To: Users of the Specifications for Aerial Triangulation Release 2.0 May 1998
Specifications for Scanning Aerial Photographic Imagery Edition May 2003

From: Base Mapping and Data Exchange Unit, Base Mapping and Geomatic Services Branch

Subject: TRIM II - Update of Specifications

Date: February 22, 2006

Effectively Immediately

Specifications for Aerial Triangulation Release 2.0 May 1998
Revised – April 01, 2004
Updated February 22, 2006

5.   SUMMARY OF RETURNS

5.1   Materials to be delivered

a) All materials supplied for the project;
b) Calibration report and instrumental test results of instruments used in measurement if requested;
c) Exterior orientation with standard deviations, points in cascading order;
d) Digital Air Photo / Model Index in Adobe Acrobat PDF format;
e) Control file listing horizontal, vertical and GPS sources;
f) Original plate coordinates;
g) Adjusted coordinate file points grouped by model in cascading order;
h) Full printout from PATB-NT or AeroSys adjustment with self calibration matching PATB-NT output format;
i) Printout file from PATB-NT or AeroSys adjustment with Inversion of Normal equations/override matching PATB-NT output format;
j) Output plate coordinates;
k) Copy of Aerial Triangulation Report Document;
l) XLS / CSV Spreadsheet deliverable for AT. (See appendix K);
m) Adjusted data of final Adjustment on CD/DVD;
n) AT'd scan on EIDE removable hard drive including a digital Thumbnail for each photo (see example on web-site http://ilmbwww.gov.bc.ca/bmgs/trim/trim/example_Soft_Copy_AT_Thumbnail.html

February 22, 2006
AT Requirements;
1) Two (2) control points per map sheet are required.
2) Von Gruber position points must be at ground position / elevation and suitable for ground points.

For additional deliverables please see 5.7.2

listing of file naming conventions for deliverables

File Type	. Extension
- Digital Air Photo / Model Index in Adobe Acrobat PDF format	*.pdf
- Control file listing horizontal, vertical and GPS sources	*.con
- Original plate coordinates	*.im
- Adjusted coordinate file, points grouped by model in cascading order	*.adj
- Full printout from PATB-NT adjustment with self calibration matching PATB-NT output format	*4.pr
- Printout file from PATB-NT or AeroSys adjustment with Inversion of Normal equations/override matching PATB-NT output format	*5.pr
- Exterior orientation with standard deviations, points in cascading order	*.ori
- Output plate coordinates	*.cor
- Copy of Aerial Triangulation Report Document see example below	*.doc
- XLS / CSV Spreadsheet deliverable for AT. (See appendix K);	**.xls/**.csv

Appendix K XLS/CSV Spreadsheet Deliverable For AT

Spreadsheet Header Definitions for Appendix K:

Sheet – 1:20 000 Mapsheet number
AT Block – Aerial triangulation block name or number
Flightline – Federal or Provincial air photo roll number
Photo – Air photo frame number
Model – Aerial triangulation model number
comment - Area available for comments

Sheet	AT Block	Flightline	Photo	Model	'comment
114O067	104CFKLMN 114IOP	BA87076	178	5418	
104L079	104CFKLMN 114IOP	BC82008	81	4457	
104L079	104CFKLMN 114IOP	BC82008	82	4458	
104K056	104CFKLMN 114IOP	BC82009	44	4171	
104K055	104CFKLMN 114IOP	BC82009	45	4171	
104K055	104CFKLMN 114IOP	BC82009	46	4170	
104K054	104CFKLMN 114IOP	BC82009	47	4169	
104K054	104CFKLMN 114IOP	BC82009	48	4168	
104K053	104CFKLMN 114IOP	BC82009	49	4167	
104K053	104CFKLMN 114IOP	BC82009	50	4166	
104K052	104CFKLMN 114IOP	BC82009	51	4165	
104K052	104CFKLMN 114IOP	BC82009	52	4164	
104K052	104CFKLMN 114IOP	BC82009	53	4163	
104K061	104CFKLMN	BC82009	54	4262	

Aerial Triangulation Report
For
Title and or job name here.

EXAMPLE

Prepared by
Your name and company here

Date

Your File:
Our File:

Covering letter and description of the project here

1. Photographic Coverage

EXAMPLE

Line	Roll	Date	From	To	From	To	From	To	Total
									Photos
50	BCB01001	8-Aug-02	1	33	5078	5080	5020	5050	33
51	BCB01001	8-Aug-02	66	34	5178	5180	5120	5150	33
52	BCB01001	8-Aug-02	67	105	5278	5280	5220	5256	39
53	BCB01001	8-Aug-02	143	106	5378	5380	5320	5355	38
54	BCB01001	8-Aug-02	144	182	5478	5480	5420	5456	39
55	BCB01001	8-Aug-02	221	183	5578	5580	5520	5556	39
56	BCB01001	8-Aug-02	222	262	5676	5680	5620	5656	41
57	BCB01002	8-Aug-02	43	1	5774	5780	5720	5756	43
58	BCB01002	8-Aug-02	44	86	5873	5880	5820	5855	43
59	BCB01002	8-Aug-02	129	87	5973	5980	5920	5955	43
60	BCB01002	8-Aug-02	130	172	6073	6080	6020	6055	43
61	BCB01002	8-Aug-02	217	173	6173	6180	6120	6155	45
62	BCB01002	8-Aug-02	218	236	6274	6280	6220	6232	19
63	BCB01002	8-Aug-02	257	237	6372	6380	6320	6332	21
62	BCB01003	12-Aug-02	26	1	6297	6255			26
63	BCB01003	12-Aug-02	27	50	6398	6354			24
64	BCB01003	12-Aug-02	103	151	6466	6480	6420	6454	49
65	BCB01003	12-Aug-02	102	51	6561	6580	6520	6552	52
66	BCB01003	12-Aug-02	201	152	6660	6680	6620	6649	50
67	BCB01003	12-Aug-02	202	251	6761	6780	6720	6750	50
68	BCB01004	12-Aug-02	51	1	6854	6880	6820	6844	51
69	BCB01004	12-Aug-02	52	99	6955	6980	6920	6942	48
70	BCB01004	12-Aug-02	148	100	7054	7080	7020	7042	49
71	BCB01004	12-Aug-02	149	186	7154	7180	7120	7131	38
72	BCB01004	12-Aug-02	209	187	7297	7280	7220	7232	23
72	BCB01005	12-Aug-02	16	1	7255	7271			16
73	BCB01005	13-Aug-02	17	57	7352	7380	7320	7331	41
74	BCB01005	13-Aug-02	99	58	7452	7480	7420	7432	42
75	BCB01005	13-Aug-02	100	144	7552	7580	7520	7555	45
76	BCB01005	13-Aug-02	186	145	7656	7680	7620	7636	42
77	BCB01006	13-Aug-02	43	1	7756	7780	7720	7737	43
78	BCB01006	13-Aug-02	44	82	7861	7880	7820	7838	39
79	BCB01006	13-Aug-02	121	83	7960	7980	7920	7937	39

80	BCB01006	13-Aug-02	122	157	8060	8080	8020	8034	36
81	BCB01006	13-Aug-02	184	158	8167	8180	8120	8132	27
82	BCB01006	13-Aug-02	185	208	8269	8280	8220	8231	24
83	BCB01006	13-Aug-02	229	209	8371	8380	8320	8330	21
84	BCB01005	13-Aug-02	187	199	8473	8480	8420	8424	13
85	BCB01005	13-Aug-02	211	200	8574	8580	8520	8524	12
86	BCB01005	13-Aug-02	212	226	8672	8680	8620	8625	15
87	BCB01007	10-Aug-02	21	1	8769	8770	8720	8728	21
88	BCB01007	10-Aug-02	22	45	8869	8880	8820	8831	24
89	BCB01007	10-Aug-02	68	46	8969	8980	8920	8930	23
90	BCB01007	10-Aug-02	69	89	9070	9080	9020	9029	21
91	BCB01007	10-Aug-02	108	90	9170	9180	9120	9127	19
92	BCB01007	10-Aug-02	109	127	9270	9280	9220	9227	19
93	BCB01007	10-Aug-02	146	128	9370	9380	9320	9327	19
94	BCB01007	10-Aug-02	147	165	9470	9480	9420	9427	19
95	BCB01007	10-Aug-02	185	166	9570	9580	9520	9528	20
10	BCB01007	10-Aug-02	186	207	1070	1080	1020	1030	22
11	BCB01007	10-Aug-02	231	208	1169	1180	1120	1131	24
12	BCB01008	10-Aug-02	1	27	1266	1280	1220	1231	27
13	BCB01008	10-Aug-02	52	28	1365	1380	1320	1328	25
14	BCB01008	10-Aug-02	53	77	1464	1480	1420	1427	25
15	BCB01008	10-Aug-02	103	78	1564	1580	1520	1528	26
16	BCB01008	10-Aug-02	104	129	1664	1680	1620	1628	26
17	BCB01008	10-Aug-02	156	130	1763	1780	1720	1729	27
18	BCB01008	10-Aug-02	157	184	1862	1880	1820	1828	28
19	BCB01008	10-Aug-02	213	185	1961	1980	1920	1928	29
20	BCB01008	10-Aug-02	214	233	2059	2078			20

EXAMPLE

2.   **Control**

a)   **Classes & Weights**

Std. Dev. Set	Description	Declared Std. Dev.
SDS1	TRIM passpoint, tiepoint or supplementary point derived from TRIM One, X-pugged, good transfer	2.0 metre (H & V)
SDS2	Blocktie from Sustat Block TRIM 2	1.0 metre (H & V)
SDS3	Control Point	infinite/rejected
SDS6	TRIM passpoint, tiepoint or supplementary point derived from TRIM One, X-pugged, good transfer	2.0 metre (H & V)
SDS9	Control Point	infinite/rejected

b)   **Control and Coding**

The original TRIM A/T code was used throughout with a 6 added to the end of TRIM 1 points and a 3 added to the end of the TRIM 2 points.

c)   **Control Coordinates**

Tape4 files supplied by BMGS were used to extract coordinates for x-pugs.
Ties to the Sustat TRIM2 blocks were supplied by BMGS

3.   Equipment and Software

a) Point transfer device and Mensuration: ATLAS   DSP   Softcopy
   workstation
b) Block adjustment: PATB-NT

4.   Methodology

Supplementary TRIM passpoints and tiepoints were transferred to achieve an overall control spacing of one point every 2nd photo on every line for block interior, and 1 point every 2nd photo on lines forming block perimeter.

All points that could be, were transferred from adjacent blocks.

Province of B.C. Specifications for Aerial Triangulation Release 1.1 November 1991 were used. Line Number and Model number coding adhered to the overall TRIM2 coding system.

The 5-point method was used where the top 2 and bottom 2 passpoints were used as tiepoints between lines where possible.

Lens and film distortion corrections were applied at mensuration stage. Earth curvature and refraction corrections were applied within PATB-NT block adjustment.

Adjustment was run with Self Calibration (all photos in one group), and with Drift Correction (for airborne profiles). Airborne points with good precision were weighted at 1 metre.

Final adjustment was run with Inversion of Normal Equations to output standard deviations.

5.   Block Adjustment Features

a)   Airborne GPS was used as the primary source of control. Input data supplied by GDBC contained UTM NAD83 coordinates, ellipsoid elevations, gps times and estimates of precision.
Drift correction was used which means each profile found its best position in the block by performing a 3D shift and rotation. This feature holds each profile rigid, i.e.: no polynomial bend.

b)   Self Calibration was used during block adjustment. This is a set of 12 polynomials which are linear independent from each other with respect to the regular grid of 3 by 3 image points in the standard

(gruber) positions of the photography. This feature takes into account the complete block to eliminate all systematic errors.

EXAMPLE

6.   **Block Adjustment Results**

Weighting system and statistical results can be found in the printouts and datafiles supplied. Overall Sigma Naught for the block result was 0.258 metres (8.01 microns).

7.   **Summary**

This block was tied to the Sustat TRIM 2 blocks on the north east corner. There were no other ties. Overlapping models were used to transfer points into the block. The models were set up in the   Altlas DSP softcopy Aertotriangulation Software system and incorporated into the block.

Due to the age of the TRIM 1 photo (1988) and glacier areas, it was difficult to transfer points in some cases.

Equipment, software and procedures used, as well as statistical results, show this to be a structurally sound block. The statistical results indicate the relative accuracy is better than 2.0 metres.

INPUT A/T FILES DELIVERED

*.con   Input control for PATB-NT. Contains horizontal, vertical, and airborne GPS control.

*.im   Original plate coordinates for input to PATB-NT. Coordinates are refined to the fiducial system by normal 6-parameter transformation & lens distortion correction, but NOT corrected for earth curvature, refraction and self calibration.

OUTPUT A/T FILES DELIVERED

*4.pr   Printout file from PATB-NT adjustment with Self Calibration. Includes statistics, corrected plate coordinates (sorted by photo) with residuals in microns, control summary with residuals in meters and critical points.

*5.pr   Printout file from the PATB-NT adjustment with Inversion of Normal Equations

*.ori   Exterior orientations, sorted by photo in cascaded order, with standard deviations. PATB rotational matrix is based on omega primary, phi secondary, kappa tertiary.

*.adj   Adjusted terrain coordinates and residuals, sorted by photo in cascaded order.

*.doc   A copy of this form with all the appropriate areas and sections filled in

*.pdf   A digital index map.

*.cor   Output plate coordinates. Coordinates are corrected for self calibration, earth curvature and refraction. At end of file are input ground control and corrected airborne control.

Hardcopy outputs provided:

- printout of block adjustment statistics, and control summary including airborne.
- Residual plots: Horizontal Control Vectors, and Vertical Error Circles.
- A/T index plot @ 1:250,000 scale on paper, with photography roll and frame numbers shown.

EXAMPLE

5.6 Output data format

The aerial triangulated (AT) scan image file shall be located within the folder on the storage media.
The naming convention shall be as follows:

Folder name　　**File name**
\ bcb97001\　　bcb97001_008_14n_at.tif
\ bcb97001\　　bcb97001_008_14n_atov.tif
Where: bcb97001 is the air film roll identifier.
　　　008 is the frame identifier.
　　　14 is the scan resolution in microns.
　　　n or d or is the scan source.
　　　　　n - negative film
　　　　　d - diapositive
　　　AT is the aerial triangulation scan.
　　　ATOV is the overview or thumbnail of the AT scan image.

Supply AT'd Scan on EIDE removable hard drive including digital Thumbnail required for each
photo (see example on web-site
http://ilmbwww.gov.bc.ca/bmgs/trim/trim/example_Soft_Copy_AT_Thumbnail.html)

BMGS may from time to time advise contractors, in writing, on a revision to this data format
specification as a result of development, improvement and changes in data storage and recording

5.7.1 Deliverables

- All files shall be delivered on a media pre-approved by the Ministry and may include one or
  more of the following:
  - EIDE Removable Hard Drive – formatted to be NT compatable
  - CD-ROM
    see also: TRIM II Information Bulletin 005
    CD Deliverables 1998 TRIM II Contracts – revised June 09, 1998
    http://ilmbwww.gov.bc.ca/bmgs/trim/trm2spcs/infobul5/infobul5.pdf
  - DVD-ROM (as per contract)
  - Other pre-approved media

- When Removable Hard Drives are utilised:
  - More than one folder (roll number) is permitted on each hard drive.
  - Each hard drive shall have a digital directory of the contents in a "Readme" file/folder.
  - Each hard drive shall have a spreadsheet of the contents in the "Readme" folder.

Appendix L

Sheet	Comment	Block	CBMAC #	Project #	Consortium	Member Contractor	Submission Date	AT Code
82J.091		Kootenay National Park	Cb011_03	1070-20-665	SML	SML	2-Feb-04	45016
82J.091		Kootenay National Park	Cb011_03	1070-20-665	SML	SML	2-Feb-04	41021
82J.091		Kootenay National Park	Cb011_03	1070-20-665	SML	SML	2-Feb-04	41022

File Name	Roll Number	Photo	Label
bcb96041_016_14n_at	BCB96041	016	ATscans#1
bcb96040_021_14n_at	BCB96040	021	ATscans#1
bcb96040_022_14n_at	BCB96040	022	ATscans#2

- Each hard drive shall have a unique label with the following information: ATScans #1 (2,3,4…), BC air film number (folder name), frame numbers.
- Each hard drive shall be delivered with the following hardcopy documentation:
- packing slip clearly identifying all deliverables.
- directory tree identifying complete contents of hard drive.

```
Volume in drive E is ATScans#1
Volume Serial Number is 3CDF-77BF

Directory of e:\

12/23/03  08:27a    <DIR>        bcb01003
12/23/03  08:26a    <DIR>        bcb01004
12/23/03  08:27a    <DIR>        RECYCLER
03/18/03  10:12a    <DIR>        System Volume Information
4 File(s)         0 bytes

Directory of e:\bcb01003

12/23/03  08:27a    <DIR>        .
12/23/03  08:27a    <DIR>        ..
04/30/03  12:38p      590,944,850 bcb01003_051_10n_at.tif
04/28/03  06:54p          428,711 bcb01003_051_10n_atov.tif
04/30/03  12:30p      590,944,850 bcb01003_052_10n_at.tif
04/28/03  06:55p          395,010 bcb01003_052_10n_atov.tif
04/30/03  12:17p      603,004,946 bcb01003_053_10n_at.tif
04/28/03  06:55p          357,099 bcb01003_053_10n_atov.tif
04/30/03  12:11p      603,004,946 bcb01003_054_10n_at.tif
```

- spreadsheet identifying complete contents of hard drive.
  see example above

- When other than Removable Hard Drive is utilised:
    - The directory structure on each media shall be as per removable hard drives
    - A spreadsheet per media is not required, but one spreadsheet for each delivery to the Branch is required.

5.7.2 General Deliverables

Contractors will submit Operating Procedures as part of the deliverables that will include the following:
- production diagram
- resume of all production personnel
- photogrammetric equipment annual calibration reports (scanning)
- quality assurance procedures
- In-house Process Inspection Procedures