ANNEXURE A: supplementary file formats for aerial imagery

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1. GNNS_INS file, compliance format

The "GNNS_INS" file contains all the relevant details related to the positioning of each image within the desired control reference frame, camera integrations with GNNS and INS systems, Boresight calibration, image identification, 3D image centre coordinates , given image exterior orientations and time stamps, exposure dates. The "GNNS_INS" file needs to be archived by operator per job as per logical file structure defined in the ITIS standard.

"sample_GNNS_INS_DATA.TXT"

```
        GPS ASSISTED AERIAL PHOTOGRAPHY

Job       : Composite job number

Contracting Company   : Company managing the awarded BID.


CONTACT PERSON      : Person responsibile for managing the contract.


Reference Ellipsoid   : WGS84
Datum       : ITRF 2014 Epoch 2018.18
Projection and LO   : Transverse Mercator (Lo 23)
Heights       : Orthometric (SAGEOID2010)
Date of photography   : DD Month(eg.May) YYYY
Antenna Offset applied during differential corrections  : Yes

TRIGNET BASE STATIONS USED:

Master 1:    Name ANTH, Status ENABLED
             Antenna height 0.000 m, to ARP [TRM59800.00(SCIS)]
             Lat, Lon, El Hgt -30 40 47.29569, 26 42 57.67864, 1349.679 m [ITRF2014, 2018.180]
Master 2:    Name BFTA, Status ENABLED
             Antenna height 0.000 m, to ARP [ASH701941.B(SCIS)]
             Lat, Lon, El Hgt -29 06 40.77943, 26 12 17.29047, 1441.239 m [ITRF2014, 2018.180]
Master 3:    Name GRNT, Status ENABLED
             Antenna height 0.000 m, to ARP [ASH701941.B(SCIS)]
             Lat, Lon, El Hgt -32 14 52.96273, 24 32 04.23248, 805.778 m [ITRF2014, 2018.180]

Integration with GNSS/INS Systems:

Geomatics practitioner Name: Name of practitioner conducting the survey.
Geomatics practitioner registration number: SAGC registration number

IMU to GNSS Antenna Lever Arm survey results

 X=-0.000, Y=0.000, Z=0.000 m (X-right, Y-fwd, Z-up), these are not literal values, only for illustration purposes,unit = meters.

Boresight Calibration :

Geomatics practitioner Name: Name of practitioner conducting the survey.
Geomatics practitioner registration number: SAGC registration number

Body to Sensor Rotations:

      XRot=0.000, YRot=0.000, ZRot=0.000 degrees (Rotate IMU into Vehicle Frame)these are not literal values, only for illustration purposes, Units =degrees

Spatial offsets between the IMU and the airborne sensor

IMU to Secondary Sensor Lever Arms: (off set between IMU and airborne sensor)

      X=-0.000, Y=0.000, Z=-0.000 m (X-right, Y-fwd., Z-up, IMU->SENSOR) these are not literal values, only for illustration purposes, Units = Meters


[Format]
COL1=Strip-ID
COL2=Photo-ID
COL3=TimeStamp
COL4=Easting
COL5=Northing
COL6=Height
COL7=Omega
COL8=Phi
COL9=Kappa
COL10=SDhor
COL11=SDhor
COL12=SDvert
COL13=SDOmega
COL14=SDPhi
COL15=SDKappa
COL16=Exposure_Date/Time

[Units]
Angles=Degree
Coordinates=Meter

[Widths]
StripID=2
PhotoID=4

# Strip  Photo TimeStamp        Easting    Northing        Height     Omega       Phi     Kappa   SDhor  SDhor  SDvert SDOmega SDPhi   SDKappa  Exposure_Date/Time
[End of Header]
     01    0001 391159.394999   -2874.666 -3598782.579     6686.547    0.01766  -0.01108  359.464  0.005  0.004  0.008  0.00223 0.00223 0.00216  2019/10/10_14:39:01
     01    0002 391171.776000   -1420.880 -3598777.145     6719.609    0.01052  -0.01103  359.467  0.005  0.004  0.008  0.00231 0.00231 0.00222  2019/10/10_14:39:14
     01    0003 391184.358999      27.134 -3598762.612     6743.281    0.00088  -0.00993  359.456  0.005  0.004  0.008  0.00239 0.00239 0.00229  2019/10/10_14:39:26
     01    0004 391196.984000    1475.065 -3598775.379     6744.243   -0.00795  -0.00987  359.451  0.005  0.004  0.008  0.00245 0.00245 0.00235  2019/10/10_14:39:39
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234
Last line is column Identifiers not literal value for this file, only for illustration purposes, data needs to be formated in this file as iilustrated.
```

Conform to the supplementary file "sample_GNNS_INS_DATA.TXT "

ANNEXURE A: supplementary file formats for aerial imagery

2. Camera file, compliance format

The “camera” file contains the following parameter settings that are required for stereo model setup within the Digital Photogrammetric Workstation (DPW) system. These parameters need to be populated by the operator, please note value are not literal, however, populated for illustration purposes. The “camera” file needs to be archived by operator per job as per logical file structure defined in the ITIS standard.

sample_camera.txt:

```
begin camera_parameters CAMERA MAKE AND MODEL
 focal_length:                          92
 film_format:                           56.9088   100.3392
 lens_distortion_flag:                 off
 post_correction_grids_enabled:        off
 drive_correction_enabled:             off
 io_required:                          yes
 camera_type:                          frame
 media_type:                           digital
 pixel_size:                            3.9000   3.9000
 image_size_in_pixels:                  14592   25728
 scanline_orientation:                  4
 photo_coord_sys_orientation:           1
 photo_coord_sys_origin:                7295.5   12863.5
 focal_length_calibration_flag:        off
 ppac_calibration_flag:                off
 self_calibration_enabled_params:       0
end camera_parameters
```

Conform to the supplementary camera file “sample_camera.txt”

ANNEXURE A: supplementary file formats for aerial imagery

3. Project file, compliance format

The “project” file contains project parameter for the DPW and aerial triangulation process. These parameters need to be populated by operator, please note values are not literal, however, populated for illustration purposes. The “project” file needs to be archived by operator per job as per logical file structure defined in the ITIS standard.

sample_project.txt

```
begin project_parameters
 file_type: ascii
 flying_height: 6708.19467110771
 average_elev_grnd: 772.862745214247
 earth_radius:  6378000
 atmospheric_flag:  off
 under_water_ref: off
 ref_index_water: 1.34
 chart_datum_above_control: 0
 curvature_flag:  off
 linear_units:  meters
 angular_units: degrees
 std_dev_meas:  3
 type_of_imagery: aerial
 coordinate_type: xyz
 io_max_iterations: 5
 eo_max_iterations: 10
 io_dvar_tolerance: 0.8
 eo_dvar_tolerance: 0.8
 io_variance_test:  off
 eo_variance_test:  on
 io_max_sigma:  10
 io_max_residual: 10
 ro_max_sigma:  10
 ro_max_parallax: 10
 eo_max_sigma:  10
 eo_max_residuals:  0.001             0.001             0.001
 eo_max_rms:  0.001             0.001             0.001
 camera_XYZ_tolerances: 0.001 0.001 0.001
 camera_att_tolerances: 0.0001            0.0001            0.0001
 ground_XYZ_tolerances: 0.001 0.001 0.001
 report_lock: off
 overwrite_reports: off
 point_id_mask: 1111
 camera_self_calibration_type:  0
 camera_calibration_flag: off
 camera_antenna_offsets_flag: off
 gps_shift_drift_correction_flag: off
 ins_shift_drift_correction_flag: off
 gps_shift_drift_correction_type: 2
 gps_z_shift_drift_correction_type: 1
 ins_shift_drift_correction_type: 1
 subproject_flag: off
 user_point_id_prefix:  -
 user_point_id_suffix:  -
 user_point_strip_id_option:  YES
end project_parameters
```

Conform to the supplementary camera file “*sample_project.txt*”

ANNEXURE A: supplementary file formats for aerial imagery

4. Model file, compliance format

The “model” file contains the model sequence identification for the entire job. These model parameters/identifiers need to be created by operator, please note values are not literal, however, populated for illustration purposes. The “model” file needs to be archived by operator per job as per logical file structure defined in the ITIS standard.

The following illustrates a four-model sequence definition.

sample_model.txt:

```
begin model 01~0001+01~0002
left_photo: 01~0001
right_photo:  01~0002
atmospheric_flag: on
earth_curve_flag: on
left_lens_flag: off
right_lens_flag:  off
end model

begin model 01~0002+01~0003
left_photo: 01~0002
right_photo:  01~0003
atmospheric_flag: on
earth_curve_flag: on
left_lens_flag: off
right_lens_flag:  off
end model

begin model 01~0003+01~0004
left_photo: 01~0003
right_photo:  01~0004
atmospheric_flag: on
earth_curve_flag: on
left_lens_flag: off
right_lens_flag:  off
end model

begin model 01~0004+01~0005
left_photo: 01~0004
right_photo:  01~0005
atmospheric_flag: on
earth_curve_flag: on
left_lens_flag: off
right_lens_flag:  off
end model
```

Conform to the supplementary camera file “sample_model.txt”

ANNEXURE A: supplementary file formats for aerial imagery

5. Photo file, compliance format

The “photo” file contains photo parameters for every photo within the job area of interest (AOI), please note values are not literal, however, populated for illustration purposes. The “photo” file needs to be archived by operator per job as per logical file structure defined in the ITIS standard.

The following illustrates a two-photo parameter sequence of details contained in the photo file.

sample photo.txt:

```
begin photo_measurements 0001 strip_id 01
end photo_measurements

begin photo_measurements 0002 strip_id 01
end photo_measurements


begin photo_parameters 0001 strip_id 01
 camera_name: Camera make and model
 camera_orientation:  1
 image_id:  \\cdsm-terrashare\digicam (H)\CALIBRATED\3223C_2019_1446\RGB\3223C_2019_1446_01_0001_RGB.TIF
 thumbnail_id:  3223C_2019_1446_1\MISSION\VBO_2019-10-10_12-38_0001_01\01_001_RGB.bmp
 GPS_TimeStamp: 391159.394999
 view_geometry: nadir
 EO_parameters: -2874.666         -3598782.579      6686.547          0.01766           -0.01108          359.46443
 GIVEN_parameters:  -2874.666         -3598782.579      6686.547          0.01766           -0.01108          359.46443
 GIVEN_std_devs:  0.1              0.1               0.1               0.1               0.1               0.1
 footprint: -4715.976568 -3601959.676075 -4656.831172 -3595566.894979 -1030.247925 -3595600.418483 -1090.626378 -3601993.941449
 active_elevation: 824.475170
 DRIVE_type: collinearity
 image_size:  14592 25728
 acquisition_source:  Camera make and Model and date of accquisition in order to identify the source.
 sensor_id: -1
end photo_parameters

begin photo_parameters 0002 strip_id 01
 camera_name: Camera make and Model
 camera_orientation:  1
 image_id:  \\cdsm-terrashare\digicam (H)\CALIBRATED\3223C_2019_1446\RGB\3223C_2019_1446_01_0002_RGB.TIF
 thumbnail_id:  3223C_2019_1446_1\MISSION\VBO_2019-10-10_12-38_0001_01\01_002_RGB.bmp
 GPS_TimeStamp: 391171.776
 view_geometry: nadir
 EO_parameters: -1420.88          -3598777.145      6719.609          0.01052           -0.01103          359.46701
 GIVEN_parameters:  -1420.88          -3598777.145      6719.609          0.01052           -0.01103          359.46701
 GIVEN_std_devs:  0.1              0.1               0.1               0.1               0.1               0.1
 footprint: -3272.557484 -3601973.187329 -3213.120526 -3595544.368537 433.660616 -3595577.913948 373.479309 -3602007.484653
 active_elevation: 824.490532
 DRIVE_type: collinearity
 image_size:  14592 25728
 acquisition_source:  Camera make and Model and date of accquisition in order to identify the source.
end photo_parameters
```

Conform to the supplementary photo file “sample_photo.txt”