1 Software Changes from Rev3 to Rev4

The SSMIS Revision 4 (Rev4) CD contains source code for the Ground Processing (GPS) and Early Orbit / State of Health (EOSOH) software. Rev4 contains software changes that have been made to the bonded version Rev3. These software changes have been unit tested, peer reviewed, regression tested, and bonded by Software Quality Engineering. The following summarizes the changes that are incorporated in Rev4 from Rev3.

1.1 Rev3A Changes

1.1.1 SCR 01-0015 Handle Dump Mode

This software change added the capability to compare dump mode data from the SSMIS sensor with the uplinked file to verify the contents of sensor memory. When running the EOSOH, the user can now select the "Memory Dump" option from the "Mode" button to run this option. A window will pop up that allows the user to load a file to compare with a dump mode data file (i.e. binary files *.bn and ascii files *.upl are provided as examples with the CD-ROM). The differences in the memory are displayed to the screen.

1.1.2 SCR 01-0019 Add Counts to Brightness Temperatures

This software change added the capability to view the sensor data as antenna temperatures, and brightness temperatures instead of just counts. When running the EOSOH, the user can select "Counts", "Antenna Temperatures", or "Brightness Temperatures" when the "Channel" button is clicked on.

In addition, the zooming capability feature was enhanced for the EOSOH in mapping mode. The EOSOH previously could zoom and pan. The user can now select three additional options under the "Zoom" button: 1) Re-center, 2) Regenerate Map, or 3) Zoom to Lat/Lon. The Re-center option will redisplay the map, centering around the selected view. The Regenerate Map option redisplays a selected view with the full resolution data – previously, the zoom was just sub-sampled. Finally, the Zoom to Lat/Lon allows the user to enter a specific latitude and longitude to zoom to.

1.2 Rev3B Changes

Rev3B incorporates Rev3A changes and the changes described in the following subsections.

1.2.1 SCR 01-0017 Improve Error and Warning Diagnostics

This software change was to:

- **Reduce the number of warning messages.** Instead of outputting multiple messages for specific warnings, a count is maintained and summarized at the end of the diagnostic file.
- **Provide a diagnostic summary of messages.** A new warning and error summary table appears at the end of the diagnostic files that summarizes the number of occurrences of each type of warning and error messages.
- **Provide a unique message code in diagnostic files.** Messages in the diagnostic files are now tagged with a unique string and number XXXX%MSG%YYY where XXXX may be SDRP, EDRP, VERP, UPDP, GRID, and YYY is a 3-digit number associated with the message (e.g. SDRP%MSG%001, EDRP%MSG%023)
- **Provide an exit code in the diagnostic file.** GPS processors use the Fortran 90 STOP statement at the end of the program to output an exit code. An exit code of 0 means normal termination. Non-zero value means exit due to fatal error. (Reference FORTRAN 90 Handbook (1992, Adams, Brainerd & others). The exit code value is also displayed in the diagnostic file.

1.2.2 SCR 01-0018 VERP Forward Model Upgrade

This software change updated the forward model for the upper air verification of the VERP processor. The updates are based on a 1999 study by Barbara Burns documenting improvements to the forward model. The forward model computes brightness temperatures from radiosonde and upper air profiles for comparison with SSMIS brightness temperatures.

1.2.3 SCR 01-0020 Allow Comments in Constants File

This software change cleaned up the constants file by removing old constants placeholders and references to programs no longer used (ARKP, DEFP, SHMP). In addition, the capability was added to include comments in this file subject to the following rules:

1. The first six characters on a comment line should be "#" (i.e. 6 "#" characters). This prevents any confusion between data labels and comments.
2. Comment lines and data lines cannot occur on the same line.
3. Do not put comments between a data label and its associated data lines. Data labels occur in the first 6 columns of the file and are used as search tokens to find the data. The data lines should occur on the same line, or immediately on the next line.
4. Do not break up multiple data lines with a comment

A prolog was added to the constants file to add comments to for tracking the revision history. Various comments were added throughout the file.

NOTE: The prior Rev3 release is not compatible with these new constants files.

1.2.4 SCR 01-0021 Update Constants for S/N 01

This software change updated the GPS and EOSOH constants files to reflect the Aug 2001 re-calibration of SSMIS sensor serial #1. Information regarding the changed constants was previously provided in Dec 2001 and is captured in this Rev3B release.

1.2.5 SCR 01-0022 Revise Gridded File Design

This software change redesigned the gridded SDR file and gridded EDR file to only contain records with actual data from the SDR or EDR file, instead of the 1024 x 1024 16^{th} mesh array. The I, J, and hemisphere values were added to the data record. A four digit year was added to the header. The first processing option in the GRID process control file determines the format of the output gridded file. If the option parameter is set to 1, the original 1024 x 1024 16^{th} mesh array is output. If the option parameter is set to 2, the smaller, dense gridded file is output instead.

1.2.6 SCR 01-0023 Fix Indexing in MUXCTOT

This software change corrected an index out of range when referencing the subframe ID value for computing housekeeping mux data.

1.2.7 SCR 02-0001 TDR LAS Surface Tag Dimension

This software change fixed a reference to an incorrectly dimensioned array for LAS surface tags in the Temperature Data Records (TDR) file. LAS surface tag values were incorrectly retrieved and written to the TDR file.

1.2.8 SCR 02-0002 TDR Init 1000mb Height When Read Error

This software change properly initializes the 1000mb height data to undefined if any type of open or read error occurred. In addition, the 1000mb data is checked before computing heights (Heights are computed by stacking thicknesses on the 1000 mb heights). Previously, the 1000mb data was not explicitly initialized and heights were potentially computed for undefined 1000mb data.

1.2.9 SCR 02-0003 Handle RSDR Header Value 2372

This software change handles the expected value of 2372 for the data size field in the RSDR file header. The GPS was previously checking only for 2370 and would output a warning message if the data size field was not 2370.

1.2.10 SCR 02-0004 Update WLTSLP Constants

This software change added additional precision to the warm load temperature slope value in the constants file, and improved an interpolation precision by changing the data type of a variable from integer to real.

1.2.11 SCR 02-0010 Fix Snow Surface Check in FDSFCT

This software change corrected the decision logic in the land surface type retrieval algorithm to match the SSMI. Previously, parameters were being set to undefined when they should have been calculated.

1.2.12 SCR 02-0012 Fix DSIM Reading of Constants

This software change corrected the reading of constants by the Data Simulator for the new constants file.

1.3 Rev3C Changes

Rev3C incorporates Rev3B changes and the changes described in the following subsections.

1.3.1 SCR 02-0006 Enhance EOSOH Text File Outputs

This software change outputs new data to the EOSOH report file including raw channel data, brightness temperatures, setup parameters, etc. Output is formatted in an manner to be easily exported to an Excel spreadsheet and plotted.

1.3.2 SCR 02-0007 Enhance Plot/Map Capabilities

This software change adds the capability in the EOSOH to automatically generate and save plots. The users can add annotations to plots, change titles of plots, save custom color tables, and adjust mapping and grid lines.

1.3.3 SCR 02-0008 Enhance Data Access Capabilities

This software change adds the capability in the EOSOH to numerically display the sensor data and allow the user to search for specific values. Access to IDL data structures are also provided for the user.

1.3.4 SCR 02-0009 Add 4-digit Year to Revolution and Scan Headers

This software change added a year field and spare fields to the GPS binary file revolution and scan headers. A file information word was also added to the revolution header. More information on changed file formats is provided later in this memo.

1.3.5 SCR 02-0011 Fix EDRP Indices Out of Range

This software change corrected indices into arrays that exceeded the array boundaries. Affected data included computation of thicknesses and ice edge. Compiler options were changed in the Makefiles to improve error detection during compile and run time.

1.3.6 SCR 02-0013 Add Snow Water Content

This software change added to the EDRP, computation of snow water content using the Kunzi algorithm. A new field was added to the EDR record. The field for the EDR using the Hollinger algorithm was correctly renamed to "snow depth". Coefficients for the snow water content are specified in the Environmental Parameter Inversion Coefficients (EPIC) file.

1.3.7 SCR 02-0014 Alternating Scans of Good and Bad Upper Heights

This software change corrected the upper air sounding height data in which one scan out of every 4 scans was set to undetermined because of inability to align lower and upper scan buffers.

1.4 Rev4 Changes

Rev4 incorporates Rev3C changes and the changes described in the following subsections.

1.4.1 SCR 02-0005 Improve EOSOH Error Handling

This software change improves the EOSOH handling of bad input data with respect to graceful termination of the program. The change also allows the EOSOH to continue processing data that is good while ignoring the bad data.

1.4.2 SCR 02-0015 Update or Create Constants File for All SN02-05

This software change created or updated the Constants Files for SSMIS sensors SN02 – SN05. Coefficients were updated after re-calibration of SN05. Comments were added to the Constants File to improve descriptions of constant values. Note, this file will continue to have updates as a result of sensor re-calibration and Cal Val.

1.4.3 SCR 02-0016 Check for Latitude and Longitude Out of Range

This software change checks the results of the geo-location output for latitudes and longitudes that have wrapped around and gone beyond the expected ranges. The latitudes and longitudes are adjusted to be stay within correct ranges (i.e. 361.5 degrees longitude = 1.5 degrees longitude)

1.4.4 SCR 02-0017 Handle 6 Types of Surface Tags

This software change updates the code to recognize all six surface tags (land, ocean, ice, coast, near coast, and possible ice). The rain rate and rain flag algorithms were updated to incorporate a check for possible ice, and to treat the near coast surface tag similarly to land. Other logic branches were update throughout the SDRP, EDRP, and VERP to treat the near coast and possible ice surface tags similarly to ocean.

1.4.5 SCR 02-0018 Improve Vertical Profile Diagnostics

This software change adds a process control option to allow the user to specify and display the data retrieved from the vertical profile SiteLib interface to the diagnostics file.

2 Software Changes from Rev4 to Rev5

The SSMIS GPS Revision 5 (Rev5) Compact Disc (CD) contains source code for the Ground Processing (GPS) and Early Orbit / State of Health (EOSOH) software. Rev5 contains software changes that have been made from the controlled Rev4 version. These software changes have been unit tested, peer reviewed, regression tested, and bonded by Software Quality Engineering. The following paragraphs summarize the changes incorporated in Rev5 since the previous Rev4 baseline.

2.1 Rev4A Changes

2.1.1 SCR 03-0003 Update SN 02 Constants

This software change revised the GPS constants files for SSMIS SN 02 (SDRP and EOSOH) as a result of testing prior to launch of DMSP F16.

2.2 Rev4B Changes

Rev4B incorporates Rev4A and the changes described in the following paragraphs.

2.2.1 SCR 03-0008 Lengthen filename strings in GPS

This software change to SDRP increased the filename lengths to 250 characters along with the corresponding format specifiers should provide sufficient room for adequate file and directory naming conventions. There should be an extra margin in this length to reduce or eliminate the likelihood of a name length error in the future.

2.2.2 SCR 04-0001 Ephemeris Data Validity Check

This software change to SDRP Added a check the quality of the ephemeris data and added an algorithm to check for bad altitude values. In the case of bad data, the bad ephemeris values are substituted with valid ones by interpolating or extrapolating the good values—values are received in every 1-second chunk of sensor data downlinked, although only values every 60 seconds are used for geolocation.

2.2.3 SCR 04-0002 Missing Factor in Soil Moisture Algorithm

This software change to EDRP corrects the missing is a factor of '2' in the equations that needs to be inserted in the routine EDRP_FDSOIL.f.

2.2.4 SCR 04-0003 Issues in Early Orbit 2a, 2b, 2c; Correct bad Time Start Scan values and MUX values

This software change updated EOSOH to formally incorporate many small changes to EOSOH that were necessary or requested for proper analysis during Early Orbit checkout of F16 SSMIS. Some changes fixed defects, some changes handled unanticipated problems in real data, and other changes were new features requested by the user customer. See the referenced SPR-0129 for a complete list.

2.2.5 SCR 04-0005 Leap Day Time Logic Correction

This software change to SDRP corrected the logic when the user enables the time checking in the GLOBAL.PCF file and now processes the data for leap day (29 February). The function that computes Julian day has been corrected to calculate the day correctly.

2.2.6 SCR 04-0006 Graceful Exit When Processing Large RSDR Files

This software change to SDRP will preclude a "core dump" action when the input file data exceeds 9373 scans. Proper error handling has been inserted so the code will exit gracefully in this event and a new Warning Message is output for this event.

2.2.7 SCR 04-0007 Improve Geolocation

This software change to SDRP modifies the algorithms to correctly locate scene data accurately and to within required performance. The geolocation algorithm is modified to improve accuracy and account for beam offsets due to differing feedhorn locations. Beam pointing offsets for the spacecraft and each of the six feedhorns are maintained in the constants file for each feedhorn/spacecraft pairing. Position information is calculated for a given channel according to its associated feedhorn.

2.2.8 SCR 04-0008 Azimuthal Corrections for Scan Non-Uniformities

This software change to the constants file for each sensor include addition of multiplicative and additive correction factors for each channel and beam position to correct for the scan non-uniformity (side lobe effects). The correction factors are incorporated into the CXPSP routine of SDRP and are included in the same equations as the residual Doppler, cross polarization, and spillover corrections.

2.2.9 SCR 04-0009 Update Output Files

This software change to SDRP implements switches to output products for modifying the SDR and TDR revolution headers. The TDR and SDR outputs now reflect updated latitude and longitude information as a result of the geolocation algorithm update in 04-0007 (latitudes and longitudes unique to each feedhorn). The TDRs contain all of the base point information for each of the feedhorns in the auxiliary sections. Additionally, the diagnostics files include the additions all of the way through the EDRP and GRID processors. The VERSION descriptor has changed to reflect the correct software version number in all output products for all processors. For improved maintenance, the INCLUDE and Fortran format files for the individual TDR and SDR components are integrated into a single module for each component contained in a single location.

2.2.10 SCR 04-0010 Cross Polarization Equation Update

This software change modified the Channel 14 cross polarization equation as requested by the customer to a new and improved algorithm.

2.2.11 SCR 04-0012 Vertical Polarization Correction

This software change to EDRP revised the D-Matrices for temperature and humidity and the EDRP logic for heavy cloud coverage to compensate for the incorrect RF polarization in the hardware. Channels 1 through 5 processing was changed from horizontal to vertical polarization.

2.2.12 SCR 04-0013 RSDR Processing Size Limit Increase to 400 Minutes

This software change to SDRP increased the processing capacity from the specified 300 minutes to the requested 400 minutes of RSDR input data.

2.3 Rev5 Changes

Rev5 incorporates Rev4B and the changes described in the following paragraphs.

2.3.1 SCR 04-0004 Correct Bad Time Start Scan Value

This software change updated EOSOH for the Scan Time value in the SSMIS scan header which gives the actual time elapsed during the scan that is compared with a previous known "good" start of scan time to determine a corrected TSS. Starting from a known point, a correction algorithm iterates forward and backward in time, correcting bad TSS values as needed by using the Scan Time as truth. Additionally to avoid user confusion, in modes 2a/2b/2c, the MUX button is disabled since its function is not applicable.

2.3.2 SCR 04-0011 Implement Backus-Gilbert Sampling

This software change to SDRP implemented an algorithm to replace the Channel 12-14 data with a weighted average implemented using the Backus-Gilbert resampling technique to derive the interpolated brightness temperatures for the revised geographic locations. The weighted coefficients have been calculated by NRL to provide the offset necessary for common geolocation with Channels 15-16. At the edge of scan swathes, the averaging use 3 along-track x 2 cross-track values. Additionally, the first 6 scans and the last scan in each RSDR file will be ignored to allow simplification of the averaging technique.

2.3.3 SCR 04-0014 Addition of Lat and Long to GRID Products

This software change to GRID adds latitude and longitude values in the gridded SDR Module structure for each of the data types--Imager, Environmental, Lower Air and Upper Air (8 new parameters in total) for each grid cell. In the Gridded EDR Module structure, parameters are added for latitude and longitude (2 new parameters in total) for each grid cell. In the appropriate write routines, the latitude and longitude values are saved in the newly created structure locations.

2.3.4 SCR 04-0015 Remove Banding

This software change to SDRP implements a smoothing algorithm (symmetric averaging) to eliminate the banding effect seen in the brightness temperature plots. Since the cold and warm cal temperatures for a given scan are currently averaged with the previous 7 scans, the expansion of averaging continues in groups of eight scans. The current averaging routine is performed on-board the spacecraft with the flight software and is part of the data compression. To achieve the desired result, the current cold cal and warm cal values are extracted from the condensed raw channel counts and replaced with the new averaged warm cal and cold cal values prior to calculating the new brightness temperatures.

2.3.5 SCR 04-0016 Version ID

This software change updates the embedded version number in LIBR and EOSOH to reflect Revision 5.

2.3.6 SCR 04-0017 Lower Air Surface Tag fix at Possible Ice/Ocean Interface

This software change to SDRP revised the Lower Air Surface Tag logic in 5x5 averages where the surface tags are mixed between Possible Ice and Ocean. Previous logic defaulted to Coast and resulted in erroneous EDRP humidity retrievals at these boundaries. Logic was revised to select the middle surface tag value of the 5x5 average and apply is for the entire scene.

3 Software Changes from Rev5 to Rev6

The SSMIS GPS Revision 6 (Rev6) Compact Disc (CD) contains source code for the Ground Processing (GPS) and Early Orbit / State of Health (EOSOH) software. Rev6 contains software changes that have been made from the bonded Rev5 version. These software changes have been unit tested, peer reviewed, regression tested, and bonded by Software Quality Engineering. The following paragraphs summarize the changes incorporated in Rev6 since the previous Rev5 baseline. These include change made in Interim Releases Rev5A and Rev5B that are rolled up into the Rev6 baseline.

3.1 Rev5A Changes

3.1.1 SCR 05-0004 Pad Geomagnetic Databases with Zeros to Achieve an Even 512 Byte Boundary

This software change corrects problems with all of the geomagnetic database files. This change was necessary before the geomagnetic files could be updated for the current year.

3.1.2 SCR 05-0013 Fill in Blank Resampled Data with Non-Resampled Temperatures

This software change corrects a problem with the resampling algorithm skipping the first six scans of the RSDR file because there is not enough information available to resample them. In previous GPS revisions, the software does not fill in these array values with anything, causing them to default to 0 degrees Kelvin.

3.1.3 SCR 05-0014 Update Revision Number to Rev 5.A/5A

This software change updates the version number to Revision 5A.

3.2 Rev5B Changes

Rev5B incorporates Rev5A and the changes described in the following paragraphs.

3.2.1 SCR 05-0001 Identify Constants File Values in SDRP and EDRP Products

This software change adds a file naming convention with a checksum to aid in the identification of the constants and provide a method for the user to verify datasets with the appropriate constant values.

3.2.2 SCR 05-0002 Add SDRP Processing Options to Limit SDR and TDR Diagnostics

This software change provides a method to limit the SDR and TDR diagnostics when they are enabled and not desired by the user.

3.2.3 SCR 05-0003 Correct File Unit #s in SDRP Diagnostics

This software change corrects a defect in reporting the file unit # in the SDR Diagnostics file.

3.2.4 SCR 05-0005 Remove All Hard coded Directory Paths within Routines

This software change improves the GPS code by eliminating hard coded directory paths resulting in reduced integration workload for the user community.

3.2.5 SCR 05-0006 Fix SDRP Checksum Processing Switch

This software change corrects a defect in the SDRP override file where the switch for checksum processing (1062) works only as if set to 0 – ‘process all frames’.

3.2.6 SCR 05-0009 Plot More Than 32767 Scans in EOSOH

This software change is an improvement to EOSOH to allow increase the number of scans that can be plotted.

3.2.7 SCR 05-0012 Add PNG Image Output to EOSOH

This software change is an improvement to EOSOH to add PNG image file format.

3.2.8 SCR 05-0015 Correct Sun Incursion into the Warm Load, Moon Intrusion into Cold Load and Remove Calibration Spikes

This software change is the most significant change in GPS Rev6. Correction algorithms has been incorporated to detect, smooth, and interpolate gain changes due to Sun incursions (direct and reflected) into the Warm Load causing abnormal radiometric gain calculations. Similarly, Moon incursions into the Cold Load window can also affect gain and are corrected. Finally, short duration spikes in the gain curves are not based on real sensor performance and are corrected.

3.2.9 SCR 05-0018 EOSOH Option to Skip Processing Truncated Last Scan

This software change is an improvement to EOSOH to preclude processing of the last scan in an RSDR file since this scan can have missing (zero) data values.

3.2.10 SCR 05-0019 Filter Known 32768 Values in Early Orbit 2a

This software change is an improvement to EOSOH Early Orbit 2a to add filtering for saturated values as currently exists in Early Orbit 2b and 2c modes..

3.2.11 SCR 05-0020 Use Calibration Counts in Early Orbit 2 Modes

This software change is an improvement to EOSOH Early Orbit 2 modes to add computing of Gain, NEDT, and Brightness Temperatures using Warm and Cold calibration counts as are found in Normal and Early Orbit 1 modes.

3.2.12 SCR 05-0021 Edit Raw Data and Save New RSDR File

This software change is an improvement to the EOSOH current ability to show raw RSDR data packets in non-editable tabular form. It allows the user to edit this data and create a new RSDR file with the changes.

3.2.13 SCR 05-0022 Load Multiple Adjacent RSDR Files Into EOSOH

This software change is an improvement to EOSOH to allow concatenation of RSDR files together as one continuous dataset.

3.2.14 SCR 05-0028 Fix Outstanding Bugs in EOSOH

This software change corrects minor defects in EOSOH. These include: the plot view does not resize after saving to an image file, Voltage button in the Housekeeping dialog should not select MUX 26, computation of Housekeeping warm load PRT does not save all 3 values for each scan, the extra 4 low bits of precision are lost when computing Housekeeping values, MUX current monitor data needs to be multiplied by 16 in Idle mode.

3.2.15 SCR 05-0033 Generate Geomagnetic Databases for years 2005-2010

This software change is a routine maintenance change to update the geomagnetic database tables to the current year. These tables are now current through 2010..

3.2.16 SCR 05-0035 Add Earth Surface Type Correction Factor to APC and Fix Ch 17-18 APC Additive Factor

This software change is in response to a request by the SSMIS F16 Cal/Val team to adjust the Antenna Pattern Correction factor (APC) to bring SSMIS more in line with those of the SSM/I environmental channels. Additionally, the APC formula needs to be corrected for the additive factor for channels 17 and 18. The multiplicative factor was inadvertently substituted for the additive factor. This error can be traced back to the code originally developed and provided by NRL.

3.2.17 SCR 05-0036 Fix Day Crossing Calculation

This software change corrects an interface issues with the logic for reverse time order in our files, which is the current format of the RSDR files. Resultant of this change is the calculated date of the files is now correct.

3.2.18 SCR 05-0037 Fix SSMIS Start-of-Scan Time Computation in SDRP

This software change corrects scan start time computations for errors introduced by the SSMIS flight software and missed interrupts from the OLS.

3.2.19 SCR 05-0038 Fix SSMIS Start-of-Scan Time Computation in EOSOH

This software change provides similar correction as 05-0037 in the EOSOH software.

3.2.20 SCR 05-0039 Add user notification message for interim builds

This software change is a improvement to Rev5b only to add a user notification when the build is not a formally qualified revision.

3.2.21 SCR 05-0040 Update Revision Number to Rev 5.B/5B

This software change updates the version number to Revision 5B.

3.2.22 SCR 05-0041 Implement update to constants file per Cal/Val team recommendation

This software change implements updates to the constants file for scan non-uniformity per recommendation of the SSMIS F16 Cal/Val team.

3.3 Rev6 Changes

Rev6 incorporates Rev5B and the changes described in the following paragraphs.

3.3.1 SCR 05-0034 EDRP Switch for Channel 1-5 Polarization

This software change implements a switch to use for SSMIS F16 which has Channels 1-5 with horizontal polarization versus the vertical polarization of subsequent SSMIS sensors.

3.3.2 SCR 05-0043 Scale SDR Environmental Channels 12-16 to Hundredths of a Degree

This software change modifies the scaling for environmental channels 12-16 1x2 averaging different from every other channel including channels 15 and 16 averaged at 5x5. The five channels in question are output at a resolution of 1/10th degree Celsius while the others are output at 1/100th degree Celsius. This change was made for consistency per recommendation of the SSMIS F16 Cal/Val team.

3.3.3 SCR 05-0044 Update Revision Number to Rev 6.0/60

This software change updates the version number to Revision 6.

3.3.4 SCR 05-0048 Incorporate Surface Tag Information for Non-Land Regions Into EDR Land Surface Type

This software change incorporates the non-land Surface Tag values into the Land Surface type output. This change was requested by AFWA in support of common modeling interfaces between sensors.

4 Software Changes from Rev6 to Rev7

The SSMIS GPS Revision 7 (Rev7) Compact Disc (CD) contains source code for the Ground Processing (GPS) and Early Orbit / State of Health (EOSOH) software. Rev7 contains software changes that have been made from the bonded Rev6 version. These software changes have been successfully unit tested, peer reviewed, regression tested, and bonded by Software Quality Engineering. The following paragraphs summarize the changes incorporated in Rev7 since the previous Rev6 baseline. These include changes made in Interim Release Rev6A that are rolled up into the Rev7 baseline.

4.1 Rev6A Changes

4.1.1 SCR 05-0047 Fix Temperature Scaling - SCLANT

This software change corrects a problem associated with the Sun intrusion correction (Rev6) and an NRL-provided equation for TDR correction. This equation has been updated by NRL and is implemented in this revision.

4.1.2 SCR 06-0001 Julian Day Calculation Bugs

This software change corrects a problem a GRID processor routine where the algorithm that checks for a midnight crossing does not adequately take into account possible data dropouts. When such an event occurs, and the time of day is greater than 43,200 seconds, the algorithm incorrectly results in an increment of the Julian day. This error case is now properly accounted for in this revision.

4.1.3 SCR 06-0002 Update Revision Number to Rev 6.A/6A

This software change updates the version number to Revision 6A and sets a user warning that this revision is only an interim build and not a formal release.

4.2 Rev7 Changes

Rev7 incorporates Rev6A and the changes described in the following paragraphs.

4.2.1 SCR 05-0032 VERP Polarization Change

This software change is a complement to a change in EDRP made in Rev6 to provide for horizontal polarization in Channels 1-5 for S/N 02 vertical polarization for all other sensor serial numbers.

4.2.2 SCR 05-0042 Modify EDRP to Allow Model Data for Verification

This software change modifies EDRP to support use of model data for system verification. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.3 SCR 05-0045 Repair GRID Diagnostic Output Volume Control

This software change corrects an error in the GRID logic and allows existing user settable controls within the process control and override files to reduce the amount of output data by channel type.

4.2.4 SCR 05-0046 Fix Wind Speed Scaling

This software change provides an improvement in EDRP whereby the user can modify the Wind Speed upper threshold (cap) as desired. Current default is 50 m/sec, however, certain users indicated a desire to match SSM/I settings of 25.3 m/sec. Moving the cap parameter to the constants file allows the users to set the software up per their needs.

4.2.5 SCR 06-0003 VERP model ingest and Lower Air verification

This software change allows the addition of model data as a source of verification by reading a flat file containing a global grid of temperatures, pressures, and dew points at various levels throughout the atmosphere. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.6 SCR 06-0004 Modify VERP Upper Air to use Model or Lidar Data

This software change will allow the addition of model data as a source of verification by reading a flat file containing a global grid of temperatures, pressures, and dew points at various levels throughout the atmosphere. The change will also allow Lidar data as a source of verification by reading in a station file representing the Lidar, as if it were a RAOB. This change assumes that a given site will complete the necessary interface to access RAOB/ROCOB (and now LIDAR) data. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.7 SCR 06-0005 Add RSDR v1.2 to recognized list

This software change matches a change to the supplied RSDR files that have undergone a version number update to 1.2. That version number is not recognized by the SDRP and must be included.

4.2.8 SCR 06-0006 Enhance VERP diagnostics to be Non-RAOB/ROCOB Specific

This software change updates the VERP diagnostics where VERP currently produces output (diagnostics) specific to RAOBs and ROCOBs. Specific references to RAOBs and ROCOBs must be removed when model data or LIDAR data is used instead. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.9 SCR 06-0007 Enhance Sea Surface Temperature SiteLib Interface

This software change provides an improvement to the SiteLib Sea Surface Temperature interface where currently a stub inserts patterns of values into the variables used by VERP. This change replaces the fixed data with an actual working interface that is easy to modify by users should the need arise. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.10 SCR 06-0008 UPDP Out of Order Variable Initialization

This software change corrects a design deficiency where the Update Processor (UPDP) does not generate an update to the Lower Air D-Matrices as expected from input DC-DM pairs. This change is part of a broader change towards correcting the overall design deficiencies with the UPDP now being discovered as a result of first time use with operational data.

4.2.11 SCR 06-0009 Update Revision Number to Rev 7.0/70

This software change updates the version number to Revision 7.

4.2.12 SCR 06-0010 NASA Team 2 Sea Ice algorithm

This software change implements the NASA Team II Sea Ice Concentration Algorithm to EDRP. The algorithm was amended to include geographic limiting as existed in the current implementation. A switch was added to allow the user to select between the original algorithm and this new NASA algorithm for comparison purposes. This change was made at the direction of AFWA.

4.2.13 SCR 06-0011 Move Vertical Profile Load to Lower Air Branch

This software change corrected a design error in the VERP implementation of SCR 06-0003. RAOB and RACOB data was no longer supported as specified and this error is now corrected. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.14 SCR 06-0012 Increase A-Priori File Resolution

This software change corrects a design deficiency in UPDP where coefficients contained within the a-priori files had reduced precision despite being read as double precision values. This change is part of a broader change towards correcting the overall design deficiencies with the UPDP now being discovered as a result of first time use with operational data.

4.2.15 SCR 06-0014 Unscramble Channel Order in Internal UPDP Matrices

This software change corrects a design deficiency in UPDP where in matrix calculations for humidity, the channel data are in the wrong rows/columns in the a-priori files. The resultant ordering is mixed-up and asymmetric and the resultant D-Matrices is gibberish. Additionally, the elemental triangular matrices are not converted to a full symmetrical form. This change is part of a broader change towards correcting the overall design deficiencies with the UPDP now being discovered as a result of first time use with operational data.

4.2.16 SCR 06-0015 Correct RAOB Tropopause Temperature Units in VERP

This software change corrects a design error in the implementation of SCR 06-0003 where the tropopause temperature statistics displayed in the VERSTAT.DAT file produced by the VERP are incorrect when using model data as reference. This change is part of the broader change towards use of model data for verification as funded by AFWA.

4.2.17 SCR 06-0016 Update S/N 04 Constants

This software change updates the sensor constants for Sensor S/N 04 in advance of the launch of this sensor with DMSP F17.

4.2.18 SCR 06-0017 Update Satellite IDs in EOSOH

This software change updates the Satellite ID for DMSP F17 (Sensor S/N 04). EOSOH uses this ID to determine the appropriate flight direction and set of sensor-specific constants from the input RSDR file.

4.2.19 SCR 06-0018 Correctly Read PDS Files in EOSOH

This software change corrects a problem introduced in the Rev6 build with reading of PDS files in EOSOH. These files are similar to RSDR; the customer has access to this format at the SOCC and for spacecraft level tests at Lockheed.

4.2.20 SCR 06-0020 Correct MINCB and MTABLE in CONSTANTS4.DAT

This software change corrects an escape from SCR 06-0016 discovered at a meeting with the customer to coordinate F17 pre-launch activities. Two values in the CONSTANTS4.dat file were in error, however, these typographic errors would not have significantly affected the resultant SDR values do to their numerical significance within the constant values.

5 Software Changes from Rev7 to Rev 8

The SSMIS GPS Revision 8 (Rev 8) Compact Disc (CD) contains source code for the Ground Processing (GPS) and Early Orbit / State of Health (EOSOH) software. Rev 8 contains software changes that have been made from the bonded Rev 7 version. These software changes have been successfully unit tested, peer reviewed, regression tested, and bonded by Software Quality Engineering. The following paragraphs summarize the changes incorporated in Rev 8 since the previous Rev7 baseline. These include changes made in Interim Releases Rev 7A, Rev 7C, Rev 7D, Rev 7E, and Rev 7F which are rolled up into the Rev 8 formal release baseline.

5.1 Rev7A Changes (Interim Release 27 October 2006)

Only the EOSOH Computer Software Component (CSC) of GPS was modified in this interim release.

5.1.1 SCR 05-0025 Add Secondary Y Axis to EOSOH

This software change added the capability to plot parameters against a second Y axis.

5.1.2 SCR 06-0022 Update Version Number to 7.A in EOSOH only

This software change updates the version number to Revision 7A and sets a user warning that this revision is only an interim build and not a formal release.

5.1.3 SCR 06-0023 Update EOSOH to run in the IDL Virtual Machine

This software change created a separate EOSOH executable that allows this software to execute on a PC platform. This executable was provided in addition to the normal IDL application program.

5.1.4 SCR 06-0024 Correct device status computation in EOSOH

This software change corrects an error in the EOSOH reported Receiver status shown as "Unknown" in the report file. EOSOH now correctly reports that status as "On".

5.1.5 SCR 06-0026 Improve NEDT Computation in EOSOH

This software change improves the NEDT computation in EOSOH to accommodate end of orbit ranges so these regions do not corrupt the overall orbital average.

5.2 Rev7B Changes (Not Released)

Not Applicable – the Rev7B changes were not released or distributed. These were contingency changes in GPS for possible F17 Pentaplexer failure that proved not necessary after F17 launch.

5.3 Rev7C Changes (Interim Release 13 November 2006)

Only the EOSOH CSC of GPS was modified in this interim release.

5.3.1 SCR 06-0029 Correct display errors in Rev7A EOSOH

This software change was released to correct a display error in Rev7A involving display of Longitude and another for orbit swath calculation for multiple orbits.

5.4 Rev7D Changes (Interim Release 12 December 2006)

Only the SDRP and EOSOH CSCs of GPS were modified in this interim release.

5.4.1 SCR 06-0030 SN04 CONSTANTS for Single Scan FSW Averaging

This software change was made in coordination with the Flight Software Version 8 upload into SN04 (F17). The change modifies the re-averaging in GPS to for a single scan average versus the previous running 8 scan average.

5.4.2 SCR 06-0031 SN04 CONSTANTS for EOSOH

This software change was made in coordination with the Flight Software Version 8 upload into SN04 (F17). The change adjusts the re-averaging in GPS to for a single scan average versus the previous running 8 scan average.

5.5 Rev7E Changes (Interim Release 13 March 2007)

Only the SDRP CSC of GPS was modified in this interim release.

5.5.1 SCR 06-0033 F16-SN02 CONSTANTS Update

This software change updates the trending limit thresholds for Sun intrusion, Moon intrusion, and spike corrections. These corrections are necessary due to changes in SN02 (F16) performance.

5.5.2 SCR 07-0001 RSDR Version Number Handling in the SDRP

This software change allows the user to set the latest compatible RSDR Generator version number in the Process Control file in concert with updates to the RSDR Generator.

5.5.3 SCR 07-0003 Fix Initialization and Logic Bugs in the SDRP

This software change corrects the spike correction algorithm containing two errors and one incompatibility that can potentially introduce small errors in calibration and gain corrections.

5.5.4 SCR 07-0005 Update Version Number to 7E

This software change updates the version number to Revision 7E and sets a user warning that this revision is only an interim build and not a formal release.

5.6 Rev7F Changes (Interim Release 15 May 2007)

Only the SDRP CSC of GPS was modified in this interim release. Distribution was only to the Aerospace Corporation for their evaluation.

5.6.1 SCR 07-0014 SDRP Moon Intrusion Enhancement

This software change improves the Moon intrusion algorithm to better correct for F17 performance. This change was validated through the Aerospace Corporation.

5.7 Rev 8 Changes

5.7.1 SCR 06-0013 Output Proposed A-Priori Files in UPDP

This software change updates UPDP to allow future D-Matrix updates to use the latest a-priori coefficients rather than the original baseline set from initial release. This change was performed in support of the AFWA FY07 directed change for validation improvements.

5.7.2 SCR 06-0027 Set Ice Surface Tag in NASA Team II Sea Ice Algorithm in EDRP

This software change corrects and error with our the NASA Team II Sea Ice implementation in EDRP to eliminate errors propagated to water vapor retrievals, wind speed, and cloud water retrievals.

5.7.3 SCR 07-0002 Doppler Status, Version #, and Serial # Downlink

This software change modifies the re-averaging in GPS to match the single scan averaging in Flight Software for all known configurations of Flight Software/Sensor serial number. GPS is modified to read the Flight Software version and Sensor serial number in the Subframe ID word. Default values are set for SN02 and SN04 current Flight Software versions without this versioning data. This change was performed in advance of the Flight Software changes to increase the single scan sampling requested by the Cal/Val team.

5.7.4 SCR 07-0010 Output B dot K in Upper Air SDRs instead of B dot K Squared

This software change modifies the calculated values for Upper Air SDR outputs of SDRP. This change was performed at the request of the Cal/Val team and SPO.

5.7.5 SCR 07-0012 UPDP Significance Test Modification

This software change improves the UPDP operation to preclude creation of new D-Matrices and alpha-beta files when an update is not determined to be necessary. This change was performed in support of the AFWA FY07 directed change for validation improvements.

5.7.6 SCR 07-0013 VERP Modification to output all SSMIS-Reference Differences

This software change outputs all of the individual soundings to file for analysis. A detailed analysis of the differences between the SSMIS produced soundings and reference soundings needs to be performed in order to better assess the validity or necessity of D-matrix updates. This change was performed in support of the AFWA FY07 directed change for validation improvements.

5.7.7 SCR 07-0017 Initialize SN04 Spike Correction Constants

This software change establishes the initial spike correction constants based on observed SN04 (F17) performance through May 2007.

5.7.8 SCR 07-0018 GRID Half Cell Data Offset

This software change modifies the grid cell reference point for closest data from the upper left corner to the cell center. This change was performed at the request of AFWA and validated by AFWA.

5.7.9 SCR 07-0019 GRID Swath Fill

This software change modifies the grid processing to calculate values for all empty grid cells within the swath. This change includes both gridded SDR and EDR outputs. This change was performed at the request of AFWA and validated by AFWA.

5.7.10 SCR 07-0020 Correct Raw Scan Computation in SDRP Preprocessor

This software change is an improvement in SDRP pre-processing as a result of observed data in the RSDR files where the offset of the 12-bit triplets does not remain constant throughout the file. The result of this issue causes erroneous scan counts in the SDRP pre-processing. This change forces word swapping on an individual scan basis rather than an entire file basis so these changes can be immediately detected and the scan count corrected.

5.7.11 SCR 07-0022 Incorporate NRL Rev 7Y Changes for Sea Ice Algorithm

This software change incorporates updated sea ice boundaries based on new polygon regions that are revised based on calendar date. This change was prototyped by the Cal/Val team and implemented at the request of the SPO. GPS Rev 8 is delivered with the NRL Sea Ice enabled.

5.7.12 SCR 07-0023 D-Matrix Implementation with De-Weighted Ch4 for F17-SN04

This software change implements a corrected D-Matrix to compensate for the uncalibrated Channel 4 observed on SN04 (F17). This change was validated through the Aerospace Corporation and implementation is at the request of SPO.

5.7.13 SCR 07-0024 Update Version to 8.0 and Switch Off Interim Advisory

This software change updates the version number to Revision 8 and removes the user warning for interim build.

5.7.14 SCR 07-0025 Update SN04 Constants per Cal/Val

This software change implements updates to the scan non-uniformity and antenna pattern correction (APC) constants for SN04 (F17). This change was prototyped by the Cal/Val team and implemented at the request of the SPO.

5.7.15 SCR 07-0026 Provide Sun Intrusion Correction Constants for SN04

This software change updates the Sun Intrusion constants for SN04 (F17) and enables the correction only for those orbits with potential Sun intrusion issues. The affected orbit ranges are established through DGS simulation and are entered in the constants file. This change was performed at the request of the Cal/Val team and SPO.

5.7.16 SCR 07-0027 SDRP Resampling of Channels 8-11 & 17-18

This software change resamples the imager channel data to compensate for scan misalignment. Implementation is based on repopulating the current scan data with the next scan data. This change was prototyped by the Cal/Val team and implemented at the request of the SPO. Specific implementation for GPS Rev 8 was coordinated with the Cal/Val team.

5.7.17 SCR 07-0028 Incorporate NRL Rev 7Y Changes for F16 Ch.18 Noise Reduction

This software change changes EDRP algorithms for cloud water over ocean and surface type to deweight use of F16 Ch.18 due to its high noise. The deweighting is enabled manually by a switch in the process control file. This change was prototyped by the Cal/Val team and implemented at the request of the SPO. GPS Rev 8 is delivered with this feature enabled.

5.7.18 SCR 07-0029 Update SN03 Constants per Calibration Test Report

This software change the nominal sensor calibration constants for SN03 based on the released Flight Hardware Calibration Test Report, RE-751A.

5.7.19 SCR 07-0030 SDRP Calibration Data Spike Correction Defect

This software change corrects a coding escape found during integration of Rev 8. This correction fixes a truncation of the cold calibration counts of channel 16 for several hundred scans resulting in a small temporary gain error for this channel.

6 Software Changes beyond Rev 8

The SSMIS GPS Revision 8 (Rev 8) has been updated in Interim Releases Rev 8A, Rev 8B, and Rev 8C. These updates will be formally released in the future Rev 9 release.

6.1 Rev8A Changes (Interim Release ?????)

6.1.1 SCR 08-0002 "F17-SN04 APC & Scan Non-uniformity Coefficient Update"

This software change revises constants only for antenna pattern correction (APC) and scan non-uniformity per Cal/Val team provided values.

6.2 Rev8B Changes (Interim Release ?????)

6.2.1 SCR 08-0003 "Output Ice-Snow Edge as part of NASA Team II Ice Algorithm"

Within the NASA Team II Ice algorithm in the routine SEAICE2 there is no code to insert the ice/snow edge values into the ice/snow edge array (XEDGE). This was overlooked in the original NASA Team II algorithm implementation.

6.2.2 SCR 08-0019 "SN04 Ch 7 Calibration Constants Update"

The Channel 7 warm calibration data is truncated due to the internal limits being exceeded. This error ripples through the calculated gain, the resultant SDRs, and into the lower air temperature soundings produced by the EDRP. By adjusting the cutoff limit values, this problem is eliminated.

6.2.3 SCR 08-0020 "Swap Calls to DRSIFG and RETDF in CRDR of SDRP"

When SSMIS passes from an ocean surface tag to a land surface tag and a rain flag has been set, there are regions along these areas adjacent to coasts where the surface tag and surface temperature are unavailable, but should be available. When the SDRP sets a rain flag for a scene, the EDRP does not calculate the surface type and surface temperature for that scene. There are some other isolated regions where the rain flag is not correctly set. This issue is corrected by swapping of two "CALL" statements and an additional line of code that checks/sets an error status.

6.2.4 SCR 08-0023 "Update Version Number to 8b & Enable Interim Advisory"

This software change updates the version number to Revision 8B and sets a user warning that this revision is only an interim build and not a formal release.

6.2.5 SCR 08-0024 "F17-SN04 Ch18 Coast and Near Coast APCAF Sign Correction"

A sign error in the CONSTANTS4.DAT file for computing the antenna pattern correction for Channel 18 for the Coast/Near Coast areas caused a large increase in the brightness temperatures in the coastal areas for Channel 18 (91H) data only (identified by NRL).

6.3 Rev8C Changes (Interim Release ?????)

Only the EOSOH CSC of GPS was modified in this interim release.

6.3.1 SCR 08-0004 "Output Warning for Moon Intrusions at Beginning or End of a File

When we updated the moon intrusion algorithm, warning messages for detected and repaired intrusions at the beginning or end of a file were not output to the diagnostics file. This was a simple fix requiring the addition of WRITE statements for the warning messages.

6.3.2 SCR 08-0005 "Correct F17 a priori files"

The format of the F17 operational a priori vapor file was not correct and some coefficients were missing from the F17 operational a priori background file. The UPDP uses these two files for a D-matrix update.

6.3.3 SCR 08-0021 "Improve distance calculation in LIBR_LLDIST.f"

This change affects results of both GRID and VERP. GRID uses this routine to calculate the distance between two points on the Earth in the process of scene selection for insertion of SDRs and EDRs into the

grid database. VERP uses the routine when it performs verification using RAOBs and ROCOBs as well as for cloud assignment to soundings. We have not exercised the RAOB-ROCOB option in VERP operationally and possibly never will.

6.3.4 SCR 08-0026 "F18 Deweighted Channel 8 Matrices"

This is a set of D-matrices that the community will use in the event that channel 8 aboard F18/SN03 is found to be unusable. These files will remove channel 8 from the sounding calculations of the EDRP. As part of this change, we copied all of the D-matrices and a priori files with the designation 'Fxx_Ch1-5_horizontal_polarization.DAT' to 'F18.DAT', 'F19.DAT', and 'F20.DAT'.

6.3.5 SCR 08-0027 "Increment Version Number to 8c"

This software change updates the version number to Revision 8C and sets a user warning that this revision is only an interim build and not a formal release.

6.3.6 SCR 08-0030 "Extract FSW Version from Sub-frame ID 0 and BP Averaged from Sub-frame ID 1"

In SSMIS GPS Rev8, we added the ability to read the flight software version number to the SDRP (SCR 07-0002). However, due to additional data downlink needs by the flight software, we modified the logic to limit the extraction of the flight software version to the case when the sub-frame ID is 0 (zero). We then added logic to extract the number of cold calibrate and warm calibrate beam positions averaged in the case when the sub-frame ID is 1 (one).