Spatial Reference Model (SRM)
Accuracy Assessment Procedure

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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.

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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
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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

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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
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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
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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

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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
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Test_sphere, PolarStereo_55a.csv to Lon_Lat.csv, 223, 1.41357985842823e-009,
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Test_sphere, Lon_Lat.csv to PolarStereo_57.csv, 252, 3.1237508787305e-009,
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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
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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
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ARS-M, WGE, 25, 0.00017942249711705, 0.000594493436922239
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ASQ, WGE, 4, 0.000329199624069217, 0.000603598321105801
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AUG, WGE, 81, 0.000127008757798357, 0.000757049986180332
BAT, WGE, 91, 9.4655697253664e-005, 0.000756555964170997
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BER, WGE, 4, 0.000376576423406989, 0.000669783068406664
BOO, WGE, 20, 0.00017813591029264, 0.000665623241206696
BUR, WGE, 9, 0.00021732097528125, 0.000679871762985266
CAC, WGE, 45, 2.67754004743137e-005, 0.000658795154315392
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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
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HER, WGE, 15, 6.80539514851931e-005, 0.00064190510655302
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HJO, WGE, 15, 0.000133523725677476, 0.000551707465428273
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LEH, WGE, 20, 0.000109726293106473, 0.000656149594431696
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LUZ-B, WGE, 9, 0.000190718996695532, 0.000745485696906126
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NAS-U, WGE, 12, 8.90260924029626e-005, 0.000393514357603854
NAS-V, WGE, 15, 0, 0.00062675067797857
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NSD, WGE, 30, 0.000134315717212429, 0.00069905849450659
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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
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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.