ONE - ECCNTS) -          GCTP0601
     .       SINPI / COM + HALF / ECCENT * DLOG ((ONE - CON) /          GCTP0602
     .       (ONE + CON)))                                              GCTP0603
      PHI = PHI + DPHI                                                  GCTP0604
      IF (DABS(DPHI) .GT. TOL) GO TO 020                                GCTP0605
      PHI1Z0 = PHI                                                      GCTP0606
      RETURN                                                            GCTP0607
  020 CONTINUE                                                          GCTP0608
*                                                                       GCTP0609
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                            GCTP0610
 2000 FORMAT (' LATITUDE FAILED TO CONVERGE')                           GCTP0611
      IFLG = 21                                                         GCTP0612
      RETURN                                                            GCTP0613
*                                                                       GCTP0614
      END                                                               GCTP0615
* ***********************************************************************GCTP0617
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0618
* ** GCTP/II                   VERSION 1.0.2           SEPTEMBER 1,1986 **GCTP0619
* ***********************************************************************GCTP0620
      DOUBLE PRECISION FUNCTION PHI2Z0 (ECCENT,TS,IPFILE,IFLG)          GCTP0621
*                                                                       GCTP0622
* FUNCTION TO COMPUTE LATITUDE ANGLE (PHI-2).                           GCTP0623
*                                                                       GCTP0624
      IMPLICIT REAL*8 (A-Z)                                             GCTP0625
      INTEGER*4 II,NIT,IPFILE,IFLG                                      GCTP0626
      DATA HALF,ONE,TWO /0.5D0,1.0D0,2.0D0/                             GCTP0627
      DATA TOL,NIT /1.0D-10,15/                                         GCTP0628
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP0629
*                                                                       GCTP0630
      ECCNTH = HALF * ECCENT                                            GCTP0631
      PHI = HALFPI - TWO * DATAN (TS)                                   GCTP0632
      DO 020 II = 1,NIT                                                 GCTP0633
      SINPI = DSIN (PHI)                                                GCTP0634
      CON = ECCENT * SINPI                                              GCTP0635
      DPHI = HALFPI - TWO * DATAN (TS * ((ONE - CON) /                  GCTP0636
     .       (ONE + CON)) ** ECCNTH) - PHI                              GCTP0637
      PHI = PHI + DPHI                                                  GCTP0638
      IF (DABS(DPHI) .GT. TOL) GO TO 020                                GCTP0639
      PHI2Z0 = PHI                                                      GCTP0640
      RETURN                                                            GCTP0641
  020 CONTINUE                                                          GCTP0642
*                                                                       GCTP0643
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                            GCTP0644
 2000 FORMAT (' LATITUDE FAILED TO CONVERGE')                           GCTP0645
      IFLG = 22                                                         GCTP0646
      RETURN                                                            GCTP0647
*                                                                       GCTP0648
      END                                                               GCTP0649
* ***********************************************************************GCTP0651
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0652
* ** GCTP/II                   VERSION 1.0.2           SEPTEMBER 1,1986 **GCTP0653
* ***********************************************************************GCTP0654
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      DOUBLE PRECISION FUNCTION PHI3Z0 (ML,E0,E1,E2,E3,IPFILE,IFLG)     GCTP0655
*                                                                       GCTP0656
* FUNCTION TO COMPUTE LATITUDE ANGLE (PHI-3).                          GCTP0657
*                                                                       GCTP0658
      IMPLICIT REAL*8 (A-Z)                                            GCTP0659
      INTEGER*4 II,NIT,IPFILE,IFLG                                     GCTP0660
      DATA TWO,FOUR,SIX /2.0D0,4.0D0,6.0D0/                            GCTP0661
      DATA TOL,NIT /1.0D-11,15/                                        GCTP0662
*                                                                       GCTP0663
      PHI = ML                                                         GCTP0664
      DO 020 II = 1,NIT                                                GCTP0665
      DPHI = (ML + E1 * DSIN (TWO * PHI) - E2 * DSIN (FOUR * PHI) +    GCTP0666
     .        E3 * DSIN (SIX * PHI)) / E0 - PHI                        GCTP0667
      PHI = PHI + DPHI                                                 GCTP0668
      IF (DABS(DPHI) .GT. TOL) GO TO 020                               GCTP0669
      PHI3Z0 = PHI                                                     GCTP0670
      RETURN                                                           GCTP0671
  020 CONTINUE                                                         GCTP0672
*                                                                       GCTP0673
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                           GCTP0674
 2000 FORMAT (' LATITUDE FAILED TO CONVERGE')                          GCTP0675
      IFLG = 23                                                        GCTP0676
      RETURN                                                           GCTP0677
*                                                                       GCTP0678
      END                                                              GCTP0679
* ***********************************************************************GCTP0681
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0682
* ** GCTP/II                    VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0683
* ***********************************************************************GCTP0684
      DOUBLE PRECISION FUNCTION PHI4Z0 (ECCNTS,E0,E1,E2,E3,A,B,C,      GCTP0685
     .                                  IPFILE,IFLG)                   GCTP0686
*                                                                       GCTP0687
* FUNCTION TO COMPUTE LATITUDE ANGLE (PHI-4).                          GCTP0688
*                                                                       GCTP0689
      IMPLICIT REAL*8 (A-Z)                                            GCTP0690
      INTEGER*4 II,NIT,IPFILE,IFLG                                     GCTP0691
      DATA ONE,TWO,FOUR,SIX /1.0D0,2.0D0,4.0D0,6.0D0/                  GCTP0692
      DATA TOL,NIT /1.0D-11,15/                                        GCTP0693
*                                                                       GCTP0694
      PHI = A                                                          GCTP0695
      DO 020 II = 1,NIT                                                GCTP0696
      SINPHI = DSIN (PHI)                                              GCTP0697
      TANPHI = DTAN (PHI)                                              GCTP0698
      C = TANPHI * DSQRT (ONE - ECCNTS * SINPHI * SINPHI)              GCTP0699
      SIN2PH = DSIN (TWO * PHI)                                        GCTP0700
      ML = E0 * PHI - E1 * SIN2PH + E2 * DSIN (FOUR * PHI) -           GCTP0701
     .     E3 * DSIN (SIX * PHI)                                       GCTP0702
      MLP = E0 - TWO * E1 * DCOS (TWO * PHI) + FOUR * E2 *             GCTP0703
     .      DCOS (FOUR * PHI) - SIX * E3 * DCOS (SIX * PHI)            GCTP0704
      CON1 = TWO * ML + C * (ML * ML + B) - TWO * A *                  GCTP0705
     .       (C * ML + ONE)                                            GCTP0706
      CON2 = ECCNTS * SIN2PH * (ML * ML + B - TWO * A * ML) / (TWO * C) GCTP0707
      CON3 = TWO * (A - ML) * (C * MLP - TWO / SIN2PH) - TWO * MLP     GCTP0708
      DPHI = CON1 / (CON2 + CON3)                                      GCTP0709
      PHI = PHI + DPHI                                                 GCTP0710
      IF (DABS(DPHI) .GT. TOL) GO TO 020                               GCTP0711
      PHI4Z0 = PHI                                                     GCTP0712
      RETURN                                                           GCTP0713
  020 CONTINUE                                                         GCTP0714
*                                                                       GCTP0715
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                           GCTP0716
 2000 FORMAT (' LATITUDE FAILED TO CONVERGE')                          GCTP0717
      IFLG = 24                                                        GCTP0718
      RETURN                                                           GCTP0719
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*                                                                      GCTP0720
      END                                                              GCTP0721
* **********************************************************************GCTP0723
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0724
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0725
* **********************************************************************GCTP0726
*                               *  U T M  *                            GCTP0727
* **********************************************************************GCTP0728
*                                                                      GCTP0729
      SUBROUTINE PJ01Z0                                                GCTP0730
*                                                                      GCTP0731
      IMPLICIT REAL*8 (A-Z)                                            GCTP0732
      INTEGER*4 SWITCH,IND,ZONE,IPFILE,IFLG                            GCTP0733
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                GCTP0734
      DIMENSION BUFFL(8)                                               GCTP0735
      DATA ZERO /0.0D0/                                                GCTP0736
      DATA SWITCH /0/                                                  GCTP0737
*                                                                      GCTP0738
* .....................................................................GCTP0739
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .     GCTP0740
* .....................................................................GCTP0741
*                                                                      GCTP0742
      ENTRY IS01Z0 (ZONE,DATA,IPFILE,IFLG)                             GCTP0743
*                                                                      GCTP0744
      IFLG = 0                                                         GCTP0745
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                     GCTP0746
      IF (ZONE .EQ. ZERO) GO TO 040                                    GCTP0747
      IF (ZONE.GE.1 .AND. ZONE.LE.60) GO TO 100                        GCTP0748
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) ZONE                      GCTP0749
 2000 FORMAT (' ILLEGAL ZONE NO = ',I6)                                GCTP0750
      IFLG = 101                                                       GCTP0751
      RETURN                                                           GCTP0752
  040 CALL UNITZ0 (DATA(3),5,CON,4,IPFILE,IFLG)                        GCTP0753
      IF (IFLG .NE. 0) RETURN                                          GCTP0754
      ZONE = CON / 6.0D0                                               GCTP0755
      IND = 1                                                          GCTP0756
      IF (ZONE .LT. 0) IND = 0                                         GCTP0757
      ZONE = MOD ((ZONE + 30) , 60) + IND                              GCTP0758
      IF (ZONE) 060,080,100                                            GCTP0759
  060 ZONE = ZONE + 60                                                 GCTP0760
      GO TO 100                                                        GCTP0761
  080 ZONE = 1                                                         GCTP0762
  100 BUFFL(1) = DATA(1)                                               GCTP0763
      BUFFL(2) = DATA(2)                                               GCTP0764
      BUFFL(3) = 0.9996D0                                              GCTP0765
      BUFFL(4) = ZERO                                                  GCTP0766
      LON0 = 6 * ZONE - 183                                            GCTP0767
      CALL UNITZ0 (LON0,4,BUFFL(5),5,IPFILE,IFLG)                      GCTP0768
      IF (IFLG .NE. 0) RETURN                                          GCTP0769
      BUFFL(6) = ZERO                                                  GCTP0770
      BUFFL(7) = 500000.0D0                                            GCTP0771
      BUFFL(8) = ZERO                                                  GCTP0772
      IF (DATA(4) .LT. ZERO) BUFFL(8) = 10000000.0D0                   GCTP0773
      SWITCH = 0                                                       GCTP0774
      CALL IS09Z0 (ZONE,BUFFL,IPFILE,IFLG)                             GCTP0775
      IF (IFLG .NE. 0) GO TO 110                                       GCTP0776
*                                                                      GCTP0777
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP0778
*                                                                      GCTP0779
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) ZONE                      GCTP0780
 2010 FORMAT (' INITIALIZATION PARAMETERS (U T M PROJECTION)'/         GCTP0781
     .        ' ZONE = ',I2)                                          GCTP0782
      SWITCH = ZONE                                                    GCTP0783
  110 RETURN                                                           GCTP0784
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*                                                                      GCTP0785
* .....................................................................GCTP0786
*                      .  FORWARD TRANSFORMATION  .                    GCTP0787
* .....................................................................GCTP0788
*                                                                      GCTP0789
      ENTRY PF01Z0 (GEOG,PROJ,IFLG)                                    GCTP0790
*                                                                      GCTP0791
      IFLG = 0                                                         GCTP0792
      IF (SWITCH .NE. 0) GO TO 140                                     GCTP0793
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                           GCTP0794
 2020 FORMAT (' UNINITIALIZED TRANSFORMATION')                         GCTP0795
      IFLG = 100                                                       GCTP0796
      RETURN                                                           GCTP0797
  140 CALL PF09Z0 (GEOG,PROJ,IFLG)                                     GCTP0798
      RETURN                                                           GCTP0799
*                                                                      GCTP0800
* .....................................................................GCTP0801
*                      .  INVERSE TRANSFORMATION  .                    GCTP0802
* .....................................................................GCTP0803
*                                                                      GCTP0804
      ENTRY PI01Z0 (PROJ,GEOG,IFLG)                                    GCTP0805
*                                                                      GCTP0806
      IFLG = 0                                                         GCTP0807
      IF (SWITCH .NE. 0) GO TO 160                                     GCTP0808
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                           GCTP0809
      IFLG = 100                                                       GCTP0810
      RETURN                                                           GCTP0811
  160 CALL PI09Z0 (PROJ,GEOG,IFLG)                                     GCTP0812
      RETURN                                                           GCTP0813
*                                                                      GCTP0814
      END                                                              GCTP0815
* *********************************************************************GCTP0817
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP0818
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP0819
* *********************************************************************GCTP0820
*                            *  STATE PLANE  *                         GCTP0821
* *********************************************************************GCTP0822
*                                                                      GCTP0823
      SUBROUTINE PJ02Z0                                                GCTP0824
*                                                                      GCTP0825
      IMPLICIT REAL*8(A-H,O-Z)                                         GCTP0826
      CHARACTER*32 PNAME                                               GCTP0827
      INTEGER*4 ID                                                     GCTP0828
      INTEGER*4 SWITCH,ZONE                                            GCTP0829
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                GCTP0830
      DIMENSION BUFFL(13)                                              GCTP0831
      DIMENSION ITEM(135),TABLE(9)                                     GCTP0832
      DATA ITEM /0101,0102,5010,5302,0201,0202,0203,0301,0302,0401,    GCTP0833
     .           0402,0403,0404,0405,0406,0407,0501,0502,0503,0601,    GCTP0834
     .           0701,0901,0902,0903,1001,1002,5101,5102,5103,5104,    GCTP0835
     .           5105,1101,1102,1103,1201,1202,1301,1302,1401,1402,    GCTP0836
     .           1501,1502,1601,1602,1701,1702,1703,1801,1802,1901,    GCTP0837
     .           2001,2002,2101,2102,2103,2111,2112,2113,2201,2202,    GCTP0838
     .           2203,2301,2302,2401,2402,2403,2501,2502,2503,2601,    GCTP0839
     .           2602,2701,2702,2703,2801,2901,3001,3002,3003,3101,    GCTP0840
     .           3102,3103,3104,3201,3301,3302,3401,3402,3501,3502,    GCTP0841
     .           3601,3602,3701,3702,3801,3901,3902,4001,4002,4101,    GCTP0842
     .           4201,4202,4203,4204,4205,4301,4302,4303,4401,4501,    GCTP0843
     .           4502,4601,4602,4701,4702,4801,4802,4803,4901,4902,    GCTP0844
     .           4903,4904,5001,5002,5003,5004,5005,5006,5007,5008,    GCTP0845
     .           5009,5301,5201,5202,5401/                             GCTP0846
      DATA ZERO /0.0D0/                                                GCTP0847
      DATA SWITCH /0/                                                  GCTP0848
*                                                                      GCTP0849
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*     .....................................................................GCTP0850
*     .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .         GCTP0851
*     .....................................................................GCTP0852
*                                                                         GCTP0853
      ENTRY IS02Z0 (ZONE,DATA,IPFILE,IFLG)                                GCTP0854
*                                                                         GCTP0855
      IFLG = 0                                                            GCTP0856
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                        GCTP0857
      IF (ZONE .LE. 0) GO TO 050                                          GCTP0858
      IZONE = ZONE                                                        GCTP0859
      IF (MOD(IZONE,100) .EQ. 0) IZONE = IZONE + 1                        GCTP0860
      DO 040 IND = 1,135                                                  GCTP0861
      IF (IZONE .EQ. ITEM(IND)) GO TO 060                                 GCTP0862
  040 CONTINUE                                                            GCTP0863
  050 IF (IPFILE .NE. 0) WRITE (IPFILE,2000) ZONE                         GCTP0864
 2000 FORMAT (' ILLEGAL ZONE NO = ',I6)                                   GCTP0865
      IFLG = 201                                                          GCTP0866
      RETURN                                                              GCTP0867
c You get here by looping through the list of FIPS State Plane
c   zone codes stored in Item, and dropping out when you
c   you find the right one.  When you do, IND is the index into the
c   the list of FIPS codes contained in ITEM(), so you probably want
c   to read that record to retrieve projection paramters.
  060 OPEN (UNIT=99,FILE='ZONESDATA',STATUS='OLD',                        GCTP0868
     .      ACCESS='DIRECT',RECL=27)                                      GCTP0869
      READ (99,rec=IND) PNAME,ID,TABLE                                    GCTP0870
c Modified from READ (99'IND) PNAME,ID,TABLE
c  to the above by Greg Pouch 940927 KGS.  This looks like a typo, or
c   transmission error.
      CLOSE (UNIT=99,STATUS='KEEP')                                       GCTP0871
      IF (ID .LE. 0) GOTO 050                                             GCTP0872
      ITYPE = ID                                                          GCTP0873
      IF (DATA(1) .NE. ZERO) TABLE(1) = DATA(1)                           GCTP0874
      IF (DATA(2) .NE. ZERO) TABLE(2) = DATA(2)                           GCTP0875
      BUFFL(1) = TABLE(1)                                                 GCTP0876
      BUFFL(2) = TABLE(2)                                                 GCTP0877
      GO TO (080,090,100,110) , ITYPE                                     GCTP0878
*                                                                         GCTP0879
* TRANSVERSE MERCATOR PROJECTION                                         GCTP0880
*                                                                         GCTP0881
  080 BUFFL(3) = TABLE(4)                                                 GCTP0882
      BUFFL(5) = TABLE(3)                                                 GCTP0883
      BUFFL(6) = TABLE(7)                                                 GCTP0884
      BUFFL(7) = TABLE(8)                                                 GCTP0885
      BUFFL(8) = TABLE(9)                                                 GCTP0886
      CALL IS09Z0 (ZONE,BUFFL,IPFILE,IFLG)                                GCTP0887
      GO TO 120                                                           GCTP0888
*                                                                         GCTP0889
* LAMBERT CONFORMAL PROJECTION                                           GCTP0890
*                                                                         GCTP0891
  090 BUFFL(3) = TABLE(6)                                                 GCTP0892
      BUFFL(4) = TABLE(5)                                                 GCTP0893
      BUFFL(5) = TABLE(3)                                                 GCTP0894
      BUFFL(6) = TABLE(7)                                                 GCTP0895
      BUFFL(7) = TABLE(8)                                                 GCTP0896
      BUFFL(8) = TABLE(9)                                                 GCTP0897
      CALL IS04Z0 (ZONE,BUFFL,IPFILE,IFLG)                                GCTP0898
      GO TO 120                                                           GCTP0899
*                                                                         GCTP0900
* POLYCONIC PROJECTION                                                   GCTP0901
*                                                                         GCTP0902
  100 BUFFL(5) = TABLE(3)                                                 GCTP0903
      BUFFL(6) = TABLE(4)                                                 GCTP0904
      BUFFL(7) = TABLE(5)                                                 GCTP0905
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      BUFFL(8) = TABLE(6)                                                GCTP0906
      CALL IS07Z0 (ZONE,BUFFL,IPFILE,IFLG)                               GCTP0907
      GO TO 120                                                          GCTP0908
*                                                                        GCTP0909
* OBLIQUE MERCATOR PROJECTION                                           GCTP0910
*                                                                        GCTP0911
  110 BUFFL(3) = TABLE(4)                                                GCTP0912
      BUFFL(4) = TABLE(6)                                                GCTP0913
      BUFFL(5) = TABLE(3)                                                GCTP0914
      BUFFL(6) = TABLE(7)                                                GCTP0915
      BUFFL(7) = TABLE(8)                                                GCTP0916
      BUFFL(8) = TABLE(9)                                                GCTP0917
      BUFFL(13) = 1.0                                                    GCTP0918
      CALL IS20Z0 (ZONE,BUFFL,IPFILE,IFLG)                               GCTP0919
*                                                                        GCTP0920
  120 IF (IFLG .NE. 0) RETURN                                            GCTP0921
*                                                                        GCTP0922
* LIST RESULTS OF PARAMETER INITIALIZATION.                             GCTP0923
*                                                                        GCTP0924
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) PNAME                       GCTP0925
 2010 FORMAT (' INITIALIZATION PARAMETERS (STATE PLANE PROJECTION)'/     GCTP0926
     .        ' ZONE = ',A32)                                           GCTP0927
      SWITCH = ZONE                                                      GCTP0928
      RETURN                                                             GCTP0929
*                                                                        GCTP0930
* .....................................................................GCTP0931
*                       .  FORWARD TRANSFORMATION  .                     GCTP0932
* .....................................................................GCTP0933
*                                                                        GCTP0934
      ENTRY PF02Z0 (GEOG,PROJ,IFLG)                                      GCTP0935
*                                                                        GCTP0936
      IFLG = 0                                                           GCTP0937
      IF (SWITCH .NE. 0) GO TO 140                                       GCTP0938
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                             GCTP0939
 2020 FORMAT (' UNINITIALIZED TRANSFORMATION')                           GCTP0940
      IFLG = 200                                                         GCTP0941
      RETURN                                                             GCTP0942
  140 GO TO (160,170,180,190) , ITYPE                                    GCTP0943
*                                                                        GCTP0944
* TRANSVERSE MERCATOR PROJECTION                                        GCTP0945
*                                                                        GCTP0946
  160 CALL PF09Z0 (GEOG,PROJ,IFLG)                                       GCTP0947
      GO TO 200                                                          GCTP0948
*                                                                        GCTP0949
* LAMBERT CONFORMAL PROJECTION                                          GCTP0950
*                                                                        GCTP0951
  170 CALL PF04Z0 (GEOG,PROJ,IFLG)                                       GCTP0952
      GO TO 200                                                          GCTP0953
*                                                                        GCTP0954
* POLYCONIC PROJECTION                                                  GCTP0955
*                                                                        GCTP0956
  180 CALL PF07Z0 (GEOG,PROJ,IFLG)                                       GCTP0957
      GO TO 200                                                          GCTP0958
*                                                                        GCTP0959
* OBLIQUE MERCATOR PROJECTION                                           GCTP0960
*                                                                        GCTP0961
  190 CALL PF20Z0 (GEOG,PROJ,IFLG)                                       GCTP0962
*                                                                        GCTP0963
  200 RETURN                                                             GCTP0964
*                                                                        GCTP0965
* .....................................................................GCTP0966
*                       .  INVERSE TRANSFORMATION  .                     GCTP0967
* .....................................................................GCTP0968
*                                                                        GCTP0969
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      ENTRY PI02Z0 (PROJ,GEOG,IFLG)                                     GCTP0970
*                                                                       GCTP0971
      IFLG = 0                                                          GCTP0972
      IF (SWITCH .NE. 0) GO TO 300                                      GCTP0973
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP0974
      IFLG = 200                                                        GCTP0975
      RETURN                                                            GCTP0976
  300 GO TO (320,330,340,350) , ITYPE                                   GCTP0977
*                                                                       GCTP0978
* TRANSVERSE MERCATOR PROJECTION                                        GCTP0979
*                                                                       GCTP0980
  320 CALL PI09Z0 (PROJ,GEOG,IFLG)                                      GCTP0981
      GO TO 360                                                         GCTP0982
*                                                                       GCTP0983
* LAMBERT CONFORMAL PROJECTION                                          GCTP0984
*                                                                       GCTP0985
  330 CALL PI04Z0 (PROJ,GEOG,IFLG)                                      GCTP0986
      GO TO 360                                                         GCTP0987
*                                                                       GCTP0988
* POLYCONIC PROJECTION                                                  GCTP0989
*                                                                       GCTP0990
  340 CALL PI07Z0 (PROJ,GEOG,IFLG)                                      GCTP0991
      GO TO 360                                                         GCTP0992
*                                                                       GCTP0993
* OBLIQUE MERCATOR PROJECTION                                           GCTP0994
*                                                                       GCTP0995
  350 CALL PI20Z0 (PROJ,GEOG,IFLG)                                      GCTP0996
*                                                                       GCTP0997
  360 RETURN                                                            GCTP0998
*                                                                       GCTP0999
      END                                                               GCTP1000
* ********************************************************************GCTP1002
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1003
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                    **GCTP1004
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1005
* ********************************************************************GCTP1006
*                     *  ALBERS CONICAL EQUAL AREA  *                   GCTP1007
* ********************************************************************GCTP1008
*                                                                       GCTP1009
      SUBROUTINE PJ03Z0                                                 GCTP1010
*                                                                       GCTP1011
      IMPLICIT REAL*8 (A-Z)                                             GCTP1012
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP1013
      CHARACTER*16 ANGS(4)                                              GCTP1014
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                     GCTP1015
* **** PARAMETERS **** A,E,ES,LAT1,LAT2,LON0,LAT0,X0,Y0,NS,C,RH0 *******GCTP1016
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP1017
      DATA TOL,EPSLN /1.0D-7,1.0D-10/                                   GCTP1018
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP1019
      DATA ZERO,HALF,ONE /0.0D0,0.5D0,1.0D0/                            GCTP1020
      DATA SWITCH /0/                                                   GCTP1021
*                                                                       GCTP1022
* .....................................................................GCTP1023
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP1024
* .....................................................................GCTP1025
*                                                                       GCTP1026
      ENTRY IS03Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP1027
*                                                                       GCTP1028
      IFLG = 0                                                          GCTP1029
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP1030
      IF (DATA(1) .LE. ZERO) GO TO 100                                  GCTP1031
      A = DATA(1)                                                       GCTP1032
      B = DATA(2)                                                       GCTP1033
      IF (B .GT. ZERO) GO TO 040                                        GCTP1034
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      E = ZERO                                                          GCTP1035
      ES = ZERO                                                         GCTP1036
      GO TO 120                                                         GCTP1037
  040 IF (B .GT. ONE) GO TO 060                                         GCTP1038
      E = DSQRT (B)                                                     GCTP1039
      ES = B                                                            GCTP1040
      GO TO 120                                                         GCTP1041
  060 ES = ONE - (B / A) ** 2                                           GCTP1042
      E = DSQRT (ES)                                                    GCTP1043
      GO TO 120                                                         GCTP1044
  100 A = AZ                                                            GCTP1045
      E = EZ                                                            GCTP1046
      ES = ESZ                                                          GCTP1047
  120 CALL UNITZ0 (DATA(3),5,LAT1,0,IPFILE,IFLG)                        GCTP1048
      IF (IFLG .NE. 0) RETURN                                           GCTP1049
      CALL UNITZ0 (DATA(4),5,LAT2,0,IPFILE,IFLG)                        GCTP1050
      IF (IFLG .NE. 0) RETURN                                           GCTP1051
      IF (DABS(LAT1+LAT2) .GE. EPSLN) GO TO 130                         GCTP1052
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                            GCTP1053
 2000 FORMAT (' EQUAL LATITUDES FOR ST. PARALLELS ON OPPOSITE',         GCTP1054
     .        ' SIDES OF EQUATOR')                                      GCTP1055
      IFLG = 301                                                        GCTP1056
      RETURN                                                            GCTP1057
  130 CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP1058
      IF (IFLG .NE. 0) RETURN                                           GCTP1059
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP1060
      IF (IFLG .NE. 0) RETURN                                           GCTP1061
      X0 = DATA(7)                                                      GCTP1062
      Y0 = DATA(8)                                                      GCTP1063
      SINPHI = DSIN (LAT1)                                              GCTP1064
      CON = SINPHI                                                      GCTP1065
      COSPHI = DCOS (LAT1)                                              GCTP1066
      MS1 = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1067
      QS1 = QSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1068
      SINPHI = DSIN (LAT2)                                              GCTP1069
      COSPHI = DCOS (LAT2)                                              GCTP1070
      MS2 = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1071
      QS2 = QSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1072
      SINPHI = DSIN (LAT0)                                              GCTP1073
      COSPHI = DCOS (LAT0)                                              GCTP1074
      QS0 = QSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1075
      IF (DABS(LAT1-LAT2) .GE. EPSLN) GO TO 140                         GCTP1076
      NS = CON                                                          GCTP1077
      GO TO 150                                                         GCTP1078
  140 NS = (MS1 * MS1 - MS2 * MS2) / (QS2 - QS1)                        GCTP1079
  150 C = MS1 * MS1 + NS * QS1                                          GCTP1080
      RH0 = A * DSQRT (C - NS * QS0) / NS                               GCTP1081
*                                                                       GCTP1082
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP1083
*                                                                       GCTP1084
      CALL DMSLZ0 (LAT1,0,ANGS(1),IPFILE,IFLG)                          GCTP1085
      CALL DMSLZ0 (LAT2,0,ANGS(2),IPFILE,IFLG)                          GCTP1086
      CALL DMSLZ0 (LON0,0,ANGS(3),IPFILE,IFLG)                          GCTP1087
      CALL DMSLZ0 (LAT0,0,ANGS(4),IPFILE,IFLG)                          GCTP1088
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) A,ES,ANGS,X0,Y0            GCTP1089
 2010 FORMAT (' INITIALIZATION PARAMETERS (ALBERS CONICAL EQUAL-AREA',  GCTP1090
     .        ' PROJECTION)'/                                           GCTP1091
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/        GCTP1092
     .        ' ECCENTRICITY SQUARED         =',F16.13/                 GCTP1093
     .        ' LATITUDE OF 1ST ST. PARALLEL =',A16/                    GCTP1094
     .        ' LATITUDE OF 2ND ST. PARALLEL =',A16/                    GCTP1095
     .        ' LONGITUDE OF ORIGIN          =',A16/                    GCTP1096
     .        ' LATITUDE OF ORIGIN           =',A16/                    GCTP1097
     .        ' FALSE EASTING                =',F16.4,' METERS'/        GCTP1098
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     .        ' FALSE NORTHING                =',F16.4,' METERS')        GCTP1099
      SWITCH = ZONE                                                      GCTP1100
      RETURN                                                             GCTP1101
*                                                                        GCTP1102
* .....................................................................GCTP1103
*                       .  FORWARD TRANSFORMATION  .                   GCTP1104
* .....................................................................GCTP1105
*                                                                        GCTP1106
      ENTRY PF03Z0 (GEOG,PROJ,IFLG)                                      GCTP1107
*                                                                        GCTP1108
      IFLG = 0                                                           GCTP1109
      IF (SWITCH .NE. 0) GO TO 220                                       GCTP1110
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                             GCTP1111
 2020 FORMAT (' UNINITIALIZED TRANSFORMATION')                           GCTP1112
      IFLG = 300                                                         GCTP1113
      RETURN                                                             GCTP1114
  220 SINPHI = DSIN (GEOG(2))                                            GCTP1115
      COSPHI = DCOS (GEOG(2))                                            GCTP1116
      QS = QSFNZ0 (E,SINPHI,COSPHI)                                      GCTP1117
      RH = A * DSQRT (C - NS * QS) / NS                                  GCTP1118
      THETA = NS * ADJLZ0 (GEOG(1) - LON0)                               GCTP1119
      PROJ(1) = X0 + RH * DSIN (THETA)                                   GCTP1120
      PROJ(2) = Y0 + RH0 - RH * DCOS (THETA)                             GCTP1121
      RETURN                                                             GCTP1122
*                                                                        GCTP1123
* .....................................................................GCTP1124
*                       .  INVERSE TRANSFORMATION  .                   GCTP1125
* .....................................................................GCTP1126
*                                                                        GCTP1127
      ENTRY PI03Z0 (PROJ,GEOG,IFLG)                                      GCTP1128
*                                                                        GCTP1129
      IFLG = 0                                                           GCTP1130
      IF (SWITCH .NE. 0) GO TO 240                                       GCTP1131
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                             GCTP1132
      IFLG = 300                                                         GCTP1133
      RETURN                                                             GCTP1134
  240 X = PROJ(1) - X0                                                   GCTP1135
      Y = RH0 - PROJ(2) + Y0                                             GCTP1136
      RH = DSIGN (DSQRT (X * X + Y * Y) , NS)                            GCTP1137
      THETA = ZERO                                                       GCTP1138
      CON = DSIGN (ONE , NS)                                             GCTP1139
      IF (RH .NE. ZERO) THETA = DATAN2 (CON * X , CON * Y)               GCTP1140
      CON = RH * NS / A                                                  GCTP1141
      QS = (C - CON * CON) / NS                                          GCTP1142
      IF (E .LT. TOL) GO TO 260                                          GCTP1143
      CON = ONE - HALF * (ONE - ES) * DLOG ((ONE - E) /                  GCTP1144
     .      (ONE + E)) / E                                               GCTP1145
      IF ((DABS(CON) - DABS(QS)) .GT. TOL) GO TO 260                     GCTP1146
      GEOG(2) = DSIGN (HALFPI , QS)                                      GCTP1147
      GO TO 280                                                          GCTP1148
  260 GEOG(2) = PHI1Z0 (E,QS,IPFILE,IFLG)                                GCTP1149
      IF (IFLG .EQ. 0) GO TO 280                                         GCTP1150
      RETURN                                                             GCTP1151
  280 GEOG(1) = ADJLZ0 (THETA / NS + LON0)                               GCTP1152
      RETURN                                                             GCTP1153
*                                                                        GCTP1154
      END                                                                GCTP1155
* *********************************************************************GCTP1157
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1158
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP1159
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1160
* *********************************************************************GCTP1161
*                       *  LAMBERT CONFORMAL CONIC  *                    GCTP1162
* *********************************************************************GCTP1163
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*                                                                       GCTP1164
      SUBROUTINE PJ04Z0                                                 GCTP1165
*                                                                       GCTP1166
      IMPLICIT REAL*8 (A-Z)                                             GCTP1167
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP1168
      CHARACTER*16 ANGS(4)                                              GCTP1169
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                     GCTP1170
* **** PARAMETERS **** A,E,ES,LAT1,LAT2,LON0,LAT0,X0,Y0,NS,F,RH0 *******GCTP1171
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP1172
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP1173
      DATA EPSLN /1.0D-10/                                              GCTP1174
      DATA ZERO,ONE /0.0D0,1.0D0/                                       GCTP1175
      DATA SWITCH /0/                                                   GCTP1176
*                                                                       GCTP1177
* .....................................................................GCTP1178
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP1179
* .....................................................................GCTP1180
*                                                                       GCTP1181
      ENTRY IS04Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP1182
*                                                                       GCTP1183
      IFLG = 0                                                          GCTP1184
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP1185
      IF (DATA(1) .LE. ZERO) GO TO 100                                  GCTP1186
      A = DATA(1)                                                       GCTP1187
      B = DATA(2)                                                       GCTP1188
      IF (B .GT. ZERO) GO TO 040                                        GCTP1189
      E = ZERO                                                          GCTP1190
      ES = ZERO                                                         GCTP1191
      GO TO 120                                                         GCTP1192
  040 IF (B .GT. ONE) GO TO 060                                         GCTP1193
      E = DSQRT (B)                                                     GCTP1194
      ES = B                                                            GCTP1195
      GO TO 120                                                         GCTP1196
  060 ES = ONE - (B / A) ** 2                                           GCTP1197
      E = DSQRT (ES)                                                    GCTP1198
      GO TO 120                                                         GCTP1199
  100 A = AZ                                                            GCTP1200
      E = EZ                                                            GCTP1201
      ES = ESZ                                                          GCTP1202
  120 CALL UNITZ0 (DATA(3),5,LAT1,0,IPFILE,IFLG)                        GCTP1203
      IF (IFLG .NE. 0) RETURN                                           GCTP1204
      CALL UNITZ0 (DATA(4),5,LAT2,0,IPFILE,IFLG)                        GCTP1205
      IF (IFLG .NE. 0) RETURN                                           GCTP1206
      IF (DABS(LAT1+LAT2) .GE. EPSLN) GO TO 130                         GCTP1207
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                            GCTP1208
 2000 FORMAT (' EQUAL LATITUDES FOR ST. PARALLELS ON OPPOSITE',         GCTP1209
     .        ' SIDES OF EQUATOR')                                      GCTP1210
      IFLG = 401                                                        GCTP1211
      RETURN                                                            GCTP1212
  130 CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP1213
      IF (IFLG .NE. 0) RETURN                                           GCTP1214
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP1215
      IF (IFLG .NE. 0) RETURN                                           GCTP1216
      X0 = DATA(7)                                                      GCTP1217
      Y0 = DATA(8)                                                      GCTP1218
      SINPHI = DSIN (LAT1)                                              GCTP1219
      CON = SINPHI                                                      GCTP1220
      COSPHI = DCOS (LAT1)                                              GCTP1221
      MS1 = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1222
      TS1 = TSFNZ0 (E,LAT1,SINPHI)                                      GCTP1223
      SINPHI = DSIN (LAT2)                                              GCTP1224
      COSPHI = DCOS (LAT2)                                              GCTP1225
      MS2 = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1226
      TS2 = TSFNZ0 (E,LAT2,SINPHI)                                      GCTP1227
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      SINPHI = DSIN (LAT0)                                                GCTP1228
      TS0 = TSFNZ0 (E,LAT0,SINPHI)                                        GCTP1229
      IF (DABS(LAT1-LAT2) .GE. EPSLN) GO TO 140                           GCTP1230
      NS = CON                                                            GCTP1231
      GO TO 150                                                           GCTP1232
  140 NS = DLOG (MS1 / MS2) / DLOG (TS1 / TS2)                            GCTP1233
  150 F = MS1 / (NS * TS1 ** NS)                                          GCTP1234
      RH0 = A * F * TS0 ** NS                                             GCTP1235
*                                                                         GCTP1236
* LIST RESULTS OF PARAMETER INITIALIZATION.                              GCTP1237
*                                                                         GCTP1238
      CALL DMSLZ0 (LAT1,0,ANGS(1),IPFILE,IFLG)                            GCTP1239
      CALL DMSLZ0 (LAT2,0,ANGS(2),IPFILE,IFLG)                            GCTP1240
      CALL DMSLZ0 (LON0,0,ANGS(3),IPFILE,IFLG)                            GCTP1241
      CALL DMSLZ0 (LAT0,0,ANGS(4),IPFILE,IFLG)                            GCTP1242
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) A,ES,ANGS,X0,Y0              GCTP1243
 2010 FORMAT (' INITIALIZATION PARAMETERS (LAMBERT CONFORMAL CONIC',      GCTP1244
     .        ' PROJECTION)'/                                            GCTP1245
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/         GCTP1246
     .        ' ECCENTRICITY SQUARED         =',F16.13/                  GCTP1247
     .        ' LATITUDE OF 1ST ST. PARALLEL =',A16/                     GCTP1248
     .        ' LATITUDE OF 2ND ST. PARALLEL =',A16/                     GCTP1249
     .        ' LONGITUDE OF ORIGIN          =',A16/                     GCTP1250
     .        ' LATITUDE OF ORIGIN           =',A16/                     GCTP1251
     .        ' FALSE EASTING                =',F16.4,' METERS'/         GCTP1252
     .        ' FALSE NORTHING               =',F16.4,' METERS')         GCTP1253
      SWITCH = ZONE                                                       GCTP1254
      RETURN                                                              GCTP1255
*                                                                         GCTP1256
* .....................................................................GCTP1257
*                       .  FORWARD TRANSFORMATION  .                      GCTP1258
* .....................................................................GCTP1259
*                                                                         GCTP1260
      ENTRY PF04Z0 (GEOG,PROJ,IFLG)                                       GCTP1261
*                                                                         GCTP1262
      IFLG = 0                                                            GCTP1263
      IF (SWITCH .NE. 0) GO TO 200                                        GCTP1264
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                              GCTP1265
 2020 FORMAT (' UNINITIALIZED TRANSFORMATION')                            GCTP1266
      IFLG = 400                                                          GCTP1267
      RETURN                                                              GCTP1268
  200 CON = DABS (DABS (GEOG(2)) - HALFPI)                                GCTP1269
      IF (CON .GT. EPSLN) GO TO 220                                       GCTP1270
      CON = GEOG(2) * NS                                                  GCTP1271
      IF (CON .GT. ZERO) GO TO 210                                        GCTP1272
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                              GCTP1273
 2030 FORMAT (' POINT CANNOT BE PROJECTED')                               GCTP1274
      IFLG = 402                                                          GCTP1275
      RETURN                                                              GCTP1276
  210 RH = ZERO                                                           GCTP1277
      GO TO 230                                                           GCTP1278
  220 SINPHI = DSIN (GEOG(2))                                             GCTP1279
      TS = TSFNZ0 (E,GEOG(2),SINPHI)                                      GCTP1280
      RH = A * F * TS ** NS                                               GCTP1281
  230 THETA = NS * ADJLZ0 (GEOG(1) - LON0)                                GCTP1282
      PROJ(1) = X0 + RH * DSIN (THETA)                                    GCTP1283
      PROJ(2) = Y0 + RH0 - RH * DCOS (THETA)                              GCTP1284
      RETURN                                                              GCTP1285
*                                                                         GCTP1286
* .....................................................................GCTP1287
*                       .  INVERSE TRANSFORMATION  .                      GCTP1288
* .....................................................................GCTP1289
*                                                                         GCTP1290
      ENTRY PI04Z0 (PROJ,GEOG,IFLG)                                       GCTP1291
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*                                                                       GCTP1292
      IFLG = 0                                                          GCTP1293
      IF (SWITCH .NE. 0) GO TO 240                                      GCTP1294
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP1295
      IFLG = 400                                                        GCTP1296
      RETURN                                                            GCTP1297
  240 X = PROJ(1) - X0                                                  GCTP1298
      Y = RH0 - PROJ(2) + Y0                                            GCTP1299
      RH = DSIGN (DSQRT (X*X + Y*Y) , NS)                               GCTP1300
      THETA = ZERO                                                      GCTP1301
      CON = DSIGN (ONE , NS)                                            GCTP1302
      IF (RH .NE. ZERO) THETA = DATAN2 (CON * X , CON * Y)              GCTP1303
      IF (RH.NE.ZERO .OR. NS.GT.ZERO) GO TO 250                         GCTP1304
      GEOG(2) = - HALFPI                                                GCTP1305
      GO TO 260                                                         GCTP1306
  250 CON = ONE / NS                                                    GCTP1307
      TS = (RH / (A * F)) ** CON                                        GCTP1308
      GEOG(2) = PHI2Z0 (E,TS,IPFILE,IFLG)                               GCTP1309
      IF (IFLG .NE. 0) RETURN                                           GCTP1310
  260 GEOG(1) = ADJLZ0 (THETA / NS + LON0)                              GCTP1311
      RETURN                                                            GCTP1312
*                                                                       GCTP1313
      END                                                               GCTP1314
* ***********************************************************************GCTP1316
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1317
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP1318
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1319
* ***********************************************************************GCTP1320
*                              *  MERCATOR  *                           GCTP1321
* ***********************************************************************GCTP1322
*                                                                       GCTP1323
      SUBROUTINE PJ05Z0                                                 GCTP1324
*                                                                       GCTP1325
      IMPLICIT REAL*8 (A-Z)                                             GCTP1326
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP1327
      CHARACTER*16 ANGS(2)                                              GCTP1328
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                     GCTP1329
* **** PARAMETERS **** A,E,ES,LON0,X0,Y0,NS,F,RH0,LAT1,M1 **************GCTP1330
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP1331
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP1332
      DATA EPSLN /1.0D-10/                                              GCTP1333
      DATA ZERO,ONE /0.0D0,1.0D0/                                       GCTP1334
      DATA SWITCH /0/                                                   GCTP1335
*                                                                       GCTP1336
* .....................................................................GCTP1337
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP1338
* .....................................................................GCTP1339
*                                                                       GCTP1340
      ENTRY IS05Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP1341
*                                                                       GCTP1342
      IFLG = 0                                                          GCTP1343
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP1344
      IF (DATA(1) .LE. ZERO) GO TO 100                                  GCTP1345
      A = DATA(1)                                                       GCTP1346
      B = DATA(2)                                                       GCTP1347
      IF (B .GT. ZERO) GO TO 040                                        GCTP1348
      E = ZERO                                                          GCTP1349
      ES = ZERO                                                         GCTP1350
      GO TO 120                                                         GCTP1351
  040 IF (B .GT. ONE) GO TO 060                                         GCTP1352
      E = DSQRT (B)                                                     GCTP1353
      ES = B                                                            GCTP1354
      GO TO 120                                                         GCTP1355
  060 ES = ONE - (B / A) ** 2                                           GCTP1356
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      E = DSQRT (ES)                                                    GCTP1357
      GO TO 120                                                         GCTP1358
  100 A = AZ                                                            GCTP1359
      E = EZ                                                            GCTP1360
      ES = ESZ                                                          GCTP1361
  120 CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP1362
      IF (IFLG .NE. 0) RETURN                                           GCTP1363
      CALL UNITZ0 (DATA(6),5,LAT1,0,IPFILE,IFLG)                        GCTP1364
      IF (IFLG .NE. 0) RETURN                                           GCTP1365
      M1 = DCOS(LAT1) / (DSQRT( ONE - ES * DSIN(LAT1) **2))             GCTP1366
      X0 = DATA(7)                                                      GCTP1367
      Y0 = DATA(8)                                                      GCTP1368
*                                                                       GCTP1369
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP1370
*                                                                       GCTP1371
      CALL DMSLZ0 (LAT1,0,ANGS(1),IPFILE,IFLG)                          GCTP1372
      CALL DMSLZ0 (LON0,0,ANGS(2),IPFILE,IFLG)                          GCTP1373
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ES,ANGS,X0,Y0            GCTP1374
 2000 FORMAT (' INITIALIZATION PARAMETERS (MERCATOR',                   GCTP1375
     .        ' PROJECTION)'/                                          GCTP1376
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/       GCTP1377
     .        ' ECCENTRICITY SQUARED         =',F16.13/                GCTP1378
     .        ' LATITUDE OF TRUE SCALE       =',A16/                   GCTP1379
     .        ' CENTRAL LONGITUDE            =',A16/                   GCTP1380
     .        ' FALSE EASTING                =',F16.4,' METERS'/       GCTP1381
     .        ' FALSE NORTHING               =',F16.4,' METERS')       GCTP1382
      SWITCH = ZONE                                                     GCTP1383
      RETURN                                                            GCTP1384
*                                                                       GCTP1385
* .....................................................................GCTP1386
*                      .  FORWARD TRANSFORMATION  .                     GCTP1387
* .....................................................................GCTP1388
*                                                                       GCTP1389
      ENTRY PF05Z0 (GEOG,PROJ,IFLG)                                     GCTP1390
*                                                                       GCTP1391
      IFLG = 0                                                          GCTP1392
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP1393
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP1394
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP1395
      IFLG = 500                                                        GCTP1396
      RETURN                                                            GCTP1397
  220 IF (DABS(DABS(GEOG(2)) - HALFPI) .GT. EPSLN) GO TO 240            GCTP1398
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP1399
 2020 FORMAT (' TRANSFORMATION CANNOT BE COMPUTED AT THE POLES')        GCTP1400
      IFLG = 501                                                        GCTP1401
      RETURN                                                            GCTP1402
  240 SINPHI = DSIN (GEOG(2))                                           GCTP1403
      TS = TSFNZ0 (E,GEOG(2),SINPHI)                                    GCTP1404
      PROJ(1) = X0 + A * M1 * ADJLZ0 (GEOG(1) - LON0)                   GCTP1405
      PROJ(2) = Y0 - A * M1 * DLOG (TS)                                 GCTP1406
      RETURN                                                            GCTP1407
*                                                                       GCTP1408
* .....................................................................GCTP1409
*                      .  INVERSE TRANSFORMATION  .                     GCTP1410
* .....................................................................GCTP1411
*                                                                       GCTP1412
      ENTRY PI05Z0 (PROJ,GEOG,IFLG)                                     GCTP1413
*                                                                       GCTP1414
      IFLG = 0                                                          GCTP1415
      IF (SWITCH .NE. 0) GO TO 260                                      GCTP1416
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP1417
      IFLG = 500                                                        GCTP1418
      RETURN                                                            GCTP1419
  260 X = PROJ(1) - X0                                                  GCTP1420
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      Y = PROJ(2) - Y0                                                  GCTP1421
      TS = DEXP (- Y / (A * M1))                                        GCTP1422
      GEOG(2) = PHI2Z0 (E,TS,IPFILE,IFLG)                               GCTP1423
      IF (IFLG .NE. 0) RETURN                                           GCTP1424
      GEOG(1) = ADJLZ0 (LON0 + X / (A * M1))                            GCTP1425
      RETURN                                                            GCTP1426
*                                                                       GCTP1427
      END                                                               GCTP1428
* ***********************************************************************GCTP1430
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1431
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP1432
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1433
* ***********************************************************************GCTP1434
*                          *  POLAR STEREOGRAPHIC  *                    GCTP1435
* ***********************************************************************GCTP1436
*                                                                       GCTP1437
      SUBROUTINE PJ06Z0                                                 GCTP1438
*                                                                       GCTP1439
      IMPLICIT REAL*8 (A-Z)                                             GCTP1440
      INTEGER*4 SWITCH,IND,I,ZONE,IPFILE,IFLG                           GCTP1441
      CHARACTER*16 ANGS(2)                                              GCTP1442
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                     GCTP1443
* **** PARAMETERS **** A,E,ES,LON0,LATC,X0,Y0,E4,MCS,TCS,FAC,IND *******GCTP1444
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP1445
      DATA NINTYD /900000.0D0/                                          GCTP1446
      DATA ZERO,ONE,TWO /0.0D0,1.0D0,2.0D0/                             GCTP1447
      DATA SWITCH /0/                                                   GCTP1448
*                                                                       GCTP1449
* .....................................................................GCTP1450
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP1451
* .....................................................................GCTP1452
*                                                                       GCTP1453
      ENTRY IS06Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP1454
*                                                                       GCTP1455
      IFLG = 0                                                          GCTP1456
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP1457
      IF (DATA(1) .LE. ZERO) GO TO 100                                  GCTP1458
      A = DATA(1)                                                       GCTP1459
      B = DATA(2)                                                       GCTP1460
      IF (B .GT. ZERO) GO TO 040                                        GCTP1461
      E = ZERO                                                          GCTP1462
      ES = ZERO                                                         GCTP1463
      E4 = ONE                                                          GCTP1464
      GO TO 120                                                         GCTP1465
  040 IF (B .GT. ONE) GO TO 060                                         GCTP1466
      E = DSQRT (B)                                                     GCTP1467
      ES = B                                                            GCTP1468
      GO TO 080                                                         GCTP1469
  060 ES = ONE - (B / A) ** 2                                           GCTP1470
      E = DSQRT (ES)                                                    GCTP1471
  080 E4 = E4FNZ0 (E)                                                   GCTP1472
      GO TO 120                                                         GCTP1473
  100 A = AZ                                                            GCTP1474
      E = EZ                                                            GCTP1475
      ES = ESZ                                                          GCTP1476
      E4 = E4Z                                                          GCTP1477
  120 CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP1478
      IF (IFLG .NE. 0) RETURN                                           GCTP1479
      SAVE = DATA(6)                                                    GCTP1480
      CALL UNITZ0 (SAVE,5,LATC,0,IPFILE,IFLG)                           GCTP1481
      IF (IFLG .NE. 0) RETURN                                           GCTP1482
      X0 = DATA(7)                                                      GCTP1483
      Y0 = DATA(8)                                                      GCTP1484
      FAC = ONE                                                         GCTP1485
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      IF (SAVE .LT. ZERO) FAC =-ONE                                     GCTP1486
      IND = 0                                                           GCTP1487
      IF (DABS(SAVE) .EQ. NINTYD) GO TO 130                             GCTP1488
      IND = 1                                                           GCTP1489
      CON1 = FAC * LATC                                                 GCTP1490
      SINPHI = DSIN (CON1)                                              GCTP1491
      COSPHI = DCOS (CON1)                                              GCTP1492
      MCS = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1493
      TCS = TSFNZ0 (E,CON1,SINPHI)                                      GCTP1494
*                                                                       GCTP1495
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP1496
*                                                                       GCTP1497
  130 CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                          GCTP1498
      CALL DMSLZ0 (LATC,0,ANGS(2),IPFILE,IFLG)                          GCTP1499
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ES,ANGS,X0,Y0            GCTP1500
 2000 FORMAT (' INITIALIZATION PARAMETERS (POLAR STEREOGRAPHIC',        GCTP1501
     .         ' PROJECTION)'/                                         GCTP1502
     .         ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/      GCTP1503
     .         ' ECCENTRICITY SQUARED         =',F16.13/               GCTP1504
     .         ' LONGITUDE OF Y-AXIS          =',A16/                  GCTP1505
     .         ' LATITUDE OF TRUE SCALE       =',A16/                  GCTP1506
     .         ' FALSE EASTING                =',F16.4,' METERS'/      GCTP1507
     .         ' FALSE NORTHING               =',F16.4,' METERS')      GCTP1508
      SWITCH = ZONE                                                     GCTP1509
      RETURN                                                            GCTP1510
*                                                                       GCTP1511
* .....................................................................GCTP1512
*                       .  FORWARD TRANSFORMATION  .                    GCTP1513
* .....................................................................GCTP1514
*                                                                       GCTP1515
      ENTRY PF06Z0 (GEOG,PROJ,IFLG)                                     GCTP1516
*                                                                       GCTP1517
      IFLG = 0                                                          GCTP1518
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP1519
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP1520
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP1521
      IFLG = 600                                                        GCTP1522
      RETURN                                                            GCTP1523
  220 CON1 = FAC * ADJLZ0 (GEOG(1) - LON0)                              GCTP1524
      CON2 = FAC * GEOG(2)                                              GCTP1525
      SINPHI = DSIN (CON2)                                              GCTP1526
      TS = TSFNZ0 (E,CON2,SINPHI)                                       GCTP1527
      IF (IND .EQ. 0) GO TO 240                                         GCTP1528
      RH = A * MCS * TS / TCS                                           GCTP1529
      GO TO 260                                                         GCTP1530
  240 RH = TWO * A * TS / E4                                            GCTP1531
  260 PROJ(1) = X0 + FAC * RH * DSIN (CON1)                             GCTP1532
      PROJ(2) = Y0 - FAC * RH * DCOS (CON1)                             GCTP1533
      RETURN                                                            GCTP1534
*                                                                       GCTP1535
* .....................................................................GCTP1536
*                       .  INVERSE TRANSFORMATION  .                    GCTP1537
* .....................................................................GCTP1538
*                                                                       GCTP1539
      ENTRY PI06Z0 (PROJ,GEOG,IFLG)                                     GCTP1540
*                                                                       GCTP1541
      IFLG = 0                                                          GCTP1542
      IF (SWITCH .NE. 0) GO TO 320                                      GCTP1543
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP1544
      IFLG = 600                                                        GCTP1545
      RETURN                                                            GCTP1546
  320 X = FAC * (PROJ(1) - X0)                                          GCTP1547
      Y = FAC * (PROJ(2) - Y0)                                          GCTP1548
      RH = DSQRT (X * X + Y * Y)                                        GCTP1549
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      IF (IND .EQ. 0) GO TO 340                                          GCTP1550
      TS = RH * TCS / (A * MCS)                                          GCTP1551
      GO TO 360                                                          GCTP1552
  340 TS = RH * E4 / (TWO * A)                                           GCTP1553
  360 GEOG(2) = FAC * PHI2Z0 (E,TS,IPFILE,IFLG)                          GCTP1554
      IF (IFLG .NE. 0) RETURN                                            GCTP1555
      IF (RH .NE. ZERO) GO TO 400                                        GCTP1556
      GEOG(1) = FAC * LON0                                               GCTP1557
      RETURN                                                             GCTP1558
  400 GEOG(1) = ADJLZ0 (FAC * DATAN2 (X , -Y) + LON0)                    GCTP1559
      RETURN                                                             GCTP1560
*                                                                        GCTP1561
      END                                                                GCTP1562
* ***********************************************************************GCTP1564
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1565
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP1566
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1567
* ***********************************************************************GCTP1568
*                              *  POLYCONIC  *                           GCTP1569
* ***********************************************************************GCTP1570
      SUBROUTINE PJ07Z0                                                  GCTP1571
*                                                                        GCTP1572
      IMPLICIT REAL*8 (A-Z)                                              GCTP1573
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                                GCTP1574
      CHARACTER*16 ANGS(2)                                               GCTP1575
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                      GCTP1576
* **** PARAMETERS **** A,E,ES,LON0,LAT0,X0,Y0,E0,E1,E2,E3,ML0 **********GCTP1577
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                  GCTP1578
      DATA TOL /1.0D-7/                                                  GCTP1579
      DATA ZERO,ONE /0.0D0,1.0D0/                                        GCTP1580
      DATA SWITCH /0/                                                    GCTP1581
*                                                                        GCTP1582
* .....................................................................GCTP1583
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .       GCTP1584
* .....................................................................GCTP1585
*                                                                        GCTP1586
      ENTRY IS07Z0 (ZONE,DATA,IPFILE,IFLG)                               GCTP1587
*                                                                        GCTP1588
      IFLG = 0                                                           GCTP1589
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                       GCTP1590
      IF (DATA(1) .LE. ZERO) GO TO 100                                   GCTP1591
      A = DATA(1)                                                        GCTP1592
      B = DATA(2)                                                        GCTP1593
      IF (B .GT. ZERO) GO TO 040                                         GCTP1594
      E = ZERO                                                           GCTP1595
      ES = ZERO                                                          GCTP1596
      E0 = ONE                                                           GCTP1597
      E1 = ZERO                                                          GCTP1598
      E2 = ZERO                                                          GCTP1599
      E3 = ZERO                                                          GCTP1600
      GO TO 120                                                          GCTP1601
  040 IF (B .GT. ONE) GO TO 060                                          GCTP1602
      E = DSQRT (B)                                                      GCTP1603
      ES = B                                                             GCTP1604
      GO TO 080                                                          GCTP1605
  060 ES = ONE - (B / A) ** 2                                            GCTP1606
      E = DSQRT (ES)                                                     GCTP1607
  080 E0 = E0FNZ0 (ES)                                                   GCTP1608
      E1 = E1FNZ0 (ES)                                                   GCTP1609
      E2 = E2FNZ0 (ES)                                                   GCTP1610
      E3 = E3FNZ0 (ES)                                                   GCTP1611
      GO TO 120                                                          GCTP1612
  100 A = AZ                                                             GCTP1613
      E = EZ                                                             GCTP1614
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      ES = ESZ                                                          GCTP1615
      E0 = E0Z                                                          GCTP1616
      E1 = E1Z                                                          GCTP1617
      E2 = E2Z                                                          GCTP1618
      E3 = E3Z                                                          GCTP1619
  120 CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP1620
      IF (IFLG .NE. 0) RETURN                                           GCTP1621
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP1622
      IF (IFLG .NE. 0) RETURN                                           GCTP1623
      X0 = DATA(7)                                                      GCTP1624
      Y0 = DATA(8)                                                      GCTP1625
      ML0 = MLFNZ0 (E0,E1,E2,E3,LAT0)                                   GCTP1626
*                                                                       GCTP1627
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP1628
*                                                                       GCTP1629
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                          GCTP1630
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                          GCTP1631
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ES,ANGS,X0,Y0            GCTP1632
 2000 FORMAT (' INITIALIZATION PARAMETERS (POLYCONIC',                  GCTP1633
     .        ' PROJECTION)'/                                          GCTP1634
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/       GCTP1635
     .        ' ECCENTRICITY SQUARED         =',F16.13/                GCTP1636
     .        ' LONGITUDE OF ORIGIN          =',A16/                   GCTP1637
     .        ' LATITUDE OF ORIGIN           =',A16/                   GCTP1638
     .        ' FALSE EASTING                =',F16.4,' METERS'/       GCTP1639
     .        ' FALSE NORTHING               =',F16.4,' METERS')       GCTP1640
      SWITCH = ZONE                                                     GCTP1641
      RETURN                                                            GCTP1642
*                                                                       GCTP1643
* .....................................................................GCTP1644
*                       .  FORWARD TRANSFORMATION  .                    GCTP1645
* .....................................................................GCTP1646
*                                                                       GCTP1647
      ENTRY PF07Z0 (GEOG,PROJ,IFLG)                                     GCTP1648
*                                                                       GCTP1649
      IFLG = 0                                                          GCTP1650
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP1651
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP1652
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP1653
      IFLG = 700                                                        GCTP1654
      RETURN                                                            GCTP1655
  220 CON = ADJLZ0 (GEOG(1) - LON0)                                     GCTP1656
      IF (DABS(GEOG(2)) .GT. TOL) GO TO 240                             GCTP1657
      PROJ(1) = X0 + A * CON                                            GCTP1658
      PROJ(2) = Y0 - A * ML0                                            GCTP1659
      RETURN                                                            GCTP1660
  240 SINPHI = DSIN (GEOG(2))                                           GCTP1661
      COSPHI = DCOS (GEOG(2))                                           GCTP1662
      ML = MLFNZ0 (E0,E1,E2,E3,GEOG(2))                                 GCTP1663
      MS = MSFNZ0 (E,SINPHI,COSPHI)                                     GCTP1664
      CON = CON * SINPHI                                                GCTP1665
      PROJ(1) = X0 + A * MS * DSIN (CON) / SINPHI                       GCTP1666
      PROJ(2) = Y0 + A * (ML - ML0 + MS * (ONE - DCOS (CON)) / SINPHI)  GCTP1667
      RETURN                                                            GCTP1668
*                                                                       GCTP1669
* .....................................................................GCTP1670
*                       .  INVERSE TRANSFORMATION  .                    GCTP1671
* .....................................................................GCTP1672
*                                                                       GCTP1673
      ENTRY PI07Z0 (PROJ,GEOG,IFLG)                                     GCTP1674
*                                                                       GCTP1675
      IFLG = 0                                                          GCTP1676
      IF (SWITCH .NE. 0) GO TO 320                                      GCTP1677
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP1678
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      IFLG = 700                                                        GCTP1679
      RETURN                                                            GCTP1680
  320 X = PROJ(1) - X0                                                  GCTP1681
      Y = PROJ(2) - Y0                                                  GCTP1682
      AL = ML0 + Y / A                                                  GCTP1683
      IF (DABS (AL) .GT. TOL) GO TO 340                                 GCTP1684
      GEOG(1) = X / A + LON0                                            GCTP1685
      GEOG(2) = ZERO                                                    GCTP1686
      RETURN                                                            GCTP1687
  340 B = AL * AL + (X / A) ** 2                                        GCTP1688
      GEOG(2) = PHI4Z0 (ES,E0,E1,E2,E3,AL,B,C,IPFILE,IFLG)              GCTP1689
      IF (IFLG .NE. 0) RETURN                                           GCTP1690
      GEOG(1) = ADJLZ0 (ASINZ0 (X * C / A) / DSIN (GEOG(2)) + LON0)     GCTP1691
      RETURN                                                            GCTP1692
*                                                                       GCTP1693
      END                                                               GCTP1694
* ***********************************************************************GCTP1696
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1697
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP1698
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1699
* ***********************************************************************GCTP1700
*                          *  EQUIDISTANT CONIC  *                      GCTP1701
* ***********************************************************************GCTP1702
*                                                                       GCTP1703
      SUBROUTINE PJ08Z0                                                 GCTP1704
*                                                                       GCTP1705
      IMPLICIT REAL*8 (A-Z)                                             GCTP1706
      INTEGER*4 SWITCH,IND,I,ZONE,IPFILE,IFLG                           GCTP1707
      CHARACTER*16 ANGS(4)                                              GCTP1708
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                     GCTP1709
* PARAMETERS ** A,E,ES,LAT1,LAT2,LON0,LAT0,X0,Y0,E0,E1,E2,E3,NS,GL,RH0 *GCTP1710
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP1711
      DATA ZERO,ONE /0.0D0,1.0D0/                                       GCTP1712
      DATA EPSLN /1.0D-10/                                              GCTP1713
      DATA SWITCH /0/                                                   GCTP1714
*                                                                       GCTP1715
* .....................................................................GCTP1716
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP1717
* .....................................................................GCTP1718
*                                                                       GCTP1719
      ENTRY IS08Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP1720
*                                                                       GCTP1721
      IFLG = 0                                                          GCTP1722
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP1723
      IF (DATA(1) .LE. ZERO) GO TO 100                                  GCTP1724
      A = DATA(1)                                                       GCTP1725
      B = DATA(2)                                                       GCTP1726
      IF (B .GT. ZERO) GO TO 040                                        GCTP1727
      E = ZERO                                                          GCTP1728
      ES = ZERO                                                         GCTP1729
      E0 = ONE                                                          GCTP1730
      E1 = ZERO                                                         GCTP1731
      E2 = ZERO                                                         GCTP1732
      E3 = ZERO                                                         GCTP1733
      GO TO 120                                                         GCTP1734
  040 IF (B .GT. ONE) GO TO 060                                         GCTP1735
      E = DSQRT (B)                                                     GCTP1736
      ES = B                                                            GCTP1737
      GO TO 080                                                         GCTP1738
  060 ES = ONE - (B / A) ** 2                                           GCTP1739
      E = DSQRT (ES)                                                    GCTP1740
  080 E0 = E0FNZ0 (ES)                                                  GCTP1741
      E1 = E1FNZ0 (ES)                                                  GCTP1742
      E2 = E2FNZ0 (ES)                                                  GCTP1743
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      E3 = E3FNZ0 (ES)                                                  GCTP1744
      GO TO 120                                                         GCTP1745
  100 A = AZ                                                            GCTP1746
      E = EZ                                                            GCTP1747
      ES = ESZ                                                          GCTP1748
      E0 = E0Z                                                          GCTP1749
      E1 = E1Z                                                          GCTP1750
      E2 = E2Z                                                          GCTP1751
      E3 = E3Z                                                          GCTP1752
  120 CALL UNITZ0 (DATA(3),5,LAT1,0,IPFILE,IFLG)                        GCTP1753
      IF (IFLG .NE. 0) RETURN                                           GCTP1754
      CALL UNITZ0 (DATA(4),5,LAT2,0,IPFILE,IFLG)                        GCTP1755
      IF (IFLG .NE. 0) RETURN                                           GCTP1756
      IF (DABS(LAT1+LAT2) .GE. EPSLN) GO TO 130                         GCTP1757
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000)                            GCTP1758
 2000 FORMAT (' EQUAL LATITUDES FOR ST. PARALLELS ON OPPOSITE',         GCTP1759
     .        ' SIDES OF EQUATOR')                                      GCTP1760
      IFLG = 801                                                        GCTP1761
      RETURN                                                            GCTP1762
  130 CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP1763
      IF (IFLG .NE. 0) RETURN                                           GCTP1764
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP1765
      IF (IFLG .NE. 0) RETURN                                           GCTP1766
      X0 = DATA(7)                                                      GCTP1767
      Y0 = DATA(8)                                                      GCTP1768
      SINPHI = DSIN (LAT1)                                              GCTP1769
      COSPHI = DCOS (LAT1)                                              GCTP1770
      MS1 = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1771
      ML1 = MLFNZ0 (E0,E1,E2,E3,LAT1)                                   GCTP1772
      IND = 0                                                           GCTP1773
      IF (DATA(9) .NE. ZERO) GO TO 140                                  GCTP1774
      NS = SINPHI                                                       GCTP1775
      GO TO 160                                                         GCTP1776
  140 IND = 1                                                           GCTP1777
      SINPHI = DSIN (LAT2)                                              GCTP1778
      COSPHI = DCOS (LAT2)                                              GCTP1779
      MS2 = MSFNZ0 (E,SINPHI,COSPHI)                                    GCTP1780
      ML2 = MLFNZ0 (E0,E1,E2,E3,LAT2)                                   GCTP1781
      IF (DABS(LAT1-LAT2) .GE. EPSLN) GO TO 150                         GCTP1782
      NS = SINPHI                                                       GCTP1783
      GO TO 160                                                         GCTP1784
  150 NS = (MS1 - MS2) / (ML2 - ML1)                                    GCTP1785
  160 GL = ML1 + MS1 / NS                                               GCTP1786
      ML0 = MLFNZ0 (E0,E1,E2,E3,LAT0)                                   GCTP1787
      RH0 = A * (GL - ML0)                                              GCTP1788
*                                                                       GCTP1789
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP1790
*                                                                       GCTP1791
      CALL DMSLZ0 (LAT1,0,ANGS(1),IPFILE,IFLG)                          GCTP1792
      CALL DMSLZ0 (LAT2,0,ANGS(2),IPFILE,IFLG)                          GCTP1793
      CALL DMSLZ0 (LON0,0,ANGS(3),IPFILE,IFLG)                          GCTP1794
      CALL DMSLZ0 (LAT0,0,ANGS(4),IPFILE,IFLG)                          GCTP1795
      IF (IND .EQ. 0) GO TO 200                                         GCTP1796
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) A,ES,ANGS,X0,Y0            GCTP1797
 2010 FORMAT (' INITIALIZATION PARAMETERS (EQUIDISTANT CONIC',          GCTP1798
     .        ' PROJECTION)'/                                           GCTP1799
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/        GCTP1800
     .        ' ECCENTRICITY SQUARED         =',F16.13/                 GCTP1801
     .        ' LATITUDE OF 1ST ST. PARALLEL =',A16/                    GCTP1802
     .        ' LATITUDE OF 2ND ST. PARALLEL =',A16/                    GCTP1803
     .        ' LONGITUDE OF ORIGIN          =',A16/                    GCTP1804
     .        ' LATITUDE OF ORIGIN           =',A16/                    GCTP1805
     .        ' FALSE EASTING                =',F16.4,' METERS'/        GCTP1806
     .        ' FALSE NORTHING               =',F16.4,' METERS')        GCTP1807
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      GO TO 220                                                         GCTP1808
  200 IF (IPFILE .NE. 0) WRITE (IPFILE,2020) A,ES,ANGS(1),ANGS(3),      GCTP1809
     .                                       ANGS(4),X0,Y0            GCTP1810
 2020 FORMAT (' INITIALIZATION PARAMETERS (EQUIDISTANT CONIC',          GCTP1811
     .        ' PROJECTION)'/                                          GCTP1812
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/       GCTP1813
     .        ' ECCENTRICITY SQUARED         =',F16.13/                GCTP1814
     .        ' LATITUDE OF ST. PARALLEL     =',A16/                   GCTP1815
     .        ' LONGITUDE OF ORIGIN          =',A16/                   GCTP1816
     .        ' LATITUDE OF ORIGIN           =',A16/                   GCTP1817
     .        ' FALSE EASTING                =',F16.4,' METERS'/       GCTP1818
     .        ' FALSE NORTHING               =',F16.4,' METERS')       GCTP1819
  220 SWITCH = ZONE                                                     GCTP1820
      RETURN                                                            GCTP1821
*                                                                       GCTP1822
* .....................................................................GCTP1823
*                     .  FORWARD TRANSFORMATION  .                      GCTP1824
* .....................................................................GCTP1825
*                                                                       GCTP1826
      ENTRY PF08Z0 (GEOG,PROJ,IFLG)                                     GCTP1827
*                                                                       GCTP1828
      IFLG = 0                                                          GCTP1829
      IF (SWITCH .NE. 0) GO TO 300                                      GCTP1830
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                            GCTP1831
 2030 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP1832
      IFLG = 800                                                        GCTP1833
      RETURN                                                            GCTP1834
  300 ML = MLFNZ0 (E0,E1,E2,E3,GEOG(2))                                 GCTP1835
      RH = A * (GL - ML)                                                GCTP1836
      THETA = NS * ADJLZ0 (GEOG(1) - LON0)                              GCTP1837
      PROJ(1) = X0 + RH * DSIN (THETA)                                  GCTP1838
      PROJ(2) = Y0 + RH0 - RH * DCOS (THETA)                            GCTP1839
      RETURN                                                            GCTP1840
*                                                                       GCTP1841
* .....................................................................GCTP1842
*                     .  INVERSE TRANSFORMATION  .                      GCTP1843
* .....................................................................GCTP1844
*                                                                       GCTP1845
      ENTRY PI08Z0 (PROJ,GEOG,IFLG)                                     GCTP1846
*                                                                       GCTP1847
      IFLG = 0                                                          GCTP1848
      IF (SWITCH .NE. 0) GO TO 320                                      GCTP1849
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                            GCTP1850
      IFLG = 800                                                        GCTP1851
      RETURN                                                            GCTP1852
  320 X = PROJ(1) - X0                                                  GCTP1853
      Y = RH0 - PROJ(2) + Y0                                            GCTP1854
      RH = DSIGN (DSQRT (X * X + Y * Y) , NS)                           GCTP1855
      THETA = ZERO                                                      GCTP1856
      CON = DSIGN (ONE , NS)                                            GCTP1857
      IF (RH .NE. ZERO) THETA = DATAN2 (CON * X , CON * Y)              GCTP1858
      ML = GL - RH / A                                                  GCTP1859
      GEOG(2) = PHI3Z0 (ML,E0,E1,E2,E3,IPFILE,IFLG)                     GCTP1860
      IF (IFLG .NE. 0) RETURN                                           GCTP1861
      GEOG(1) = ADJLZ0 (LON0 + THETA / NS)                              GCTP1862
      RETURN                                                            GCTP1863
*                                                                       GCTP1864
      END                                                               GCTP1865
* **********************************************************************GCTP1867
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP1868
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP1869
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP1870
* **********************************************************************GCTP1871
*                       *  TRANSVERSE MERCATOR  *                       GCTP1872
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* ********************************************************************GCTP1873
*                                                                     GCTP1874
      SUBROUTINE PJ09Z0                                              GCTP1875
*                                                                     GCTP1876
      IMPLICIT REAL*8 (A-Z)                                          GCTP1877
      INTEGER*4 SWITCH,I,ZONE,IND,NIT,IPFILE,IFLG                    GCTP1878
      CHARACTER*16 ANGS(2)                                           GCTP1879
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                  GCTP1880
* * PARAMETERS **** A,E,ES,KS0,LON0,LAT0,X0,Y0,E0,E1,E2,E3,ESP,ML0,IND *GCTP1881
      DIMENSION DATA(1),GEOG(1),PROJ(1)                              GCTP1882
      DATA ZERO,HALF,ONE,TWO,THREE /0.0D0,0.5D0,1.0D0,2.0D0,3.0D0/   GCTP1883
      DATA FOUR,FIVE,SIX,EIGHT,NINE /4.0D0,5.0D0,6.0D0,8.0D0,9.0D0/  GCTP1884
      DATA HALFPI /1.5707963267948966192 3D0/                        GCTP1885
      DATA TEN /10.0D0/                                              GCTP1886
      DATA TOL,EPSLN,NIT /1.0D-5,1.0D-10,6/                          GCTP1887
      DATA SWITCH /0/                                                GCTP1888
*                                                                     GCTP1889
* .....................................................................GCTP1890
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .    GCTP1891
* .....................................................................GCTP1892
*                                                                     GCTP1893
      ENTRY IS09Z0 (ZONE,DATA,IPFILE,IFLG)                           GCTP1894
*                                                                     GCTP1895
      IFLG = 0                                                       GCTP1896
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                   GCTP1897
      IF (DATA(1) .LE. ZERO) GO TO 100                               GCTP1898
      A = DATA(1)                                                    GCTP1899
      B = DATA(2)                                                    GCTP1900
      IF (B .GT. ZERO) GO TO 040                                     GCTP1901
      E = ZERO                                                       GCTP1902
      ES = ZERO                                                      GCTP1903
      E0 = ONE                                                       GCTP1904
      E1 = ZERO                                                      GCTP1905
      E2 = ZERO                                                      GCTP1906
      E3 = ZERO                                                      GCTP1907
      GO TO 120                                                      GCTP1908
  040 IF (B .GT. ONE) GO TO 060                                      GCTP1909
      E = DSQRT (B)                                                  GCTP1910
      ES = B                                                         GCTP1911
      GO TO 080                                                      GCTP1912
  060 ES = ONE - (B / A) ** 2                                        GCTP1913
      E = DSQRT (ES)                                                 GCTP1914
  080 E0 = E0FNZ0 (ES)                                               GCTP1915
      E1 = E1FNZ0 (ES)                                               GCTP1916
      E2 = E2FNZ0 (ES)                                               GCTP1917
      E3 = E3FNZ0 (ES)                                               GCTP1918
      GO TO 120                                                      GCTP1919
  100 A = AZ                                                         GCTP1920
      E = EZ                                                         GCTP1921
      ES = ESZ                                                       GCTP1922
      E0 = E0Z                                                       GCTP1923
      E1 = E1Z                                                       GCTP1924
      E2 = E2Z                                                       GCTP1925
      E3 = E3Z                                                       GCTP1926
  120 KS0 = DATA(3)                                                  GCTP1927
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                     GCTP1928
      IF (IFLG .NE. 0) RETURN                                        GCTP1929
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                     GCTP1930
      IF (IFLG .NE. 0) RETURN                                        GCTP1931
      X0 = DATA(7)                                                   GCTP1932
      Y0 = DATA(8)                                                   GCTP1933
      ML0 = A * MLFNZ0 (E0,E1,E2,E3,LAT0)                            GCTP1934
      IND = 1                                                        GCTP1935
      IF (E .LT. TOL) GO TO 130                                      GCTP1936
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      IND = 0                                                          GCTP1937
      ESP = ES / (ONE - ES)                                            GCTP1938
*                                                                      GCTP1939
* LIST RESULTS OF PARAMETER INITIALIZATION.                           GCTP1940
*                                                                      GCTP1941
  130 CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                         GCTP1942
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                         GCTP1943
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ES,KS0,ANGS,X0,Y0       GCTP1944
 2000 FORMAT (' INITIALIZATION PARAMETERS (TRANSVERSE MERCATOR',       GCTP1945
     .        ' PROJECTION)'/                                         GCTP1946
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/      GCTP1947
     .        ' ECCENTRICITY SQUARED         =',F16.13/               GCTP1948
     .        ' SCALE FACTOR AT C. MERIDIAN  =',F9.6/                 GCTP1949
     .        ' LONGITUDE OF C. MERIDIAN     =',A16/                  GCTP1950
     .        ' LATITUDE OF ORIGIN           =',A16/                  GCTP1951
     .        ' FALSE EASTING                =',F16.4,' METERS'/      GCTP1952
     .        ' FALSE NORTHING               =',F16.4,' METERS')      GCTP1953
      SWITCH = ZONE                                                    GCTP1954
      RETURN                                                           GCTP1955
*                                                                      GCTP1956
* .....................................................................GCTP1957
*                      .  FORWARD TRANSFORMATION  .                    GCTP1958
* .....................................................................GCTP1959
*                                                                      GCTP1960
      ENTRY PF09Z0 (GEOG,PROJ,IFLG)                                    GCTP1961
*                                                                      GCTP1962
      IFLG = 0                                                         GCTP1963
      IF (SWITCH .NE. 0) GO TO 220                                     GCTP1964
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                           GCTP1965
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                         GCTP1966
      IFLG = 900                                                       GCTP1967
      RETURN                                                           GCTP1968
  220 DLON = ADJLZ0 (GEOG(1) - LON0)                                   GCTP1969
      LAT = GEOG(2)                                                    GCTP1970
      IF (IND .EQ. 0) GO TO 240                                        GCTP1971
      COSPHI = DCOS (LAT)                                              GCTP1972
      B = COSPHI * DSIN (DLON)                                         GCTP1973
      IF (DABS(DABS(B) - ONE) .GT. EPSLN) GO TO 230                    GCTP1974
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                           GCTP1975
 2020 FORMAT (' POINT PROJECTS INTO INFINITY')                         GCTP1976
      IFLG = 901                                                       GCTP1977
      RETURN                                                           GCTP1978
  230 PROJ(1) = HALF * A * KS0 * DLOG ((ONE + B) / (ONE - B))          GCTP1979
      CON = DACOS (COSPHI * DCOS (DLON) / DSQRT (ONE - B * B))         GCTP1980
      IF (LAT .LT. ZERO) CON =-CON                                     GCTP1981
      PROJ(2) = A * KS0 * (CON - LAT0)                                 GCTP1982
      RETURN                                                           GCTP1983
*                                                                      GCTP1984
  240 SINPHI = DSIN (LAT)                                              GCTP1985
      COSPHI = DCOS (LAT)                                              GCTP1986
      AL = COSPHI * DLON                                               GCTP1987
      ALS = AL * AL                                                    GCTP1988
      C = ESP * COSPHI * COSPHI                                        GCTP1989
      TQ = DTAN (LAT)                                                  GCTP1990
      T = TQ * TQ                                                      GCTP1991
      N = A / DSQRT (ONE - ES * SINPHI * SINPHI)                       GCTP1992
      ML = A * MLFNZ0 (E0,E1,E2,E3,LAT)                                GCTP1993
      PROJ(1) = KS0 * N * AL * (ONE + ALS / SIX * (ONE - T + C +       GCTP1994
     .          ALS / 20.0D0 * (FIVE - 18.0D0 * T + T * T + 72.0D0 *   GCTP1995
     .          C - 58.0D0 * ESP))) + X0                               GCTP1996
      PROJ(2) = KS0 * (ML - ML0 + N * TQ * (ALS * (HALF + ALS / 24.0D0 *GCTP1997
     .          (FIVE - T + NINE * C + FOUR * C * C + ALS / 30.0D0 *   GCTP1998
     .          (61.0D0 - 58.0D0 * T + T * T + 600.0D0 * C -           GCTP1999
     .          330.0D0 * ESP))))) + Y0                                GCTP2000
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      RETURN                                                            GCTP2001
*                                                                       GCTP2002
* .....................................................................GCTP2003
*                       .  INVERSE TRANSFORMATION  .                    GCTP2004
* .....................................................................GCTP2005
*                                                                       GCTP2006
      ENTRY PI09Z0 (PROJ,GEOG,IFLG)                                     GCTP2007
*                                                                       GCTP2008
      IFLG = 0                                                          GCTP2009
      IF (SWITCH .NE. 0) GO TO 320                                      GCTP2010
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2011
      IFLG = 900                                                        GCTP2012
      RETURN                                                            GCTP2013
  320 X = PROJ(1) - X0                                                  GCTP2014
      Y = PROJ(2) - Y0                                                  GCTP2015
      IF (IND .EQ. 0) GO TO 340                                         GCTP2016
      F = DEXP (X / (A * KS0))                                          GCTP2017
      G = HALF * (F - ONE / F)                                          GCTP2018
      C = LAT0 + Y / (A * KS0)                                          GCTP2019
      H = DCOS (C)                                                      GCTP2020
      CON = DSQRT ((ONE - H * H) / (ONE + G * G))                       GCTP2021
      GEOG(2) = ASINZ0 (CON)                                            GCTP2022
      IF (C .LT. ZERO) GEOG(2) =-GEOG(2)                                GCTP2023
      IF (G.NE.ZERO .OR. H.NE.ZERO) GO TO 330                           GCTP2024
      GEOG(1) = LON0                                                    GCTP2025
      RETURN                                                            GCTP2026
  330 GEOG(1) = ADJLZ0 (DATAN2 (G,H) + LON0)                            GCTP2027
      RETURN                                                            GCTP2028
*                                                                       GCTP2029
  340 CON = (ML0 + Y / KS0) / A                                         GCTP2030
      PHI = PHI3Z0 (CON,E0,E1,E2,E3,IPFILE,IFLG)                        GCTP2031
      IF (IFLG .NE. 0) RETURN                                           GCTP2032
      IF (DABS(PHI) .LT. HALFPI) GO TO 400                              GCTP2033
      GEOG(2) = DSIGN (HALFPI , Y)                                      GCTP2034
      GEOG(1) = LON0                                                    GCTP2035
      RETURN                                                            GCTP2036
  400 SINPHI = DSIN (PHI)                                               GCTP2037
      COSPHI = DCOS (PHI)                                               GCTP2038
      TANPHI = DTAN (PHI)                                               GCTP2039
      C = ESP * COSPHI * COSPHI                                         GCTP2040
      CS = C * C                                                        GCTP2041
      T = TANPHI * TANPHI                                               GCTP2042
      TS = T * T                                                        GCTP2043
      CON = ONE - ES * SINPHI * SINPHI                                  GCTP2044
      N = A / DSQRT (CON)                                               GCTP2045
      R = N * (ONE - ES) / CON                                          GCTP2046
      D = X / (N * KS0)                                                 GCTP2047
      DS = D * D                                                        GCTP2048
      GEOG(2) = PHI - (N * TANPHI * DS / R) * (HALF - DS / 24.0D0 *     GCTP2049
     .          (FIVE + THREE * T + TEN * C - FOUR * CS - NINE * ESP -  GCTP2050
     .          DS / 30.0D0 * (61.0D0 + 90.0D0 * T + 298.0D0 * C +      GCTP2051
     .          45.0D0 * TS - 252.0D0 * ESP - THREE * CS)))             GCTP2052
      GEOG(1) = ADJLZ0 (LON0 + (D * (ONE - DS / SIX * (ONE + TWO *      GCTP2053
     .          T + C - DS / 20.0D0 * (FIVE - TWO * C + 28.0D0 * T -    GCTP2054
     .          THREE * CS + EIGHT * ESP + 24.0D0 * TS))) / COSPHI))    GCTP2055
      RETURN                                                            GCTP2056
*                                                                       GCTP2057
      END                                                               GCTP2058
* ********************************************************************GCTP2060
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2061
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                    **GCTP2062
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2063
* ********************************************************************GCTP2064
*                          *  STEREOGRAPHIC  *                        GCTP2065
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* ********************************************************************GCTP2066
*                                                                     GCTP2067
      SUBROUTINE PJ10Z0                                              GCTP2068
*                                                                     GCTP2069
      IMPLICIT REAL*8 (A-Z)                                          GCTP2070
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                            GCTP2071
      CHARACTER*16 ANGS(2)                                           GCTP2072
      COMMON /SPHRZ0/ AZZ                                            GCTP2073
* **** PARAMETERS **** A,LON0,LAT0,X0,Y0,SINPH0,COSPH0 ***************GCTP2074
      DIMENSION DATA(1),GEOG(1),PROJ(1)                              GCTP2075
      DATA HALFPI /1.5707963267948966192 3D0/                        GCTP2076
      DATA EPSLN /1.0D-10/                                           GCTP2077
      DATA ZERO,ONE,TWO /0.0D0,1.0D0,2.0D0/                          GCTP2078
      DATA SWITCH /0/                                                GCTP2079
*                                                                     GCTP2080
* .....................................................................GCTP2081
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .    GCTP2082
* .....................................................................GCTP2083
*                                                                     GCTP2084
      ENTRY IS10Z0 (ZONE,DATA,IPFILE,IFLG)                           GCTP2085
*                                                                     GCTP2086
      IFLG = 0                                                       GCTP2087
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                   GCTP2088
      A = DATA(1)                                                    GCTP2089
      IF (A .LE. ZERO) A = AZZ                                       GCTP2090
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                     GCTP2091
      IF (IFLG .NE. 0) RETURN                                        GCTP2092
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                     GCTP2093
      IF (IFLG .NE. 0) RETURN                                        GCTP2094
      X0 = DATA(7)                                                   GCTP2095
      Y0 = DATA(8)                                                   GCTP2096
      SINPH0 = DSIN (LAT0)                                           GCTP2097
      COSPH0 = DCOS (LAT0)                                           GCTP2098
*                                                                     GCTP2099
* LIST RESULTS OF PARAMETER INITIALIZATION.                          GCTP2100
*                                                                     GCTP2101
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                       GCTP2102
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                       GCTP2103
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0            GCTP2104
 2000 FORMAT (' INITIALIZATION PARAMETERS (STEREOGRAPHIC',           GCTP2105
     .        ' PROJECTION)'/                                       GCTP2106
     .        ' RADIUS OF SPHERE             =',F16.4,' METERS'/    GCTP2107
     .        ' LONGITUDE OF CENTER          =',A16/                GCTP2108
     .        ' LATITUDE  OF CENTER          =',A16/                GCTP2109
     .        ' FALSE EASTING                =',F16.4,' METERS'/    GCTP2110
     .        ' FALSE NORTHING               =',F16.4,' METERS')    GCTP2111
      SWITCH = ZONE                                                  GCTP2112
      RETURN                                                         GCTP2113
*                                                                     GCTP2114
* .....................................................................GCTP2115
*                      .  FORWARD TRANSFORMATION  .                   GCTP2116
* .....................................................................GCTP2117
*                                                                     GCTP2118
      ENTRY PF10Z0 (GEOG,PROJ,IFLG)                                  GCTP2119
*                                                                     GCTP2120
      IFLG = 0                                                       GCTP2121
      IF (SWITCH .NE. 0) GO TO 120                                   GCTP2122
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                         GCTP2123
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                       GCTP2124
      IFLG = 1000                                                    GCTP2125
      RETURN                                                         GCTP2126
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                  GCTP2127
      SINPHI = DSIN (GEOG(2))                                        GCTP2128
      COSPHI = DCOS (GEOG(2))                                        GCTP2129
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      COSLON = DCOS (LON)                                                GCTP2130
      G = SINPH0 * SINPHI + COSPH0 * COSPHI * COSLON                     GCTP2131
      IF (DABS(G + ONE) .GT. EPSLN) GO TO 140                            GCTP2132
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                             GCTP2133
 2020 FORMAT (' POINT PROJECTS INTO INFINITY')                           GCTP2134
      IFLG = 1001                                                        GCTP2135
      RETURN                                                             GCTP2136
  140 KSP = TWO / (ONE + G)                                              GCTP2137
      PROJ(1) = X0 + A * KSP * COSPHI * DSIN (LON)                       GCTP2138
      PROJ(2) = Y0 + A * KSP * (COSPH0 * SINPHI - SINPH0 * COSPHI *      GCTP2139
     .          COSLON)                                                  GCTP2140
      RETURN                                                             GCTP2141
*                                                                        GCTP2142
* .....................................................................GCTP2143
*                        .  INVERSE TRANSFORMATION  .                    GCTP2144
* .....................................................................GCTP2145
*                                                                        GCTP2146
      ENTRY PI10Z0 (PROJ,GEOG,IFLG)                                      GCTP2147
*                                                                        GCTP2148
      IFLG = 0                                                           GCTP2149
      IF (SWITCH .NE. 0) GO TO 220                                       GCTP2150
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                             GCTP2151
      IFLG = 1000                                                        GCTP2152
      RETURN                                                             GCTP2153
  220 X = PROJ(1) - X0                                                   GCTP2154
      Y = PROJ(2) - Y0                                                   GCTP2155
      RH = DSQRT (X * X + Y * Y)                                         GCTP2156
      Z = TWO * DATAN (RH / (TWO * A))                                   GCTP2157
      SINZ = DSIN (Z)                                                    GCTP2158
      COSZ = DCOS (Z)                                                    GCTP2159
      GEOG(1) = LON0                                                     GCTP2160
      IF (DABS(RH) .GT. EPSLN) GO TO 240                                 GCTP2161
      GEOG(2) = LAT0                                                     GCTP2162
      RETURN                                                             GCTP2163
  240 GEOG(2) = ASINZ0 (COSZ * SINPH0 + Y * SINZ * COSPH0 / RH)          GCTP2164
      CON = DABS (LAT0) - HALFPI                                         GCTP2165
      IF (DABS (CON) .GT. EPSLN) GO TO 260                               GCTP2166
      IF (LAT0 .LT. ZERO) GO TO 250                                      GCTP2167
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 (X , -Y))                          GCTP2168
      RETURN                                                             GCTP2169
  250 GEOG(1) = ADJLZ0 (LON0 - DATAN2 (-X , Y))                          GCTP2170
      RETURN                                                             GCTP2171
  260 CON = COSZ - SINPH0 * DSIN (GEOG(2))                               GCTP2172
      IF (DABS(CON).LE.EPSLN .AND. DABS(X).LE.EPSLN) RETURN              GCTP2173
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 ((X*SINZ*COSPH0) , (CON*RH)))      GCTP2174
      RETURN                                                             GCTP2175
*                                                                        GCTP2176
      END                                                                GCTP2177
* *********************************************************************GCTP2179
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2180
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP2181
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2182
* *********************************************************************GCTP2183
*                    *  LAMBERT AZIMUTHAL EQUAL-AREA  *                 GCTP2184
* *********************************************************************GCTP2185
*                                                                        GCTP2186
      SUBROUTINE PJ11Z0                                                  GCTP2187
*                                                                        GCTP2188
      IMPLICIT REAL*8 (A-Z)                                              GCTP2189
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                                GCTP2190
      CHARACTER*16 ANGS(2)                                               GCTP2191
      COMMON /SPHRZ0/ AZZ                                                GCTP2192
* **** PARAMETERS **** A,LON0,LAT0,X0,Y0,SINPH0,COSPH0 ****************GCTP2193
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                  GCTP2194
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      DATA HALFPI /1.5707963267948966192 3D0/                          GCTP2195
      DATA EPSLN /1.0D-10/                                             GCTP2196
      DATA ZERO,ONE,TWO /0.0D0,1.0D0,2.0D0/                            GCTP2197
      DATA SWITCH /0/                                                  GCTP2198
*                                                                      GCTP2199
* .....................................................................GCTP2200
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .     GCTP2201
* .....................................................................GCTP2202
*                                                                      GCTP2203
      ENTRY IS11Z0 (ZONE,DATA,IPFILE,IFLG)                             GCTP2204
*                                                                      GCTP2205
      IFLG = 0                                                         GCTP2206
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                     GCTP2207
      A = DATA(1)                                                      GCTP2208
      IF (A .LE. ZERO) A = AZZ                                         GCTP2209
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                       GCTP2210
      IF (IFLG .NE. 0) RETURN                                          GCTP2211
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                       GCTP2212
      IF (IFLG .NE. 0) RETURN                                          GCTP2213
      X0 = DATA(7)                                                     GCTP2214
      Y0 = DATA(8)                                                     GCTP2215
      SINPH0 = DSIN (LAT0)                                             GCTP2216
      COSPH0 = DCOS (LAT0)                                             GCTP2217
*                                                                      GCTP2218
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP2219
*                                                                      GCTP2220
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                         GCTP2221
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                         GCTP2222
      IF (IPFILE .NE. 0) WRITE(IPFILE,2000) A,ANGS,X0,Y0               GCTP2223
 2000 FORMAT (' INITIALIZATION PARAMETERS (LAMBERT AZIMUTHAL EQUAL-AREA'GCTP2224
     .       ,' PROJECTION)'/                                         GCTP2225
     .        ' RADIUS OF SPHERE             =',F16.4,' METERS'/      GCTP2226
     .        ' LONGITUDE OF CENTER          =',A16/                  GCTP2227
     .        ' LATITUDE  OF CENTER          =',A16/                  GCTP2228
     .        ' FALSE EASTING                =',F16.4,' METERS'/      GCTP2229
     .        ' FALSE NORTHING               =',F16.4,' METERS')      GCTP2230
      SWITCH = ZONE                                                    GCTP2231
      RETURN                                                           GCTP2232
*                                                                      GCTP2233
* .....................................................................GCTP2234
*                      .  FORWARD TRANSFORMATION  .                    GCTP2235
* .....................................................................GCTP2236
*                                                                      GCTP2237
      ENTRY PF11Z0 (GEOG,PROJ,IFLG)                                    GCTP2238
*                                                                      GCTP2239
      IFLG = 0                                                         GCTP2240
      IF (SWITCH .NE. 0) GO TO 120                                     GCTP2241
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                           GCTP2242
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                         GCTP2243
      IFLG = 1100                                                      GCTP2244
      RETURN                                                           GCTP2245
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                    GCTP2246
      SINPHI = DSIN (GEOG(2))                                          GCTP2247
      COSPHI = DCOS (GEOG(2))                                          GCTP2248
      COSLON = DCOS (LON)                                              GCTP2249
      G = SINPH0 * SINPHI + COSPH0 * COSPHI * COSLON                   GCTP2250
      IF (G .NE. -ONE) GO TO 140                                       GCTP2251
      CON = TWO * A                                                    GCTP2252
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                           GCTP2253
 2020 FORMAT (' POINT PROJECTS INTO A CIRCLE')                         GCTP2254
      IFLG = 1101                                                      GCTP2255
      RETURN                                                           GCTP2256
  140 KSP = DSQRT (TWO / (ONE + G))                                    GCTP2257
      PROJ(1) = X0 + A * KSP * COSPHI * DSIN (LON)                     GCTP2258
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      PROJ(2) = Y0 + A * KSP * (COSPH0 * SINPHI - SINPH0 * COSPHI *     GCTP2259
     .          COSLON)                                                 GCTP2260
      RETURN                                                            GCTP2261
*                                                                       GCTP2262
* .....................................................................GCTP2263
*                        .  INVERSE TRANSFORMATION  .                   GCTP2264
* .....................................................................GCTP2265
*                                                                       GCTP2266
      ENTRY PI11Z0 (PROJ,GEOG,IFLG)                                     GCTP2267
*                                                                       GCTP2268
      IFLG = 0                                                          GCTP2269
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP2270
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2271
      IFLG = 1100                                                       GCTP2272
      RETURN                                                            GCTP2273
  220 X = PROJ(1) - X0                                                  GCTP2274
      Y = PROJ(2) - Y0                                                  GCTP2275
      RH = DSQRT (X * X + Y * Y)                                        GCTP2276
      CON = RH / (TWO * A)                                              GCTP2277
      IF (CON .LE. ONE) GO TO 230                                       GCTP2278
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                            GCTP2279
 2030 FORMAT (' IMPROPER PARAMETER')                                    GCTP2280
      IFLG = 1102                                                       GCTP2281
      RETURN                                                            GCTP2282
  230 Z = TWO * ASINZ0 (CON)                                            GCTP2283
      SINZ = DSIN (Z)                                                   GCTP2284
      COSZ = DCOS (Z)                                                   GCTP2285
      GEOG(1) = LON0                                                    GCTP2286
      IF (DABS(RH) .GT. EPSLN) GO TO 240                                GCTP2287
      GEOG(2) = LAT0                                                    GCTP2288
      RETURN                                                            GCTP2289
  240 GEOG(2) = ASINZ0 (COSZ * SINPH0 + Y * SINZ * COSPH0 / RH)         GCTP2290
      CON = DABS (LAT0) - HALFPI                                        GCTP2291
      IF (DABS (CON) .GT. EPSLN) GO TO 260                              GCTP2292
      IF (LAT0 .LT. ZERO) GO TO 250                                     GCTP2293
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 (X , -Y))                         GCTP2294
      RETURN                                                            GCTP2295
  250 GEOG(1) = ADJLZ0 (LON0 - DATAN2 (-X , Y))                         GCTP2296
      RETURN                                                            GCTP2297
  260 CON = COSZ - SINPH0 * DSIN (GEOG(2))                              GCTP2298
      IF (DABS(CON).LE.EPSLN .AND. DABS(X).LE.EPSLN) RETURN             GCTP2299
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 ((X*SINZ*COSPH0) , (CON*RH)))     GCTP2300
      RETURN                                                            GCTP2301
*                                                                       GCTP2302
      END                                                               GCTP2303
* ********************************************************************GCTP2305
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2306
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                    **GCTP2307
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2308
* ********************************************************************GCTP2309
*                       *  AZIMUTHAL EQUIDISTANT  *                     GCTP2310
* ********************************************************************GCTP2311
*                                                                       GCTP2312
      SUBROUTINE PJ12Z0                                                 GCTP2313
*                                                                       GCTP2314
      IMPLICIT REAL*8 (A-Z)                                             GCTP2315
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP2316
      CHARACTER*16 ANGS(2)                                              GCTP2317
      COMMON /SPHRZ0/ AZZ                                               GCTP2318
* **** PARAMETERS **** A,LON0,LAT0,X0,Y0,SINPH0,COSPH0 ****************GCTP2319
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP2320
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP2321
      DATA EPSLN /1.0D-10/                                              GCTP2322
      DATA ZERO,ONE,TWO /0.0D0,1.0D0,2.0D0/                             GCTP2323
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      DATA SWITCH /0/                                                   GCTP2324
*                                                                       GCTP2325
* .....................................................................GCTP2326
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP2327
* .....................................................................GCTP2328
*                                                                       GCTP2329
      ENTRY IS12Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP2330
*                                                                       GCTP2331
      IFLG = 0                                                          GCTP2332
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP2333
      A = DATA(1)                                                       GCTP2334
      IF (A .LE. ZERO) A = AZZ                                          GCTP2335
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP2336
      IF (IFLG .NE. 0) RETURN                                           GCTP2337
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP2338
      IF (IFLG .NE. 0) RETURN                                           GCTP2339
      X0 = DATA(7)                                                      GCTP2340
      Y0 = DATA(8)                                                      GCTP2341
      SINPH0 = DSIN (LAT0)                                              GCTP2342
      COSPH0 = DCOS (LAT0)                                              GCTP2343
*                                                                       GCTP2344
* LIST RESULTS OF PARAMETER INITIALIZATION.                             GCTP2345
*                                                                       GCTP2346
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                          GCTP2347
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                          GCTP2348
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0               GCTP2349
 2000 FORMAT (' INITIALIZATION PARAMETERS (AZIMUTHAL EQUIDISTANT',      GCTP2350
     .        ' PROJECTION)'/                                          GCTP2351
     .        ' RADIUS OF SPHERE             =',F16.4,' METERS'/       GCTP2352
     .        ' LONGITUDE OF CENTER          =',A16/                   GCTP2353
     .        ' LATITUDE  OF CENTER          =',A16/                   GCTP2354
     .        ' FALSE EASTING                =',F16.4,' METERS'/       GCTP2355
     .        ' FALSE NORTHING               =',F16.4,' METERS')       GCTP2356
      SWITCH = ZONE                                                     GCTP2357
      RETURN                                                            GCTP2358
*                                                                       GCTP2359
* .....................................................................GCTP2360
*                      .  FORWARD TRANSFORMATION  .                     GCTP2361
* .....................................................................GCTP2362
*                                                                       GCTP2363
      ENTRY PF12Z0 (GEOG,PROJ,IFLG)                                     GCTP2364
*                                                                       GCTP2365
      IFLG = 0                                                          GCTP2366
      IF (SWITCH .NE. 0) GO TO 120                                      GCTP2367
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2368
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP2369
      IFLG = 1200                                                       GCTP2370
      RETURN                                                            GCTP2371
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                     GCTP2372
      SINPHI = DSIN (GEOG(2))                                           GCTP2373
      COSPHI = DCOS (GEOG(2))                                           GCTP2374
      COSLON = DCOS (LON)                                               GCTP2375
      G = SINPH0 * SINPHI + COSPH0 * COSPHI * COSLON                    GCTP2376
      IF (DABS(DABS(G) - ONE) .GE. EPSLN) GO TO 140                     GCTP2377
      KSP = ONE                                                         GCTP2378
      IF (G .GE. ZERO) GO TO 160                                        GCTP2379
      CON = TWO * HALFPI * A                                            GCTP2380
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP2381
 2020 FORMAT (' POINT PROJECTS INTO A CIRCLE')                          GCTP2382
      IFLG = 1201                                                       GCTP2383
      RETURN                                                            GCTP2384
  140 Z = DACOS (G)                                                     GCTP2385
      KSP = Z / DSIN (Z)                                                GCTP2386
  160 PROJ(1) = X0 + A * KSP * COSPHI * DSIN (LON)                      GCTP2387
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      PROJ(2) = Y0 + A * KSP * (COSPH0 * SINPHI - SINPH0 * COSPHI *     GCTP2388
     .          COSLON)                                                 GCTP2389
      RETURN                                                            GCTP2390
*                                                                       GCTP2391
* .....................................................................GCTP2392
*                        .  INVERSE TRANSFORMATION  .                   GCTP2393
* .....................................................................GCTP2394
*                                                                       GCTP2395
      ENTRY PI12Z0 (PROJ,GEOG,IFLG)                                     GCTP2396
*                                                                       GCTP2397
      IFLG = 0                                                          GCTP2398
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP2399
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2400
      IFLG = 1200                                                       GCTP2401
      RETURN                                                            GCTP2402
  220 X = PROJ(1) - X0                                                  GCTP2403
      Y = PROJ(2) - Y0                                                  GCTP2404
      RH = DSQRT (X * X + Y * Y)                                        GCTP2405
      IF (RH .LE. (TWO * HALFPI * A)) GO TO 230                         GCTP2406
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                            GCTP2407
 2030 FORMAT (' IMPROPER PARAMETER')                                    GCTP2408
      IFLG = 1202                                                       GCTP2409
      RETURN                                                            GCTP2410
  230 Z = RH / A                                                        GCTP2411
      SINZ = DSIN (Z)                                                   GCTP2412
      COSZ = DCOS (Z)                                                   GCTP2413
      GEOG(1) = LON0                                                    GCTP2414
      IF (DABS(RH) .GT. EPSLN) GO TO 240                                GCTP2415
      GEOG(2) = LAT0                                                    GCTP2416
      RETURN                                                            GCTP2417
  240 GEOG(2) = ASINZ0 (COSZ * SINPH0 + Y * SINZ * COSPH0 / RH)         GCTP2418
      CON = DABS (LAT0) - HALFPI                                        GCTP2419
      IF (DABS (CON) .GT. EPSLN) GO TO 260                              GCTP2420
      IF (LAT0 .LT. ZERO) GO TO 250                                     GCTP2421
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 (X , -Y))                         GCTP2422
      RETURN                                                            GCTP2423
  250 GEOG(1) = ADJLZ0 (LON0 - DATAN2 (-X , Y))                         GCTP2424
      RETURN                                                            GCTP2425
  260 CON = COSZ - SINPH0 * DSIN (GEOG(2))                              GCTP2426
      IF (DABS(CON).LE.EPSLN .AND. DABS(X).LE.EPSLN) RETURN             GCTP2427
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 ((X*SINZ*COSPH0) , (CON*RH)))     GCTP2428
      RETURN                                                            GCTP2429
*                                                                       GCTP2430
      END                                                               GCTP2431
* ********************************************************************GCTP2433
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2434
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                    **GCTP2435
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2436
* ********************************************************************GCTP2437
*                              *  GNOMONIC  *                           GCTP2438
* ********************************************************************GCTP2439
*                                                                       GCTP2440
      SUBROUTINE PJ13Z0                                                 GCTP2441
*                                                                       GCTP2442
      IMPLICIT REAL*8 (A-Z)                                             GCTP2443
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP2444
      CHARACTER*16 ANGS(2)                                              GCTP2445
      COMMON /SPHRZ0/ AZZ                                               GCTP2446
* **** PARAMETERS **** A,LON0,LAT0,X0,Y0,SINPH0,COSPH0 ****************GCTP2447
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP2448
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP2449
      DATA EPSLN /1.0D-10/                                              GCTP2450
      DATA ZERO,ONE /0.0D0,1.0D0/                                       GCTP2451
      DATA SWITCH /0/                                                   GCTP2452
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*                                                                       GCTP2453
* .....................................................................GCTP2454
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP2455
* .....................................................................GCTP2456
*                                                                       GCTP2457
      ENTRY IS13Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP2458
*                                                                       GCTP2459
      IFLG = 0                                                          GCTP2460
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP2461
      A = DATA(1)                                                       GCTP2462
      IF (A .LE. ZERO) A = AZZ                                          GCTP2463
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP2464
      IF (IFLG .NE. 0) RETURN                                           GCTP2465
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP2466
      IF (IFLG .NE. 0) RETURN                                           GCTP2467
      X0 = DATA(7)                                                      GCTP2468
      Y0 = DATA(8)                                                      GCTP2469
      SINPH0 = DSIN (LAT0)                                              GCTP2470
      COSPH0 = DCOS (LAT0)                                              GCTP2471
*                                                                       GCTP2472
* LIST RESULTS OF PARAMETER INITIALIZATION.                             GCTP2473
*                                                                       GCTP2474
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                          GCTP2475
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                          GCTP2476
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0               GCTP2477
 2000 FORMAT (' INITIALIZATION PARAMETERS (GNOMONIC',                   GCTP2478
     .        ' PROJECTION)'/                                           GCTP2479
     .        ' RADIUS OF SPHERE             =',F16.4,' METERS'/        GCTP2480
     .        ' LONGITUDE OF CENTER          =',A16/                    GCTP2481
     .        ' LATITUDE  OF CENTER          =',A16/                    GCTP2482
     .        ' FALSE EASTING                =',F16.4,' METERS'/        GCTP2483
     .        ' FALSE NORTHING               =',F16.4,' METERS')        GCTP2484
      SWITCH = ZONE                                                     GCTP2485
      RETURN                                                            GCTP2486
*                                                                       GCTP2487
* .....................................................................GCTP2488
*                      .  FORWARD TRANSFORMATION  .                     GCTP2489
* .....................................................................GCTP2490
*                                                                       GCTP2491
      ENTRY PF13Z0 (GEOG,PROJ,IFLG)                                     GCTP2492
*                                                                       GCTP2493
      IFLG = 0                                                          GCTP2494
      IF (SWITCH .NE. 0) GO TO 120                                      GCTP2495
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2496
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP2497
      IFLG = 1300                                                       GCTP2498
      RETURN                                                            GCTP2499
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                     GCTP2500
      SINPHI = DSIN (GEOG(2))                                           GCTP2501
      COSPHI = DCOS (GEOG(2))                                           GCTP2502
      COSLON = DCOS (LON)                                               GCTP2503
      G = SINPH0 * SINPHI + COSPH0 * COSPHI * COSLON                    GCTP2504
      IF (G .GT. EPSLN) GO TO 140                                       GCTP2505
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP2506
 2020 FORMAT (' POINT PROJECTS INTO INFINITY')                          GCTP2507
      IFLG = 1301                                                       GCTP2508
      RETURN                                                            GCTP2509
  140 KSP = ONE / G                                                     GCTP2510
      PROJ(1) = X0 + A * KSP * COSPHI * DSIN (LON)                      GCTP2511
      PROJ(2) = Y0 + A * KSP * (COSPH0 * SINPHI - SINPH0 * COSPHI *     GCTP2512
     .          COSLON)                                                 GCTP2513
      RETURN                                                            GCTP2514
*                                                                       GCTP2515
* .....................................................................GCTP2516
```

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*                       .  INVERSE TRANSFORMATION  .                       GCTP2517
* .....................................................................GCTP2518
*                                                                          GCTP2519
      ENTRY PI13Z0 (PROJ,GEOG,IFLG)                                       GCTP2520
*                                                                          GCTP2521
      IFLG = 0                                                            GCTP2522
      IF (SWITCH .NE. 0) GO TO 220                                        GCTP2523
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                              GCTP2524
      IFLG = 1300                                                         GCTP2525
      RETURN                                                              GCTP2526
  220 X = PROJ(1) - X0                                                    GCTP2527
      Y = PROJ(2) - Y0                                                    GCTP2528
      RH = DSQRT (X * X + Y * Y)                                          GCTP2529
      Z = DATAN (RH / A)                                                  GCTP2530
      SINZ = DSIN (Z)                                                     GCTP2531
      COSZ = DCOS (Z)                                                     GCTP2532
      GEOG(1) = LON0                                                      GCTP2533
      IF (DABS(RH) .GT. EPSLN) GO TO 240                                  GCTP2534
      GEOG(2) = LAT0                                                      GCTP2535
      RETURN                                                              GCTP2536
  240 GEOG(2) = ASINZ0 (COSZ * SINPH0 + Y * SINZ * COSPH0 / RH)           GCTP2537
      CON = DABS (LAT0) - HALFPI                                          GCTP2538
      IF (DABS (CON) .GT. EPSLN) GO TO 260                                GCTP2539
      IF (LAT0 .LT. ZERO) GO TO 250                                       GCTP2540
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 (X , -Y))                           GCTP2541
      RETURN                                                              GCTP2542
  250 GEOG(1) = ADJLZ0 (LON0 - DATAN2 (-X , Y))                           GCTP2543
      RETURN                                                              GCTP2544
  260 CON = COSZ - SINPH0 * DSIN (GEOG(2))                                GCTP2545
      IF (DABS(CON).LE.EPSLN .AND. DABS(X).LE.EPSLN) RETURN               GCTP2546
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 ((X*SINZ*COSPH0) , (CON*RH)))       GCTP2547
      RETURN                                                              GCTP2548
*                                                                          GCTP2549
      END                                                                 GCTP2550
* *********************************************************************GCTP2552
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2553
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP2554
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2555
* *********************************************************************GCTP2556
*                           *  ORTHOGRAPHIC  *                           GCTP2557
* *********************************************************************GCTP2558
*                                                                          GCTP2559
      SUBROUTINE PJ14Z0                                                   GCTP2560
*                                                                          GCTP2561
      IMPLICIT REAL*8 (A-Z)                                               GCTP2562
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                                 GCTP2563
      CHARACTER*16 ANGS(2)                                                GCTP2564
      COMMON /SPHRZ0/ AZZ                                                 GCTP2565
* **** PARAMETERS **** A,LON0,LAT0,X0,Y0,SINPH0,COSPH0 ****************GCTP2566
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                   GCTP2567
      DATA HALFPI /1.5707963267948966192 3D0/                             GCTP2568
      DATA EPSLN /1.0D-10/                                                GCTP2569
      DATA ZERO,ONE /0.0D0,1.0D0/                                         GCTP2570
      DATA SWITCH /0/                                                     GCTP2571
*                                                                          GCTP2572
* .....................................................................GCTP2573
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .        GCTP2574
* .....................................................................GCTP2575
*                                                                          GCTP2576
      ENTRY IS14Z0 (ZONE,DATA,IPFILE,IFLG)                                GCTP2577
*                                                                          GCTP2578
      IFLG = 0                                                            GCTP2579
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                        GCTP2580
      A = DATA(1)                                                         GCTP2581
```

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      IF (A .LE. ZERO) A = AZZ                                          GCTP2582
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP2583
      IF (IFLG .NE. 0) RETURN                                           GCTP2584
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP2585
      IF (IFLG .NE. 0) RETURN                                           GCTP2586
      X0 = DATA(7)                                                      GCTP2587
      Y0 = DATA(8)                                                      GCTP2588
      SINPH0 = DSIN (LAT0)                                              GCTP2589
      COSPH0 = DCOS (LAT0)                                              GCTP2590
*                                                                       GCTP2591
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP2592
*                                                                       GCTP2593
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                          GCTP2594
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                          GCTP2595
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0               GCTP2596
 2000 FORMAT (' INITIALIZATION PARAMETERS (ORTHOGRAPHIC',               GCTP2597
     .        ' PROJECTION)'/                                          GCTP2598
     .        ' RADIUS OF SPHERE              =',F16.4,' METERS'/      GCTP2599
     .        ' LONGITUDE OF CENTER           =',A16/                  GCTP2600
     .        ' LATITUDE  OF CENTER           =',A16/                  GCTP2601
     .        ' FALSE EASTING                 =',F16.4,' METERS'/      GCTP2602
     .        ' FALSE NORTHING                =',F16.4,' METERS')      GCTP2603
      SWITCH = ZONE                                                     GCTP2604
      RETURN                                                            GCTP2605
*                                                                       GCTP2606
* .....................................................................GCTP2607
*                       .  FORWARD TRANSFORMATION  .                    GCTP2608
* .....................................................................GCTP2609
*                                                                       GCTP2610
      ENTRY PF14Z0 (GEOG,PROJ,IFLG)                                     GCTP2611
*                                                                       GCTP2612
      IFLG = 0                                                          GCTP2613
      IF (SWITCH .NE. 0) GO TO 120                                      GCTP2614
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2615
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP2616
      IFLG = 1400                                                       GCTP2617
      RETURN                                                            GCTP2618
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                     GCTP2619
      SINPHI = DSIN (GEOG(2))                                           GCTP2620
      COSPHI = DCOS (GEOG(2))                                           GCTP2621
      COSLON = DCOS (LON)                                               GCTP2622
      G = SINPH0 * SINPHI + COSPH0 * COSPHI * COSLON                    GCTP2623
      KSP = ONE                                                         GCTP2624
      IF (G.GT.ZERO .OR. DABS(G).LE.EPSLN) GO TO 140                    GCTP2625
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP2626
 2020 FORMAT (' POINT CANNOT BE PROJECTED')                             GCTP2627
      IFLG = 1401                                                       GCTP2628
      RETURN                                                            GCTP2629
  140 PROJ(1) = X0 + A * KSP * COSPHI * DSIN (LON)                      GCTP2630
      PROJ(2) = Y0 + A * KSP * (COSPH0 * SINPHI - SINPH0 * COSPHI *     GCTP2631
     .          COSLON)                                                 GCTP2632
      RETURN                                                            GCTP2633
*                                                                       GCTP2634
* .....................................................................GCTP2635
*                       .  INVERSE TRANSFORMATION  .                    GCTP2636
* .....................................................................GCTP2637
*                                                                       GCTP2638
      ENTRY PI14Z0 (PROJ,GEOG,IFLG)                                     GCTP2639
*                                                                       GCTP2640
      IFLG = 0                                                          GCTP2641
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP2642
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2643
      IFLG = 1400                                                       GCTP2644
      RETURN                                                            GCTP2645
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  220 X = PROJ(1) - X0                                                    GCTP2646
      Y = PROJ(2) - Y0                                                    GCTP2647
      RH = DSQRT (X * X + Y * Y)                                          GCTP2648
      IF (RH .LE. A) GO TO 230                                            GCTP2649
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                              GCTP2650
 2030 FORMAT (' IMPROPER PARAMETER')                                      GCTP2651
      IFLG = 1402                                                         GCTP2652
      RETURN                                                              GCTP2653
  230 Z = ASINZ0 (RH / A)                                                 GCTP2654
      SINZ = DSIN (Z)                                                     GCTP2655
      COSZ = DCOS (Z)                                                     GCTP2656
      GEOG(1) = LON0                                                      GCTP2657
      IF (DABS(RH) .GT. EPSLN) GO TO 240                                  GCTP2658
      GEOG(2) = LAT0                                                      GCTP2659
      RETURN                                                              GCTP2660
  240 GEOG(2) = ASINZ0 (COSZ * SINPH0 + Y * SINZ * COSPH0 / RH)           GCTP2661
      CON = DABS (LAT0) - HALFPI                                          GCTP2662
      IF (DABS (CON) .GT. EPSLN) GO TO 260                                GCTP2663
      IF (LAT0 .LT. ZERO) GO TO 250                                       GCTP2664
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 (X , -Y))                           GCTP2665
      RETURN                                                              GCTP2666
  250 GEOG(1) = ADJLZ0 (LON0 - DATAN2 (-X , Y))                           GCTP2667
      RETURN                                                              GCTP2668
  260 CON = COSZ - SINPH0 * DSIN (GEOG(2))                                GCTP2669
      IF (DABS(CON).LE.EPSLN .AND. DABS(X).LE.EPSLN) RETURN               GCTP2670
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 ((X*SINZ*COSPH0) , (CON*RH)))       GCTP2671
      RETURN                                                              GCTP2672
*                                                                         GCTP2673
      END                                                                 GCTP2674
* ************************************************************************GCTP2676
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2677
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                      **GCTP2678
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2679
* ************************************************************************GCTP2680
*              *  GENERAL VERTICAL NEAR-SIDE PERSPECTIVE  *               GCTP2681
* ************************************************************************GCTP2682
*                                                                         GCTP2683
      SUBROUTINE PJ15Z0                                                   GCTP2684
*                                                                         GCTP2685
      IMPLICIT REAL*8 (A-Z)                                               GCTP2686
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                                 GCTP2687
      CHARACTER*16 ANGS(2)                                                GCTP2688
      COMMON /SPHRZ0/ AZZ                                                 GCTP2689
* **** PARAMETERS **** A,P,LON0,LAT0,X0,Y0,SINPH0,COSPH0 **************GCTP2690
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                   GCTP2691
      DATA HALFPI /1.5707963267948966192 3D0/                             GCTP2692
      DATA EPSLN /1.0D-10/                                                GCTP2693
      DATA ZERO,ONE /0.0D0,1.0D0/                                         GCTP2694
      DATA SWITCH /0/                                                     GCTP2695
*                                                                         GCTP2696
* .......................................................................GCTP2697
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .        GCTP2698
* .......................................................................GCTP2699
*                                                                         GCTP2700
      ENTRY IS15Z0 (ZONE,DATA,IPFILE,IFLG)                                GCTP2701
*                                                                         GCTP2702
      IFLG = 0                                                            GCTP2703
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                        GCTP2704
      A = DATA(1)                                                         GCTP2705
      IF (A .LE. ZERO) A = AZZ                                            GCTP2706
      P = ONE + DATA(3) / A                                               GCTP2707
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                          GCTP2708
      IF (IFLG .NE. 0) RETURN                                             GCTP2709
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                          GCTP2710
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      IF (IFLG .NE. 0) RETURN                                          GCTP2711
      X0 = DATA(7)                                                     GCTP2712
      Y0 = DATA(8)                                                     GCTP2713
      SINPH0 = DSIN (LAT0)                                             GCTP2714
      COSPH0 = DCOS (LAT0)                                             GCTP2715
*                                                                      GCTP2716
* LIST RESULTS OF PARAMETER INITIALIZATION.                           GCTP2717
*                                                                      GCTP2718
      CALL DMSLZ0 (LON0,0,ANGS(1),IPFILE,IFLG)                         GCTP2719
      CALL DMSLZ0 (LAT0,0,ANGS(2),IPFILE,IFLG)                         GCTP2720
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,DATA(3),ANGS,X0,Y0      GCTP2721
 2000 FORMAT (' INITIALIZATION PARAMETERS (GENERAL VERTICAL NEAR-SIDE', GCTP2722
     .        ' PERSPECTIVE PROJECTION)'/                             GCTP2723
     .        ' RADIUS OF SPHERE              =',F16.4,' METERS'/     GCTP2724
     .        ' HEIGHT OF PERSPECTIVE POINT'/                         GCTP2725
     .        ' ABOVE SPHERE                  =',F16.4,' METERS'/     GCTP2726
     .        ' LONGITUDE OF CENTER           =',A16/                 GCTP2727
     .        ' LATITUDE  OF CENTER           =',A16/                 GCTP2728
     .        ' FALSE EASTING                 =',F16.4,' METERS'/     GCTP2729
     .        ' FALSE NORTHING                =',F16.4,' METERS')     GCTP2730
      SWITCH = ZONE                                                    GCTP2731
      RETURN                                                           GCTP2732
*                                                                      GCTP2733
* .....................................................................GCTP2734
*                     .  FORWARD TRANSFORMATION  .                     GCTP2735
* .....................................................................GCTP2736
*                                                                      GCTP2737
      ENTRY PF15Z0 (GEOG,PROJ,IFLG)                                    GCTP2738
*                                                                      GCTP2739
      IFLG = 0                                                         GCTP2740
      IF (SWITCH .NE. 0) GO TO 120                                     GCTP2741
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                           GCTP2742
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                         GCTP2743
      IFLG = 1500                                                      GCTP2744
      RETURN                                                           GCTP2745
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                    GCTP2746
      SINPHI = DSIN (GEOG(2))                                          GCTP2747
      COSPHI = DCOS (GEOG(2))                                          GCTP2748
      COSLON = DCOS (LON)                                              GCTP2749
      G = SINPH0 * SINPHI + COSPH0 * COSPHI * COSLON                   GCTP2750
      IF (G .GE. (ONE / P)) GO TO 140                                  GCTP2751
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                           GCTP2752
 2020 FORMAT (' POINT CANNOT BE PROJECTED')                            GCTP2753
      IFLG = 1501                                                      GCTP2754
      RETURN                                                           GCTP2755
  140 KSP = (P - ONE) / (P - G)                                        GCTP2756
      PROJ(1) = X0 + A * KSP * COSPHI * DSIN (LON)                     GCTP2757
      PROJ(2) = Y0 + A * KSP * (COSPH0 * SINPHI - SINPH0 * COSPHI *    GCTP2758
     .          COSLON)                                                GCTP2759
      RETURN                                                           GCTP2760
*                                                                      GCTP2761
* .....................................................................GCTP2762
*                     .  INVERSE TRANSFORMATION  .                     GCTP2763
* .....................................................................GCTP2764
*                                                                      GCTP2765
      ENTRY PI15Z0 (PROJ,GEOG,IFLG)                                    GCTP2766
*                                                                      GCTP2767
      IFLG = 0                                                         GCTP2768
      IF (SWITCH .NE. 0) GO TO 220                                     GCTP2769
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                           GCTP2770
      IFLG = 1500                                                      GCTP2771
      RETURN                                                           GCTP2772
  220 X = PROJ(1) - X0                                                 GCTP2773
      Y = PROJ(2) - Y0                                                 GCTP2774
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      RH = DSQRT (X * X + Y * Y)                                        GCTP2775
      R = RH / A                                                        GCTP2776
      CON = P - ONE                                                     GCTP2777
      COM = P + ONE                                                     GCTP2778
      IF (R .LE. DSQRT (CON / COM)) GO TO 230                           GCTP2779
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                            GCTP2780
 2030 FORMAT (' IMPROPER PARAMETER')                                    GCTP2781
      IFLG = 1502                                                       GCTP2782
      RETURN                                                            GCTP2783
  230 SINZ = (P - DSQRT (ONE - R * R * COM / CON)) /                    GCTP2784
     .       (CON / R + R / CON)                                        GCTP2785
      Z = ASINZ0 (SINZ)                                                 GCTP2786
      SINZ = DSIN (Z)                                                   GCTP2787
      COSZ = DCOS (Z)                                                   GCTP2788
      GEOG(1) = LON0                                                    GCTP2789
      IF (DABS(RH) .GT. EPSLN) GO TO 240                                GCTP2790
      GEOG(2) = LAT0                                                    GCTP2791
      RETURN                                                            GCTP2792
  240 GEOG(2) = ASINZ0 (COSZ * SINPH0 + Y * SINZ * COSPH0 / RH)         GCTP2793
      CON = DABS (LAT0) - HALFPI                                        GCTP2794
      IF (DABS (CON) .GT. EPSLN) GO TO 260                              GCTP2795
      IF (LAT0 .LT. ZERO) GO TO 250                                     GCTP2796
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 (X , -Y))                         GCTP2797
      RETURN                                                            GCTP2798
  250 GEOG(1) = ADJLZ0 (LON0 - DATAN2 (-X , Y))                         GCTP2799
      RETURN                                                            GCTP2800
  260 CON = COSZ - SINPH0 * DSIN (GEOG(2))                              GCTP2801
      IF (DABS(CON).LE.EPSLN .AND. DABS(X).LE.EPSLN) RETURN             GCTP2802
      GEOG(1) = ADJLZ0 (LON0 + DATAN2 ((X*SINZ*COSPH0) , (CON*RH)))     GCTP2803
      RETURN                                                            GCTP2804
*                                                                       GCTP2805
      END                                                               GCTP2806
* ********************************************************************GCTP2808
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2809
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                    **GCTP2810
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2811
* ********************************************************************GCTP2812
*                            *  SINUSOIDAL  *                         GCTP2813
* ********************************************************************GCTP2814
*                                                                       GCTP2815
      SUBROUTINE PJ16Z0                                                 GCTP2816
*                                                                       GCTP2817
      IMPLICIT REAL*8 (A-Z)                                             GCTP2818
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP2819
      CHARACTER*16 ANGS                                                 GCTP2820
      COMMON /SPHRZ0/ AZZ                                               GCTP2821
* **** PARAMETERS **** A,LON0,X0,Y0 ***********************************GCTP2822
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP2823
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP2824
      DATA EPSLN /1.0D-10/                                              GCTP2825
      DATA ZERO /0.0D0/                                                 GCTP2826
      DATA SWITCH /0/                                                   GCTP2827
*                                                                       GCTP2828
* .....................................................................GCTP2829
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .      GCTP2830
* .....................................................................GCTP2831
*                                                                       GCTP2832
      ENTRY IS16Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP2833
*                                                                       GCTP2834
      IFLG = 0                                                          GCTP2835
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP2836
      A = DATA(1)                                                       GCTP2837
      IF (A .LE. ZERO) A = AZZ                                          GCTP2838
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP2839
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      IF (IFLG .NE. 0) RETURN                                          GCTP2840
      X0 = DATA(7)                                                     GCTP2841
      Y0 = DATA(8)                                                     GCTP2842
*                                                                      GCTP2843
* LIST RESULTS OF PARAMETER INITIALIZATION.                           GCTP2844
*                                                                      GCTP2845
      CALL DMSLZ0 (LON0,0,ANGS,IPFILE,IFLG)                            GCTP2846
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0              GCTP2847
 2000 FORMAT (' INITIALIZATION PARAMETERS (SINUSOIDAL PROJECTION)'/    GCTP2848
     .        ' RADIUS OF SPHERE              =',F16.4,' METERS'/     GCTP2849
     .        ' LONGITUDE OF C. MERIDIAN      =',A16/                 GCTP2850
     .        ' FALSE EASTING                 =',F16.4,' METERS'/     GCTP2851
     .        ' FALSE NORTHING                =',F16.4,' METERS')     GCTP2852
      SWITCH = ZONE                                                    GCTP2853
      RETURN                                                           GCTP2854
*                                                                      GCTP2855
* .....................................................................GCTP2856
*                       .  FORWARD TRANSFORMATION  .                   GCTP2857
* .....................................................................GCTP2858
*                                                                      GCTP2859
      ENTRY PF16Z0 (GEOG,PROJ,IFLG)                                    GCTP2860
*                                                                      GCTP2861
      IFLG = 0                                                         GCTP2862
      IF (SWITCH .NE. 0) GO TO 120                                     GCTP2863
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                           GCTP2864
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                         GCTP2865
      IFLG = 1600                                                      GCTP2866
      RETURN                                                           GCTP2867
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                    GCTP2868
      PROJ(1) = X0 + A * LON * DCOS (GEOG(2))                          GCTP2869
      PROJ(2) = Y0 + A * GEOG(2)                                       GCTP2870
      RETURN                                                           GCTP2871
*                                                                      GCTP2872
* .....................................................................GCTP2873
*                       .  INVERSE TRANSFORMATION  .                   GCTP2874
* .....................................................................GCTP2875
*                                                                      GCTP2876
      ENTRY PI16Z0 (PROJ,GEOG,IFLG)                                    GCTP2877
*                                                                      GCTP2878
      IFLG = 0                                                         GCTP2879
      IF (SWITCH .NE. 0) GO TO 220                                     GCTP2880
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                           GCTP2881
      IFLG = 1600                                                      GCTP2882
      RETURN                                                           GCTP2883
  220 X = PROJ(1) - X0                                                 GCTP2884
      Y = PROJ(2) - Y0                                                 GCTP2885
      GEOG(2) = Y / A                                                  GCTP2886
      IF (DABS(GEOG(2)) .LE. HALFPI) GO TO 230                         GCTP2887
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                           GCTP2888
 2020 FORMAT (' IMPROPER PARAMETER')                                   GCTP2889
      IFLG = 1601                                                      GCTP2890
      RETURN                                                           GCTP2891
  230 CON = DABS (GEOG(2)) - HALFPI                                    GCTP2892
      IF (DABS (CON) .GT. EPSLN) GO TO 240                             GCTP2893
      GEOG(1) = LON0                                                   GCTP2894
      RETURN                                                           GCTP2895
  240 GEOG(1) = ADJLZ0 (LON0 + X / (A * DCOS (GEOG(2))))               GCTP2896
      RETURN                                                           GCTP2897
*                                                                      GCTP2898
      END                                                              GCTP2899
* *********************************************************************GCTP2901
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2902
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                    **GCTP2903
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2904
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* ********************************************************************GCTP2905
*                        *  EQUIRECTANGULAR   *                        GCTP2906
* ********************************************************************GCTP2907
*                                                                      GCTP2908
      SUBROUTINE PJ17Z0                                               GCTP2909
*                                                                      GCTP2910
      IMPLICIT REAL*8 (A-Z)                                           GCTP2911
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                             GCTP2912
      CHARACTER*16 ANGS(2)                                            GCTP2913
      COMMON /SPHRZ0/ AZZ                                             GCTP2914
* **** PARAMETERS **** A,LON0,X0,Y0,LAT1 ******************************GCTP2915
      DIMENSION DATA(1),GEOG(1),PROJ(1)                               GCTP2916
      DATA HALFPI /1.5707963267948966192 3D0/                         GCTP2917
      DATA ZERO /0.0D0/                                               GCTP2918
      DATA SWITCH /0/                                                 GCTP2919
*                                                                     GCTP2920
* .....................................................................GCTP2921
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .    GCTP2922
* .....................................................................GCTP2923
*                                                                     GCTP2924
      ENTRY IS17Z0 (ZONE,DATA,IPFILE,IFLG)                            GCTP2925
*                                                                     GCTP2926
      IFLG = 0                                                        GCTP2927
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                    GCTP2928
      A = DATA(1)                                                     GCTP2929
      IF (A .LE. ZERO) A = AZZ                                        GCTP2930
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                      GCTP2931
      IF (IFLG .NE. 0) RETURN                                         GCTP2932
      CALL UNITZ0 (DATA(6),5,LAT1,0,IPFILE,IFLG)                      GCTP2933
      IF (IFLG .NE. 0) RETURN                                         GCTP2934
      X0 = DATA(7)                                                    GCTP2935
      Y0 = DATA(8)                                                    GCTP2936
*                                                                     GCTP2937
* LIST RESULTS OF PARAMETER INITIALIZATION.                           GCTP2938
*                                                                     GCTP2939
      CALL DMSLZ0 (LAT1,0,ANGS(1),IPFILE,IFLG)                        GCTP2940
      CALL DMSLZ0 (LON0,0,ANGS(2),IPFILE,IFLG)                        GCTP2941
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0             GCTP2942
 2000 FORMAT (' INITIALIZATION PARAMETERS (EQUIRECTANGULAR PROJECTION)'/GCTP2943
     .        ' RADIUS OF SPHERE              =',F16.4,' METERS'/     GCTP2944
     .        ' LATITUDE OF TRUE SCALE        =',A16/                 GCTP2945
     .        ' LONGITUDE OF C. MERIDIAN      =',A16/                 GCTP2946
     .        ' FALSE EASTING                 =',F16.4,' METERS'/     GCTP2947
     .        ' FALSE NORTHING                =',F16.4,' METERS')     GCTP2948
      SWITCH = ZONE                                                   GCTP2949
      RETURN                                                          GCTP2950
*                                                                     GCTP2951
* .....................................................................GCTP2952
*                      .  FORWARD TRANSFORMATION  .                   GCTP2953
* .....................................................................GCTP2954
*                                                                     GCTP2955
      ENTRY PF17Z0 (GEOG,PROJ,IFLG)                                   GCTP2956
*                                                                     GCTP2957
      IFLG = 0                                                        GCTP2958
      IF (SWITCH .NE. 0) GO TO 120                                    GCTP2959
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                          GCTP2960
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                        GCTP2961
      IFLG = 1700                                                     GCTP2962
      RETURN                                                          GCTP2963
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                   GCTP2964
      PROJ(1) = X0 + A * LON * DCOS(LAT1)                             GCTP2965
      PROJ(2) = Y0 + A * GEOG(2)                                      GCTP2966
      RETURN                                                          GCTP2967
*                                                                     GCTP2968
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*  .....                                                                GCTP2969
*                       .  INVERSE TRANSFORMATION  .                    GCTP2970
*  .....                                                                GCTP2971
*                                                                       GCTP2972
      ENTRY PI17Z0 (PROJ,GEOG,IFLG)                                     GCTP2973
*                                                                       GCTP2974
      IFLG = 0                                                          GCTP2975
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP2976
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP2977
      IFLG = 1700                                                       GCTP2978
      RETURN                                                            GCTP2979
  220 X = PROJ(1) - X0                                                  GCTP2980
      Y = PROJ(2) - Y0                                                  GCTP2981
      GEOG(2) = Y / A                                                   GCTP2982
      IF (DABS(GEOG(2)) .LE. HALFPI) GO TO 240                          GCTP2983
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP2984
 2020 FORMAT (' IMPROPER PARAMETER')                                    GCTP2985
      IFLG = 1701                                                       GCTP2986
      RETURN                                                            GCTP2987
  240 GEOG(1) = ADJLZ0 (LON0 + X / (A * DCOS(LAT1) ))                   GCTP2988
      RETURN                                                            GCTP2989
*                                                                       GCTP2990
      END                                                               GCTP2991
* ***********************************************************************GCTP2993
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP2994
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP2995
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP2996
* ***********************************************************************GCTP2997
*                        *  MILLER CYLINDRICAL  *                       GCTP2998
* ***********************************************************************GCTP2999
*                                                                       GCTP3000
      SUBROUTINE PJ18Z0                                                 GCTP3001
*                                                                       GCTP3002
      IMPLICIT REAL*8 (A-Z)                                             GCTP3003
      INTEGER*4 SWITCH,I,ZONE,IPFILE,IFLG                               GCTP3004
      CHARACTER*16 ANGS                                                 GCTP3005
      COMMON /SPHRZ0/ AZZ                                               GCTP3006
* **** PARAMETERS **** A,LON0,X0,Y0 ************************************GCTP3007
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                 GCTP3008
      DATA FORTPI /0.78539816339744833D0/                               GCTP3009
      DATA ZERO,ONEQ,TWOH /0.0D0,1.25D0,2.5D0/                          GCTP3010
      DATA SWITCH /0/                                                   GCTP3011
*                                                                       GCTP3012
*  .....                                                                GCTP3013
*       .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .     GCTP3014
*  .....                                                                GCTP3015
*                                                                       GCTP3016
      ENTRY IS18Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP3017
*                                                                       GCTP3018
      IFLG = 0                                                          GCTP3019
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP3020
      A = DATA(1)                                                       GCTP3021
      IF (A .LE. ZERO) A = AZZ                                          GCTP3022
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP3023
      IF (IFLG .NE. 0) RETURN                                           GCTP3024
      X0 = DATA(7)                                                      GCTP3025
      Y0 = DATA(8)                                                      GCTP3026
*                                                                       GCTP3027
* LIST RESULTS OF PARAMETER INITIALIZATION.                             GCTP3028
*                                                                       GCTP3029
      CALL DMSLZ0 (LON0,0,ANGS,IPFILE,IFLG)                             GCTP3030
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0               GCTP3031
 2000 FORMAT (' INITIALIZATION PARAMETERS (MILLER CYLINDRICAL',         GCTP3032
     .        ' PROJECTION)'/                                          GCTP3033
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     .        ' RADIUS OF SPHERE              =',F16.4,' METERS'/        GCTP3034
     .        ' LONGITUDE OF C. MERIDIAN      =',A16/                    GCTP3035
     .        ' FALSE EASTING                 =',F16.4,' METERS'/        GCTP3036
     .        ' FALSE NORTHING                =',F16.4,' METERS')        GCTP3037
      SWITCH = ZONE                                                      GCTP3038
      RETURN                                                             GCTP3039
*                                                                        GCTP3040
* .....................................................................GCTP3041
*                       .  FORWARD TRANSFORMATION  .                   GCTP3042
* .....................................................................GCTP3043
*                                                                        GCTP3044
      ENTRY PF18Z0 (GEOG,PROJ,IFLG)                                      GCTP3045
*                                                                        GCTP3046
      IFLG = 0                                                           GCTP3047
      IF (SWITCH .NE. 0) GO TO 120                                       GCTP3048
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                             GCTP3049
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                           GCTP3050
      IFLG = 1800                                                        GCTP3051
      RETURN                                                             GCTP3052
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                      GCTP3053
      PROJ(1) = X0 + A * LON                                             GCTP3054
      PROJ(2) = Y0 + A * DLOG (DTAN (FORTPI + GEOG(2) / TWOH)) * ONEQ    GCTP3055
      RETURN                                                             GCTP3056
*                                                                        GCTP3057
* .....................................................................GCTP3058
*                       .  INVERSE TRANSFORMATION  .                   GCTP3059
* .....................................................................GCTP3060
*                                                                        GCTP3061
      ENTRY PI18Z0 (PROJ,GEOG,IFLG)                                      GCTP3062
*                                                                        GCTP3063
      IFLG = 0                                                           GCTP3064
      IF (SWITCH .NE. 0) GO TO 220                                       GCTP3065
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                             GCTP3066
      IFLG = 1800                                                        GCTP3067
      RETURN                                                             GCTP3068
  220 X = PROJ(1) - X0                                                   GCTP3069
      Y = PROJ(2) - Y0                                                   GCTP3070
      GEOG(1) = ADJLZ0 (LON0 + X / A)                                    GCTP3071
      GEOG(2) = TWOH * DATAN (DEXP (Y / A / ONEQ)) - FORTPI * TWOH       GCTP3072
      RETURN                                                             GCTP3073
*                                                                        GCTP3074
      END                                                                GCTP3075
* *********************************************************************GCTP3077
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3078
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP3079
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3080
* *********************************************************************GCTP3081
*                          *  VAN DER GRINTEN I  *                     GCTP3082
* *********************************************************************GCTP3083
*                                                                        GCTP3084
      SUBROUTINE PJ19Z0                                                  GCTP3085
*                                                                        GCTP3086
      IMPLICIT REAL*8 (A-Z)                                              GCTP3087
      INTEGER*4 SWITCH,I,ZONE,NIT,IPFILE,IFLG                            GCTP3088
      CHARACTER*16 ANGS                                                  GCTP3089
      COMMON /SPHRZ0/ AZZ                                                GCTP3090
* **** PARAMETERS **** A,LON0,X0,Y0 ***********************************GCTP3091
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                  GCTP3092
      DATA PI /3.14159265358979323846D0/                                 GCTP3093
      DATA HALFPI /1.5707963267948966192 3D0/                            GCTP3094
      DATA EPSLN,TOL,NIT /1.0D-10,0.7D0,35/                              GCTP3095
      DATA ZERO,HALF,ONE,TWO,FOUR /0.0D0,0.5D0,1.0D0,2.0D0,4.0D0/        GCTP3096
      DATA SWITCH /0/                                                    GCTP3097
*                                                                        GCTP3098
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      ENTRY IS19Z0 (ZONE,DATA,IPFILE,IFLG)                              GCTP3099
*                                                                       GCTP3100
      IFLG = 0                                                          GCTP3101
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                      GCTP3102
      A = DATA(1)                                                       GCTP3103
      IF (A .LE. ZERO) A = AZZ                                          GCTP3104
      CALL UNITZ0 (DATA(5),5,LON0,0,IPFILE,IFLG)                        GCTP3105
      IF (IFLG .NE. 0) RETURN                                           GCTP3106
      X0 = DATA(7)                                                      GCTP3107
      Y0 = DATA(8)                                                      GCTP3108
*                                                                       GCTP3109
* LIST RESULTS OF PARAMETER INITIALIZATION.                            GCTP3110
*                                                                       GCTP3111
      CALL DMSLZ0 (LON0,0,ANGS,IPFILE,IFLG)                             GCTP3112
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ANGS,X0,Y0               GCTP3113
 2000 FORMAT (' INITIALIZATION PARAMETERS (VAN DER GRINTEN I',          GCTP3114
     .        ' PROJECTION)'/                                          GCTP3115
     .        ' RADIUS OF SPHERE              =',F16.4,' METERS'/      GCTP3116
     .        ' LONGITUDE OF C. MERIDIAN      =',A16/                  GCTP3117
     .        ' FALSE EASTING                 =',F16.4,' METERS'/      GCTP3118
     .        ' FALSE NORTHING                =',F16.4,' METERS')      GCTP3119
      SWITCH = ZONE                                                     GCTP3120
      RETURN                                                            GCTP3121
*                                                                       GCTP3122
* .....................................................................GCTP3123
*                       .  FORWARD TRANSFORMATION  .                    GCTP3124
* .....................................................................GCTP3125
*                                                                       GCTP3126
      ENTRY PF19Z0 (GEOG,PROJ,IFLG)                                     GCTP3127
*                                                                       GCTP3128
      IFLG = 0                                                          GCTP3129
      IF (SWITCH .NE. 0) GO TO 120                                      GCTP3130
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP3131
 2010 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP3132
      IFLG = 1900                                                       GCTP3133
      RETURN                                                            GCTP3134
  120 LON = ADJLZ0 (GEOG(1) - LON0)                                     GCTP3135
      LAT = GEOG(2)                                                     GCTP3136
      IF (DABS(LAT) .GT. EPSLN) GO TO 140                               GCTP3137
      PROJ(1) = X0 + A * LON                                            GCTP3138
      PROJ(2) = Y0                                                      GCTP3139
      RETURN                                                            GCTP3140
  140 THETA = ASINZ0 (DABS (LAT /HALFPI))                               GCTP3141
      IF (DABS(LON).GT.EPSLN .AND.                                      GCTP3142
     .    DABS(DABS(LAT)-HALFPI).GT.EPSLN) GO TO 160                    GCTP3143
      PROJ(1) = X0                                                      GCTP3144
      PROJ(2) = Y0 + PI * A * DSIGN( DTAN (HALF * THETA), LAT)          GCTP3145
      RETURN                                                            GCTP3146
  160 AL = HALF * DABS (PI / LON - LON / PI)                            GCTP3147
      ASQ = AL * AL                                                     GCTP3148
      SINTHT = DSIN (THETA)                                             GCTP3149
      COSTHT = DCOS (THETA)                                             GCTP3150
      G = COSTHT / (SINTHT + COSTHT - ONE)                              GCTP3151
      GSQ = G * G                                                       GCTP3152
      M = G * (TWO / SINTHT - ONE)                                      GCTP3153
      MSQ = M * M                                                       GCTP3154
      CON = PI * A * (AL * (G - MSQ) + DSQRT (ASQ * (G - MSQ)**2 -      GCTP3155
     .      (MSQ + ASQ) * (GSQ - MSQ))) / (MSQ + ASQ)                   GCTP3156
      CON = DSIGN (CON , LON)                                           GCTP3157
      PROJ(1) = X0 + CON                                                GCTP3158
      CON = DABS (CON / (PI * A))                                       GCTP3159
      PROJ(2) = Y0 + DSIGN (PI * A * DSQRT (ONE - CON * CON -           GCTP3160
     .          TWO * AL * CON) , LAT)                                  GCTP3161
      RETURN                                                            GCTP3162
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*                                                                       GCTP3163
* .....................................................................GCTP3164
*                        .  INVERSE TRANSFORMATION  .                   GCTP3165
* .....................................................................GCTP3166
*                                                                       GCTP3167
      ENTRY PI19Z0 (PROJ,GEOG,IFLG)                                     GCTP3168
*                                                                       GCTP3169
      IFLG = 0                                                          GCTP3170
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP3171
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010)                            GCTP3172
      IFLG = 1900                                                       GCTP3173
      RETURN                                                            GCTP3174
  220 X = PROJ(1) - X0                                                  GCTP3175
      Y = PROJ(2) - Y0                                                  GCTP3176
      CON = DABS (Y / (PI * A))                                         GCTP3177
      THETA = TWO * DATAN (CON)                                         GCTP3178
      IF (DABS(X) .GT. EPSLN) GO TO 240                                 GCTP3179
      GEOG(1) = LON0                                                    GCTP3180
      GEOG(2) = HALFPI * DSIGN( DSIN (THETA), Y)                        GCTP3181
      RETURN                                                            GCTP3182
  240 IF (DABS(Y) .GT. EPSLN) GO TO 260                                 GCTP3183
      GEOG(1) = ADJLZ0 (LON0 + X / A)                                   GCTP3184
      GEOG(2) = ZERO                                                    GCTP3185
      RETURN                                                            GCTP3186
  260 IF (DSQRT(X*X+Y*Y) .LE. PI*A) GO TO 270                           GCTP3187
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP3188
 2020 FORMAT (' IMPROPER PARAMETER')                                    GCTP3189
      IFLG = 1901                                                       GCTP3190
      RETURN                                                            GCTP3191
  270 CNN = CON * CON                                                   GCTP3192
      COM = DABS (X / (PI * A))                                         GCTP3193
      CMM = COM * COM                                                   GCTP3194
      AL = (ONE - CMM - CNN) / (TWO * COM)                              GCTP3195
      GEOG(1) = ADJLZ0 (LON0 + DSIGN (PI*(-AL + DSQRT (AL*AL+ONE)) , X))GCTP3196
      PHI = THETA                                                       GCTP3197
      IF (CON .GT. TOL) GO TO 320                                       GCTP3198
*                                                                       GCTP3199
* LOW LATITUDE CASE                                                    GCTP3200
*                                                                       GCTP3201
      DO 280 I = 1,NIT                                                  GCTP3202
      THETA = ASINZ0 (PHI / HALFPI)                                     GCTP3203
      SINTHT = DSIN (THETA)                                             GCTP3204
      COSTHT = DCOS (THETA)                                             GCTP3205
      G = COSTHT / (SINTHT + COSTHT - ONE)                              GCTP3206
      D = CON / SINTHT - ONE / (ONE + COSTHT)                           GCTP3207
      H = TWO - SINTHT                                                  GCTP3208
      J = DTAN (HALF * THETA)                                           GCTP3209
      DPHI = (CMM + CNN - TWO * D * G * H - J * J) * PI * COSTHT /      GCTP3210
     .       (FOUR * (G * H * (CON * COSTHT / (ONE - COSTHT) + J) /     GCTP3211
     .       (ONE + COSTHT) + D * G * ((ONE + TWO * COSTHT * COSTHT) /  GCTP3212
     .       COSTHT + H * (COSTHT - SINTHT) / (SINTHT + COSTHT - ONE)) -GCTP3213
     .       J * (J * J + ONE)))                                        GCTP3214
      PHI = PHI - DPHI                                                  GCTP3215
      IF (DABS(DPHI) .LT. EPSLN) GO TO 400                              GCTP3216
  280 CONTINUE                                                          GCTP3217
  300 IF (IPFILE .NE. 0) WRITE (IPFILE,2030)                            GCTP3218
 2030 FORMAT (' LATITUDE FAILED TO CONVERGE')                           GCTP3219
      IFLG = 1902                                                       GCTP3220
      RETURN                                                            GCTP3221
*                                                                       GCTP3222
* HIGH LATITUDE CASE.                                                  GCTP3223
*                                                                       GCTP3224
  320 LON = ADJLZ0 (GEOG(1) - LON0)                                     GCTP3225
      DO 380 I = 1,NIT                                                  GCTP3226
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      IF (DABS(PHI) .GT. EPSLN) GO TO 330                                GCTP3227
      Y1 = ZERO                                                          GCTP3228
      GO TO 360                                                          GCTP3229
  330 THETA = ASINZ0 (DABS (PHI /HALFPI))                                GCTP3230
      IF (DABS(LON) .GT. EPSLN) GO TO 340                                GCTP3231
      Y1 = PI * A * DTAN (HALF * THETA)                                  GCTP3232
      GO TO 360                                                          GCTP3233
  340 AL = HALF * DABS (PI / LON - LON / PI)                             GCTP3234
      ASQ = AL * AL                                                      GCTP3235
      SINTHT = DSIN (THETA)                                              GCTP3236
      COSTHT = DCOS (THETA)                                              GCTP3237
      G = COSTHT / (SINTHT + COSTHT - ONE)                               GCTP3238
      GSQ = G * G                                                        GCTP3239
      M = G * (TWO / SINTHT - ONE)                                       GCTP3240
      MSQ = M * M                                                        GCTP3241
      CON = DABS ((AL * (G - MSQ) + DSQRT (ASQ * (G - MSQ)**2 -          GCTP3242
     .      (MSQ + ASQ) * (GSQ - MSQ))) / (MSQ + ASQ))                   GCTP3243
      Y1 = DSIGN (PI * A * DSQRT (ONE - CON * CON -                      GCTP3244
     .          TWO * AL * CON) , PHI)                                   GCTP3245
  360 DPHI = ((DABS(Y) - Y1) / (PI * A - Y1)) * (HALFPI - PHI)           GCTP3246
      PHI = PHI + DPHI                                                   GCTP3247
      IF (DABS(DPHI) .LT. EPSLN) GO TO 400                               GCTP3248
  380 CONTINUE                                                           GCTP3249
      GO TO 300                                                          GCTP3250
  400 GEOG(2) = DSIGN (PHI , Y)                                          GCTP3251
      RETURN                                                             GCTP3252
*                                                                        GCTP3253
      END                                                                GCTP3254
* ***********************************************************************GCTP3256
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3257
* **          MATHEMATICAL ANALYSIS BY JOHN SNYDER                     **GCTP3258
* ** GCTP/II                VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3259
* ***********************************************************************GCTP3260
*                    *  OBLIQUE MERCATOR (HOTINE)  *                     GCTP3261
* ***********************************************************************GCTP3262
*                                                                        GCTP3263
      SUBROUTINE PJ20Z0                                                  GCTP3264
*                                                                        GCTP3265
      IMPLICIT REAL*8 (A-Z)                                              GCTP3266
      INTEGER*4 SWITCH,I,ZONE,MODE,IPFILE,IFLG                           GCTP3267
      DIMENSION DATA(1),GEOG(1),PROJ(1)                                  GCTP3275
      CHARACTER*16 ANGS1(5),ANGS2(3)                                     GCTP3268
      COMMON /ELLPZ0/ AZ,EZ,ESZ,E0Z,E1Z,E2Z,E3Z,E4Z                      GCTP3269
* **** PARAMETERS **** A,E,ES,KS0,ALPHA,LONC,LON1,LAT1,LON2,LAT2,LAT0 **GCTP3270
* ********************** X0,Y0,GAMMA,LON0,AL,BL,EL *********************GCTP3271
      DATA PI /3.14159265358979323846D0/                                 GCTP3272
      DATA HALFPI /1.57079632679489661923D0/                             GCTP3273
      DATA TOL,EPSLN /1.0D-7,1.0D-10/                                    GCTP3274

      DATA ZERO,HALF,ONE /0.0D0,0.5D0,1.0D0/                             GCTP3276
      DATA SWITCH /0/                                                    GCTP3277
*                                                                        GCTP3278
* .....................................................................GCTP3279
*      .  INITIALIZATION OF PROJECTION PARAMETERS (ENTRY INPUT)  .       GCTP3280
* .....................................................................GCTP3281
*                                                                        GCTP3282
      ENTRY IS20Z0 (ZONE,DATA,IPFILE,IFLG)                               GCTP3283
*                                                                        GCTP3284
      IFLG = 0                                                           GCTP3285
      IF (SWITCH.NE.0 .AND. SWITCH.EQ.ZONE) RETURN                       GCTP3286
      MODE = 0                                                           GCTP3287
      IF (DATA(13) .NE. ZERO) MODE = 1                                   GCTP3288
      IF (DATA(1) .LE. ZERO) GO TO 100                                   GCTP3289
      A = DATA(1)                                                        GCTP3290
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      B = DATA(2)                                                       GCTP3291
      IF (B .GT. ZERO) GO TO 040                                        GCTP3292
      E = ZERO                                                          GCTP3293
      ES = ZERO                                                         GCTP3294
      GO TO 120                                                         GCTP3295
  040 IF (B .GT. ONE) GO TO 060                                         GCTP3296
      E = DSQRT (B)                                                     GCTP3297
      ES = B                                                            GCTP3298
      GO TO 120                                                         GCTP3299
  060 ES = ONE - (B / A) ** 2                                           GCTP3300
      E = DSQRT (ES)                                                    GCTP3301
      GO TO 120                                                         GCTP3302
  100 A = AZ                                                            GCTP3303
      E = EZ                                                            GCTP3304
      ES = ESZ                                                          GCTP3305
  120 KS0 = DATA(3)                                                     GCTP3306
      CALL UNITZ0 (DATA(6),5,LAT0,0,IPFILE,IFLG)                        GCTP3307
      IF (IFLG .NE. 0) RETURN                                           GCTP3308
      X0 = DATA(7)                                                      GCTP3309
      Y0 = DATA(8)                                                      GCTP3310
      SINPH0 = DSIN (LAT0)                                              GCTP3311
      COSPH0 = DCOS (LAT0)                                              GCTP3312
      CON = ONE - ES * SINPH0 * SINPH0                                  GCTP3313
      COM = DSQRT (ONE - ES)                                            GCTP3314
      BL = DSQRT (ONE + ES * COSPH0 ** 4 / (ONE - ES))                  GCTP3315
      AL = A * BL * KS0 * COM / CON                                     GCTP3316
      TS0 = TSFNZ0 (E,LAT0,SINPH0)                                      GCTP3317
      CON = DSQRT (CON)                                                 GCTP3318
      D = BL * COM / (COSPH0 * CON)                                     GCTP3319
      F = D + DSIGN (DSQRT (DMAX1 ((D * D - ONE), 0.0D0)) , LAT0)       GCTP3320
      EL = F * TS0 ** BL                                                GCTP3321
      IF (IPFILE .NE. 0) WRITE (IPFILE,2000) A,ES,KS0                   GCTP3322
 2000 FORMAT (' INITIALIZATION PARAMETERS (OBLIQUE MERCATOR ''HOTINE''',GCTP3323
     .        ' PROJECTION)'/                                          GCTP3324
     .        ' SEMI-MAJOR AXIS OF ELLIPSOID =',F16.4,' METERS'/       GCTP3325
     .        ' ECCENTRICITY SQUARED         =',F16.13/                GCTP3326
     .        ' SCALE AT CENTER              =',F16.13)                GCTP3327
      IF (MODE .EQ. 0) GO TO 140                                        GCTP3328
      CALL UNITZ0 (DATA(4),5,ALPHA,0,IPFILE,IFLG)                       GCTP3329
      IF (IFLG .NE. 0) RETURN                                           GCTP3330
      CALL UNITZ0 (DATA(5),5,LONC,0,IPFILE,IFLG)                        GCTP3331
      IF (IFLG .NE. 0) RETURN                                           GCTP3332
      G = HALF * (F - ONE / F)                                          GCTP3333
      GAMMA = ASINZ0 (DSIN (ALPHA) / D)                                 GCTP3334
      LON0 = LONC - ASINZ0 (G * DTAN (GAMMA)) / BL                      GCTP3335
*                                                                       GCTP3336
* LIST INITIALIZATION PARAMETERS (CASE B).                             GCTP3337
*                                                                       GCTP3338
      CALL DMSLZ0 (ALPHA,0,ANGS2(1),IPFILE,IFLG)                        GCTP3339
      CALL DMSLZ0 (LONC,0,ANGS2(2),IPFILE,IFLG)                         GCTP3340
      CALL DMSLZ0 (LAT0,0,ANGS2(3),IPFILE,IFLG)                         GCTP3341
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) ANGS2                      GCTP3342
 2010 FORMAT (' AZIMUTH OF CENTRAL LINE      =',A16/                   GCTP3343
     .        ' LONGITUDE OF ORIGIN          =',A16/                   GCTP3344
     .        ' LATITUDE OF ORIGIN           =',A16)                   GCTP3345
      CON = DABS (LAT0)                                                 GCTP3346
      IF (CON.GT.EPSLN .AND. DABS(CON - HALFPI).GT.EPSLN) GO TO 160     GCTP3347
      IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP3348
 2020 FORMAT (' IMPROPER PARAMETER')                                    GCTP3349
      IFLG = 2002                                                       GCTP3350
      RETURN                                                            GCTP3351
  140 CALL UNITZ0 (DATA(9),5,LON1,0,IPFILE,IFLG)                        GCTP3352
      IF (IFLG .NE. 0) RETURN                                           GCTP3353
      CALL UNITZ0 (DATA(10),5,LAT1,0,IPFILE,IFLG)                       GCTP3354
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      IF (IFLG .NE. 0) RETURN                                           GCTP3355
      CALL UNITZ0 (DATA(11),5,LON2,0,IPFILE,IFLG)                       GCTP3356
      IF (IFLG .NE. 0) RETURN                                           GCTP3357
      CALL UNITZ0 (DATA(12),5,LAT2,0,IPFILE,IFLG)                       GCTP3358
      IF (IFLG .NE. 0) RETURN                                           GCTP3359
      SINPHI = DSIN (LAT1)                                              GCTP3360
      TS1 = TSFNZ0 (E,LAT1,SINPHI)                                      GCTP3361
      SINPHI = DSIN (LAT2)                                              GCTP3362
      TS2 = TSFNZ0 (E,LAT2,SINPHI)                                      GCTP3363
      H = TS1 ** BL                                                     GCTP3364
      L = TS2 ** BL                                                     GCTP3365
      F = EL / H                                                        GCTP3366
      G = HALF * (F - ONE / F)                                          GCTP3367
      J = (EL * EL - L * H) / (EL * EL + L * H)                         GCTP3368
      P = (L - H) / (L + H)                                             GCTP3369
      CALL DMSLZ0 (LON2,0,ANGS1(3),IPFILE,IFLG)                         GCTP3370
      DLON = LON1 - LON2                                                GCTP3371
      IF (DLON .LT. -PI) LON2 = LON2 - 2.D0 * PI                        GCTP3372
      IF (DLON .GT.  PI) LON2 = LON2 + 2.D0 * PI                        GCTP3373
      DLON = LON1 - LON2                                                GCTP3374
      LON0 = HALF * (LON1 + LON2) - DATAN (J * DTAN (HALF * BL *        GCTP3375
     .       DLON) / P) / BL                                            GCTP3376
      DLON = ADJLZ0 (LON1 - LON0)                                       GCTP3377
      GAMMA = DATAN (DSIN (BL * DLON) / G)                              GCTP3378
      ALPHA = ASINZ0 (D * DSIN (GAMMA))                                 GCTP3379
      CALL DMSLZ0 (LON1,0,ANGS1(1),IPFILE,IFLG)                         GCTP3380
      CALL DMSLZ0 (LAT1,0,ANGS1(2),IPFILE,IFLG)                         GCTP3381
*     CALL DMSLZ0 (LON2,0,ANGS1(3),IPFILE,IFLG)                         GCTP3382
      CALL DMSLZ0 (LAT2,0,ANGS1(4),IPFILE,IFLG)                         GCTP3383
      CALL DMSLZ0 (LAT0,0,ANGS1(5),IPFILE,IFLG)                         GCTP3384
      IF (IPFILE .NE. 0) WRITE (IPFILE,2030) ANGS1                      GCTP3385
 2030 FORMAT (' LONGITUDE OF 1ST POINT       =',A16/                    GCTP3386
     .        ' LATITUDE OF 1ST POINT        =',A16/                    GCTP3387
     .        ' LONGITUDE OF 2ND POINT       =',A16/                    GCTP3388
     .        ' LATITUDE OF 2ND POINT        =',A16/                    GCTP3389
     .        ' LATITUDE OF ORIGIN           =',A16)                    GCTP3390
      IF (DABS(LAT1 - LAT2) .LE. EPSLN) GO TO 150                       GCTP3391
      CON = DABS (LAT1)                                                 GCTP3392
      IF (CON.LE.EPSLN .OR. DABS(CON - HALFPI).LE.EPSLN) GO TO 150      GCTP3393
      IF (DABS(DABS(LAT0) - HALFPI) .GT. EPSLN) GO TO 160               GCTP3394
  150 IF (IPFILE .NE. 0) WRITE (IPFILE,2020)                            GCTP3395
      IFLG = 2002                                                       GCTP3396
      RETURN                                                            GCTP3397
  160 SINGAM = DSIN (GAMMA)                                             GCTP3398
      COSGAM = DCOS (GAMMA)                                             GCTP3399
      SINALF = DSIN (ALPHA)                                             GCTP3400
      COSALF = DCOS (ALPHA)                                             GCTP3401
      IF (IPFILE .NE. 0) WRITE (IPFILE,2040) X0,Y0                      GCTP3402
 2040 FORMAT (' FALSE EASTING                =',F16.4,' METERS'/       GCTP3403
     .        ' FALSE NORTHING               =',F16.4,' METERS')       GCTP3404
      SWITCH = ZONE                                                     GCTP3405
      RETURN                                                            GCTP3406
*                                                                       GCTP3407
* .....................................................................GCTP3408
*                     .  FORWARD TRANSFORMATION  .                      GCTP3409
* .....................................................................GCTP3410
*                                                                       GCTP3411
      ENTRY PF20Z0 (GEOG,PROJ,IFLG)                                     GCTP3412
*                                                                       GCTP3413
      IFLG = 0                                                          GCTP3414
      IF (SWITCH .NE. 0) GO TO 220                                      GCTP3415
      IF (IPFILE .NE. 0) WRITE (IPFILE,2050)                            GCTP3416
 2050 FORMAT (' UNINITIALIZED TRANSFORMATION')                          GCTP3417
      IFLG = 2000                                                       GCTP3418
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      RETURN                                                            GCTP3419
  220 SINPHI = DSIN (GEOG(2))                                           GCTP3420
      DLON = ADJLZ0 (GEOG(1) - LON0)                                    GCTP3421
      VL = DSIN (BL * DLON)                                             GCTP3422
      IF (DABS(DABS(GEOG(2)) - HALFPI) .GT. EPSLN) GO TO 230            GCTP3423
      UL = SINGAM * DSIGN (ONE , GEOG(2))                               GCTP3424
      US = AL * GEOG(2) / BL                                            GCTP3425
      GO TO 250                                                         GCTP3426
  230 TS = TSFNZ0 (E,GEOG(2),SINPHI)                                    GCTP3427
      Q = EL / TS ** BL                                                 GCTP3428
      S = HALF * (Q - ONE / Q)                                          GCTP3429
      T = HALF * (Q + ONE / Q)                                          GCTP3430
      UL = (S * SINGAM - VL * COSGAM) / T                               GCTP3431
      CON = DCOS (BL * DLON)                                            GCTP3432
      IF (DABS(CON) .LT. TOL) GO TO 240                                 GCTP3433
      US = AL * DATAN ((S * COSGAM + VL * SINGAM) / CON) / BL           GCTP3434
      IF (CON .LT. ZERO) US = US + PI * AL / BL                         GCTP3435
      GO TO 250                                                         GCTP3436
  240 US = AL * BL * DLON                                               GCTP3437
  250 IF (DABS(DABS(UL) - ONE) .GT. EPSLN) GO TO 260                    GCTP3438
      IF (IPFILE .NE. 0) WRITE (IPFILE,2060)                            GCTP3439
 2060 FORMAT (' POINT PROJECTS INTO INFINITY')                          GCTP3440
      IFLG = 2001                                                       GCTP3441
      RETURN                                                            GCTP3442
  260 VS = HALF * AL * DLOG ((ONE - UL) / (ONE + UL)) / BL              GCTP3443
      PROJ(1) = X0 + VS * COSALF + US * SINALF                          GCTP3444
      PROJ(2) = Y0 + US * COSALF - VS * SINALF                          GCTP3445
      RETURN                                                            GCTP3446
*                                                                       GCTP3447
* .....................................................................GCTP3448
*                       .  INVERSE TRANSFORMATION  .                    GCTP3449
* .....................................................................GCTP3450
*                                                                       GCTP3451
      ENTRY PI20Z0 (PROJ,GEOG,IFLG)                                     GCTP3452
*                                                                       GCTP3453
      IFLG = 0                                                          GCTP3454
      IF (SWITCH .NE. 0) GO TO 280                                      GCTP3455
      IF (IPFILE .NE. 0) WRITE (IPFILE,2050)                            GCTP3456
      IFLG = 2000                                                       GCTP3457
      RETURN                                                            GCTP3458
  280 X = PROJ(1) - X0                                                  GCTP3459
      Y = PROJ(2) - Y0                                                  GCTP3460
      VS = X * COSALF - Y * SINALF                                      GCTP3461
      US = Y * COSALF + X * SINALF                                      GCTP3462
      Q = DEXP (- BL * VS / AL)                                         GCTP3463
      S = HALF * (Q - ONE / Q)                                          GCTP3464
      T = HALF * (Q + ONE / Q)                                          GCTP3465
      VL = DSIN (BL * US / AL)                                          GCTP3466
      UL = (VL * COSGAM + S * SINGAM) / T                               GCTP3467
      IF (DABS (DABS (UL) - ONE) .GE. EPSLN) GO TO 300                  GCTP3468
      GEOG(1) = LON0                                                    GCTP3469
      GEOG(2) = DSIGN (HALFPI , UL)                                     GCTP3470
      RETURN                                                            GCTP3471
  300 CON = ONE / BL                                                    GCTP3472
      TS = (EL / DSQRT ((ONE + UL) / (ONE - UL))) ** CON                GCTP3473
      GEOG(2) = PHI2Z0 (E,TS,IPFILE,IFLG)                               GCTP3474
      IF (IFLG .NE. 0) RETURN                                           GCTP3475
      CON = DCOS (BL * US / AL)                                         GCTP3476
      LON = LON0 - DATAN2 ((S * COSGAM - VL * SINGAM) , CON) / BL       GCTP3477
      GEOG(1) = ADJLZ0 (LON)                                            GCTP3478
      RETURN                                                            GCTP3479
*                                                                       GCTP3480
      END                                                               GCTP3481
* *********************************************************************GCTP3483
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* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3484
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3485
* ***********************************************************************GCTP3486
      DOUBLE PRECISION FUNCTION QSFNZ0 (ECCENT,SINPHI,COSPHI)             GCTP3487
*                                                                         GCTP3488
* FUNCTION TO COMPUTE CONSTANT (SMALL Q).                                 GCTP3489
*                                                                         GCTP3490
      IMPLICIT REAL*8 (A-Z)                                               GCTP3491
      DATA HALF,ONE,TWO /0.5D0,1.0D0,2.0D0/                               GCTP3492
      DATA EPSLN /1.0D-7/                                                 GCTP3493
*                                                                         GCTP3494
      IF (ECCENT .LT. EPSLN) GO TO 020                                    GCTP3495
      CON = ECCENT * SINPHI                                               GCTP3496
      QSFNZ0 = (ONE - ECCENT * ECCENT) * (SINPHI / (ONE - CON * CON) -    GCTP3497
     .         (HALF / ECCENT) * DLOG ((ONE - CON) / (ONE + CON)))        GCTP3498
      RETURN                                                              GCTP3499
*                                                                         GCTP3500
  020 QSFNZ0 = TWO * SINPHI                                               GCTP3501
      RETURN                                                              GCTP3502
      END                                                                 GCTP3503
* ***********************************************************************GCTP3505
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3506
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3507
* ***********************************************************************GCTP3508
      DOUBLE PRECISION FUNCTION SPAKZ0 (ANG,IPFILE,IFLG)                  GCTP3509
*                                                                         GCTP3510
* FUNCTION TO CONVERT SECONDS OF ARC TO PACKED DMS                        GCTP3511
*                                                                         GCTP3512
      IMPLICIT REAL*8 (A-H,M-Z)                                           GCTP3513
      DIMENSION CODE(2)                                                   GCTP3514
      DATA CODE /10000.0D0,100.0D0/                                       GCTP3515
      DATA ZERO,ONE /0.0D0,1.0D0/                                         GCTP3516
      DATA C1,C2 /3600.0D0,60.0D0/                                        GCTP3517
*                                                                         GCTP3518
* SEPERATE DEGREE FIELD.                                                  GCTP3519
*                                                                         GCTP3520
      IFLG = 0                                                            GCTP3521
      FACTOR = ONE                                                        GCTP3522
      IF (ANG .LT. ZERO) FACTOR = - ONE                                   GCTP3523
      SEC = DABS(ANG)                                                     GCTP3524
      I = SEC / C1                                                        GCTP3525
      IF (I .GT. 360) GO TO 020                                           GCTP3526
      DEG = I                                                             GCTP3527
*                                                                         GCTP3528
* SEPERATE MINUTES FIELD.                                                 GCTP3529
*                                                                         GCTP3530
      SEC = SEC - DEG * C1                                                GCTP3531
      I = SEC / C2                                                        GCTP3532
      MIN = I                                                             GCTP3533
*                                                                         GCTP3534
* SEPERATE SECONDS FIELD.                                                 GCTP3535
*                                                                         GCTP3536
      SEC = SEC - MIN * C2                                                GCTP3537
      SEC = FACTOR * (DEG * CODE(1) + MIN * CODE(2) + SEC)                GCTP3538
      GO TO 040                                                           GCTP3539
*                                                                         GCTP3540
* ERROR DETECTED IN DMS FORM.                                             GCTP3541
*                                                                         GCTP3542
  020 IF (IPFILE .NE. 0) WRITE (IPFILE,2000) ANG                          GCTP3543
 2000 FORMAT (' ANGLE G.T. 360 DEGREES = ',F15.3)                         GCTP3544
      IFLG = 13                                                           GCTP3545
      RETURN                                                              GCTP3546
*                                                                         GCTP3547
  040 SPAKZ0 = SEC                                                        GCTP3548
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*                                                                       GCTP3549
      RETURN                                                            GCTP3550
      END                                                               GCTP3551
* ***********************************************************************GCTP3553
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3554
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3555
* ***********************************************************************GCTP3556
      DOUBLE PRECISION FUNCTION TSFNZ0 (ECCENT,PHI,SINPHI)              GCTP3557
*                                                                       GCTP3558
* FUNCTION TO COMPUTE CONSTANT (SMALL T).                               GCTP3559
*                                                                       GCTP3560
      IMPLICIT REAL*8 (A-Z)                                             GCTP3561
      DATA HALF,ONE /0.5D0,1.0D0/                                       GCTP3562
      DATA HALFPI /1.5707963267948966192 3D0/                           GCTP3563
*                                                                       GCTP3564
      CON = ECCENT * SINPHI                                             GCTP3565
      COM = HALF * ECCENT                                               GCTP3566
      CON = ((ONE - CON) / (ONE + CON)) ** COM                          GCTP3567
      TSFNZ0 = DTAN (HALF * (HALFPI - PHI)) / CON                       GCTP3568
*                                                                       GCTP3569
      RETURN                                                            GCTP3570
      END                                                               GCTP3571
* ***********************************************************************GCTP3573
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3574
* ** GCTP/II                  VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3575
* ***********************************************************************GCTP3576
      SUBROUTINE UNITZ0 (PARIN,INUNIT,PARIO,IOUNIT,IPFILE,IFLG)         GCTP3577
*                                                                       GCTP3578
* SUBROUTINE TO TRANSFORM UNITS OF MEASURE FOR A PARAMETER              GCTP3579
*                                                                       GCTP3580
* INPUT ......                                                          GCTP3581
* INUNIT * UNIT CODE OF SOURCE                                          GCTP3582
* PARIN  * SOURCE PARAMETER                                             GCTP3583
* IOUNIT * UNIT CODE OF TARGET                                          GCTP3584
* IPFILE * LOGICAL NUMBER OF MESSAGES FILE.                             GCTP3585
*                                                                       GCTP3586
* OUTPUT .....                                                          GCTP3587
* PARIO  * TARGET PARAMETER                                             GCTP3588
* IFLG   * RETURN FLAG                                                  GCTP3589
*                                                                       GCTP3590
      IMPLICIT REAL*8 (A-H,O-Z)                                         GCTP3591
*                                                                       GCTP3592
      IFLG = 0                                                          GCTP3593
      IF (INUNIT .EQ. IOUNIT) THEN                                      GCTP3594
      PARIO = PARIN                                                     GCTP3595
      RETURN                                                            GCTP3596
      ENDIF                                                             GCTP3597
*                                                                       GCTP3598
* ADJUST FOR PACKED DMS UNITS                                           GCTP3599
*                                                                       GCTP3600
      IF (INUNIT .EQ. 5) THEN                                           GCTP3601
       INUNT = 3                                                        GCTP3602
       CIN = PAKSZ0 (PARIN,IPFILE,IFLG)                                 GCTP3603
       IF (IFLG .NE. 0) RETURN                                          GCTP3604
       ELSE                                                             GCTP3605
       INUNT = INUNIT                                                   GCTP3606
       CIN = PARIN                                                      GCTP3607
       ENDIF                                                            GCTP3608
      IF (IOUNIT .EQ. 5) THEN                                           GCTP3609
       IOUNT = 3                                                        GCTP3610
       ELSE                                                             GCTP3611
       IOUNT = IOUNIT                                                   GCTP3612
       ENDIF                                                            GCTP3613
*                                                                       GCTP3614
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* COMPUTE TRANSFORMATION FACTOR                                          GCTP3615
*                                                                       GCTP3616
      CALL UNTFZ0 (INUNT,IOUNT,FACTOR,IPFILE,IFLG)                      GCTP3617
      IF (IFLG .NE. 0) RETURN                                           GCTP3618
      CIO = FACTOR * CIN                                                GCTP3619
*                                                                       GCTP3620
* ADJUST OUTPUT FOR DMS UNITS                                           GCTP3621
*                                                                       GCTP3622
      IF (IOUNIT .EQ. 5) THEN                                           GCTP3623
       PARIO = SPAKZ0 (CIO,IPFILE,IFLG)                                 GCTP3624
       IF (IFLG .NE. 0) RETURN                                          GCTP3625
       ELSE                                                             GCTP3626
       PARIO = CIO                                                      GCTP3627
       ENDIF                                                            GCTP3628
*                                                                       GCTP3629
       RETURN                                                           GCTP3630
       END                                                              GCTP3631
* *********************************************************************GCTP3633
* ** NOAA/USGS GENERAL MAP PROJECTION PACKAGE ..... DR. A. A. ELASSAL **GCTP3634
* ** GCTP/II                    VERSION 1.0.2          SEPTEMBER 1,1986 **GCTP3635
* *********************************************************************GCTP3636
     SUBROUTINE UNTFZ0 (INUNIT,IOUNIT,FACTOR,IPFILE,IFLG)               GCTP3637
*                                                                       GCTP3638
* SUBROUTINE TO DETERMINE CONVERGENCE FACTOR BETWEEN TWO LINEAL UNITS   GCTP3639
*                                                                       GCTP3640
* * INPUT ........                                                      GCTP3641
* * INUNIT * UNIT CODE OF SOURCE.                                       GCTP3642
* * IOUNIT * UNIT CODE OF TARGET.                                       GCTP3643
* * IPFILE * LOGICAL NUMBER OF MESSAGES FILE.                           GCTP3644
*                                                                       GCTP3645
* * OUTPUT .......                                                      GCTP3646
* * FACTOR * CONVERGENCE FACTOR FROM SOURCE TO TARGET.                  GCTP3647
* * IFLG   * RETURN FLAG = 0 , NORMAL RETURN.                           GCTP3648
*                        = I , ABNORMAL RETURN.                         GCTP3649
*                                                                       GCTP3650
      IMPLICIT REAL*8 (A-H,O-Z)                                         GCTP3651
      DIMENSION FACTRS(5,5)                                             GCTP3652
      DATA ZERO,MAXUNT /0.0D0,5/                                        GCTP3653
      DATA FACTRS /0.1000000000000000D01 , 0.0000000000000000D00 ,      GCTP3654
     .             0.0000000000000000D00 , 0.2062648062470963D06 ,      GCTP3655
     .             0.5729577951308231D02 ,                              GCTP3656
     .             0.0000000000000000D00 , 0.1000000000000000D01 ,      GCTP3657
     .             0.3048006096012192D00 , 0.0000000000000000D00 ,      GCTP3658
     .             0.0000000000000000D00 ,                              GCTP3659
     .             0.0000000000000000D00 , 0.3280833333333333D01 ,      GCTP3660
     .             0.1000000000000000D01 , 0.0000000000000000D00 ,      GCTP3661
     .             0.0000000000000000D00 ,                              GCTP3662
     .             0.4848136811095360D-5 , 0.0000000000000000D00 ,      GCTP3663
     .             0.0000000000000000D00 , 0.1000000000000000D01 ,      GCTP3664
     .             0.2777777777777778D-3 ,                              GCTP3665
     .             0.1745329251994330D-1 , 0.0000000000000000D00 ,      GCTP3666
     .             0.0000000000000000D00 , 0.3600000000000000D04 ,      GCTP3667
     .             0.1000000000000000D01 /                              GCTP3668
*                                                                       GCTP3669
      IF (INUNIT.LT.0 .OR. INUNIT.GE.MAXUNT) GO TO 020                  GCTP3670
      IF (IOUNIT.GE.0 .AND. IOUNIT.LT.MAXUNT) GO TO 040                 GCTP3671
  020 IF (IPFILE .NE. 0) WRITE (IPFILE,2000) INUNIT,IOUNIT              GCTP3672
 2000 FORMAT (' ILLEGAL SOURCE OR TARGET UNIT CODE = ',I6,' / ',I6)     GCTP3673
      IFLG = 11                                                         GCTP3674
      RETURN                                                            GCTP3675
  040 FACTOR = FACTRS(IOUNIT+1 , INUNIT+1)                              GCTP3676
      IF (FACTOR .NE. ZERO) GO TO 060                                   GCTP3677
      IF (IPFILE .NE. 0) WRITE (IPFILE,2010) INUNIT,IOUNIT              GCTP3678
 2010 FORMAT (' INCONSISTANT UNIT CODES = ',I6,' / ',I6)                GCTP3679
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      IFLG = 12                                                         GCTP3680
      RETURN                                                            GCTP3681
  060 IFLG = 0                                                          GCTP3682
      RETURN                                                            GCTP3683
*                                                                       GCTP3684
      END                                                               GCTP3685
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