# EROS Metadata specifications

## March 07, 2010

## ImageSat International, N.V.

## Version 3

## Changes from Version 1, October 19, 2006

| # | Date | Change |
|---|---|---|
| (1) | Jan 30, 2008 | Addition of "str_config" line before "comment" line |
| (2) | Mar 7, 2010 | Addition of RPC format |
| (3) | | |
| (4) | | |

## 1. Background

Metadata is data about data. It describes the attributes and contents of an original document or work, and can relieve potential data users of having to have full advance knowledge of a dataset's existence and characteristics.
Particularly, in case of imagery products provided by earth observation satellites, the metadata is simply documentation for a digital geospatial dataset. It is an ASCII text document that describes who, what, when, where and how questions about the data, so that a potential data user can decide whether or not the data is appropriate for the user's intended use and can farther process the data by a variety of suitable tools.

## 2. EROS metadata concept

The metadata to be accompanied to the images received and processed by EROS Satellites will enable the following:

a) **Archive**
b) **Browsing**
c) **Retrieve**
d) **Display**
e) **Geometric correction**
f) **Orthorectification**
g) ……

The (a) through (d) processes require data about the satellite, the camera, the date and the geolocation of the image, as well as some additional data about the conditions and setups the image has been gathered upon.
The geometric correction and the orthorectification of the image require the knowledge about the line of sign of each pixel during the acquisition.
Two kinds of information (about the satellite and camera and about the line-of-sign) will be encapsulated in two separate files that will together define the EROS metadata.

## 3. EROS-A pass-file

The EROS-A legacy pass-file contains all metadata in one file, but requires a lot of exceptional processing associated with customized coordinate system (so-called Q-frame). The structure of the EROS-A pass-file is explained in Annex I.

## 4. EROS metadata

The data in the EROS metadata file that is associated with the image (like rows and columns) is related to Level 1A processing.
The metadata file has the extension ".pass" (and there is the nickname of the metadata file – "pass-file").
From backward compatibility reasons, the fields found in the EROS-A pass-file are encapsulated in the EROS pass-file under the same name and meaning.

**Fields not relevant for either EROS-A or EROS-B shall have "NA" value. The structure of pass-file is explained in Annex II.**
**The data defining the line-of-sign of the central pixel of the camera for each row on the image is explained in Annex III. This data is called TQR and included in file with the extension ".tqr" (Time + Quaternions + Rvector).**
**The Rational Polynom Coefficients (RPC) file is explained in Annex IV. This data is included in file with the extension ".rpc".**

## 5. Formats

**The standard format for Level 1A is TIFF 6.0.**
**The standard format for Level 1B is GEO-TIFF 2.1.**

## Annex I
## EROS-A pass-file

| # | Field | Format | Units |
|---|---|---|---|
| 1. | scene_id | string | |
| 2. | satellite | string | |
| 3. | camera | string | |
| 4. | optical_sensor | string | |
| 5. | image_type | string | |
| 6. | related_img | string | |
| 7. | integ_time | float | msec |
| 8. | sun_elev | float | deg |
| 9. | sun_azim | float | deg |
| 10. | gsd | float | meter |
| 11. | mean_pt_angle | float | deg |
| 12. | mean_img_azim | float | deg |
| 13. | sweep_start_utc | YYYY-MM-DD,HH:MM:SS.SSSSS | |
| 14. | sweep_end_utc | YYYY-MM-DD,HH:MM:SS.SSSSS | |
| 15. | t_offset | int | msec |
| 16. | image_length | float | km |
| 17. | image_width | float | km |
| 18. | QF_time | float (MJD) | days |
| 19. | QF_vector | float: Xi,Yi,Zi,Vxi,Vyi,Vzi | meter |
| 20. | num of state vectors | int | |
| 21. | vector #1 | YYYYMMDDHHMMSS.SSSSS,MJD, Xi,Yi,Zi,Vxi,Vyi,Vzi | |
| 22. | vector … | YYYYMMDDHHMMSS.SSSSS,MJD, Xi,Yi,Zi,Vxi,Vyi,Vzi | |
| 23. | vector #n | YYYYMMDDHHMMSS.SSSSS,MJD, Xi,Yi,Zi,Vxi,Vyi,Vzi | |
| 24. | num of attitude sets | int | |
| 25. | set #1 | YYYYMMDDHHMMSS.SSSSS,MJD, A1,B1,C1,D1,A2,B2,C2,D2,… | |
| 26. | set… | YYYYMMDDHHMMSS.SSSSS,MJD, A1,B1,C1,D1,A2,B2,C2,D2,… | |
| 27. | set #k | YYYYMMDDHHMMSS.SSSSS,MJD, A1,B1,C1,D1,A2,B2,C2,D2,… | |
| 28. | phi_s | float | deg |
| 29. | tht_s | float | deg |
| 30. | psi_s | float | deg |
| 31. | gma_s | float | deg |
| 32. | phi_e | float | deg |
| 33. | tht_e | float | deg |
| 34. | psi_e | float | deg |
| 35. | gma_e | float | deg |
| 36. | os_factor | float | |
| 37. | os_angle | float | deg |
| 38. | latc | float | deg |
| 39. | lonc | float | deg |
| 40. | lat1 | float | deg |

| | | | |
|---|---|---|---|
| 41. | lon1 | float | deg |
| 42. | lat2 | float | deg |
| 43. | lon2 | float | deg |
| 44. | lat3 | float | deg |
| 45. | lon3 | float | deg |
| 46. | lat4 | float | deg |
| 47. | lon4 | float | deg |
| 48. | lat5 | float | deg |
| 49. | lon5 | float | deg |
| 50. | lat6 | float | deg |
| 51. | lon6 | float | deg |
| 52. | width | int | |
| 53. | height | int | |
| 54. | bands | int | |
| 55. | precision (bits/pix) | int | |
| 56. | cc_assess | int | |
| 57. | overall_cc | int | |
| 58. | detail_cc | int | |
| 59. | cc_ul | int | |
| 60. | cc_ur | int | |
| 61. | cc_lr | int | |
| 62. | cc_ll | int | |
| 63. | noise_level | string | |
| 64. | missing_lines | int | |
| 65. | averaged_lines | int | |
| 66. | missing_cols | int | |
| 67. | pixel field of view | float | microrad |
| 68. | central_pixel | int | |
| 69. | active_pixels | int | |
| 70. | camera_matrix | a11,a12,a13,a21,… | |
| 71. | la_comments | None | |
| 72. | ca_comments | None | |

**Example of EROS-A pass-file:**

```
scene_id          ITA1-e1263491
satellite         A01
camera            NA30
optical_sensor    CCD
image_type        basic_scene
related_img       NA
integ_time        3.937
sun_elev          45.67
sun_azim          23.83
gsd               1.9
mean_pt_angle     1.6
mean_img_azim     82.0
sweep_start_utc   2005-08-29,10:01:02.88968
sweep_end_utc     2005-08-29,10:01:31.86107
t_offset          0
image_length      13.982100
image_width       14.231000
QF_time           2066.9163945564971
QF_vector         -3180174.3328999998,2945476.8609000002,
5324918.0566999996,-3188.4902000000,5079.5442000000,-
4702.3559000000
num_vectors       8
state_vector      20050829100102.88900,+2066.9173945564971,-
3180174.3328999998,2945476.8609000002,5324918.0566999996,-
3188.4902000000,5079.5442000000,-4702.3559000000
state_vector      20050829100106.82700,+2066.9174401282562,-
3192698.2697000001,2965448.8464000002,5306352.2717000004,-
3173.0833000000,5065.2546000000,-4728.1294000000
state_vector      20050829100110.76400,+2066.9174857000157,-
3205161.0362000000,2985364.0129000000,5287685.1957999999,-
3157.6152000000,5050.8680000000,-4753.8148000000
state_vector      20050829100114.70100,+2066.9175312717748,-
3217562.9432000001,3005222.4986000000,5268917.1522000004,-
3142.0870000000,5036.3852000000,-4779.4091000000
state_vector      20050829100118.63900,+2066.9175768435343,-
3229903.7549999999,3025023.9257999999,5250048.5001999997,-
3126.4990000000,5021.8064000000,-4804.9117000000
state_vector      20050829100122.57600,+2066.9176224152934,-
3242183.2368999999,3044767.9167999998,5231079.6020999998,-
3110.8516000000,5007.1321000000,-4830.3222000000
state_vector      20050829100126.51400,+2066.9176679870525,-
3254401.1556000002,3064454.0961000002,5212010.8213000000,-
3095.1451000000,4992.3624000000,-4855.6401000000
```

| | |
|---|---|
| state_vector | 20050829100130.45100,+2066.9177135588120,-3266557.2788000000,3084082.0888000000,5192842.5232999995,-3079.3798000000,4977.4976000000,-4880.8649000000 |
| num_sets | 3 |
| coefficient_set | 20050829100100.08800,+2066.9173621411469,-0.0376444534,0.0005850692,0.0000020734,0.0000000356,-0.1478279802,-0.0135315060,-0.0000469821,0.0000008159,-0.2185047847,-0.0012127215,0.0000241468,0.0000002122 |
| coefficient_set | 20050829100115.13800,+2066.9175363309619,-0.0282484700,0.0006723410,0.0000036212,0.0000000536,-0.3593310875,-0.0143892402,-0.0000082419,0.0000009055,-0.2305620025,-0.0003488351,0.0000341501,0.0000000086 |
| coefficient_set | 20050829100131.88800,+2066.9177301967029,-0.0157194251,0.0008429626,-0.0000233455,-0.0000007956,-0.5984097646,-0.0138200030,0.0016188708,-0.0000000442,-0.2267879446,0.0007893954,-0.0001671281,-0.0000009406 |
| phi_s | -2.07 |
| tht_s | 11.48 |
| psi_s | -11.90 |
| gma_s | 11.66 |
| phi_e | -.75 |
| tht_e | -10.27 |
| psi_e | -12.62 |
| gma_e | 10.30 |
| os_factor | 1.00 |
| os_angle | 0.00 |
| latc | 50.1100 |
| lonc | 8.6802 |
| lat1 | 50.1716 |
| lon1 | 8.5774 |
| lat2 | 50.1739 |
| lon2 | 8.7794 |
| lat3 | 50.1088 |
| lon3 | 8.5819 |
| lat4 | 50.1110 |
| lon4 | 8.7786 |
| lat5 | 50.0461 |
| lon5 | 8.5821 |
| lat6 | 50.0483 |
| lon6 | 8.7820 |
| width | 7490 |
| height | 7359 |
| bands | 1 |
| precision | 11 |
| cc_assess | 0 |

| | |
|---|---|
| overall_cc | 0 |
| detail_cc | 0 |
| cc_ul | 0 |
| cc_ur | 0 |
| cc_lr | 0 |
| cc_ll | 0 |
| noise_level | None |
| missing_lines | 0 |
| averaged_lines | 0 |
| missing_cols | 0 |
| pel_fov | 3.75 |
| center_pixel | 3745 |
| active_pixels | 7490 |
| camera_matrix | 0.999992730903,0.003715805948,-0.000854942379,-0.003715944421,0.999993082984,-0.000160437635,0.000854340310,0.000163613387,0.999999621667 |
| la_comments | None |
| ca_comments | None |

## Annex II
## EROS pass-file

| # | Field | Format | Unit | Description |
|---|---|---|---|---|
| 1. | scene_id | string | | Example : AAAA-SSPPPPPT<br>MBT1-e201386f<br><br>AAAA - designator of the ground station where the image was received<br><br>SS - satellite code (E1 for Eros A1,E2 for EROS B)<br><br>PPPPP - satellite revolution number during which the image was acquired<br><br>T - number of the scene within the download pass over the ground receiving station (“0” to “9” and “a” to “z” – total 35 images per download pass) |
| 2. | satellite | string | | EROS-A1 or EROS-B1 |
| 3. | camera | string | | NA30(Eros-A) or NA50(Eros-B) |
| 4. | optical_sensor | string | | CCD(Eros-A) or CCD-TDI(Eros-B) |
| 5. | image_type | string | | basic_scene, os_scene (only Eros-A) |
| 6. | related_img | string | | AAAA-SSPPPPPT, last image points to first in list, NA for empty field |
| 7. | integ_time | float | msec | Area scanned by pixel line during time period |
| 8. | sun_elev | float | deg | Sun elevation over the horizon |
| 9. | sun_azim | float | deg | Sun azimuth to north |
| 10. | gsd | float | meter | Ground Sampling Distance (resolution) |
| 11. | mean_pt_angle | float | deg | Mean pointing angle from nadir |

| # | Field | Format | Unit | Description |
|---|---|---|---|---|
| 12. | mean_img_azim | float | deg | Mean Imaging Azimuth |
| 13. | sweep_start_utc | UTC[1] | | Sweep Start UTC |
| 14. | sweep_end_utc | UTC | | Sweep End UTC |
| 15. | t_offset | int | msec | Time offset for sweep beginning and end |
| 16. | image_length | float | km | Image Length |
| 17. | image_width | float | km | Image Width |
| 18. | QF_time | MJD[2] | | Time of freezing Q Frame (0 for EROS-B) |
| 19. | QF_vector | R[3],V[4] | | Q Frame Vector (0 for EROS-B) |
| 20. | num of state vectors | int | | State Vectors (0 for EROS-B) |
| 21. | vector #1 | CUTC[5],MJD,R,V | | State Vector #1 |
| 22. | vector … | CUTC,MJD,R,V | | "" |
| 23. | vector #n | CUTC,MJD,R,V | | "" |
| 24. | num of attitude sets | int | | Attitude sets (0 for EROS-B) |
| 25. | set #1 | CUTC,MJD,Pf[6],Pt,Ps | | coefficients of attitude polynomial |
| 26. | set… | CUTC,MJD,Pf,Pt,Ps | | "" |
| 27. | set #k | CUTC,MJD,Pf,Pt,Ps | | "" |
| 28. | phi_s | float | deg | Phi (B2R) start – angle around X-axis (perpendicular to solar arrays) |
| 29. | tht_s | float | deg | Theta (B2R) start – angle around Y-axis (parallel to solar arrays) |
| 30. | psi_s | float | deg | Psi (B2R) start – angle around Z-axis (optical axis of the camera) |
| 31. | gma_s | float | deg | Gamma start – total angle off-nadir |

[1] UTC format is "YYYY-MM-DD,HH:MM:SS.SSSSS"
[2] MJD base is January 01, 12:00, 2000
[3] R is location vector in IF "Xi,Yi,Zi" in meters
[4] V is velocity vector in IF "Vxi,Vyi,Vzi" in meters/sec
[5] CUTC is Compact UTC formatted as "YYYYMMDDHHMMSS.SSSSS"
[6] Pf are four coefficients for phi (a,b,c,d) so that $phi=a+bt+ct^2+dt^3$ where t=(time_between_two_sets-MJD)*86400;
Pt is the same for theta and Ps for psi

| # | Field | Format | Unit | Description |
|---|---|---|---|---|
| 32. | phi_e | float | deg | Phi (B2R) end |
| 33. | tht_e | float | deg | Theta (B2R) end |
| 34. | psi_e | float | deg | Psi (B2R) end |
| 35. | gma_e | float | deg | Gamma end |
| 36. | os_factor | float | | OS Factor (only Eros-B) |
| 37. | os_angle | float | deg | OS Angle(only Eros-B) |
| 38. | latc | float | deg | Center LAT |
| 39. | lonc | float | deg | Center LON |
| 40. | lat1 | float | deg | (corner 1) |
| 41. | lon1 | float | deg | (corner 1) |
| 42. | lat2 | float | deg | (corner 2) |
| 43. | lon2 | float | deg | (corner 2) |
| 44. | lat3 | float | deg | (corner 3) |
| 45. | lon3 | float | deg | (corner 3) |
| 46. | lat4 | float | deg | (corner 4) |
| 47. | lon4 | float | deg | (corner 4) |
| 48. | lat5 | float | deg | (corner 5) |
| 49. | lon5 | float | deg | (corner 5) |
| 50. | lat6 | float | deg | (corner 6) |
| 51. | lon6 | float | deg | (corner 6) |
| 52. | width | int | | columns in 1A |
| 53. | height | int | | rows in 1A |
| 54. | bands | int | | Number of Bands |
| 55. | precision (bits/pix) | int | | Sampling Depth |
| 56. | cc_assess | int | 1 or 0 | Cloud coverage Assessment |
| 57. | overall_cc | int | % | Overall Cloud coverage |
| 58. | detail_cc | int | 1 or 0 | Detailed Cloud coverage |
| 59. | cc_ul | int | | Upper left cloud coverage (percentage) |
| 60. | cc_ur | int | | Upper right cloud coverage (percentage) |
| 61. | cc_lr | int | | Lower right cloud coverage (percentage) |
| 62. | cc_ll | int | | Lower left cloud coverage (percentage) |

| # | Field | Format | Unit | Description |
|---|---|---|---|---|
| 63. | noise_level | string | | Noise Level |
| 64. | missing_lines | int | | Number of missing lines |
| 65. | averaged_lines | int | | Averaged (filled) lines |
| 66. | missing_cols | int | | Number of missing columns |
| 67. | pixel field of view | float | microrad | Pixel Field of View |
| 68. | central_pixel | int | | Center Field of View - Pixel # |
| 69. | active_pixels | int | | Number of Active Pixels |
| 70. | camera_matrix | a(i,j) | | Body to Camera Matrix (UNIT for EROS-B) |
| 71. | la_comments | None | | |
| 72. | ca_comments | None | | |
| 73. | sampling | int | | Transmitted bits/pixel |
| 74. | exclusive | int | 1 or 0 | Exclusive target flag |
| 75. | download_start | UTC | | TX start time UTC |
| 76. | download_end | UTC | | TX end time UTC |
| 77. | other_downloads | String | | |
| 78. | download_station | String | | Download station designator |
| 79. | GRS_range_start | float | km | Ground Receiving Station range from satellite at TX start |
| 80. | GRS_range_end | float | km | Ground Receiving Station range from satellite at TX end |
| 81. | GRS_elevation_start | float | deg | Ground Receiving Station antenna elevation at TX start |
| 82. | GRS_elevation_end | float | deg | Ground Receiving Station antenna elevation at TX end |
| 83. | GRS_azimuth_start | float | deg | Satellite azimuth from GRS at TX start |
| 84. | GRS_azimuth_end | float | deg | Satellite azimuth from GRS at TX end |
| 85. | DT_value | float | seconds | Time delta value in satellite during image scanning |
| 86. | DT_date_UTC | UTC | | Last date of Delta-T prior to image |
| 87. | line_rate | float | lps | Line rate |
| 88. | TDI_stages | int | 1 to 96 | TDI level (0 for EROS-A) |

| # | Field | Format | Unit | Description |
|---|---|---|---|---|
| 89. | gsd_maximum_across | float | meter | Maximal cross-scan GSD |
| 90. | gsd_minimum_across | float | meter | Minimal cross-scan GSD |
| 91. | gsd_maximum_along | float | meter | Maximal along-scan GSD |
| 92. | gsd_minimum_along | float | meter | Minimal along-scan GSD |
| 93. | scan_azimuth | float | deg | Target scan azimuth |
| 94. | local_DTM_altitude | float | meter | Mean surface altitude above see |
| 95. | BER | E-format | | Bit Error Rate |
| 96. | roll_A3_coeff[7] | E-format | rad | For roll angle of a pixel in CF[8] |
| 97. | roll_A2_coeff | E-format | rad | "" |
| 98. | roll_A1_coeff | E-format | rad | "" |
| 99. | roll_A0_coeff | E-format | rad | "" |
| 100. | pitch_A3_coeff | E-format | rad | For pitch angle of a pixel in CF |
| 101. | pitch_A2_coeff | E-format | rad | "" |
| 102. | pitch_A1_coeff | E-format | rad | "" |
| 103. | pitch_A0_coeff | E-format | rad | "" |
| 104. | yaw_A3_coeff | E-format | rad | For yaw angle of a pixel in CF |
| 105. | yaw_A2_coeff | E-format | rad | "" |
| 106. | yaw_A1_coeff | E-format | rad | "" |
| 107. | yaw_A0_coeff | E-format | rad | "" |
| 108. | str_config | int | | Configuration of active star trackers |
| 109. | comments | None | | comments |

**In each record:**
**(a) the record name is separated from data by space(es)**
**(b) the record is terminated by line feed (character value 10)**

[7] For pixel in column j, the roll angle is "phi=a3*$j^3$+a2*$j^2$+a1*j+a0". The same is for pitch and for yaw angles. The "j" is counted from ZERO to "active_pixels-1".
[8] CF – Camera Frame.

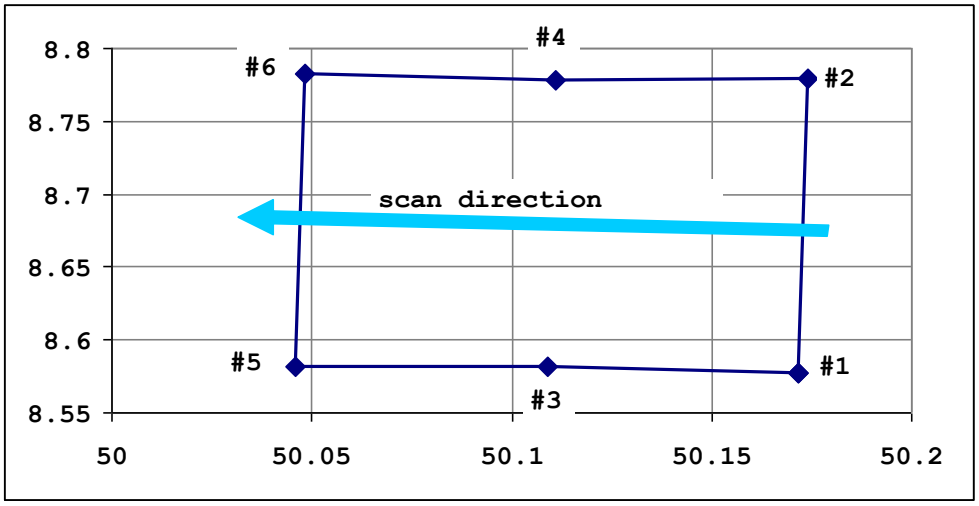


**Figure 1: Definition of six corners of the image**

## Annex III
## EROS TQR file

**The TQR file contains at least a number of records equal to the number of rows in the image.**

**The extension TQR is derived from Time, Q-vector (quaternions) and R-vector (spatial location of the Satellite).**

**The first record in the TQR file ALWAYS coincides with the first row in the image, the second record in the TQR file ALWAYS coincides with the second row in the image, and so no.**

**Each record in the TQR file presents the followings:**

a) **The Universal Time at the sampling moment of the specific row.**
b) **Reference Coordinate System (RCS), the Q-vector and the R-vector are expressed in. The RCS can be either the Inertial Frame or the WGS84 Frame.**
c) **DT1 (GMST correction) in seconds used for RCS.**
d) **Four quaternions presenting the rotation from Camera Frame to RCS at the sampling moment of the specific row.**
e) **Three Cartesian coordinates (in meters) in RCS presenting the spatial location of the Camera at the sampling moment of the specific row.**

***Universal Time*** - **MJD, based on 2000-01-01 12:00:00.00000.**

***Camera Frame*** - **Defined by Z axis that crosses the line-of-sign pixel ("central pixel" in Pass-file), Y is normal to Z and going along the detector array in descending direction of pixels, X complements the right Cartesian Coordinate System.**

***Inertial Frame*** - **True Equator and Mean Equinox of Date (TEMED) system that is aligned with the *true* equator and the *mean* equinox at the time of consideration. Its *Z*-axis is parallel to the instantaneous rotation axis of the Earth but the *X*-axis points into the direction of the *mean* vernal equinox at the concerned time. The TEMED system arises implicitly in an orbit determination program, when true sidereal time is substituted by mean sidereal time in the transformation of measurements from the Earth-fixed frame to inertial frame.**

***WGS84 Frame*** - **As defined in "NATIONAL IMAGERY AND MAPPING AGENCY TECHNICAL REPORT 8350.2, Third Edition".**

***DT1*** - **(UT1-UTC) as defined in "NATIONAL IMAGERY AND**

**MAPPING AGENCY TECHNICAL REPORT 8350.2, Third Edition".**

| # | Field | Type | Description/units |
|---|---|---|---|
| 1. | Time | double | MJD of the row |
| 2. | RCS | long | 1 for TEMED, 2 for WGS84 |
| 3. | DT1 | double | UT1 – UTC (seconds) |
| 4. | Q1 | double | First quaternion |
| 5. | Q2 | double | Second quaternion |
| 6. | Q3 | double | Third quaternion |
| 7. | Q4 | double | Forth quaternion |
| 8. | X | double | X coordinate (meters) |
| 9. | Y | double | Y coordinate (meters) |
| 10. | Z | double | Z coordinate (meters) |

In each record:
(a) the data field are separated by space(es)
(b) the record is terminated by line feed (character value 10)

Example:

```
2066.917394556481700000  2 -0.1 0.339405085159 0.907621212509 -
0.056608214522 -0.240465034509  -3180174.3286  2945476.8541
5324918.0630
2066.917394602048700000  2 -0.1 0.339403193501 0.907615301096 -
0.056624102262 -0.240486275078  -3180186.8817  2945496.8522
5324899.5498
2066.917394647615800000  2 -0.1 0.339401301926 0.907609388744 -
0.056639990320 -0.240507515913  -3180199.4346  2945516.8503
5324881.0365
2066.917394693182800000  2 -0.1 0.339399410434 0.907603475453 -
0.056655878696 -0.240528757015  -3180211.9876  2945536.8482
5324862.5231
2066.917394738749900000  2 -0.1 0.339397519024 0.907597561223 -
0.056671767389 -0.240549998384  -3180224.5404  2945556.8462
5324844.0096
2066.917394784316900000  2 -0.1 0.339395627697 0.907591646054 -
0.056687656400 -0.240571240020  -3180237.0932  2945576.8441
5324825.4960
```

The line of sign of pixel located in column J and row N (J varies from 0 to "active_pixels" and N varies from 0 to "height") in the row is computed as followings:

(a) compute phi, theta & psi angle of the pixel in CF (column J) using the A3,A2,A1,A0 coefficients for each angle as explained above in ANNEX II, EROS pass-file;
(b) Compose Pixel-To-Camera matrix in 1-2-3 sequence;
(c) Multiply by C2RCS matrix generated by quaternions of the specific row (N).

**Note 1: the values of "height", "active_pixels" and A3,A2,A1,A0 coefficients see in pass-file.**

**Note 2: By default, the TRQ file is provided in WGS84 coordinate system.**

## Annex IV
## EROS RPC file

**The EROS RPC file format is compliant with the current standard used by the satellite imaging community. The format is composed of an ASCII text file where each line is of the form:**

**Field_name : value**

**The lines are separated by a LF/CR sequence (DOS/Windows style).**

| FIELD | NAME | SIZE | VALUE RANGE | UNITS |
|---|---|---|---|---|
| LINE_OFF | Line Offset | 10 | -999999.99 to 999999.99 | pixels |
| SAMP_OFF | Sample Offset | 10 | -999999.99 to 999999.99 | pixels |
| LAT_OFF | Latitude Offset | 12 | -90.00000000 to 90.00000000 | degrees |
| LONG_OFF | Longitude Offset | 13 | -180.00000000 to 180.00000000 | degrees |
| HEIGHT_ OFF | Height Offset | 9 | -9999.999 to +9999.999 | meters |
| LINE_ SCALE | Line Scale | 10 | -999999.99 to 999999.99 | pixels |
| SAMP_ SCALE | Sample Scale | 10 | -999999.99 to 999999.99 | pixels |
| LAT_ SCALE | Latitude Scale | 12 | -90.00000000 to 90.00000000 | degrees |
| LONG_ SCALE | Longitude Scale | 13 | -180.00000000 to 180.00000000 | degrees |
| HEIGHT_ SCALE | Height Scale | 9 | -9999.999 to +9999.999 | meters |
| LINE_NUM_COEFF_1 | 20 Line Numerator Coefficients | 22 | ±9.999999999999999E+99 | |
| (through) | . . . | . . . | . . . | |
| LINE_NUM_COEFF_20 | 20 Line Numerator Coefficients | 22 | ±9.999999999999999E+99 | |
| LINE_DEN_COEFF_1 | 20 Line Denominator Coefficients | 22 | ±9.999999999999999E+99 | |
| (through) | . . . | . . . | . . . | |
| LINE_DEN_COEFF_20 | 20 Line Denominator Coefficients | 22 | ±9.999999999999999E+99 | |
| SAMP_NUM_COEFF_1 | 20 Line Numerator Coefficients | 22 | ±9.999999999999999E+99 | |
| (through) | . . . | . . . | . . . | |
| SAMP_NUM_COEFF_20 | 20 Line Numerator Coefficients | 22 | ±9.999999999999999E+99 | |
| SAMP_DEN_COEFF_1 | 20 Line Denominator Coefficients | 22 | ±9.999999999999999E+99 | |
| (through) | . . . | . . . | . . . | |
| SAMP_DEN_COEFF_20 | 20 Line Denominator Coefficients | 22 | ±9.999999999999999E+99 | |
| ERR_BIAS | RMS bias error | 7 | 0000.00 to 9999.99 | meters |
| ERR_RAND | RMS random error | 7 | 0000.00 to 9999.99 | meters |

**An example of an RPC file:**

**Note that the fields ERR_BIAS and ERR_RAND are not calculated and are always set to zero.**

LINE_OFF: +003577.86 pixels
SAMP_OFF: +005073.81 pixels
LAT_OFF: -25.46203790 degrees
LONG_OFF: +030.92821397 degrees
HEIGHT_OFF: +0799.818 meters
LINE_SCALE: +003701.00 pixels
SAMP_SCALE: +005073.50 pixels
LAT_SCALE: +00.03366450 degrees
LONG_SCALE: +000.03933000 degrees
HEIGHT_SCALE: +0800.000 meters
LINE_NUM_COEFF_1: -5.685732320958757E-05
LINE_NUM_COEFF_2: -1.688452124667677E-01
LINE_NUM_COEFF_3: +1.026285109792635E-02
LINE_NUM_COEFF_4: +3.370333778549677E-02
LINE_NUM_COEFF_5: -1.688452123504236E-01
LINE_NUM_COEFF_6: -9.210941236359113E-05
LINE_NUM_COEFF_7: +1.026285112455623E-02
LINE_NUM_COEFF_8: +7.275450748233468E-04
LINE_NUM_COEFF_9: -5.685732326117261E-05
LINE_NUM_COEFF_10: +1.275991345347366E-05
LINE_NUM_COEFF_11: -9.210941329658526E-05
LINE_NUM_COEFF_12: -7.107935332182441E-03
LINE_NUM_COEFF_13: -1.688452124517246E-01
LINE_NUM_COEFF_14: -7.817702560991569E-05
LINE_NUM_COEFF_15: +7.275450726536353E-04
LINE_NUM_COEFF_16: +1.259657328251798E-03
LINE_NUM_COEFF_17: -5.685732319980720E-05
LINE_NUM_COEFF_18: +1.275991335486938E-05
LINE_NUM_COEFF_19: +1.026285112524951E-02
LINE_NUM_COEFF_20: -4.046048387797195E-06
LINE_DEN_COEFF_1: +1.000000000000000E+00
LINE_DEN_COEFF_2: -1.660629248792338E-05
LINE_DEN_COEFF_3: +7.781766191075484E-04
LINE_DEN_COEFF_4: +1.552004958811531E-03
LINE_DEN_COEFF_5: -1.660629300111096E-05
LINE_DEN_COEFF_6: -5.496314032583734E-04
LINE_DEN_COEFF_7: +7.781766202266671E-04
LINE_DEN_COEFF_8: +4.691190242093672E-03
LINE_DEN_COEFF_9: -2.800290040998603E-01
LINE_DEN_COEFF_10: +9.190822500847878E-06
LINE_DEN_COEFF_11: -5.496313957449625E-04
LINE_DEN_COEFF_12: -1.556308710889394E-03

LINE_DEN_COEFF_13: -1.660629304429864E-05
LINE_DEN_COEFF_14: +1.675835981211626E-05
LINE_DEN_COEFF_15: +4.691190212377331E-03
LINE_DEN_COEFF_16: +3.805520978922899E-04
LINE_DEN_COEFF_17: -2.800290039595706E-01
LINE_DEN_COEFF_18: +9.190789503243230E-06
LINE_DEN_COEFF_19: +7.781766189033090E-04
LINE_DEN_COEFF_20: +1.574732057685324E-05
SAMP_NUM_COEFF_1: -2.129060789027837E-04
SAMP_NUM_COEFF_2: +3.493776357942976E-06
SAMP_NUM_COEFF_3: +1.936345819081399E-01
SAMP_NUM_COEFF_4: -2.382498929970764E-02
SAMP_NUM_COEFF_5: +3.493752749279915E-06
SAMP_NUM_COEFF_6: -7.113250768332150E-03
SAMP_NUM_COEFF_7: +1.936345817997452E-01
SAMP_NUM_COEFF_8: -1.993343984792224E-04
SAMP_NUM_COEFF_9: -2.129060800454212E-04
SAMP_NUM_COEFF_10: +1.244388483525128E-02
SAMP_NUM_COEFF_11: -7.113250770281199E-03
SAMP_NUM_COEFF_12: -6.640580663263980E-04
SAMP_NUM_COEFF_13: +3.493770676204088E-06
SAMP_NUM_COEFF_14: -1.090930315505032E-03
SAMP_NUM_COEFF_15: -1.993343996887753E-04
SAMP_NUM_COEFF_16: +3.766611282534946E-03
SAMP_NUM_COEFF_17: -2.129060800034271E-04
SAMP_NUM_COEFF_18: +1.244388483322245E-02
SAMP_NUM_COEFF_19: +1.936345816322605E-01
SAMP_NUM_COEFF_20: -4.930201160996610E-03
SAMP_DEN_COEFF_1: +1.000000000000000E+00
SAMP_DEN_COEFF_2: -3.399660026730292E-03
SAMP_DEN_COEFF_3: +7.140161558631606E-03
SAMP_DEN_COEFF_4: -1.404299913797778E-04
SAMP_DEN_COEFF_5: -3.399660026924333E-03
SAMP_DEN_COEFF_6: -4.408923950531601E-04
SAMP_DEN_COEFF_7: +7.140161558382806E-03
SAMP_DEN_COEFF_8: +1.744314123010001E-03
SAMP_DEN_COEFF_9: -2.218626461126291E-01
SAMP_DEN_COEFF_10: -3.870828853713920E-03
SAMP_DEN_COEFF_11: -4.408924020411851E-04
SAMP_DEN_COEFF_12: -1.053716488104013E-05
SAMP_DEN_COEFF_13: -3.399660027333339E-03
SAMP_DEN_COEFF_14: +6.221075558288873E-05
SAMP_DEN_COEFF_15: +1.744314147054657E-03

SAMP_DEN_COEFF_16: -2.066729793693595E-05
SAMP_DEN_COEFF_17: -2.218626462941301E-01
SAMP_DEN_COEFF_18: -3.870828817334132E-03
SAMP_DEN_COEFF_19: +7.140161557935442E-03
SAMP_DEN_COEFF_20: -1.231838158165972E-04
ERR_BIAS: 0000.00 meters
ERR_RAND: 0000.00 meters