ZONE OVERPASS TOOL – FILE TRANSFER DOCUMENT

1. INTRODUCTION

This is the File Transfer Document for the ZoneOverPass executable program that calculates the entry and exit time when a given instrument swath passes over a zone or set of zones.

1.1 Change History

Issue	Change Description
1.3	First Issue
1.3.1	Update *mission_configuration_files* folder to v1.2
1.4	Update *mission_configuration_files* folder to v1.3 ZoneOverPass generates HTML output files Corrected path to ORBIT SDF for Aeolus
1.4.1	Update *mission_configuration_files* folder to v1.4
2.0	Distinguish between Ground Site (zone with num_points=1) and Zone in output files For Ground Site, calculate distance to ground track Swath filename in configuration file User-defined Swath identifier in configuration file Update *mission_configuration_files* folder to v1.5
2.0.1	Update *mission_configuration_files* folder to v1.6
2.1	Add support for TLE files Add support for non pre-defined missions (using satellite configuration file)
2.1.1	Update *mission_configuration_files* folder to v1.10
2.2	Draw circle of given radius around ground sites in KML output Add balloon in KML for point-zone Add relative orbit number if orbit file input is Orbit Scenario File (ORBSCT type) Update *mission_configuration_files* folder to v1.12
2.3	Add cycle number to output when ORBSCT file type Add GENERIC_MEO Add parameter to input configuration file to set the duration when using TLE file (before 15 days was used as default) Update *mission_configuration_files* folder to v1.17
2.3.1	Disable verbose command to log warning messages in zone calculation function Calculate distance to mid-swath instead of distance to ground-track Enlarge width of HTML report in CSS stylesheet
2.3.2	Correct 0.5 seconds offset in distance to mid-swath output (for point or circle zones) Calculate distance from ground site to satellite and pointing angles from ground site to satellite (for point or circle zones) Add support for SENTINEL1/2/3-C Remove *mission_configuration_files* from package
2.4	Correct issue with KML: coordinates of swath points after step not updated

1.2 Reference Documents

[RD 01] Earth Observation Mission Software File Format Specification
Ref. PE-ID-ESA-GS-584-1.1 - Issue 1.1- 21/03/17

[RD 02] OGC® KML Standard
Ref. OGC 12-007r2 - Version: 2.3.0 - Date: 2015-08-04

2. ARCHIVE CONTENT

Separate archive files are available, to support execution in Linux, Mac OS X and Windows platforms.

2.1 Linux 64-bit

The following archive file has been delivered (compressed with the zip utility):
ZoneOverPass_LINUX64_v2_4_date_19_OCT_2020.zip

The archive has the following MD5 checksum:
9ee885f6e1d84ae9e5a54e96ef81bf96

The archive contains the following files:
```
input_config_file_S2A_MSI.txt
input_config_file_S2A_ORBIT.txt
input_config_file_S3A_OLCI.txt
example_input_files/…
overpass_table.css
Readme.txt
ZoneOverPass
```

2.2 Mac OS X 64-bit

The following archive file has been delivered (compressed with the zip utility):
ZoneOverPass_MACIN64_v2_4_date_19_OCT_2020.zip

The archive has the following MD5 checksum:
0b0837e977e019c54a9249282e4c3e8b

The archive contains the following files:
```
input_config_file_S2A_MSI.txt
input_config_file_S2A_ORBIT.txt
input_config_file_S3A_OLCI
example_input_files/…
overpass_table.css
Readme.txt
ZoneOverPass
```

2.3 Windows 64-bit

The following archive file has been delivered (compressed with the zip utility):
ZoneOverPass_WINDOWS64_v2_4_date_19_OCT_2020.zip

The archive has the following MD5 checksum:
6966eb387a899f49079ed3ad06881434

The archive contains the following files:
```
input_config_file_S2A_MSI.txt
input_config_file_S2A_ORBIT.txt
input_config_file_S3A_OLCI
overpass_table.css
pthreadVC2.dll
```

```
example_input_files\…
Readme.txt
ZoneOverPass.exe
```

3. ARCHIVE CONTENT DESCRIPTION

The files contained in the archives are described in table below:

File		Description
`EXAMPLE_ZONEDBFILE.EOF`		Example Zone Database File
`input_config_file_S2A_MSI.txt`		Example configuration file of SENTINEL2A with MSI swath, with example zone database file
`input_config_file_S3A_ORBIT.txt`		Example configuration file of SENTINEL3A with ORBIT ground-track, with example zone database file
`input_config_file_S3A_OLCI.txt`		Example configuration file of SENTINEL3A with OLCI swath, with example zone database file
`example_input_files/…`		Example input orbit files and swath files Note: Package with mission files for all supported missions can be found under the link: http://eop-cfi.esa.int/Repo/PUBLIC/DOCUMENTATION/MISSION_DATA/ORBIT_SWATH_DATA/ See Readme_mission_config.txt for further details
`Readme.txt`		Readme file with example commands and input/output file description
`overpass_table.css`		CSS stylesheet file for HTML output
For LINUX 64-bit	`ZoneOverPass`	Executable file for Linux
For MAC OS X 64-bit	`ZoneOverPass`	Executable file for Mac OS X
For WINDOWS 64-bit	`ZoneOverPass.exe`	Executable file for Windows
	`pthreadVC2.dll`	Auxiliary pthread library for Windows

4. INSTALLATION

The archive can be expanded with Winzip / 7-zip (in MS Windows) or with the command unzip (in Linux/Mac OS).

5. USAGE

5.1 Executable program *ZoneOverPass*

For a requested UTC time interval, the executable program *ZoneOverPass* calculates the entry and exit times when a given instrument swath passes over a zone or set of zones. The program expects as input a configuration file setting the various input parameters, among them the mission name, orbit file, zone database file and instrument swath name.

The default orbit and swath characteristics are defined in the mission configuration files folder. It is possible to provide as orbit file other types of EOCFI-compatible OSV-based orbit files see ([RD 01]), e.g. Predicted Orbit File (ORBPRE file type) or Restituted Orbit Files (ORBRES file type).

The program generates a set of output files with the overpass tables per zone (in .CSV, .KML format and .HTML format).

5.1.1 Command line input parameters description

The command line parameters of the executable routine are the following (provided in the order in which they have to be supplied):

INPUT PARAMETERS	Definition	Value
Input Configuration File	Filename (it may include the path to the file)	Given by the user
UTC Start Time	UTC start time of the time interval CCSDS-A ASCII format with seconds (YYYY-MM-DDTHH:mm:ss)	Given by the user
UTC Stop Time	UTC stop time of the time interval CCSDS-A ASCII format with seconds (YYYY-MM-DDTHH:mm:ss)	Given by the user

5.1.2 Input configuration file format description

The contents of the input configuration file are detailed below:

INPUT PARAMETERS	Definition	Value
Satellite	Satellite identifier	AEOLUS CRYOSAT2 EARTHCARE FLEX METOPSG SEOSAT SENTINEL1A SENTINEL1B SENTINEL1C SENTINEL2A SENTINEL2B SENTINEL2C SENTINEL3A SENTINEL3B SENTINEL3C SENTINEL5P SENTINEL6 SMOS GENERIC (see Section 5.2) Mission Name String (see Section 5.2) GENERIC_MEO
Orbit Filename	Orbit Filename Default: Orbit Scenario Filename in mission_configuration_files folder	Given by the user
Instrument Swath	Instrument Swath Filename Default: Swath Definition Files in mission_configuration_files folder	Given by the user
Zone Database Filename	File with list of zones, in EO CFI / Esov NG Zone Database format	Given by the user
Swath Colour	Swath Color (aabbggrr, aa=alpha, bb=blue, gg=green rr=red, with ranges 00 to ff)	Given by the user
TLE number of days	Number of days to propagate after TLE record time (e.g to propagate for one month into the future, set to 30.0). If orbit file type other than TLE, this parameters is not used	Given by the user

5.1.3 Output file format description

The executable program *ZoneOverPass* produces two output files per zone in Zone Database file:

- Comma Separated Value (.CSV)
- Google Earth KML file (.KML)
- Web browser HTML file (.HTML)

The output file names are automatically generated using the satellite identifier, the zone name, the swath name and the start and stop UTC times.

5.1.3.1 CSV Files

5.1.3.1.1 If ORBSCT is given as input orbit file

The CSV output file contains one row per each entry/exit visibility time segment, format of the CSV output file:

- Row 1-7: Header containing execution input information
- From Row 8:
  - Column 1: UTC Time Start in calendar format (CCSDS format “yyyy-mm-ddThh:mm:ss”)
  - Column 2: Absolute Orbit Start
  - Column 3: Relative Orbit Start
  - Column 4: Cycle Start
  - Column 5: Start Seconds since Ascending Node Crossing (ANX)
  - Column 6: UTC Time Stop in calendar format (CCSDS format “yyyy-mm-ddThh:mm:ss”)
  - Column 7: Absolute Orbit Stop
  - Column 8: Relative Orbit Stop
  - Column 9: Cycle Stop
  - Column 10: Stop Seconds since Ascending Node Crossing (ANX)
  - Column 11: Pass Duration (seconds)
  - Column 12 (optional, if Ground Site): Distance from site to mid-swath [km] is the geodetic distance between the two points. The mid-swath point corresponds to the mid-point of the swath file at the time half-way between entry and exit times of the ground site circle
  - Column 13 (optional, if Ground Site): Topocentric Azimuth from site to satellite [deg]
  - Column 14 (optional, if Ground Site): Topocentric Elevation from site to satellite [deg]
  - Column 15 (optional, if Ground Site): Range from site to satellite [km]
  - Column 16 (10): Ascending or Descending Pass (ASC/DESC)
  - Column 17 (11): Zone/Ground Site Name
  - Column 18 (12): Instrument Swath Name
- Last Row: End of file (EOF)

5.1.3.1.2 If input orbit file other than ORBSCT

The CSV output file contains one row per each entry/exit visibility time segment, format of the CSV output file:

- Row 1-7: Header containing execution input information
- From Row 8:
  - Column 1: UTC Time Start in calendar format (CCSDS format “yyyy-mm-ddThh:mm:ss”)
  - Column 2: Absolute Orbit Start
  - Column 3: Start Seconds since Ascending Node Crossing (ANX)
  - Column 4: UTC Time Stop in calendar format (CCSDS format “yyyy-mm-ddThh:mm:ss”)
  - Column 5: Absolute Orbit Stop
  - Column 6: Stop Seconds since Ascending Node Crossing (ANX)
  - Column 7: Pass Duration (seconds)
  - Column 8 (optional, if Ground Site): Distance from site to mid-swath [km] is the geodetic distance between the two points. The mid-swath point corresponds to the mid-point of the swath file at the time half-way between entry and exit times of the ground site circle

- Column 9 (optional, if Ground Site): Topocentric Azimuth from site to satellite [deg]
- Column 10 (optional, if Ground Site): Topocentric Elevation from site to satellite [deg]
- Column 11 (optional, if Ground Site): Range from site to satellite [km]
- Column 12 (9): Ascending or Descending Pass (ASC/DESC)
- Column 13 (10): Zone/Ground Site Name
- Column 14 (11): Instrument Swath Name

- Last Row: End of file (EOF)

The CSV files can be opened with dedicated spreadsheet software (e.g. Excel, LibreOffice) or any text editor.

5.1.3.2 KML Files

The KML output file contains the same information as the CSV but presented graphically.
The format of the provided KML files is defined in KML Version 2.3 standard (see [RD 02]).

The KML files can be opened with Google Earth v7 or higher.

5.1.3.3 HTML Files

The HTML output file contains the same information as the CSV but presented in a tabular format, ready to be displayed in a web browser. A CSS stylesheet (*overpass_table.css*) is provided as part of the package to apply a given style to the HMTL elements. The HTML output file requires the CSS stylesheet to be located in the same folder.

The HTML files can be opened with any web browser (e.g. Firefox). Once opened in a web browser, it is possible to export the HTML report to PDF.

5.1.4 Example

5.1.4.1 Running the executable

The executable program can be called in the following way:

- From Mac OSX / Linux Terminal window

```
./ZoneOverPass input_config_file_S2A_MSI.txt 2016-06-06T00:00:00 2016-06-08T00:00:00
```

- From Windows command prompt window

```
ZoneOverPass.exe input_config_file_S2A_MSI.txt 2016-06-06T00:00:00 2016-06-08T00:00:00
```

The executable program shows the following messages:

```
Execution of program ZoneOverPass v2.4

Input data set by the user:
Satellite: SENTINEL2A
Orbit File:
  ./example_input_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF
Swath File: ./example_input_files/SENTINEL2A/SDF/SDF_MSI.S2
Swath ID: MSI
Zone File: ./example_input_files/EXAMPLE_ZONEDBFILE.EOF
Start Time: 2016-06-06T00:00:00
Stop  Time: 2016-06-08T00:00:00
Start Time: 6001.000000000000
Stop Time: 6003.000000000000
Start Orbit: 4989
Stop  Orbit: 5018
```

```
Output Filename KML:
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV:
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML:
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output Filename KML:
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV:
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML:
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output Filename KML: S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV: S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML: S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output Filename KML: S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
Output Filename CSV: S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
Output Filename HTML:
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Output files created successfully
```

5.1.4.2 Input File

Contents of the input configuration file used as example (`input_config_file_S2A_MSI.txt`):

```
SENTINEL2A
./example_input_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF
./example_input_files/SENTINEL2A/SDF/SDF_MSI.S2
./example_input_files/EXAMPLE_ZONEDBFILE.EOF
MSI
500000ff
```

5.1.4.3 Output Files

5.1.4.3.1 CSV Files

Several CSV output files are created (on per zone in zone database file):

```
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV
```

Example ZONE output file
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV:

	A	B	C	D	E	F	G	H	I	J	K
1	FILENAME	S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV									
2	CREATION_DATE	2018-06-12T15:24:36									
3	EXECUTABLE_NAME_VERSI	ZoneOverPass_v2.0									
4	MISSION	SENTINEL2A									
5	ORBIT_FILE	./mission_configuration_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF									
6	ZONE	AFRICA									
7	VALIDITY_START	2016-06-06T00:00:00									
8	VALIDITY_STOP	2016-06-08T00:00:00									
9	PASS	UTC_TIME_START	ABS_ORB	ANX_TIME	UTC_TIME_STOP	ABS_ORE	ANX_TIME	DURATION[	ASCENDIN	ZONE	SWATH
10	1	2016-06-06T08:04:5	4994	2709.51278	2016-06-06T08:19:39	4994	3590.39923	880.886454	DESC	AFRICA	MSI
11	2	2016-06-06T09:42:0	4995	2494.59228	2016-06-06T09:51:21	4995	3050.44436	555.852081	DESC	AFRICA	MSI
12	3	2016-06-06T11:21:3	4996	2419.69083	2016-06-06T11:29:09	4996	2876.39784	456.707006	DESC	AFRICA	MSI
13	4	2016-06-06T19:06:4	5001	119.981559	2016-06-06T19:07:48	5001	185.651548	65.669989	ASC	AFRICA	MSI
14	5	2016-06-06T20:37:2	5001	5564.15809	2016-06-06T20:54:06	5002	521.888342	999.688426	ASC	AFRICA	MSI
15	6	2016-06-06T22:27:4	5003	96.122194	2016-06-06T22:35:48	5003	581.624151	485.501957	ASC	AFRICA	MSI
16	7	2016-06-07T07:36:5	5008	2836.6197	2016-06-07T07:40:21	5008	3045.03545	208.415743	DESC	AFRICA	MSI
17	8	2016-06-07T07:42:3	5008	3178.8175	2016-06-07T07:44:52	5008	3315.29066	136.473158	DESC	AFRICA	MSI
18	9	2016-06-07T09:11:4	5009	2484.27609	2016-06-07T09:26:31	5009	3372.79748	888.521392	DESC	AFRICA	MSI
19	10	2016-06-07T10:50:5	5010	2395.34603	2016-06-07T11:00:03	5010	2942.8409	547.494878	DESC	AFRICA	MSI
20	11	2016-06-07T20:10:1	5015	5742.04492	2016-06-07T20:24:09	5016	536.574156	836.48741	ASC	AFRICA	MSI
21	12	2016-06-07T21:47:2	5016	5530.87337	2016-06-07T21:51:43	5016	5791.33325	260.459878	ASC	AFRICA	MSI
22	13	2016-06-07T21:55:2	5016	6010.1818	2016-06-07T21:56:03	5017	8.881835	40.658204	ASC	AFRICA	MSI
23	14	2016-06-07T21:57:1	5017	76.513713	2016-06-07T22:05:57	5017	602.952671	526.438958	ASC	AFRICA	MSI
24	EOF										

Example of GROUND_SITE output file
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV:

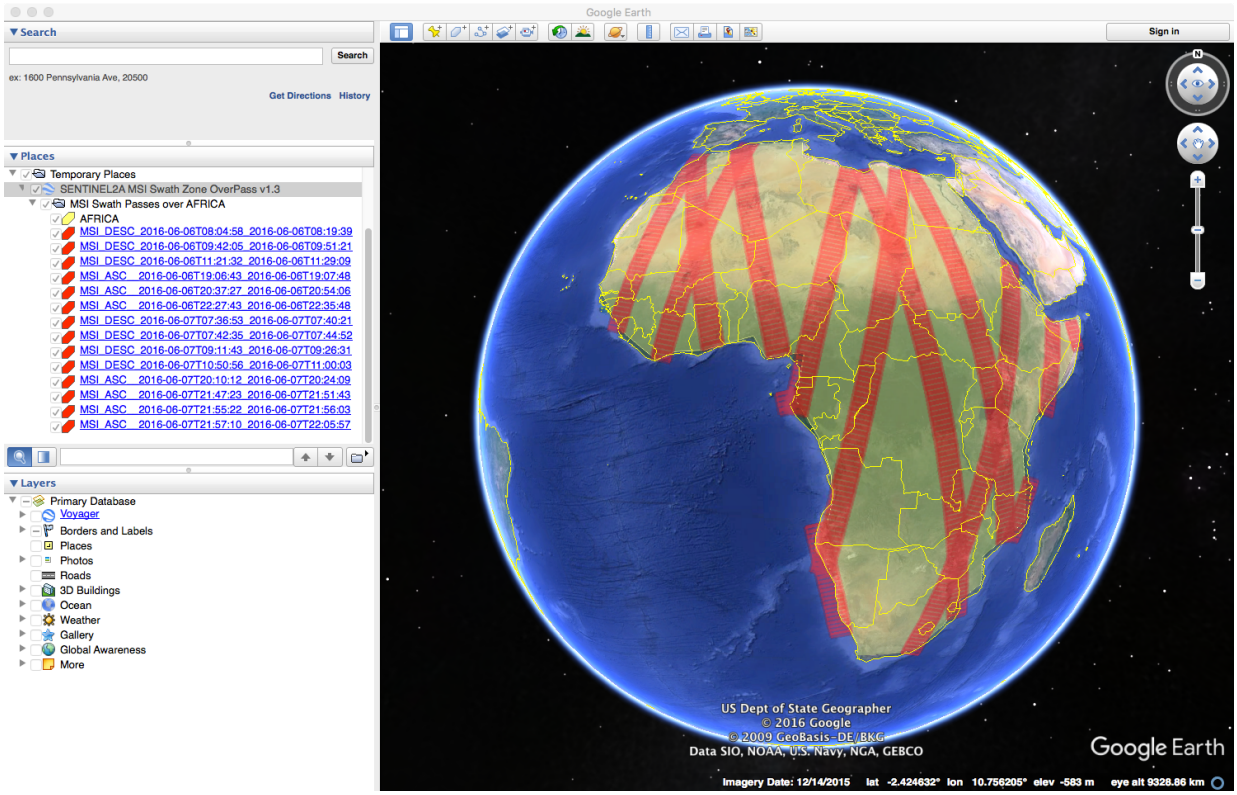
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	FILENAME	S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.CSV																	
2	CREATION_DATE	2020-10-12T18:48:03																	
3	EXECUTABLE_NAME_VERSION	ZoneOverPass_v2.3.1																	
4	MISSION	SENTINEL2A																	
5	ORBIT_FILE	./example_input_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF																	
6	GROUND_SITE	EXAMPLE_CIRCLE																	
7	GROUND_SITE_RADIUS[km]	5																	
8	VALIDITY_START	2016-06-06T00:00:00																	
9	VALIDITY_STOP	2016-06-08T00:00:00																	
10	PASS	UTC_TIME_START	ABS_ORBIT_STA	REL_ORBIT	CYCLE_S	ANX_TIME	UTC_TIME_STOP	ABS_ORBIT	REL_ORBIT_	CYCLE_STO	ANX_TIME_STC	DURATION[s]	DISTANCE_TO_MID_SWATH[	SITE_TO_SATELLITE_AZIM	SITE_TO_SATELLITE_ELE	SITE_TO_SATELLITE_RANGE[km]	ASCENDIN	GROUND_SITE	SWATH
11	1	2016-06-07T23:47:12	5018	16	39	636,20328	2016-06-07T23:47:14	5018	16	39	637,693558	1,490277	36,929997	253,307589	86,955907	794,660885	ASC	EXAMPLE_CIR	MSI
12	EOF																		

5.1.4.3.2 KML Files

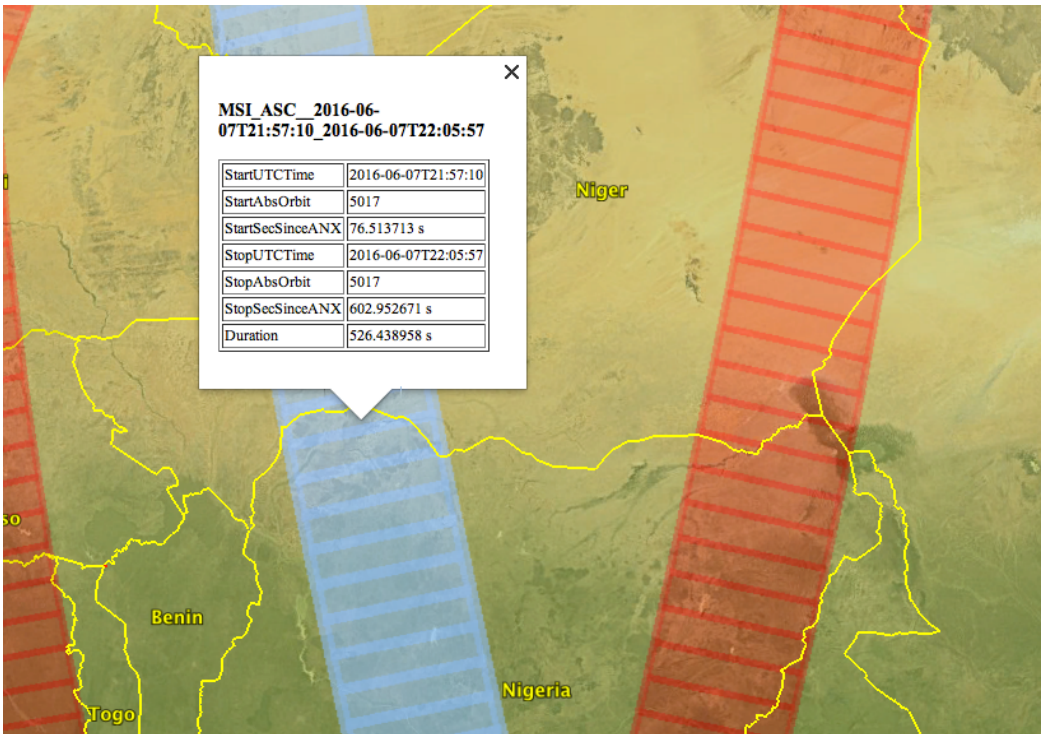
Several KML output files are created (on per zone in zone database file):
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML

After loading the files with Google Earth, the overpass data can be found in the “Places” window, under “Temporary Places”.

Example of ZONE output file
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.KML:



When moving the mouse over the swaths, the lines are highlighted (increase in thickness and lighter in colour). Then by clicking on top of the track, a balloon showing additional information is displayed, namely the absolute and relative orbit number sand the longitude and UTC time of the ascending node crossing of the selected orbit.



5.1.4.3.3 HTML Files

Several HTML output files are created (on per zone in zone database file):

```
S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
S2A_EXAMPLE_POINT_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
S2A_PACIFIC_AREA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
```

By double-clicking on the HTML file, it opens with the default browser, applying the style from CSS stylesheet.
Example of ZONE output file
S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML:

ZONE OVERPASS TABLE HTML REPORT

Creation Date: 2018-06-12T12:13:59

Filename	S2A_AFRICA_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Executable Name and Version	ZoneOverPass_v2.0
Mission	SENTINEL2A
Orbit File	./mission_configuration_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF
Zone	AFRICA
Validity Start	2016-06-06T00:00:00
Validity Stop	2016-06-08T00:00:00

Zone Overpass Table

Pass	UTC Time Start	Abs Orbit Start	ANX Time Start[s]	UTC Time Stop	Abs Orbit Stop	ANX Time Stop[s]	Duration[s]	Ascending / Descending	Zone	Swath
1	2016-06-06T08:04:58	4994	2709.512780	2016-06-06T08:19:39	4994	3590.399234	880.886454	DESC	AFRICA	MSI
2	2016-06-06T09:42:05	4995	2494.592276	2016-06-06T09:51:21	4995	3050.444357	555.852081	DESC	AFRICA	MSI
3	2016-06-06T11:21:32	4996	2419.690834	2016-06-06T11:29:09	4996	2876.397840	456.707006	DESC	AFRICA	MSI

Example of GROUND_SITE output file *S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML*:

GROUND SITE OVERPASS TABLE HTML REPORT

Creation Date: 2020-10-12T18:48:03

Filename	S2A_EXAMPLE_CIRCLE_MSI_VISIBILITY_SEGMENTS_20160606_000000_20160608_000000_0001.HTML
Executable Name and Version	ZoneOverPass_v2.3.1
Mission	SENTINEL2A
Orbit File	./example_input_files/SENTINEL2A/OSF/S2A_OPER_MPL_ORBSCT_20150625T073255_99999999T999999_0006.EOF
Ground Site	EXAMPLE_CIRCLE
Ground Site Radius	5.000000 km
Validity Start	2016-06-06T00:00:00
Validity Stop	2016-06-08T00:00:00

Ground Site Overpass Table

Pass	UTC Time Start	Abs Orbit Start	Rel Orbit Start	Cycle Start	ANX Time Start[s]	UTC Time Stop	Abs Orbit Stop	Rel Orbit Stop	Cycle Stop	ANX Time Stop[s]	Duration[s]	Distance to Mid-Swath[km]	Site to Satellite Azimuth[deg]	Site to Satellite Elevation[deg]	Site to Satellite Range[km]	Ascending / Descending	Ground Site	Swath
1	2016-06-07T23:47:12	5018	16	39	636.203281	2016-06-07T23:47:14	5018	16	39	637.693558	1.490277	36.929997	253.307589	86.955907	794.660885	ASC	EXAMPLE_CIRCLE	MSI

5.2 User-defined Mission Configuration

It is possible to use the ZoneOverPass tool with user-defined missions.

5.2.1 Input Configuration Files

A dedicated input configuration file (see Section 5.1.2) needs to be created to set the satellite identifier, the path of the orbit file and the path to the instrument swath file, among other inputs.

5.2.2 Satellite Identifier

The satellite identifier GENERIC can be used for a user-defined satellite. This identifier assumes certain values for the internal orbit parameters, among them the mean frozen eccentricity which is set to a default value (0.001165). This assumption introduces about 100 meters of error in altitude respect to the orbit that it would be obtained by applying the frozen eccentricity value that would be applicable to the user-defined orbit. For certain applications this approximation is good enough.

For more accurate orbit settings, it is possible to set the internal orbit parameters through a Satellite Configuration File (see [RD 01]). The expected file name of the Satellite Configuration File is *sat_default_conf_file.xml*. In this case, it is possible to set the satellite identifier to a string, which needs to match the mission name given to the user-defined mission folder.

5.2.3 User-defined Mission File Folder Organisation

The user-defined folder must be located at the same level of the *ZoneOverPass* executable tool. As mentioned in Section 5.2.1, the name of the folder should match the string GENERIC or the string set in the input configuration file, depending on the option selected.

5.2.4 Orbit Files

The path to the orbit file is specified in the input configuration file (see Section 5.1.2).
The supported Orbit File types are ORBSCT, ORBPRE, ORBRES and ORBTLE (see [RD 01]) for file format specification.

In the particular case of a TLE file, the format of the TLE should be as follows (example for SENTINEL-1A):

```
SENTINEL-1A
1 39634U 14016A   18203.57882331 -.00000001  00000-0  94119-5 0  9999
2 39634  98.1824 210.5045 0001348  77.6271 282.5085 14.59197755229086
```

For user-defined missions, the TLE parameters need to be set through the Satellite Configuration File [RD 01]. This means that user-defined missions having TLE as orbit file source cannot use the GENERIC identifier (so a Satellite Configuration File needs to be provided).

An intermediate ORBPRE file is created when using TLE files. This is done to improve the performance for TLE propagation beyond 1 day time span.

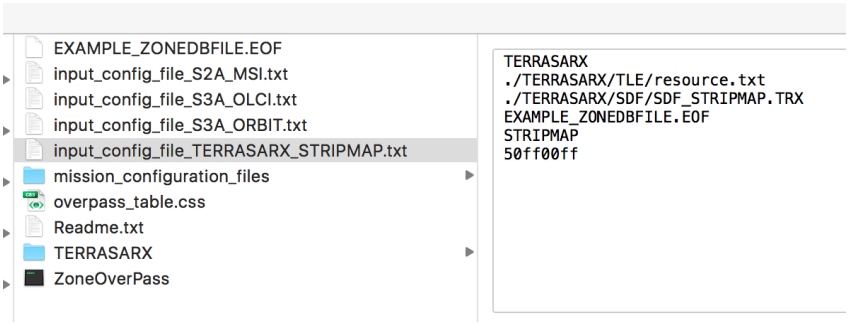
5.2.5 Instrument Swath Definition Files

The path to the instrument swath file is specified in the input configuration file (see Section 5.1.2).
See [RD 01] for file format specification.

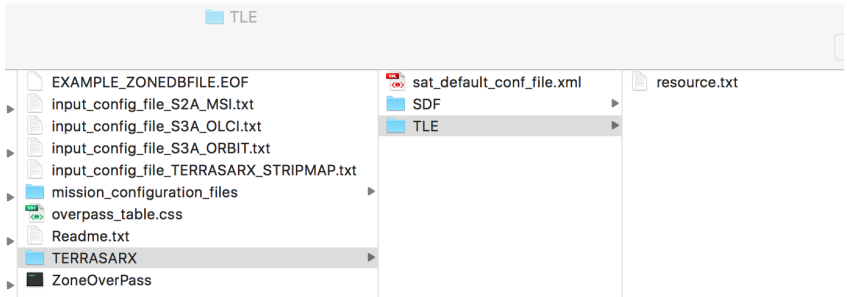
5.2.6 Example

For example, user-defined Mission File Folder TERRASARX in combination with TLE orbit files.

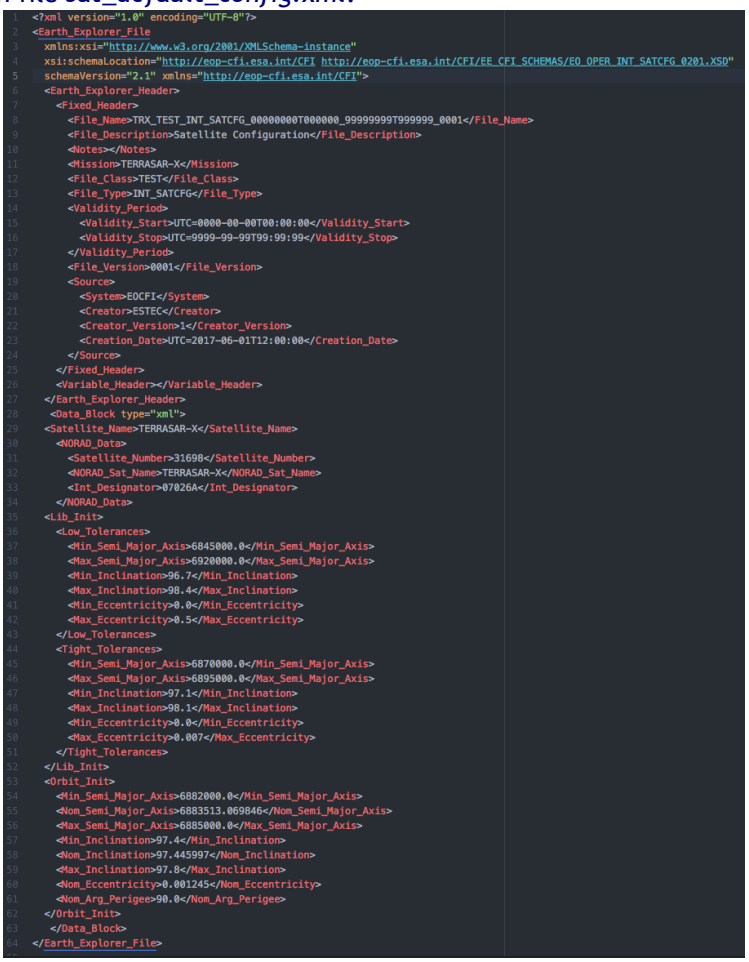
Folder name: TERRASARX
Input Configuration file example: input_config_file_TERRASARX_STRIPMAP.txt



with mission folder contents:



and satellite configuration file *sat_default_config.xml*:



```
<?xml version="1.0" encoding="UTF-8"?>
<Earth_Explorer_File
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://eop-cfi.esa.int/CFI http://eop-cfi.esa.int/CFI/EE_CFI_SCHEMAS/EO_OPER_INT_SATCFG_0201.XSD"
  schemaVersion="2.1" xmlns="http://eop-cfi.esa.int/CFI">
  <Earth_Explorer_Header>
    <Fixed_Header>
      <File_Name>TRX_TEST_INT_SATCFG_00000000T000000_99999999T999999_0001</File_Name>
      <File_Description>Satellite Configuration</File_Description>
      <Notes></Notes>
      <Mission>TERRASAR-X</Mission>
      <File_Class>TEST</File_Class>
      <File_Type>INT_SATCFG</File_Type>
      <Validity_Period>
        <Validity_Start>UTC=0000-00-00T00:00:00</Validity_Start>
        <Validity_Stop>UTC=9999-99-99T99:99:99</Validity_Stop>
      </Validity_Period>
      <File_Version>0001</File_Version>
      <Source>
        <System>EOCFI</System>
        <Creator>ESTEC</Creator>
        <Creator_Version>1</Creator_Version>
        <Creation_Date>UTC=2017-06-01T12:00:00</Creation_Date>
      </Source>
    </Fixed_Header>
    <Variable_Header></Variable_Header>
  </Earth_Explorer_Header>
   <Data_Block type="xml">
  <Satellite_Name>TERRASAR-X</Satellite_Name>
    <NORAD_Data>
      <Satellite_Number>31698</Satellite_Number>
      <NORAD_Sat_Name>TERRASAR-X</NORAD_Sat_Name>
      <Int_Designator>07026A</Int_Designator>
    </NORAD_Data>
  <Lib_Init>
    <Low_Tolerances>
      <Min_Semi_Major_Axis>6845000.0</Min_Semi_Major_Axis>
      <Max_Semi_Major_Axis>6920000.0</Max_Semi_Major_Axis>
      <Min_Inclination>96.7</Min_Inclination>
      <Max_Inclination>98.4</Max_Inclination>
      <Min_Eccentricity>0.0</Min_Eccentricity>
      <Max_Eccentricity>0.5</Max_Eccentricity>
    </Low_Tolerances>
    <Tight_Tolerances>
      <Min_Semi_Major_Axis>6870000.0</Min_Semi_Major_Axis>
      <Max_Semi_Major_Axis>6895000.0</Max_Semi_Major_Axis>
      <Min_Inclination>97.1</Min_Inclination>
      <Max_Inclination>98.1</Max_Inclination>
      <Min_Eccentricity>0.0</Min_Eccentricity>
      <Max_Eccentricity>0.007</Max_Eccentricity>
    </Tight_Tolerances>
  </Lib_Init>
  <Orbit_Init>
    <Min_Semi_Major_Axis>6882000.0</Min_Semi_Major_Axis>
    <Nom_Semi_Major_Axis>6883513.069846</Nom_Semi_Major_Axis>
    <Max_Semi_Major_Axis>6885000.0</Max_Semi_Major_Axis>
    <Min_Inclination>97.4</Min_Inclination>
    <Nom_Inclination>97.445997</Nom_Inclination>
    <Max_Inclination>97.8</Max_Inclination>
    <Nom_Eccentricity>0.001245</Nom_Eccentricity>
    <Nom_Arg_Perigee>90.0</Nom_Arg_Perigee>
  </Orbit_Init>
   </Data_Block>
</Earth_Explorer_File>
```

6. TECHNICAL DETAILS AND ASSUMPTIONS

6.1 Earth Observation CFI Software Version

The executable has been created using EO CFI SW libraries v4.15.