

REUSE MANUAL

GEOREF

10xxxxxx.1

Implementation

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SECTION 1. INTRODUCTION

1.1 PURPOSE OF THE REUSE MANUAL

This document describes the characteristics of the GEOREF reusable software component and provides instructions on its installation and operation. The manual is a self-contained reference for the software engineer intending to incorporate the component in another software system. This manual was written with the assumption that the user has a basic working knowledge of C and is familiar with fundamental C concepts and terminology.

1.2 PURPOSE OF THE REUSABLE SOFTWARE COMPONENT

The purpose of GEOREF is to provide a reusable software component which supports the following coordinate conversions :

- Geodetic coordinates (latitude and longitude in radians) to a GEOREF coordinate string, and
- GEOREF coordinate string to Geodetic coordinates (latitude and longitude in radians).

1.3 GENERAL INFORMATION

1.3.1 POINT OF CONTACT

U.S. Army Topographic Engineering Center (USATEC)

Geospatial Information Division (GID)

ATTN: CETEC-GD-A (Dan Specht)

7701 Telegraph Road

Alexandria, VA 22315-3864

Dan Specht (703) 428 - 6761 Project Manager

1.3.2 CERTIFICATION LEVEL

This RSC has been certified at level 4. A level 4 component satisfies the criteria for reliability, testing, and documentation for the Army Reuse Center (ARC). The component comes with test materials and a Reuse Manual that aids in integrating the component into a software system.

1.3.3 LEGAL RESTRICTIONS

This Reusable Software Component (RSC) contains data with Unlimited Government Rights.

SECTION 2. INSTALLATION

The following is a list of the files which make up the GEOREF component:

Source Code Files:

`georef.c`

Header Files :

`georef.h`

Data Files :

`none`

The compilation instructions for the GEOREF component are as follows:

DOS Makefile (Uses Microsoft C):

```
cl /nologo /W3 /FR /G2 /DNDEBUG /Gs /Ox /AM /D_DOS /c georef.c
```

UNIX Makefile (Uses gcc compiler):

```
cc -g -O -ansi -Wall -c georef.c
```

The compilation order of the GEOREF component relative to other components is unconstrained.

2.1 PARTIAL REUSE

The GEOREF component does not allow for partial reuse.

2.2 MODIFICATIONS

The GEOREF component does not permit modifications.

SECTION 3. ENVIRONMENT

This section provides details on the environment under which GEOREF was developed, tested, and executed.

3.1 HARDWARE

3.1.1 DEVELOPMENT

The following is a list of hardware configurations under which GEOREF was developed and tested.

- SUN SparcStation 20
- IBM compatible Pentium PC

3.1.2 TARGET

The following is a list of hardware configurations under which GEOREF was executed.

- SUN SparcStation 20
- IBM compatible Pentium PC

3.2 SOFTWARE

3.2.1 OPERATING SYSTEM

The following is a list of operating systems under which GEOREF was executed and tested.

- Solaris 2.5
- Windows 95

3.2.2 COMPILERS

The following is a list of compilers on which GEOREF was compiled successfully.

- GCC version 2.8.1

- Microsoft Visual C++ version 6

3.3 ASSUMPTIONS AND PERFORMANCE LIMITATIONS

There are no hardware or environment constraints. There are no limitations.

This RSC is written in ANSI C.

SECTION 4. GLOBAL RSC ENVIRONMENT

4.1 TYPES

Not applicable.

4.2 CONSTANTS

The following is a list of significant visible constants declared globally in GEOREF with their descriptions.

GEOREF_NO_ERROR	: No errors occurred in function
GEOREF_LAT_ERROR	: Latitude outside of valid range (-90 to 90 degrees)
GEOREF_LON_ERROR	: Longitude outside of valid range (-180 to 360 degrees)
GEOREF_STR_ERROR	: A GEOREF string error: string too long, string too short, or string length not even
GEOREF_STR_LAT_ERROR	: The latitude part of the GEOREF string (second or fourth character) is invalid.
GEOREF_STR_LON_ERROR	: The longitude part of the GEOREF string (first or third character) is invalid.
GEOREF_STR_LAT_MIN_ERROR	: The latitude minute part of the GEOREF string is greater than 60.
GEOREF_STR_LON_MIN_ERROR	: The longitude minute part of the GEOREF string is greater than 60.
GEOREF_PRECISION_ERROR	: The precision must be between 0 and 5 inclusive.

4.3 VARIABLES

Not applicable.

4.4 INCLUDE FILES

stdlib.h	: Used to call atof
ctype.h	: Used to call toupper, isalpha, and isdigit
string.h	: Used to call strlen and strcat
georef.h	: Error codes and prototype error checking

4.5 DEPENDENCIES

None, other than the ANSI C character, string, and standard libraries.

SECTION 5. FUNCTIONS

5.1 CONVERT_GEODETTIC_TO_GEOREF

5.1.1 DESCRIPTION

This function converts Geodetic coordinates (latitude and longitude in radians) to a GEOREF coordinate string with the specified level of precision.

5.1.2 INTERFACES AND EXAMPLES

The following is a list of the formal arguments required to use this function.

```
long Convert_Geodetic_To_GEOREF (double Latitude,  
                                double Longitude,  
                                double Precision,  
                                char *GEOREF_String);
```

Latitude	Latitude in radians (input),
Longitude	Longitude in radians (input),
Precision	Level of precision (number of digits) for GEOREF minute fields,
GEOREF_String	GEOREF coordinate string.

Example:

```
status = Convert_Geodetic_To_GEOREF (Latitude, Longitude, Precision, GEOREF)
```

Inputs:

Latitude:	35.5
Longitude:	-75.25
Precision	5

Outputs:

GEOREF:	GJQF4500030000
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5.1.3 DECLARATIONS

5.1.3.1 TYPES

Not applicable.

5.1.3.2 CONSTANTS

Not applicable.

5.1.3.3 VARIABLES

Not applicable.

5.1.4 DEPENDENCIES

None.

5.1.5 ERROR HANDLING

This function returns the following status codes:

GEOREF_NO_ERROR	: No errors occurred in function
GEOREF_LAT_ERROR	: Latitude outside of valid range (-90 to 90 degrees)
GEOREF_LON_ERROR	: Longitude outside of valid range (-180 to 360 degrees)
GEOREF_PRECISION_ERROR	: The precision must be between 0 and 5 inclusive.

5.2 CONVERT_GEOREF_TO_GEODETTIC

5.2.1 DESCRIPTION

This function converts a GEOREF coordinate string to Geodetic coordinates (latitude and longitude in radians).

5.2.2 INTERFACES AND EXAMPLES

The following is a list of the formal arguments required to use this function.

```
long Convert_GEOREF_To_Geodetic (char *GEOREF_String,
```

```
double *Latitude,  
double *Longitude);
```

GEOREF_String GEOREF coordinate string (input),

Latitude Latitude in radians (output),

Longitude Longitude in radians (output).

Example:

```
status = Convert_GEOREF_To_Geodetic (GEOREF, Latitude, Longitude)
```

Inputs:

GEOREF: GJQF4530

Outputs:

Latitude: 35.5

Longitude: -75.25

5.2.3 DECLARATIONS

5.2.3.1 TYPES

Not applicable.

5.2.3.2 CONSTANTS

Not applicable.

5.2.3.3 VARIABLES

Not applicable.

5.2.4 DEPENDENCIES

None.

5.2.5 ERROR HANDLING

This function returns the following status codes:

GEOREF_NO_ERROR	: No errors occurred in function
GEOREF_STR_ERROR	: A GEOREF string error: string too long, string too short, string length not even.
GEOREF_STR_LAT_ERROR	: The latitude part of the GEOREF string (second or fourth character) is invalid.
GEOREF_STR_LON_ERROR	: The longitude part of the GEOREF string (first or third character) is invalid.
GEOREF_STR_LAT_MIN_ERROR	: The latitude minute part of the GEOREF string is greater than 60.
GEOREF_STR_LON_MIN_ERROR	: The longitude minute part of the GEOREF string is greater than 60.

APPENDIX A STRUCTURE/DEPENDENCY DIAGRAMS

This component consists of a single compilation unit and depends only on the ANSI C character, string, and standard libraries.

APPENDIX B DEFINITIONS/GLOSSARY

Coordinate – Linear or angular quantities that designate the position that a point occupies in a given reference frame or system. Also used as a general term to designate the particular kind of reference frame or system, such as Cartesian coordinates or spherical coordinates.

Ellipsoid – The surface generated by an ellipse rotating about one of its axes.

Geodetic Coordinates – The quantities of latitude and longitude that define the position of a point on the surface of the earth with respect to the reference ellipsoid. Also, imprecisely called geographic coordinates.

Geodetic Latitude – The angle between the plane of the equator and the normal to the ellipsoid through the computation point. Geodetic latitude is positive north of the equator and negative south of the equator.

Geodetic Longitude – The angle between the plane of a meridian and the plane of the prime meridian. A longitude can be measured from the angle formed between the local and prime meridians at the pole of rotation of the reference ellipsoid, or by the arc along the equator intercepted by these meridians.

GEOREF Coordinates – World Geographic Reference System (GEOREF) coordinates. Alpha-numeric coordinates based on Geodetic coordinates used for reporting positions for air defense and strategic air operations. The first two letters identify a 15° quadrangle. The next two letters define a 1° cell within that quadrangle. The remaining digits define the location within the cell in terms of decimal minutes of longitude and latitude.

APPENDIX C REFERENCES

- (1) Topographic Engineering Center, TEC-SR-7, **Handbook for transformation of DATUMS, PROJECTIONS, GRIDS, AND COMMON COORDINATE SYSTEMS**, January 1996.