Spatial Reference Model (SRM)
Accuracy Assessment Procedure

RELEASE / REVISION DATE:
V1.0b/ 27 June 2008

ABSTRACT:
This procedure describes the steps to be taken in assessing the SRM accuracy performance in a consistent way by establishing an assessment method based on a fixed set of Gold Data supplied by NGA and pre-established runtime routines. This document is intended for users who are to independently assess the SRM accuracy in their particular computing environment and capture the results of the assessment in the results section of this document.

Authors

Name	Role	Organization	E-mail / Phone
David Shen	SEDRIS Eng.	SEDRIS Project	david.t.shen@saic.com

Contributors

Name	Role	Organization	E-mail / Phone
Farid Mamaghani	SEDRIS Eng.	SEDRIS Project	farid@halcyon.com
Ralph Toms	SRM SME; SEDRIS Eng.	SRI; SEDRIS Project	ralph.toms@sri.com
Paul Berner	SRM SME; SEDRIS Eng.	SEDRIS Project	berner@consultant.com
Kevin Trott	SRM SME; SEDRIS Eng.	Northrop-Grumann; SEDRIS Project	kevin.trott@ngc.com
Craig Rollins	Geodesist	National Geospatial-Intelligence Agency (NGA) Coordinate Systems Analysis Team	Craig.M.Rollins@nga.mil 314-676-0781 Mail Stop L-41 3838 Vogel Road Arnold, MO 63010-6238
Rob Cox	Environment SME	FCS Training IPT	robert.m.cox@saic.com
Michele Worley	SEDRIS Eng.	SEDRIS Project	Michele.l.worley@saic.com

Revision History

Version	Date	Description of Update
v0.1	May 28, 2008	Initial draft for review.
v1.0	June 27, 2008	Initial release

1 SRM Accuracy Assessment

1.1 Test Item:

The software under test is the SRM C/C++ SDK version 4.3. Only the C++ implementation is currently included in the assessment procedure described in this document. The C and Java implementations of the SRM may be included in the future.

1.2 Description:

The assessment procedure described in this document is for the collection of accuracy metrics related to the execution of the SRM coordinate conversion and transformation operations applied to a select set of coordinates in various spatial reference frames (SRF) supported by the SRM. These SRFs include, but are not limited to, Celestiocentric, Celestiodetic (commonly known as geocentric and geodetic, respectively), and Transverse Mercator. The select set of test coordinates is organized as separate data files, each containing the specification of the reference frame for the associated coordinates. The select set of data is available from the National Geospatial-Intelligence Agency (NGA) as the "gold" coordinate conversion data. The package name containing these test data files is "GoldData_v6.1". For more information on obtaining the NGA "gold" data, please contact Mr. Craig Rollins whose contact information is included in the "Contributors" listed above. A general description of the gold data is in Appendix A.

This assessment is divided into three test categories based on the *NGA gold data*:

- Coordinate conversions between the Celestiodetic SRF and map projection SRFs. The map projection SRFs include Mercator, Transverse Mercator, Lambert Conformal Conic, and Polar Stereographic
- Coordinate conversions between the Celestiodetic SRF and global 3D SRFs
- Coordinate transformations between a Celestiodetic SRF using the WGS 1984 Object Reference Models (ORM) and Celestiodetic SRFs using a number of different ORMs. These are also known as *datum transformations* from the WGS84 datum to various locally defined datums.

Note: The gold data available from NGA supports both the single standard parallel (LCC-1) and the double standard parallel (LCC-2) varieties of the Lambert Conformal Conic map projection. The test data includes test vectors for both. The SRM supports only one of these forms, the LCC-2. Therefore, there are nine data files, related to the LCC SRF under the map projection category, which need to be modified to provide the equivalent SRM LCC parameter set. There is also an error in the line ordering in the NGA_3parDT/Set_A/Local_geodetic_201.csv file. The changes to those files are captured in Appendix E.

The accuracy assessment application (herein called the *Test Driver*) invokes the SRM `changeCoordinateSRF` operation on the coordinate in all the three categories of conversions described above. All coordinate conversion tests are bi-directional, i.e., test data provided in SRF A is converted to SRF B (and the results are compared to the expected gold data values for SRF B), and test data provided in SRF B is converted to SRF A (and the results are compared to the expected gold data values for SRF A). Once the computed coordinates are compared with the gold data, a difference value is computed for each individual test vector. Only those reference frames that are supported by the SRM (and within those only those coordinates that fall within the acceptable domain and range of the given SRF) are included in the test. SRM defines the concept of valid regions for the coordinates, and only coordinates within the valid region can be used in a coordinate operation. For example, in a Celestiodetic SRF, only coordinates whose longitude component value is within the range of (-π, π], and latitude component value is within the range of (-π/2, π/2), and ellipsoidal height component value is greater than the minus semi-minor axis are considered valid.

All tests use the accuracy domain of the SRM default profile (see ISO/IEC 18026 Spatial Reference Model specification for more details). The difference computation is the Euclidean distance between the computed position and the expected position via the gold data (see Appendix F for additional details). Within each category, a coordinate test operation involves a pair of .csv files, where one .csv file serves as the set of input test coordinates and the other serves as the expected set of output values for the corresponding input test coordinates. For each test set, the following statistics are computed on the resulting differences:

1. Number of (input) coordinates used in the test.
2. Minimum.
3. Maximum.

Any coordinate that does not fall within the valid region is excluded from the conversion computation, and from the statistics; hence the number of coordinates accounts for a subset of the input coordinates, excluding those that are not in the valid range or fall outside the accuracy domain.

1.3 Software Information:

The software under test is SRM C++ SDK version 4.3. The Test Driver invokes the necessary SRM initialization and execution of operations for the SRM C++. It also computes and collects the coordinate conversion accuracy metrics.

1.4 Test Driver/Environment Information:

The Test Driver invokes the SRM C++ `changeCoordinateSRF` method to carry out the coordinate test operations according to the test configuration file `test_accuracy_config_all.csv`. This configuration file specifies the path as well as the source and target files for the coordinate operations. The content of the configuration file is in Appendix B.

The output of the accuracy assessment is also stored as a .csv file whose name is specified in the Test Driver argument list. The Test Driver software was written in C++ and supports both WIN32 and Linux platforms, and can be built using the native SRM C/C++ SDK build environment with minimal setup. See the SRM C/C++ SDK documentation for instructions on how to compile and build an SRM application with the SRM API.

1.5 Test Runtime Environment:

Any WIN32 or Linux computing platform supported by the SRM C/C++ SDK can be used to run the SRM performance test. The platform characteristics should be recorded and kept with the test results. As a minimum, the following platform characteristics should be captured:

CPU. (Example: 2.4 GHz Xeon / 533 Processor)
RAM. (Example: 1.5 Gb DDR at 266 MHz)
Operating System. (Example: Linux RedHat 8.0)
Compiler. (Example: GCC v3.2.2)

1.6 Initial Conditions:

It is recommended that all other applications running on the platform be terminated, prior to running the SRM tests for the purposes of efficiency. This includes any background applications that may be part of the operating system functions that may preempt the CPU and force the Test Driver application to wait while the CPU responds to a different program.

1.7 Accuracy Assessment

1.7.1 Description

For the accuracy assessment, the Test Driver invokes the SRM `changeCoordinateSRF` operation according to the input accuracy configuration file. Upon completion of the accuracy assessment execution, two output .csv files are created:

1. srm_conv_accuracy_results.csv - containing the results of coordinate conversion associated with the map projection (map_proj directory)) and global 3D (global_3D directory) gold data.
2. srm_datum_accuracy_results.csv – containing the results of coordinate conversion associated with the datum (NGA_3parDT) gold data.

Example output .csv files are in Appendix C and D.

1.7.2 Test Procedure

This test procedure assumes that `srm_accuracy` (Test Driver) executable is built from the `srm_accuracy.cpp` source code and statically linked to the SRM C++ 4.3 library. The SRM C/C++ SDK 4.3 documentation can be consulted on how to build an executable using SRM. The input configuration file and the top directory of the gold data package should be in the same directory where the Test Driver executable is run.

No.	Step Description	Expected Result
1	Make changes to the following files under GoldData_v6.1 according to Appendix E: map_proj/Sphere/LCC_60a.csv map_proj/Sphere/LCC_61.csv map_proj/Sphere/LCC_67.csv map_proj/SRMmax/LCC_37a.csv map_proj/SRMmax/LCC_38.csv map_proj/SRMmax/LCC_44.csv map_proj/WGS84/LCC_14a.csv map_proj/WGS84/LCC_15.csv map_proj/WGS84/LCC_21.csv NGA_3parDT/Set_A/ Local_geodetic_201.csv Note: The gold data files are in MS-DOS text file format with <CR> at the end of each line. Those must be removed prior to use the files in a Unix system.	The LCC SRF parameter set in the gold data is compatible with the SRM specification and the row ordering in `Local_geodetic_201.csv` is fixed.
2	Run the `srm_accuracy` executable with the following command line arguments: `srm_accuracy test_accuracy_config_all.csv` This configuration file assumes the root of the gold data tree (GoldData_v6.1) to be in the same directory where the test driver resides.	Two messages will appear on the display indicating the beginning and the end of the test as follows: “Running SRM accuracy test...” and “Completed accuracy test!” The result of the test will be saved in `srm_conv_accuracy_results.csv` and `srm_datum_accuracy_results.csv`.

	Note: Users can also use a third command line argument “t” to turn on the verbose mode for the output file. In that mode, each conversion result is listed with its corresponding gold data.	

Note: The content of the output file (.csv) can be viewed in Excel.

1.7.3 Actual Accuracy Results

This section is intended for recording the relevant information associated with a particular accuracy assessment experiment including the actual results from that assessment.

Person who performed the assessment:

- Name:
- Affiliation:
- Phone #:
- E-mail:

Accuracy Assessment Execution Information:

- Date (mm/dd/yyyy):
- Time Started (hh:mm):
- Time Completed (hh:mm):

Accuracy Assessment computation environment:

- CPU:
- RAM:
- Operating System:
- Compiler:

Accuracy Assessment Results:

< Insert here the accuracy results from the output srm_conv_accuracy_results.csv and srm_datum_accuracy_results.csv files or references to them >

Notes and/or Conclusions:

Appendix A

NGA's gold data package (GoldData_v6.1) file organization structure is as follows:

```
GOLDDATA_V6.1
|   Instructions.rtf
|   Release_Notes.rtf
|
+---global_3D
|   |   global_3D_index.xls
|   |
|   +---SRMmax
|   |       ellipsoidal_110.csv
|   |       geodetic_106.csv
|   |       geodetic_Lat_first_107.c
|   |       rectangular_108.csv
|   |       spherical_109.csv
|   |
|   \---WGS84
|           ellipsoidal_105.csv
|           geodetic_101.csv
|           geodetic_Lat_first_102.c
|           rectangular_103.csv
|           spherical_104.csv
|
+---map_proj
|   |   map_proj_index.xls
|   |   Show_Lon_Lat_points.pdf
|   |
|   +---Sphere
|   |       Lat_Lon.csv
|   |       LCC_60.csv
|   |       LCC_60a.csv
|   |       LCC_61.csv
|   |       LCC_62.csv
|   |       LCC_62a.csv
|   |       LCC_63.csv
|   |       LCC_64.csv
|   |       LCC_65.csv
|   |       LCC_66.csv
|   |       LCC_67.csv
|   |       LCC_68.csv
|   |       LCC_69.csv
|   |       Lon_Lat.csv
|   |       Mercator_51.csv
|   |       Mercator_51a.csv
|   |       Mercator_52.csv
|   |       Mercator_53.csv
|   |       Mercator_54.csv
|   |       Mercator_54a.csv
|   |       Mercator_54b.csv
|   |       Ney_70.csv
|   |       Ney_71.csv
|   |       PolarStereo_55.csv
|   |       PolarStereo_55a.csv
|   |       PolarStereo_55b.csv
```

```
|   |       PolarStereo_56.csv
|   |       PolarStereo_57.csv
|   |       PolarStereo_57a.csv
|   |       PolarStereo_57b.csv
|   |       PolarStereo_58.csv
|   |       PolarStereo_58a.csv
|   |       PolarStereo_59.csv
|   |       PolarStereo_59a.csv
|   |       TransMerc_72.csv
|   |       TransMerc_72a.csv
|   |       TransMerc_73.csv
|   |
|   +---SRMmax
|   |       Lat_Lon.csv
|   |       LCC_37.csv
|   |       LCC_37a.csv
|   |       LCC_38.csv
|   |       LCC_39.csv
|   |       LCC_39a.csv
|   |       LCC_40.csv
|   |       LCC_41.csv
|   |       LCC_42.csv
|   |       LCC_43.csv
|   |       LCC_44.csv
|   |       LCC_45.csv
|   |       LCC_46.csv
|   |       Lon_Lat.csv
|   |       Mercator_28.csv
|   |       Mercator_28a.csv
|   |       Mercator_29.csv
|   |       Mercator_30.csv
|   |       Mercator_31.csv
|   |       Mercator_31a.csv
|   |       Mercator_31b.csv
|   |       Ney_47.csv
|   |       Ney_48.csv
|   |       PolarStereo_32.csv
|   |       PolarStereo_32a.csv
|   |       PolarStereo_32b.csv
|   |       PolarStereo_33.csv
|   |       PolarStereo_34.csv
|   |       PolarStereo_34a.csv
|   |       PolarStereo_34b.csv
|   |       PolarStereo_35.csv
|   |       PolarStereo_35a.csv
|   |       PolarStereo_36.csv
|   |       PolarStereo_36a.csv
|   |       TransMerc_49.csv
|   |       TransMerc_49a.csv
|   |       TransMerc_50.csv
|   |
|   \---WGS84
|           Lat_Lon.csv
|           LCC_14.csv
|           LCC_14a.csv
|           LCC_15.csv
|           LCC_16.csv
```

```
|           LCC_16a.csv
|           LCC_17.csv
|           LCC_18.csv
|           LCC_19.csv
|           LCC_20.csv
|           LCC_21.csv
|           LCC_22.csv
|           LCC_23.csv
|           Lon_Lat.csv
|           Mercator_5.csv
|           Mercator_5a.csv
|           Mercator_6.csv
|           Mercator_7.csv
|           Mercator_8.csv
|           Mercator_8a.csv
|           Mercator_8b.csv
|           Ney_24.csv
|           Ney_25.csv
|           PolarStereo_09.csv
|           PolarStereo_09a.csv
|           PolarStereo_09b.csv
|           PolarStereo_10.csv
|           PolarStereo_11.csv
|           PolarStereo_11a.csv
|           PolarStereo_11b.csv
|           PolarStereo_12.csv
|           PolarStereo_12a.csv
|           PolarStereo_13.csv
|           PolarStereo_13a.csv
|           TransMerc_26.csv
|           TransMerc_26a.csv
|           TransMerc_27.csv
|
\---NGA_3parDT
    |   NGA_3parDT_index.xls
    |
    +---Set_A
    |       Local_geodetic_201.csv
    |       WGS84_geodetic_202.csv
    |
    \---Set_B
            Local_geodetic_203.csv
            WGS84_geodetic_204.csv
```

The gold data provides a set of comma separated value (csv) files, where each file specifies a coordinate reference frame along with the necessary parameters, and a set of coordinates within that reference frame. The gold data includes three broad categories of coordinate test data:

1. Map projection coordinate test data. (map_proj branch)
2. Three-dimensional coordinate test data. (global_3d branch)
3. Geodetic coordinate test data for various Earth model datums (NGA_3parDT branch)

For map projection and global 3D branches, each of their sub-branches group data files containing the coordinate values for a same set of coordinates in different spatial reference frames using the same datum. There are 300 coordinate values for the map projection case and 600 coordinate values for the global 3D case. For instance, in the map_proj/WGS84 branch, the lon_lat.csv file contains 300 locations specified as geodetic coordinates, while the TransMerc_27.csv contains the same 300 locations as coordinates in a Transverse Mercator (map projection) reference frame. Both reference frames use the WGS 1984 Earth model datum.

For the NGA_3parDT branch, there are two sub-branches including two files with 5000 geodetic coordinates each, with one file having all the geodetic coordinates based on the WGS 1984 and the other file containing the same 5000 locations in space, but associated with a geodetic reference frame using various Earth model datums other than WGS 1984.

The gold data also includes documentation describing an overview of its content.

APPENDIX B

The content of the test_accuracy_config_all.csv file is as follows:

```
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_14.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_14a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_15.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_16.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_16a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_17.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_18.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_19.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_20.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_21.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_22.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,LCC_23.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_5.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_5a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_6.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_7.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_8.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_8a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Mercator_8b.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Ney_24.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,Ney_25.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_09.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_09a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_09b.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_10.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_11.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_11a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_11b.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_12.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_12a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_13.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,PolarStereo_13a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,TransMerc_26.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,TransMerc_26a.csv
GoldData_v6.1/map_proj/WGS84/,Lon_Lat.csv,TransMerc_27.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_37.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_37a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_38.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_39.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_39a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_40.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_41.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_42.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_43.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_44.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_45.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,LCC_46.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_28.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_28a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_29.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_30.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_31.csv
```

GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_31a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Mercator_31b.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Ney_48.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,Ney_47.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_32.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_32a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_32b.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_33.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_34.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_34a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_34b.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_35.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_35a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_36.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,PolarStereo_36a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,TransMerc_49.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,TransMerc_49a.csv
GoldData_v6.1/map_proj/SRMmax/,Lon_Lat.csv,TransMerc_50.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_60.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_60a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_61.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_62.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_62a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_63.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_64.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_65.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_66.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_67.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_68.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,LCC_69.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_51.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_51a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_52.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_53.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_54.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_54a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Mercator_54b.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Ney_71.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,Ney_70.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_55.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_55a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_55b.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_56.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_57.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_57a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_57b.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_58.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_58a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_59.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,PolarStereo_59a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,TransMerc_72.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,TransMerc_72a.csv
GoldData_v6.1/map_proj/Sphere/,Lon_Lat.csv,TransMerc_73.csv
GoldData_v6.1/global_3D/WGS84/,geodetic_101.csv,rectangular_103.csv
GoldData_v6.1/global_3D/WGS84/,geodetic_101.csv,spherical_104.csv
GoldData_v6.1/global_3D/WGS84/,geodetic_101.csv,ellipsoidal_105.csv
GoldData_v6.1/global_3D/SRMmax/,geodetic_106.csv,rectangular_108.csv

```
GoldData_v6.1/global_3D/SRMmax/,geodetic_106.csv,spherical_109.csv
GoldData_v6.1/global_3D/SRMmax/,geodetic_106.csv,ellipsoidal_110.csv
GoldData_v6.1/NGA_3parDT/Set_A/,Local_geodetic_201.csv,WGS84_geodetic_202.csv
GoldData_v6.1/NGA_3parDT/Set_B/,WGS84_geodetic_204.csv,Local_geodetic_203.csv
```

Appendix C

A sample accuracy assessment output srm_conv_accuracy_results.csv file is as follows:

Note: These files can be viewed in MS Excel in a tabular form. You may cut and paste the following into an ASCII test file with extension ".csv", and from there, load into Excel.

```
Coordinate conversion accuracy assessment for SRM C++ 4.3
(The results are given as the Euclidean distance (in meters) between the
computed coordinate and the gold data)

Test conducted: Wed Jun 25 09:58:35 2008

ORM/RT, Conversion, Count, MIN (m), MAX (m)

WGE, Lon_Lat.csv to LCC_14.csv, 300, 4.3930397983904e-008, 1.03190621959572e-
005
WGE, LCC_14.csv to Lon_Lat.csv, 300, 3.49560439936265e-008,
1.24937044102701e-005
WGE, Lon_Lat.csv to LCC_14a.csv, 300, 4.65661287307739e-008,
0.0485254914475023
WGE, LCC_14a.csv to Lon_Lat.csv, 300, 1.00069251178863e-006,
0.00898214764877519
WGE, Lon_Lat.csv to LCC_15.csv, 300, 7.30355248611219e-005,
0.00664613155240192
WGE, LCC_15.csv to Lon_Lat.csv, 300, 1.0284373776686e-005,
0.00945956664182126
WGE, Lon_Lat.csv to LCC_16.csv, 300, 3.5255203453354e-008, 2.45155000351608e-
005
WGE, LCC_16.csv to Lon_Lat.csv, 300, 0, 1.25115230455474e-005
WGE, Lon_Lat.csv to LCC_16a.csv, 300, 2.20636981362144e-008,
2.45654229393535e-005
WGE, LCC_16a.csv to Lon_Lat.csv, 300, 5.32964690989503e-008,
1.25542277928617e-005
WGE, Lon_Lat.csv to LCC_17.csv, 300, 8.33000234328132e-009, 2.8117780703377e-
006
WGE, LCC_17.csv to Lon_Lat.csv, 300, 1.41623091030368e-009,
1.21358793240946e-005
WGE, Lon_Lat.csv to LCC_18.csv, 300, 5.66903088064723e-005,
0.0107708494103355
WGE, LCC_18.csv to Lon_Lat.csv, 300, 4.74007611481407e-006,
0.000216296817328449
WGE, Lon_Lat.csv to LCC_19.csv, 300, 4.50551360010351e-008,
2.88336157733516e-006
WGE, LCC_19.csv to Lon_Lat.csv, 300, 2.84195548410481e-009,
1.29002225001415e-005
WGE, Lon_Lat.csv to LCC_20.csv, 300, 1.32644007987903e-007,
0.000310699666542567
WGE, LCC_20.csv to Lon_Lat.csv, 300, 1.55785400133405e-008,
1.19909643732123e-005
WGE, Lon_Lat.csv to LCC_21.csv, 300, 2.27839541853074e-006, 0.059845581565247
WGE, LCC_21.csv to Lon_Lat.csv, 300, 2.35574989449233e-006,
0.00250128106958158
WGE, Lon_Lat.csv to LCC_22.csv, 300, 0.00712329229267342, 0.0220999677618538
```

```
WGE, LCC_22.csv to Lon_Lat.csv, 300, 1.27764408034037e-007,
0.000217996382087533
WGE, Lon_Lat.csv to LCC_23.csv, Exception: Incompatible SRF Parameter Set
WGE, LCC_23.csv to Lon_Lat.csv, Exception: Incompatible SRF Parameter Set
WGE, Lon_Lat.csv to Mercator_5.csv, 300, 5.68944960832596e-006,
0.000889730736278927
WGE, Mercator_5.csv to Lon_Lat.csv, 300, 0, 1.21723992758586e-005
WGE, Lon_Lat.csv to Mercator_5a.csv, 300, 5.68851828575134e-006,
0.000889733529813024
WGE, Mercator_5a.csv to Lon_Lat.csv, 300, 0, 1.21723537268119e-005
WGE, Lon_Lat.csv to Mercator_6.csv, 300, 4.34182584285736e-006,
0.000771385180608366
WGE, Mercator_6.csv to Lon_Lat.csv, 300, 0, 1.20150911592185e-005
WGE, Lon_Lat.csv to Mercator_7.csv, 300, 4.08198684453964e-006,
0.000623211456412458
WGE, Mercator_7.csv to Lon_Lat.csv, 300, 0, 1.23205701746336e-005
WGE, Lon_Lat.csv to Mercator_8.csv, 300, 5.68974261141936e-006,
0.000889730764801951
WGE, Mercator_8.csv to Lon_Lat.csv, 300, 0, 1.21742965875402e-005
WGE, Lon_Lat.csv to Mercator_8a.csv, 300, 4.34238765651804e-006,
0.000771385164711863
WGE, Mercator_8a.csv to Lon_Lat.csv, 300, 0, 1.20137961906253e-005
WGE, Lon_Lat.csv to Mercator_8b.csv, 300, 4.34425006078347e-006,
0.000771384699220933
WGE, Mercator_8b.csv to Lon_Lat.csv, 300, 0, 1.20124065799497e-005
WGE, Lon_Lat.csv to Ney_24.csv, Ney SRF not supported
WGE, Ney_24.csv to Lon_Lat.csv, Ney SRF not supported
WGE, Lon_Lat.csv to Ney_25.csv, Ney SRF not supported
WGE, Ney_25.csv to Lon_Lat.csv, Ney SRF not supported
WGE, Lon_Lat.csv to PolarStereo_09.csv, 252, 3.08487919021495e-006,
0.000593962147831917
WGE, PolarStereo_09.csv to Lon_Lat.csv, 222, 5.68354450217515e-009,
1.25207627983441e-005
WGE, Lon_Lat.csv to PolarStereo_09a.csv, 252, 3.08487919021495e-006,
0.000593962147831917
WGE, PolarStereo_09a.csv to Lon_Lat.csv, 222, 5.68354450217515e-009,
1.25207627983441e-005
WGE, Lon_Lat.csv to PolarStereo_09b.csv, 252, 1.71464986118016e-006,
0.00041587371379137
WGE, PolarStereo_09b.csv to Lon_Lat.csv, 207, 5.68354450217515e-009,
1.25735358362838e-005
WGE, Lon_Lat.csv to PolarStereo_10.csv, 252, 2.61761368897605e-006,
0.000554230064153671
WGE, PolarStereo_10.csv to Lon_Lat.csv, 218, 2.04491907860038e-008,
1.26319046745504e-005
WGE, Lon_Lat.csv to PolarStereo_11.csv, 252, 3.13126695236495e-006,
0.000593868950151787
WGE, PolarStereo_11.csv to Lon_Lat.csv, 222, 5.68354450217515e-009,
1.24838314071052e-005
WGE, Lon_Lat.csv to PolarStereo_11a.csv, 252, 2.58684616047907e-006,
0.000554373021150332
WGE, PolarStereo_11a.csv to Lon_Lat.csv, 217, 4.54410718675068e-008,
1.23673291029248e-005
WGE, Lon_Lat.csv to PolarStereo_11b.csv, 252, 2.5867974057413e-006,
0.000554373976036101
WGE, PolarStereo_11b.csv to Lon_Lat.csv, 217, 4.40210383716472e-008,
1.23673291029248e-005
```

WGE, Lon_Lat.csv to PolarStereo_12.csv, 252, 3.11050621885369e-006,
0.000594038516283035
WGE, PolarStereo_12.csv to Lon_Lat.csv, 222, 5.68354450217515e-009,
1.25207627983441e-005
WGE, Lon_Lat.csv to PolarStereo_12a.csv, 252, 2.64176203624273e-006,
0.000554300844669342
WGE, PolarStereo_12a.csv to Lon_Lat.csv, 218, 2.04583993721597e-008,
1.26347197608437e-005
WGE, Lon_Lat.csv to PolarStereo_13.csv, 111, 1.98936964798464e-005,
0.000593829203242181
WGE, PolarStereo_13.csv to Lon_Lat.csv, 81, 5.68354450217515e-009,
1.15713440730081e-005
WGE, Lon_Lat.csv to PolarStereo_13a.csv, 111, 1.84684928866687e-005,
0.000554335498995751
WGE, PolarStereo_13a.csv to Lon_Lat.csv, 76, 4.90488615570422e-008,
1.17314952284449e-005
WGE, Lon_Lat.csv to TransMerc_26.csv, 66, 2.84006076064948e-010,
0.000267375347903085
WGE, TransMerc_26.csv to Lon_Lat.csv, 66, 2.85436789319599e-010,
0.000190458064180728
WGE, Lon_Lat.csv to TransMerc_26a.csv, 66, 1.532267380387e-007,
0.000267375622558535
WGE, TransMerc_26a.csv to Lon_Lat.csv, 64, 3.83140637555062e-007,
0.000190073497145352
WGE, Lon_Lat.csv to TransMerc_27.csv, 71, 1.00675970315933e-006,
0.000438463757746003
WGE, TransMerc_27.csv to Lon_Lat.csv, 71, 8.00174958423453e-008,
0.000180355782610913
Test_SRMmax, Lon_Lat.csv to LCC_37.csv, 300, 3.9731051925366e-008,
9.85375831954678e-006
Test_SRMmax, LCC_37.csv to Lon_Lat.csv, 300, 2.31663510935513e-008,
0.000381471110865589
Test_SRMmax, Lon_Lat.csv to LCC_37a.csv, 300, 4.65661287307739e-008,
0.0401512034695211
Test_SRMmax, LCC_37a.csv to Lon_Lat.csv, 300, 9.41325314645159e-007,
0.00965499422757313
Test_SRMmax, Lon_Lat.csv to LCC_38.csv, 300, 2.52956713766325e-006,
0.00662580777350205
Test_SRMmax, LCC_38.csv to Lon_Lat.csv, 300, 1.83949883577976e-006,
0.00854663467275184
Test_SRMmax, Lon_Lat.csv to LCC_39.csv, 300, 3.17879918327108e-008,
2.54439596365702e-005
Test_SRMmax, LCC_39.csv to Lon_Lat.csv, 300, 9.4423231718582e-012,
0.0003816018433031
Test_SRMmax, Lon_Lat.csv to LCC_39a.csv, 300, 3.35793129677324e-009,
2.56787186768267e-005
Test_SRMmax, LCC_39a.csv to Lon_Lat.csv, 300, 1.00907209044798e-007,
0.000381331955398546
Test_SRMmax, Lon_Lat.csv to LCC_40.csv, 300, 6.97435633348266e-008,
2.70789465825182e-006
Test_SRMmax, LCC_40.csv to Lon_Lat.csv, 300, 1.42108547093127e-009,
0.000381475497860136
Test_SRMmax, Lon_Lat.csv to LCC_41.csv, 300, 0.000105477298273556,
0.0109390436232343
Test_SRMmax, LCC_41.csv to Lon_Lat.csv, 300, 1.02447255963871e-007,
0.000419616733474439

```
Test_SRMmax, Lon_Lat.csv to LCC_42.csv, 300, 6.29096378358862e-008,
2.95248282283958e-006
Test_SRMmax, LCC_42.csv to Lon_Lat.csv, 300, 2.13162820639691e-008,
0.00038189483838088
Test_SRMmax, Lon_Lat.csv to LCC_43.csv, 300, 9.56001602152622e-008,
0.000308814768255255
Test_SRMmax, LCC_43.csv to Lon_Lat.csv, 300, 1.42202970324846e-008,
0.000381063030310385
Test_SRMmax, Lon_Lat.csv to LCC_44.csv, 300, 1.1184171582029e-005,
0.0691533759061338
Test_SRMmax, LCC_44.csv to Lon_Lat.csv, 300, 8.05559878559813e-006,
0.00312757018463405
Test_SRMmax, Lon_Lat.csv to LCC_45.csv, 300, 0.00713659264489731,
0.0221745803747782
Test_SRMmax, LCC_45.csv to Lon_Lat.csv, 300, 6.25379996108334e-007,
0.000477747507327764
Test_SRMmax, Lon_Lat.csv to LCC_46.csv, Exception: Incompatible SRF Parameter
Set
Test_SRMmax, LCC_46.csv to Lon_Lat.csv, Exception: Incompatible SRF Parameter
Set
Test_SRMmax, Lon_Lat.csv to Mercator_28.csv, 300, 0.000211504413986261,
0.052903074771642
Test_SRMmax, Mercator_28.csv to Lon_Lat.csv, 300, 0, 0.000380789435076393
Test_SRMmax, Lon_Lat.csv to Mercator_28a.csv, 300, 0.000211503356695175,
0.0529030710463556
Test_SRMmax, Mercator_28a.csv to Lon_Lat.csv, 300, 0, 0.000380789435076393
Test_SRMmax, Lon_Lat.csv to Mercator_29.csv, 300, 0.000183473218475712,
0.0458918958926174
Test_SRMmax, Mercator_29.csv to Lon_Lat.csv, 300, 0, 0.000381102261885513
Test_SRMmax, Lon_Lat.csv to Mercator_30.csv, 300, 0.000148053089790383,
0.037032753229939
Test_SRMmax, Mercator_30.csv to Lon_Lat.csv, 300, 0, 0.000381204179223797
Test_SRMmax, Lon_Lat.csv to Mercator_31.csv, 300, 0.000211504413986261,
0.0529030747733655
Test_SRMmax, Mercator_31.csv to Lon_Lat.csv, 300, 0, 0.000380789662435794
Test_SRMmax, Lon_Lat.csv to Mercator_31a.csv, 300, 0.000183473218475712,
0.0458918958912901
Test_SRMmax, Mercator_31a.csv to Lon_Lat.csv, 300, 0, 0.000381102062462656
Test_SRMmax, Lon_Lat.csv to Mercator_31b.csv, 300, 0.000183474272489548,
0.0458918958912901
Test_SRMmax, Mercator_31b.csv to Lon_Lat.csv, 300, 0, 0.000381100483145287
Test_SRMmax, Lon_Lat.csv to Ney_48.csv, Ney SRF not supported
Test_SRMmax, Ney_48.csv to Lon_Lat.csv, Ney SRF not supported
Test_SRMmax, Lon_Lat.csv to Ney_47.csv, Ney SRF not supported
Test_SRMmax, Ney_47.csv to Lon_Lat.csv, Ney SRF not supported
Test_SRMmax, Lon_Lat.csv to PolarStereo_32.csv, 252, 0.000419197672253563,
0.0258558383211493
Test_SRMmax, PolarStereo_32.csv to Lon_Lat.csv, 209, 4.69052628639038e-008,
0.00038151239272577
Test_SRMmax, Lon_Lat.csv to PolarStereo_32a.csv, 252, 0.000419197672253563,
0.025855838728603
Test_SRMmax, PolarStereo_32a.csv to Lon_Lat.csv, 209, 4.69052628639038e-008,
0.00038151239272577
Test_SRMmax, Lon_Lat.csv to PolarStereo_32b.csv, 252, 0.000293187313380958,
0.0180987874045968
Test_SRMmax, PolarStereo_32b.csv to Lon_Lat.csv, 224, 1.17067171846081e-007,
0.000381296508482604
```

Test_SRMmax, Lon_Lat.csv to PolarStereo_33.csv, 252, 0.000391141453155978,
0.0241265594959259
Test_SRMmax, PolarStereo_33.csv to Lon_Lat.csv, 215, 4.47280576117359e-008,
0.000381295038154911
Test_SRMmax, Lon_Lat.csv to PolarStereo_34.csv, 252, 0.000419292107276018,
0.0258554814719444
Test_SRMmax, PolarStereo_34.csv to Lon_Lat.csv, 212, 4.69052628639038e-008,
0.000381506752136568
Test_SRMmax, Lon_Lat.csv to PolarStereo_34a.csv, 252, 0.000391192585067766,
0.0241268068875943
Test_SRMmax, PolarStereo_34a.csv to Lon_Lat.csv, 211, 4.45187478651762e-008,
0.00038144001542608
Test_SRMmax, Lon_Lat.csv to PolarStereo_34b.csv, 252, 0.000391192596210981,
0.0241268069471143
Test_SRMmax, PolarStereo_34b.csv to Lon_Lat.csv, 211, 4.58726742220965e-008,
0.00038144001542608
Test_SRMmax, Lon_Lat.csv to PolarStereo_35.csv, 252, 0.000419288998205169,
0.0258558737114072
Test_SRMmax, PolarStereo_35.csv to Lon_Lat.csv, 209, 4.69052628639038e-008,
0.000381512393391594
Test_SRMmax, Lon_Lat.csv to PolarStereo_35a.csv, 252, 0.000391224440113484,
0.0241265930235386
Test_SRMmax, PolarStereo_35a.csv to Lon_Lat.csv, 215, 4.43198423644104e-008,
0.000381295038154911
Test_SRMmax, Lon_Lat.csv to PolarStereo_36.csv, 111, 0.000419254768020084,
0.021778890388896
Test_SRMmax, PolarStereo_36.csv to Lon_Lat.csv, 71, 4.69052628639038e-008,
0.000353769370532931
Test_SRMmax, Lon_Lat.csv to PolarStereo_36a.csv, 111, 0.000391153251395546,
0.0203222285279267
Test_SRMmax, PolarStereo_36a.csv to Lon_Lat.csv, 70, 4.54969341130958e-008,
0.000353837632266746
Test_SRMmax, Lon_Lat.csv to TransMerc_49.csv, 66, 5.64884257905767e-010,
0.000637112185359001
Test_SRMmax, TransMerc_49.csv to Lon_Lat.csv, 66, 5.70551786294043e-010,
0.00276694164617706
Test_SRMmax, Lon_Lat.csv to TransMerc_49a.csv, 66, 4.30736690759659e-008,
0.000637069344520569
Test_SRMmax, TransMerc_49a.csv to Lon_Lat.csv, 64, 4.06982792571014e-008,
0.00276698574508127
Test_SRMmax, Lon_Lat.csv to TransMerc_50.csv, 71, 8.10250639915466e-006,
0.000636642772448865
Test_SRMmax, TransMerc_50.csv to Lon_Lat.csv, 71, 6.1719543180262e-007,
0.00277182644903772
Test_sphere, Lon_Lat.csv to LCC_60.csv, 300, 2.47714213974188e-008,
1.04297164783592e-005
Test_sphere, LCC_60.csv to Lon_Lat.csv, 300, 0, 6.84213903986634e-007
Test_sphere, Lon_Lat.csv to LCC_60a.csv, 300, 4.65661287307739e-008,
0.0455912039798063
Test_sphere, LCC_60a.csv to Lon_Lat.csv, 300, 1.41357985842823e-009,
0.00865865116965006
Test_sphere, Lon_Lat.csv to LCC_61.csv, 300, 3.19584421529403e-005,
0.0066746355576476
Test_sphere, LCC_61.csv to Lon_Lat.csv, 300, 2.93170188787499e-005,
0.00935023718831485
Test_sphere, Lon_Lat.csv to LCC_62.csv, 300, 2.35711561721142e-008,
2.41241377986281e-005

```
Test_sphere, LCC_62.csv to Lon_Lat.csv, 300, 1.41357985842823e-009,
9.16641076056836e-007
Test_sphere, Lon_Lat.csv to LCC_62a.csv, 300, 2.51628325015469e-008,
2.42184213798607e-005
Test_sphere, LCC_62a.csv to Lon_Lat.csv, 300, 7.06789929214115e-010,
7.39740700580065e-007
Test_sphere, Lon_Lat.csv to LCC_63.csv, 300, 2.60770320892334e-008,
2.53882291900524e-006
Test_sphere, LCC_63.csv to Lon_Lat.csv, 300, 0, 8.8364600094405e-007
Test_sphere, Lon_Lat.csv to LCC_64.csv, 300, 0.000321165392554622,
0.0110012488668346
Test_sphere, LCC_64.csv to Lon_Lat.csv, 300, 4.96166530308309e-007,
0.000136901827149544
Test_sphere, Lon_Lat.csv to LCC_65.csv, 300, 9.27288779165189e-008,
2.87775390524984e-006
Test_sphere, LCC_65.csv to Lon_Lat.csv, 300, 2.20871852879411e-009,
2.88076451141454e-006
Test_sphere, Lon_Lat.csv to LCC_66.csv, 300, 5.3443635759516e-008,
0.000310509664698685
Test_sphere, LCC_66.csv to Lon_Lat.csv, 300, 3.7172148830415e-008,
1.21001499069945e-006
Test_sphere, Lon_Lat.csv to LCC_67.csv, 300, 1.37261757534828e-006,
0.055352537611593
Test_sphere, LCC_67.csv to Lon_Lat.csv, 300, 1.37117246267538e-006,
0.00232038561875955
Test_sphere, Lon_Lat.csv to LCC_68.csv, 300, 0.0070968184314018,
0.022054825736481
Test_sphere, LCC_68.csv to Lon_Lat.csv, 300, 8.36485881224905e-007,
0.000212723601285799
Test_sphere, Lon_Lat.csv to LCC_69.csv, Exception: Incompatible SRF Parameter
Set
Test_sphere, LCC_69.csv to Lon_Lat.csv, Exception: Incompatible SRF Parameter
Set
Test_sphere, Lon_Lat.csv to Mercator_51.csv, 300, 1.11758708953857e-008,
1.43872312857315e-005
Test_sphere, Mercator_51.csv to Lon_Lat.csv, 300, 0, 5.87943609408888e-007
Test_sphere, Lon_Lat.csv to Mercator_51a.csv, 300, 1.49011611938477e-008,
1.43909339629506e-005
Test_sphere, Mercator_51a.csv to Lon_Lat.csv, 300, 0, 5.85983399065315e-007
Test_sphere, Lon_Lat.csv to Mercator_52.csv, 300, 3.25962901115417e-008,
1.31788587718062e-005
Test_sphere, Mercator_52.csv to Lon_Lat.csv, 300, 0, 6.09661764990871e-007
Test_sphere, Lon_Lat.csv to Mercator_53.csv, 300, 1.16415321826935e-008,
1.05776592700142e-005
Test_sphere, Mercator_53.csv to Lon_Lat.csv, 300, 0, 8.09078039194165e-007
Test_sphere, Lon_Lat.csv to Mercator_54.csv, 300, 1.13086388674259e-007,
1.4390175849312e-005
Test_sphere, Mercator_54.csv to Lon_Lat.csv, 300, 0, 6.57044384932635e-007
Test_sphere, Lon_Lat.csv to Mercator_54a.csv, 300, 9.79356854141494e-008,
1.31856813332219e-005
Test_sphere, Mercator_54a.csv to Lon_Lat.csv, 300, 0, 7.80651082838086e-007
Test_sphere, Lon_Lat.csv to Mercator_54b.csv, 300, 9.68575477600098e-008,
1.31893864875032e-005
Test_sphere, Mercator_54b.csv to Lon_Lat.csv, 300, 0, 7.81616201196255e-007
Test_sphere, Lon_Lat.csv to Ney_71.csv, Ney SRF not supported
Test_sphere, Ney_71.csv to Lon_Lat.csv, Ney SRF not supported
Test_sphere, Lon_Lat.csv to Ney_70.csv, Ney SRF not supported
```

Test_sphere, Ney_70.csv to Lon_Lat.csv, Ney SRF not supported
Test_sphere, Lon_Lat.csv to PolarStereo_55.csv, 252, 0, 1.53411140153789e-006
Test_sphere, PolarStereo_55.csv to Lon_Lat.csv, 223, 1.41357985842823e-009,
5.90510148157952e-007
Test_sphere, Lon_Lat.csv to PolarStereo_55a.csv, 252, 0, 1.53367989199901e-
006
Test_sphere, PolarStereo_55a.csv to Lon_Lat.csv, 223, 1.41357985842823e-009,
5.89225158488262e-007
Test_sphere, Lon_Lat.csv to PolarStereo_55b.csv, 252, 1.62981450557709e-009,
1.12561974674463e-006
Test_sphere, PolarStereo_55b.csv to Lon_Lat.csv, 230, 3.6753076319134e-008,
8.84277910477777e-007
Test_sphere, Lon_Lat.csv to PolarStereo_56.csv, 252, 5.58793544769287e-009,
1.54980807565153e-006
Test_sphere, PolarStereo_56.csv to Lon_Lat.csv, 219, 6.71450432753409e-009,
6.87940544355078e-007
Test_sphere, Lon_Lat.csv to PolarStereo_57.csv, 252, 3.1237508787305e-009,
1.00760229313804e-006
Test_sphere, PolarStereo_57.csv to Lon_Lat.csv, 226, 4.06168096074863e-008,
6.38352861399537e-007
Test_sphere, Lon_Lat.csv to PolarStereo_57a.csv, 252, 1.01863406598568e-008,
1.26955914886279e-006
Test_sphere, PolarStereo_57a.csv to Lon_Lat.csv, 220, 3.72676320917817e-008,
6.87954355513313e-007
Test_sphere, Lon_Lat.csv to PolarStereo_57b.csv, 252, 1.02445483207703e-008,
1.26948286011266e-006
Test_sphere, PolarStereo_57b.csv to Lon_Lat.csv, 220, 3.72676320917817e-008,
6.87761099580543e-007
Test_sphere, Lon_Lat.csv to PolarStereo_58.csv, 252, 9.31322574615479e-010,
1.53567273596216e-006
Test_sphere, PolarStereo_58.csv to Lon_Lat.csv, 223, 1.41357985842823e-009,
5.9054188846257e-007
Test_sphere, Lon_Lat.csv to PolarStereo_58a.csv, 252, 9.31322574615479e-009,
1.55065208673477e-006
Test_sphere, PolarStereo_58a.csv to Lon_Lat.csv, 219, 6.71450432753409e-009,
6.87719715705118e-007
Test_sphere, Lon_Lat.csv to PolarStereo_59.csv, 111, 1.74000993292158e-008,
9.57941667805879e-007
Test_sphere, PolarStereo_59.csv to Lon_Lat.csv, 85, 4.06168096074863e-008,
5.57902464033805e-007
Test_sphere, Lon_Lat.csv to PolarStereo_59a.csv, 111, 1.49011611938477e-008,
1.1116356136608e-006
Test_sphere, PolarStereo_59a.csv to Lon_Lat.csv, 79, 5.5129614478701e-008,
6.89715155228241e-007
Test_sphere, Lon_Lat.csv to TransMerc_72.csv, 66, 1.16218487640948e-007,
5.63410920975438e-007
Test_sphere, TransMerc_72.csv to Lon_Lat.csv, 66, 1.41357985842823e-009,
8.72255499434866e-005
Test_sphere, Lon_Lat.csv to TransMerc_72a.csv, 66, 3.1978802839534e-008,
5.9502908560011e-007
Test_sphere, TransMerc_72a.csv to Lon_Lat.csv, 64, 1.41357985842823e-008,
8.72065624766737e-005
Test_sphere, Lon_Lat.csv to TransMerc_73.csv, 71, 6.05035246763156e-008,
8.19529345476624e-007
Test_sphere, TransMerc_73.csv to Lon_Lat.csv, 71, 1.0813885916976e-007,
0.000495939578571915

```
WGE, geodetic_101.csv to rectangular_103.csv, 465, 1.47773920917936e-007,
0.000101433130052283
WGE, rectangular_103.csv to geodetic_101.csv, 451, 0, 0.000878061633994873
WGE, geodetic_101.csv to spherical_104.csv, Spherical SRF not supported
WGE, spherical_104.csv to geodetic_101.csv, Spherical SRF not supported
WGE, geodetic_101.csv to ellipsoidal_105.csv, Ellipsoidal SRF not supported
WGE, ellipsoidal_105.csv to geodetic_101.csv, Ellipsoidal SRF not supported
Test_SRMmax, geodetic_106.csv to rectangular_108.csv, 465, 1.192905853l6948e-
007, 0.00159103050874449
Test_SRMmax, rectangular_108.csv to geodetic_106.csv, 449, 0,
0.0141402706503869
Test_SRMmax, geodetic_106.csv to spherical_109.csv, Spherical SRF not
supported
Test_SRMmax, spherical_109.csv to geodetic_106.csv, Spherical SRF not
supported
Test_SRMmax, geodetic_106.csv to ellipsoidal_110.csv, Ellipsoidal SRF not
supported
Test_SRMmax, ellipsoidal_110.csv to geodetic_106.csv Ellipsoidal SRF not
supported
```

Appendix D

A sample accuracy assessment output srm_datum_accuracy_results.csv file is as follows:

Note: These files can be viewed in MS Excel in a tabular form. You may cut and paste the following into an ASCII test file with extension ".csv", and from there, load into Excel.

```
Datum conversion accuracy assessment for SRM C++ 4.3
(The results are given as the Euclidean distance (in meters) between the
computed coordinate and the gold data)

Test conducted: Wed Jun 25 09:58:35 2008

Src ORM, Tgt ORM, Count, MIN (m), MAX (m)

ADI-M, WGE, 63, 8.53482834778243e-005, 0.000684794025855462
ADI-A, WGE, 25, 0.000105869212791717, 0.000649439183311397
ADI-B, WGE, 63, 5.79789479334134e-005, 0.000723187539449374
ADI-C, WGE, 25, 0.000144617845158476, 0.00065220103845651
ADI-D, WGE, 25, 0.000137210658688357, 0.000688068315707844
ADI-E, WGE, 25, 0.000183871177698355, 0.000711967586058017
ADI-F, WGE, 25, 3.42482206188252e-005, 0.000759040794003536
AFG, WGE, 42, 0.0001142325238321, 0.000728725012330328
AIA, WGE, 4, 0.000240846327600401, 0.000513322113202536
AIN-A, WGE, 4, 0.000283328358896137, 0.000527836218703765
AIN-B, WGE, 63, 9.47155455725548e-005, 0.000700950150624384
AMA, WGE, 9, 0.000260401306694595, 0.000705106629580444
ANO, WGE, 9, 0.000258595970091232, 0.000727018283424189
ARF-M, WGE, 81, 5.21662214311581e-005, 0.000735907679517239
ARF-A, WGE, 25, 0.000180725408762206, 0.000681688885792637
ARF-B, WGE, 9, 0.000138407818754077, 0.000637434071935685
ARF-C, WGE, 15, 7.69353986064306e-005, 0.000617219724687299
ARF-D, WGE, 12, 0.00022559943899655, 0.000593523770849389
ARF-E, WGE, 25, 8.43136497076124e-005, 0.000699902268419647
ARF-F, WGE, 30, 9.76516137302036e-005, 0.000683657938905388
ARF-G, WGE, 25, 0.000140659470561947, 0.000579546042190806
ARF-H, WGE, 20, 0.000185895238732357, 0.0006996939804098
ARS-M, WGE, 25, 0.00017942249711705, 0.000594493436922239
ARS-A, WGE, 25, 5.56233327911203e-005, 0.000719710620029538
ARS-B, WGE, 25, 0.000136056355087104, 0.000668853371221885
ASC, WGE, 4, 8.92900495825326e-005, 0.000337895439549552
ASM, WGE, 4, 0.000377988567304506, 0.000548306646905164
ASQ, WGE, 4, 0.000329199624069217, 0.000603598321105801
ATF, WGE, 4, 0.00031105579523321, 0.0005238800106655
AUA, WGE, 81, 8.59962951137982e-005, 0.000706681689828524
AUG, WGE, 81, 0.000127008757798357, 0.000757049986180332
BAT, WGE, 91, 9.4655697253664e-005, 0.000756555964170997
BID, WGE, 25, 7.0559157517937e-005, 0.000714765408706571
BER, WGE, 4, 0.000376576423406989, 0.000669783068406664
BOO, WGE, 20, 0.000178135910296264, 0.000665623241206696
BUR, WGE, 9, 0.00021732097528125, 0.000679871762985266
CAC, WGE, 45, 2.67754004743137e-005, 0.000658795154315392
CAI, WGE, 35, 9.69147533823896e-005, 0.000637817210637768
CAO, WGE, 20, 0, 0.000770879448032731
```

CAP, WGE, 30, 0.000144853732590523, 0.000696965400999164
CAZ, WGE, 24, 6.82119524919458e-005, 0.00054050621568625
CCD, WGE, 15, 0.000112752027196039, 0.000525312431976338
CGE, WGE, 25, 0.000102039208557214, 0.000665825510585806
CHI, WGE, 9, 0, 0.000563186523306158
CHU, WGE, 25, 6.74800046661727e-005, 0.000677263254786291
COA, WGE, 63, 7.44910598612308e-005, 0.000732991229792425
DAL, WGE, 12, 0.000115375770033492, 0.000708499242717393
DID, WGE, 4, 8.57069841707881e-005, 0.000516083869771412
DOB, WGE, 4, 0.000328074213011248, 0.00054967412112793
EAS, WGE, 4, 6.1658932393854e-005, 0.000614668128967747
ENW, WGE, 12, 6.99725712992829e-005, 0.000661109887768964
EST, WGE, 12, 0.000112462589317352, 0.00052172391757494
EUR-M, WGE, 55, 5.42197010706884e-005, 0.000633676435368288
EUR-A, WGE, 117, 3.52089219684744e-005, 0.000616848925140719
EUR-B, WGE, 35, 6.66309928770263e-005, 0.000630598594636395
EUR-C, WGE, 25, 6.77822999458347e-005, 0.000539171752528883
EUR-D, WGE, 30, 0.000122530147658872, 0.000653757654053248
EUR-E, WGE, 4, 0.000189975034565023, 0.00044567862039257
EUR-F, WGE, 25, 0.000150740263820446, 0.000611450882261435
EUR-G, WGE, 9, 0.000114807800052287, 0.0005223903028465
EUR-H, WGE, 25, 0.000103883923063546, 0.000663375961323414
EUR-I, WGE, 9, 0.000390046529858001, 0.000658967322243146
EUR-J, WGE, 9, 0.000281182006581855, 0.000625254218974776
EUR-K, WGE, 12, 0.000114807800052287, 0.000574084816650084
EUR-L, WGE, 4, 0.000411842263743718, 0.000535084970076117
EUR-S, WGE, 35, 0.000143935504060055, 0.000709842095973375
EUR-T, WGE, 25, 7.63837021475411e-005, 0.000707446284671715
EUS, WGE, 77, 9.2590110802433e-005, 0.000650169483292201
FAH, WGE, 25, 0.000134851586593575, 0.000602928257647751
FLO, WGE, 4, 0.000222636519967007, 0.000608488676012927
FOT, WGE, 4, 0.000207017006836397, 0.00062778169571762
GAA, WGE, 6, 0.000244440246243386, 0.000586874660544884
GEO, WGE, 16, 0.000207049994361501, 0.00069242603548384
GIZ, WGE, 4, 0.000188270615356461, 0.000525620027695499
GRA, WGE, 4, 0.000328078341680464, 0.000553331258722857
GUA, WGE, 4, 0.000309858835438289, 0.000516364667294522
GSE, WGE, 16, 7.84338166711095e-005, 0.000699522669693586
HEN, WGE, 25, 0.00010916005984751, 0.000683209292520733
HER, WGE, 15, 6.80539514851931e-005, 0.00064190510655302
HIT, WGE, 45, 7.21508983237587e-005, 0.00069311423578083
HJO, WGE, 15, 0.000133523725677476, 0.000551707465428273
HKD, WGE, 6, 0.000264466557707718, 0.000619738847751661
HTN, WGE, 9, 0.000304386349391583, 0.000680665012546732
IBE, WGE, 4, 0.000366714096198744, 0.000565923304528146
IDN, WGE, 36, 3.91850924474543e-005, 0.000714458450408677
IND-B, WGE, 20, 0.000143135312182181, 0.000560521872291734
IND-I, WGE, 35, 0.000108820817725928, 0.000681125677210297
IND-P, WGE, 35, 6.93454391277418e-005, 0.000669581788459123
INF-A, WGE, 35, 0.0001697317724436, 0.00077569885024991
ING-A, WGE, 15, 0.000221211859399246, 0.000530753896422263
ING-B, WGE, 4, 0.000277285334978323, 0.000718957815063897
INH-A, WGE, 20, 5.15096818323262e-005, 0.000608820715330811
INH-A1, WGE, 20, 0.00017549953488816, 0.000683591053914874
IRL, WGE, 6, 0.000235651763708524, 0.000568136870425771
ISG, WGE, 4, 0.00036227295587067, 0.000508839209673342
IST, WGE, 9, 0.000325315464607068, 0.000696315676034577

JOH, WGE, 6, 0.000269909430072831, 0.000589799570308492
KAN, WGE, 9, 7.12686954521292e-005, 0.000567779245853865
KEG, WGE, 8, 0.000295978544710364, 0.000520013283366359
KEA, WGE, 12, 0.000126279050445553, 0.000585897866724519
KUS, WGE, 15, 0.000205681325070388, 0.000690931910792234
LCF, WGE, 4, 8.58932252219336e-005, 0.000448797632022427
LEH, WGE, 20, 0.000109726293106473, 0.000656149594431696
LIB, WGE, 20, 4.61446649850831e-005, 0.000762045327448522
LUZ-A, WGE, 15, 0.000133002635843841, 0.000604108662430422
LUZ-B, WGE, 9, 0.000190718996695532, 0.000745485696906126
MAS, WGE, 20, 0.000112542573254702, 0.000675912140375032
MER, WGE, 25, 8.3540890635297e-005, 0.000682626797599417
MID, WGE, 6, 0, 0.000650307563081876
MIK, WGE, 4, 0.000476970127100119, 0.000613457238808841
MIN-A, WGE, 25, 0.000101389117339056, 0.000665795329460025
MIN-B, WGE, 25, 2.44254978020457e-005, 0.000638669069547925
MOD, WGE, 9, 0.000149804631528258, 0.000597967467315108
MPO, WGE, 12, 0.000103575907578717, 0.000635425333791438
MVS, WGE, 4, 0.000288626520336691, 0.000600673674399154
NAH-A, WGE, 4, 0.000128228107559419, 0.000579838146594048
NAH-B, WGE, 20, 0.000109828012363525, 0.000640343994105618
NAH-C, WGE, 63, 8.00369650674565e-005, 0.00071807529816343
NAP, WGE, 4, 0.000266111801818283, 0.000607921340453797
NAR-A, WGE, 20, 6.67502941344795e-005, 0.000120284010836361
NAR-B, WGE, 24, 0, 0.000127343353986759
NAR-C, WGE, 16, 5.32010677409758e-005, 0.00012825680784736
NAR-D, WGE, 24, 3.93415212727902e-005, 0.000124997383346781
NAR-E, WGE, 50, 0, 0.00052581964558656
NAR-H, WGE, 9, 0.000334020565811857, 0.000689854702289375
NAS-A, WGE, 35, 6.61451474861816e-005, 0.000686012571068583
NAS-B, WGE, 30, 0.000112206220063253, 0.000668021703171208
NAS-C, WGE, 36, 0.000124980982091029, 0.000727298922643932
NAS-D, WGE, 30, 6.43456914666887e-005, 0.000627133653229253
NAS-E, WGE, 77, 0, 0.000630531611040718
NAS-F, WGE, 15, 0.000198292054223548, 0.000617098276759556
NAS-G, WGE, 36, 0.000134593563121927, 0.000581584579315322
NAS-H, WGE, 20, 0.000144639837697178, 0.000579728914082564
NAS-I, WGE, 45, 0, 0.000624494414880353
NAS-J, WGE, 35, 0.000126557562351739, 0.000559429494326987
NAS-L, WGE, 40, 0.000127537807232349, 0.000685611990465758
NAS-N, WGE, 12, 9.05691848279998e-005, 0.000591004739533963
NAS-O, WGE, 9, 0.000259839662933896, 0.000644606979992319
NAS-P, WGE, 20, 0.000337129399089866, 0.000727920517110186
NAS-Q, WGE, 9, 0.000163643117256663, 0.000516934838731615
NAS-R, WGE, 4, 0.000270228697132379, 0.000664970009663595
NAS-T, WGE, 12, 6.20520001789246e-005, 0.000603853651691739
NAS-U, WGE, 12, 8.90260924029626e-005, 0.000393514357603854
NAS-V, WGE, 15, 0, 0.00062675067797857
NAS-W, WGE, 9, 0.000233315661634821, 0.000470346269910331
NSD, WGE, 30, 0.000134315717212429, 0.00069905849450659
OEG, WGE, 9, 0.000279771056669436, 0.000538728281113187
OGB-M, WGE, 9, 0.000177604814537564, 0.000563709149968086
OGB-A, WGE, 9, 0.000129144936082018, 0.000627638082747919
OGB-B, WGE, 9, 0.000300983250997801, 0.000547247353363513
OGB-C, WGE, 20, 0.000123412348518123, 0.000554626493618185
OGB-D, WGE, 9, 8.78994084642965e-005, 0.000431692918821963
OHA-M, WGE, 9, 6.83472894459661e-005, 0.000614522365236718

OHA-A, WGE, 6, 0.000164591842735161, 0.000662896621078041
OHA-B, WGE, 6, 0.000290938774447988, 0.000539120807750705
OHA-C, WGE, 4, 0.000163699942569841, 0.00053606036700609
OHA-D, WGE, 6, 7.83774445901129e-005, 0.000534817705554968
OHI-M, WGE, 9, 0.000171255071836122, 0.000678554448779057
OHI-A, WGE, 4, 0.000312545019365143, 0.000614100927591543
OHI-B, WGE, 6, 0.000288507423161466, 0.000698356520793525
OHI-C, WGE, 4, 0.000269674071456813, 0.000556551255633037
OHI-D, WGE, 6, 9.78612973551707e-005, 0.000510194417524325
PHA, WGE, 12, 0.000171194156536228, 0.000615645464944824
PIT, WGE, 12, 0.000191572820131487, 0.000602009531026443
PLN, WGE, 6, 0.000159432161153684, 0.000404241806243186
POS, WGE, 6, 0.000204954312529092, 0.000592811368000116
PRP-A, WGE, 25, 3.31917813103432e-005, 0.000750550362650189
PRP-B, WGE, 45, 7.61975194215269e-005, 0.000591190390947721
PRP-C, WGE, 45, 9.89395841540135e-005, 0.000637930189543793
PRP-D, WGE, 25, 8.15757378890959e-005, 0.000589380579701663
PRP-E, WGE, 16, 1.17159321960095e-005, 0.000627704491591138
PRP-F, WGE, 20, 0.000149375954420164, 0.000677028589381577
PRP-G, WGE, 25, 0.000143662816878305, 0.000661253342905702
PRP-H, WGE, 30, 0.000130559439903926, 0.000740241470082162
PRP-M, WGE, 45, 8.67336442270797e-005, 0.000659618279290968
PTB, WGE, 27, 8.78778529501815e-005, 0.000723353087474574
PTN, WGE, 20, 0.000149565597013478, 0.000655769015795303
PUK, WGE, 198, 0, 0.000672987032521947
PUR, WGE, 9, 0.000160910271533671, 0.000613142699260259
QAT, WGE, 12, 0.000258428473739766, 0.000580052692960888
QUO, WGE, 55, 4.53377772133153e-005, 0.000570614575998048
REU, WGE, 16, 0.000196602568191421, 0.000661541346743695
SAE, WGE, 16, 0.000101970091738817, 0.000724147862744746
SAO, WGE, 4, 0.000423845012624591, 0.000567367777230621
SAP, WGE, 9, 0.000201900331501675, 0.000565909610496171
SAN-M, WGE, 56, 5.31032996813274e-005, 0.000610049854760225
SAN-A, WGE, 40, 8.52303368208182e-005, 0.000722471974946464
SAN-B, WGE, 25, 0.000156958720058627, 0.000673748985984799
SAN-C, WGE, 49, 6.74389098023793e-005, 0.000738898681256001
SAN-D, WGE, 45, 9.08598635465084e-005, 0.000579223596721974
SAN-E, WGE, 25, 0.000122724663694949, 0.000717904550483173
SAN-F, WGE, 16, 0.000192341673146258, 0.000758910761422151
SAN-G, WGE, 20, 0.000214308918025543, 0.000646551720665953
SAN-H, WGE, 25, 2.30828579616464e-005, 0.000696720258303137
SAN-I, WGE, 25, 0.000101872658540463, 0.000713821996808731
SAN-J, WGE, 4, 0.000183763671995888, 0.000359249964731092
SAN-K, WGE, 9, 7.24649226588947e-005, 0.000669202211776817
SAN-L, WGE, 30, 0.000136535666116711, 0.000618496722726913
SCK, WGE, 25, 4.30036768387167e-005, 0.000672387792948524
SGM, WGE, 4, 0.000204389644976599, 0.000655638437170408
SHB, WGE, 4, 8.9423303597071e-005, 0.000635978159898251
SOA, WGE, 4, 0.000390450100676176, 0.000711070967391275
SPK-A, WGE, 12, 0.000190164412904056, 0.000531749516412172
SPK-B, WGE, 15, 0.000159622194370156, 0.000615879810887703
SPK-C, WGE, 15, 0.000101123641051504, 0.000605984713608905
SPK-D, WGE, 9, 0.000220128225490506, 0.000545952838229192
SPK-E, WGE, 36, 9.18912928504347e-005, 0.000639629181480138
SPK-F, WGE, 9, 0.000271030728966145, 0.000557823007136946
SPK-G, WGE, 25, 0.000139538823273113, 0.000638995245836027
SRL, WGE, 16, 0.000308875720201864, 0.000661298059135942

TAN, WGE, 15, 0.000132827618040199, 0.000661268882682196
TDC, WGE, 4, 9.3635998825093e-005, 0.000439260202476475
TIL, WGE, 25, 3.6402149017962e-005, 0.000731081066192322
TOY-A, WGE, 25, 0.000109466481565474, 0.000658726557389585
TOY-B, WGE, 20, 0.000148624242166006, 0.000628135319134516
TOY-B1, WGE, 20, 0.000181812749294708, 0.000645409012504429
TOY-C, WGE, 16, 0.000122782286412368, 0.000598564371945449
TOY-M, WGE, 36, 0.000104128907413989, 0.000691335506201731
TRN, WGE, 4, 0.000161909321515689, 0.000566525078390033
VOI, WGE, 30, 8.39044503726128e-005, 0.000709918396706009
VOR, WGE, 30, 0.000109472794537291, 0.000722160157656264
WAK, WGE, 4, 3.26853296766212e-005, 0.000563702802824218
YAC, WGE, 16, 0.000181296060429717, 0.000650763644639936
ZAN, WGE, 30, 0.000165380413525537, 0.000747379210555281
KGS, WGE, 20, 4.66174643989729e-005, 8.26168791306086e-005
SIR, WGE, 44, 9.1953755086051e-005, 0.000114333681449093
WGE, ADI-M, 63, 6.95490762915862e-005, 0.000710030977977126
WGE, ADI-A, 25, 0.000105826051720114, 0.000711092023913069
WGE, ADI-B, 63, 5.85534741670301e-005, 0.000706958988458495
WGE, ADI-C, 25, 8.22310457153654e-005, 0.000734708128697017
WGE, ADI-D, 25, 9.01704020526385e-005, 0.000700143996713598
WGE, ADI-E, 25, 0.00011564408999156, 0.000632928667050799
WGE, ADI-F, 25, 7.56663716297398e-005, 0.000600316952236043
WGE, AFG, 42, 4.83693835426576e-005, 0.00073863326697798
WGE, AIA, 4, 0.000293040170718324, 0.000708566354133033
WGE, AIN-A, 4, 0.000266182867358252, 0.000517546372747619
WGE, AIN-B, 63, 4.01557051033081e-005, 0.000695252080217739
WGE, AMA, 9, 0.000125872917129261, 0.000624918518728738
WGE, ANO, 9, 0.000110556568502837, 0.000652733916682142
WGE, ARF-M, 81, 5.84541293387346e-005, 0.000736923856423037
WGE, ARF-A, 25, 6.21251407435602e-005, 0.000648614562634583
WGE, ARF-B, 9, 0.000122291259410345, 0.000597926579176583
WGE, ARF-C, 15, 8.9961672070103e-005, 0.000556041306064898
WGE, ARF-D, 12, 0.000255584600701361, 0.000695606459885719
WGE, ARF-E, 25, 0.0001273458944158, 0.00069227454876697
WGE, ARF-F, 30, 4.71418129370125e-005, 0.000752905043468362
WGE, ARF-G, 25, 3.64872553046599e-005, 0.000693106406779246
WGE, ARF-H, 20, 0.000168244880593048, 0.000681034878084499
WGE, ARS-M, 25, 0.000171140577987803, 0.000740576900921056
WGE, ARS-A, 25, 0.000130320620444184, 0.000696397384676737
WGE, ARS-B, 25, 6.37289148075525e-005, 0.000603670185454237
WGE, ASC, 4, 0.000399190943972455, 0.000517096824703023
WGE, ASM, 4, 0.000191545617324528, 0.000634148900663777
WGE, ASQ, 4, 0.000147849242932377, 0.000334220570769528
WGE, ATF, 4, 0.000166955010558082, 0.000562029166914748
WGE, AUA, 81, 5.96675748868695e-005, 0.000712119769826733
WGE, AUG, 81, 0.000111624481268522, 0.000722288785337555
WGE, BAT, 91, 1.25534742077505e-005, 0.000748390493603058
WGE, BID, 25, 5.64927402242864e-005, 0.000636487826540492
WGE, BER, 4, 0.000455022350529137, 0.000709928723438896
WGE, BOO, 20, 1.50001447721498e-005, 0.000666934574942398
WGE, BUR, 9, 0.000176652829999134, 0.000576406237582459
WGE, CAC, 45, 0.000109370185941343, 0.000687019880728259
WGE, CAI, 35, 0.000195772104952091, 0.000685965376845351
WGE, CAO, 20, 0, 0.000615762411293715
WGE, CAP, 30, 0.000172610785977804, 0.000625045039056231
WGE, CAZ, 24, 4.16815149305552e-005, 0.000560685389245342

WGE, CCD, 15, 0.000159759738175031, 0.000650911177814426
WGE, CGE, 25, 0.000138567283873719, 0.000564637439195284
WGE, CHI, 9, 0, 0.000488244080249181
WGE, CHU, 25, 0.000108534817032212, 0.000663159718935262
WGE, COA, 63, 0.000122898794885279, 0.000745374159917439
WGE, DAL, 12, 0.000246115393512063, 0.000712976426441596
WGE, DID, 4, 0.00020196493816334, 0.000361751655259052
WGE, DOB, 4, 0.000275827340228929, 0.000497678945702926
WGE, EAS, 4, 0.000277446163794161, 0.000478607644149916
WGE, ENW, 12, 4.24221484958809e-005, 0.000635377865764015
WGE, EST, 12, 5.5855333086371e-005, 0.000512938405088807
WGE, EUR-M, 55, 0.000103088359059564, 0.000597149462265144
WGE, EUR-A, 117, 2.16792698931292e-005, 0.000678507047112365
WGE, EUR-B, 35, 9.24215145560949e-005, 0.000612672353187322
WGE, EUR-C, 25, 2.78748507612024e-005, 0.000582154701130386
WGE, EUR-D, 30, 0.000132984536128628, 0.000607225153025331
WGE, EUR-E, 4, 0.000137280578104091, 0.000577655234820449
WGE, EUR-F, 25, 9.96463047181043e-005, 0.000681436973649203
WGE, EUR-G, 9, 0.000234335276426223, 0.00055672606581511
WGE, EUR-H, 25, 0.000158741968107988, 0.000677664082002159
WGE, EUR-I, 9, 0.000152315265087555, 0.000650652657051929
WGE, EUR-J, 9, 0.00019474795760335, 0.000582943750871636
WGE, EUR-K, 12, 0.000114167628625721, 0.000625876937127291
WGE, EUR-L, 4, 0.000198543092216772, 0.000392945797654548
WGE, EUR-S, 35, 0.000105410198740961, 0.000694917468812209
WGE, EUR-T, 25, 0.000132279637379923, 0.000571690446181355
WGE, EUS, 77, 5.50920304700796e-005, 0.000609850864189803
WGE, FAH, 25, 0.000122788511320817, 0.000750353365459866
WGE, FLO, 4, 0.000230841956513549, 0.000558812686134708
WGE, FOT, 4, 0.000130032221294868, 0.000420966363767448
WGE, GAA, 6, 0.000391780231361683, 0.000753936548818515
WGE, GEO, 16, 0.000181930771436849, 0.000597006978253965
WGE, GIZ, 4, 0.000274198031665933, 0.0004864150850058
WGE, GRA, 4, 0.000277787061091642, 0.000607247681724222
WGE, GUA, 4, 0.000469713628093436, 0.000545688897534816
WGE, GSE, 16, 0.000156918509475043, 0.000693827517872539
WGE, HEN, 25, 9.11391989002346e-005, 0.000695645296890169
WGE, HER, 15, 0.000117343095395851, 0.000610071879017461
WGE, HIT, 45, 0.000108047927691436, 0.000645601627246572
WGE, HJO, 15, 0.00012370777012553, 0.000585839409764442
WGE, HKD, 6, 0.000207603925406865, 0.000601778665787044
WGE, HTN, 9, 6.23781429652211e-005, 0.000632417475707207
WGE, IBE, 4, 0.000289427846243524, 0.000386058156439769
WGE, IDN, 36, 3.1625712146025e-005, 0.00070131564030387
WGE, IND-B, 20, 0.000132743517698532, 0.000713739855244919
WGE, IND-I, 35, 8.8695557826701e-005, 0.000625052516006272
WGE, IND-P, 35, 0.000132220572911687, 0.000732770854448925
WGE, INF-A, 35, 9.92060824871881e-005, 0.000739117300564487
WGE, ING-A, 15, 0.00017742130408237, 0.000622059016767433
WGE, ING-B, 4, 0.000379886108487295, 0.000588668320380416
WGE, INH-A, 20, 0.000126395552086782, 0.000621170627624374
WGE, INH-A1, 20, 8.20313135161744e-005, 0.000723068964141674
WGE, IRL, 6, 0.000239925066050327, 0.000531403430853278
WGE, ISG, 4, 0.000165010945698387, 0.000277419764439336
WGE, IST, 9, 3.03620821653337e-005, 0.000487067478911231
WGE, JOH, 6, 0.000138105876322978, 0.000499178185383416
WGE, KAN, 9, 0.000188022282573207, 0.00069701635617593

WGE, KEG, 8, 0.000224338062785103, 0.000582725251439755
WGE, KEA, 12, 0.000181219772859987, 0.000643556682428016
WGE, KUS, 15, 8.98244991484672e-005, 0.000740572888020788
WGE, LCF, 4, 0.000162981352641199, 0.000562953939756734
WGE, LEH, 20, 6.25751689793217e-005, 0.000633310312461828
WGE, LIB, 20, 9.52317960046637e-005, 0.000659667007370989
WGE, LUZ-A, 15, 0.00031610603497011, 0.000626293387238625
WGE, LUZ-B, 9, 0.000226053517123669, 0.00066134447002523
WGE, MAS, 20, 2.666661937566e-005, 0.000686423572850056
WGE, MER, 25, 0.000170776912843691, 0.000573763624910857
WGE, MID, 6, 0, 0.000702448671547613
WGE, MIK, 4, 0.000193272839367498, 0.000741757353212644
WGE, MIN-A, 25, 0.000146342563219062, 0.000603645119396991
WGE, MIN-B, 25, 7.96323129790759e-005, 0.000738809098718428
WGE, MOD, 9, 0.000153970008931036, 0.000653420997133298
WGE, MPO, 12, 0.000139235868692303, 0.000668044511753474
WGE, MVS, 4, 0.000324631125070086, 0.000513010518091492
WGE, NAH-A, 4, 0.000108241298988282, 0.000399401422172941
WGE, NAH-B, 20, 3.66576031009888e-005, 0.000664054360132494
WGE, NAH-C, 63, 0.000136897607674506, 0.000684057500019765
WGE, NAP, 4, 0.000282598349104327, 0.000631513937311492
WGE, NAR-A, 20, 6.67617774322433e-005, 0.000120550825073527
WGE, NAR-B, 24, 0, 0.000127155166103389
WGE, NAR-C, 16, 5.2963320202207e-005, 0.000127771791208392
WGE, NAR-D, 24, 3.958520908771e-005, 0.000124847434901975
WGE, NAR-E, 50, 0, 0.000524362617035209
WGE, NAR-H, 9, 0.000333705700241603, 0.000690277378131894
WGE, NAS-A, 35, 0.000116798949529643, 0.000695959298285609
WGE, NAS-B, 30, 0.000109413271636834, 0.000702100762046053
WGE, NAS-C, 36, 0.000122781141321235, 0.000670844841535415
WGE, NAS-D, 30, 6.89127871905409e-005, 0.000558509929123531
WGE, NAS-E, 77, 0, 0.00061037409672862
WGE, NAS-F, 15, 5.90533498260414e-005, 0.000574807256064888
WGE, NAS-G, 36, 0.000110449770261689, 0.000564871282197352
WGE, NAS-H, 20, 6.63296317517787e-005, 0.000580136263008395
WGE, NAS-I, 45, 0, 0.000587168282065817
WGE, NAS-J, 35, 6.42153770257754e-005, 0.000593220084229828
WGE, NAS-L, 40, 0.000158021665965481, 0.000695065787425683
WGE, NAS-N, 12, 0.000287118906737868, 0.000665967419409686
WGE, NAS-O, 9, 0.000263511446391328, 0.000607118700687507
WGE, NAS-P, 20, 0.000218045968536146, 0.000681709578919531
WGE, NAS-Q, 9, 0.000258922309772644, 0.000568215973717351
WGE, NAS-R, 4, 0.000466723548087967, 0.000572612135907035
WGE, NAS-T, 12, 9.25543110713837e-005, 0.000671127016734345
WGE, NAS-U, 12, 6.15956671216955e-005, 0.000519897128669827
WGE, NAS-V, 15, 0, 0.000625940891597988
WGE, NAS-W, 9, 0.000204156427330618, 0.000469019832427678
WGE, NSD, 30, 0.000138781281305928, 0.000694904719813455
WGE, OEG, 9, 0.000213595197283862, 0.000687671231309289
WGE, OGB-M, 9, 0.000229575814366462, 0.000561344142508429
WGE, OGB-A, 9, 0.000240835801359704, 0.000497912847811516
WGE, OGB-B, 9, 0.000124348686991425, 0.000500669543347822
WGE, OGB-C, 20, 6.57283656140818e-005, 0.000572077366064132
WGE, OGB-D, 9, 0.000194866571472919, 0.000570017147947245
WGE, OHA-M, 9, 0.000259306424067758, 0.000594672098874743
WGE, OHA-A, 6, 2.91792907878309e-005, 0.000597316957760813
WGE, OHA-B, 6, 0.000330254036631509, 0.000668010080101128

WGE, OHA-C, 4, 0.000217690567299106, 0.000426035669113181
WGE, OHA-D, 6, 0.000142345402391693, 0.000596776938430601
WGE, OHI-M, 9, 0.000131501660282535, 0.000628270277080195
WGE, OHI-A, 4, 0.000210958906830105, 0.00058284405355758
WGE, OHI-B, 6, 0.000177295014153578, 0.000694024730078236
WGE, OHI-C, 4, 0.000207301080480239, 0.000339501622037014
WGE, OHI-D, 6, 0.000129246078109171, 0.000644819622408634
WGE, PHA, 12, 0.000181164258965633, 0.000624509322922671
WGE, PIT, 12, 4.96971405828356e-005, 0.000650316130968614
WGE, PLN, 6, 6.60477538829572e-005, 0.000547817582116612
WGE, POS, 6, 0.000218506748043226, 0.000607865940790986
WGE, PRP-A, 25, 0.000115419170122686, 0.000705388546053293
WGE, PRP-B, 45, 6.15998072957346e-005, 0.000717776644441416
WGE, PRP-C, 45, 0.000152761346104966, 0.000653138801644602
WGE, PRP-D, 25, 9.85339085154735e-005, 0.000743550484325476
WGE, PRP-E, 16, 6.41681238833428e-005, 0.000658739124112394
WGE, PRP-F, 20, 8.14586017431888e-005, 0.000721800564747554
WGE, PRP-G, 25, 4.14071958017231e-005, 0.000630136011212198
WGE, PRP-H, 30, 0.00015506728358617, 0.000750990728267011
WGE, PRP-M, 45, 8.81537979752558e-005, 0.000643473321965607
WGE, PTB, 27, 0.000176763305117527, 0.000746233716697834
WGE, PTN, 20, 6.10959606204449e-005, 0.00067542784855703
WGE, PUK, 198, 0, 0.000634126307323697
WGE, PUR, 9, 8.37957007718936e-005, 0.000691683620618064
WGE, QAT, 12, 9.60873400318364e-005, 0.000698613192398033
WGE, QUO, 55, 4.84377051351454e-005, 0.00055935477631236
WGE, REU, 16, 0.000119363704478912, 0.000712868766127348
WGE, SAE, 16, 5.57853820959614e-005, 0.000537752680866026
WGE, SAO, 4, 0.000166002394393811, 0.000641650534143188
WGE, SAP, 9, 0.000189246163091935, 0.000538580100563081
WGE, SAN-M, 56, 7.48047983259737e-005, 0.000626801724784132
WGE, SAN-A, 40, 8.3230756827441e-005, 0.000634064930508107
WGE, SAN-B, 25, 0.000129757146186419, 0.000670319529813515
WGE, SAN-C, 49, 0.000104214800263595, 0.000756439566795787
WGE, SAN-D, 45, 7.62811523837954e-005, 0.000659898076268727
WGE, SAN-E, 25, 0.000123719287878404, 0.00059782678070203
WGE, SAN-F, 16, 0.000154994643172008, 0.000677014684148906
WGE, SAN-G, 20, 8.74011058724939e-005, 0.00074154217382866
WGE, SAN-H, 25, 5.00639341357245e-005, 0.000628280445510781
WGE, SAN-I, 25, 7.36212672587569e-005, 0.000701534141502246
WGE, SAN-J, 4, 0.000123035856465539, 0.000489468465500211
WGE, SAN-K, 9, 0.0002320037743642, 0.000617073268570584
WGE, SAN-L, 30, 0.000132323161608302, 0.000677414201503246
WGE, SCK, 25, 4.53823811053926e-005, 0.000721841446837876
WGE, SGM, 4, 0.000283056802122847, 0.000624214264378747
WGE, SHB, 4, 0.000257778686248323, 0.000535012995280803
WGE, SOA, 4, 0.000442171369027587, 0.000744444116407635
WGE, SPK-A, 12, 0.000157743550276786, 0.000438078052064491
WGE, SPK-B, 15, 0.000112336593917938, 0.000587415075710645
WGE, SPK-C, 15, 0.000106219925193243, 0.000638223395715249
WGE, SPK-D, 9, 0.00010175489924711, 0.000551257037260293
WGE, SPK-E, 36, 9.88959091266816e-005, 0.000588379313629153
WGE, SPK-F, 9, 0.000146858466013788, 0.000573998570832085
WGE, SPK-G, 25, 0.000100478524726637, 0.000601282541548002
WGE, SRL, 16, 0.000201525797457385, 0.000630874104736024
WGE, TAN, 15, 8.71280421530551e-005, 0.00067641634437494
WGE, TDC, 4, 0.000195001848342871, 0.000590274748735089

WGE, TIL, 25, 3.35338807800704e-005, 0.000588566991399642
WGE, TOY-A, 25, 5.41770379040165e-005, 0.000633603367119386
WGE, TOY-B, 20, 0.000211329641199272, 0.000602438692742127
WGE, TOY-B1, 20, 0.000143585271315407, 0.000646773667786607
WGE, TOY-C, 16, 7.56740391538856e-005, 0.000684493110846273
WGE, TOY-M, 36, 0.000153444600816333, 0.000645985184093849
WGE, TRN, 4, 8.84108217011204e-005, 0.000529462166735195
WGE, VOI, 30, 0.000125903402648854, 0.000637343696453944
WGE, VOR, 30, 0.000105510571150949, 0.000701034887242213
WGE, WAK, 4, 0.000176439783712463, 0.0004837884799862
WGE, YAC, 16, 0.000158599726131509, 0.000694776097532106
WGE, ZAN, 30, 0.000147173296833793, 0.000730498974802784
WGE, KGS, 20, 4.66174643989729e-005, 8.26168791306086e-005
WGE, SIR, 44, 9.23995488491718e-005, 0.000114287982731782

Appendix E

The following changes must be applied to the gold data files under GoldData_v6.1 before running the accuracy assessment software:

File Name	Changes

map_proj/Sphere/LCC_60a.csv	Replace:
	
	`SCALE FACTOR: 0.70000`
	
	With:
	
	`PARALLEL ONE: 88.721725469719`
	`PARALLEL TWO: 6.400806738511`
	`#SCALE FACTOR: 0.70000`

map_proj/Sphere/LCC_61.csv	Replace:
	
	`SCALE FACTOR: 0.70000`
	
	With:
	
	`PARALLEL ONE: 41.171577695673`
	`PARALLEL TWO: -49.946673509297`
	`#SCALE FACTOR: 0.70000`

map_proj/Sphere/LCC_67.csv	Replace:
	
	`SCALE FACTOR: 1.00000`
	
	With:
	
	`PARALLEL ONE: 89.99970000`
	`PARALLEL TWO: 89.99970000`
	`#SCALE FACTOR: 1.00000`

map_proj/SRMmax/LCC_37a.csv	Replace:
	
	`SCALE FACTOR: 0.70000`
	
	With:
	
	`PARALLEL ONE: 6.11179388706249`
	`PARALLEL TWO: 88.7228746084839`
	`#SCALE FACTOR: 0.70000`

map_proj/SRMmax/LCC_38.csv	Replace: `SCALE FACTOR: 0.70000`

	With:
	
	`PARALLEL ONE: 41.386639345913`
	`PARALLEL TWO: -50.113947418586`
	`#SCALE FACTOR: 0.70000`

map_proj/SRMmax/LCC_44.csv	Replace:
	
	`SCALE FACTOR: 1.00000`
	
	With:
	
	`PARALLEL ONE: 89.99970000`
	`PARALLEL TWO: 89.99970000`
	`#SCALE FACTOR: 1.00000`

map_proj/WGS84/LCC_14a.csv	Replace:
	
	`SCALE FACTOR: 0.70000`
	
	With:
	
	`PARALLEL ONE: 6.25610696306762`
	`PARALLEL TWO: 88.7223009764950`
	`#SCALE FACTOR: 0.70000`

map_proj/WGS84/LCC_15.csv	Replace:
	
	`SCALE FACTOR: 0.70000`
	
	With:
	
	`PARALLEL ONE: -50.0306612963145`
	`PARALLEL TWO: 41.279556918820`
	`#SCALE FACTOR: 0.70000`

map_proj/WGS84/LCC_21.csv	Replace:
	
	`SCALE FACTOR: 1.00000`
	
	With:
	
	`PARALLEL ONE: 89.99970000`
	`PARALLEL TWO: 89.99970000`
	`#SCALE FACTOR: 1.00000`

NGA_3parDT/Set_A/Local_geodetic_201.csv	Replace:
	
	`3, DI-M,  25.000,  -5.000,  0`
	`2, DI-M,  20.000,  -5.000,  0`
	
	With:

	2, DI-M, 20.000, -5.000, 0 3, DI-M, 25.000, -5.000, 0

Appendix F

Section 1.2 states that, “The difference computation is the Euclidean distance between the computed position and the expected position via the gold data”.

The following explains the meaning of the phrase, “the Euclidean distance between the computed position and the expected position”. There are four cases:

For the forward map projection tests, whose outputs are rectangular coordinates in the projection plane and may be labeled (u, v), the difference is measured as:

$$E = \sqrt{(u_1 - u_2)^2 + (v_1 - v_2)^2}$$

For the inverse map projection tests, whose outputs are longitude (λ) and latitude (φ) in radians, the difference is measured as:

$$E = \sqrt{{R_N}^2 \cos^2(\varphi)\,(\lambda_1 - \lambda_2)^2 + {R_M}^2 (\varphi_1 - \varphi_2)^2}$$

For any coordinate conversion tests whose outputs are Euclidean_3D coordinates (x, y, z), the difference is measured as:

$$E = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

For any coordinate conversion or datum transformation tests whose outputs are geodetic coordinates (λ, φ, h), the difference is measured as:

$$E = \sqrt{(R_N + h)^2 \cos^2(\varphi)\,(\lambda_1 - \lambda_2)^2 + (R_M + h)^2 (\varphi_1 - \varphi_2)^2 + (h_1 - h_2)^2}$$

In the above formulas, the quantities $R_M, R_N, R_M + h, R_N + h$ are functions of φ and h, and may be evaluated at any of φ_1 or φ_2 or $(\varphi_1 + \varphi_2)/2$ for φ and any of h_1 or h_2 or $(h_1 + h_2)/2$ for h. The symbols R_M, R_N are defined in Table 5.6 of the SRM standard ISO/IEC 18026.