HORIZONS, INC.

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

Horizon's Inc.
LIDAR METADATA DOCUMENT
Yakima River Basin, WA
Umatilla River Basin, OR
AeroScan LIDAR Project

LIDAR Acquisition

LIDAR acquisition for the Yakima and Umatilla projects was performed by Horizons Inc. and Earth Data Aviation. Horizons' Cessna 310 and Earth Data's Twin Otter were equipped with an AeroScan LIDAR system including an inertial measuring unit (IMU) and a dual frequency GPS receiver. Acquisition for the Yakima project was accomplished in three zones: Zone 1 was collected by Earth Data on 8,9,11 October 2000/Horizons on 1 November 2000 and Zones 2 & 3 were collected by Horizons on 23,25,27,30 October 2000. Acquisition for the Umatilla project was accomplished in two zones: Zone 1 was collected by Horizons on 22 October 2000 and Zone 2 was collected by Earth Data on 16 October 2000. LIDAR collection log sheets containing information regarding flights, times, conditions, etc are included in Appendix 2. LIDAR acquisition maps identifying flight lines are included in Appendix 1. The LIDAR specifications follow:

Flying Height	7500 feet AMT
Airspeed	110-115 Knots
Laser Pulse Rate	15 kHz
Field of View	30
Scan Rate	13 Hz Sinusoidal
Average Swath Width	4018 feet
Post Spacing	3.77 meters
Side Lap	30%
Horizontal Accuracy	(+/-) 40 cm
Vertical Accuracy	(+/-) 20 cm

The AeroScan LIDAR is able to receive up to five returns from each laser shot fired. This allows receipt of return data from multiple objects as the laser beam travels towards the ground. For example, in a vegetated area, the laser beam may first hit the leaves of a tree (generating Return 1), then a branch (generating Return 2), and finally the ground (generating Return 3). This sequence continued for five returns. All ranges are corrected for atmospheric refraction and transmission delays. Delivery of the Raw LIDAR files included the First/Only and Last of Many returns.

GPS Data Collection

An additional GPS receiver was in constant operation over a National Geodetic Survey control point during each flight acquisition. The control point "base station" is located at the airport where flight

acquisition begins. The NGS data sheet for these points are included in Appendix 3. During acquisition, the receivers collected phase data at an epoch rate of 1 Hz. In addition, five GPS control points were established throughout the airport for each flight acquisition. A series of GPS control points were also established throughout the project areas using rapid static GPS survey techniques. Six points were established for Yakima and eight points for Umatilla. This survey data was used for accuracy verification of the processed LIDAR data.

Flight	Station ID
Yakima Zone 1	XELN=NGS PID:SX1548, Bowers Field Airport
Yakima Zones 2 & 3	XYKM=NGS PID:SB1129, Yakima Air Terminal Airport
Umatilla Zones 1 & 2	XPDT=NGS PID:AD9177, Eastern Oregon Regional at Pendleton Airport

GPS Data Processing

GPS Data Processing: The GPS data was processed as a kinematic survey, using both forward and reverse processing techniques. Both processes produced a fixed integer solution. The results of each process were combined into a single fixed integer solution. The results of the individual solutions were compared to yield an indicator of the quality of the combined solution. The RMS and the standard deviation were also checked to confirm the accuracy of the solution. The accuracy was determined to be <20cm horizontally and vertically.

LIDAR Data Processing

The processing of Horizons LIDAR data is accomplished in four stages: Preprocessing, Post-Processing, Surfacing and 3-D Stereocompilation.

I. PREPROCESSING

GPS, IMU, and AeroScan timed reflection data sets are processed using LIDAR processing software producing a raw LIDAR data set. During LIDAR acquisition, LIDAR data is collected for bi- and cross-directional flight lines over the airport. The raw LIDAR data set and the LIDAR data from the airport flight lines are analyzed and difference calculations are preformed. This is an iterative process which involves analyzing the raster difference calculations in ArcView and calculating the Omega, Phi, and Kappa angles of the scanning unit to the plane's fuselage. This process is called the boresighting. After each calculation the LIDAR swaths are reprocessed, rastered and evaluated. This process is continued until angles meet project specifications. A final raw LIDAR data set is produced following this process. The final LIDAR project flight lines are rastered and difference calculations of the flight line overlaps are analyzed to assure that they also meet project specifications. Coordinate system projections and vertical bias checks are also performed during the preprocessing stage. LIDAR software automatically outputs the data to its corresponding UTM zone in meters with a GRS80 ellipsoidal height. The raw LIDAR data is transformed to the applicable project coordinate system. The LIDAR data is vertically checked to the static survey

ground control points collected at the airport and throughout the project area. LIDAR has a consistent vertical offset that is removed by checking true surveyed ground points and vertically biasing the LIDAR down to the ground.

II. POST-PROCESSING

This stage prepares raw LIDAR data for vegetation and surface feature removal. The process begins with removal of the LIDAR data in overlap areas of project flight lines. These areas are removed because the data at the edges of the field of view is typically less accurate than the rest of the LIDAR swath and there is an extremely high density of points. LIDAR data from all swaths is then merged into a single database. The LIDAR data set is trimmed to a digital project boundary including an additional buffer zone of 300 feet. The buffer zone assures adequate contour generation from the DEM and coverage of all features for the orthophotography to the limits of the digital project boundary. A tiling scheme is then produced creating files of LIDAR data at a reasonable size for editing in 3D sterocompilation. The tile layout is produced in ArcView and a tiling utility is used to cut data tiles. The tiles are translated to a file format that is compatible for the surfacing process.

III. SURFACING

The surfacing stage involves removal of the majority of vegetation and surface features from the LIDAR tiles. This is a semi-autonomous procedure using quality control checks to reclaim ground features incorrectly reclassified as vegetation. The first step in this process creates a surfacing macro over all of the LIDAR tiles removing most of the vegetation without any human interaction. The tiles are then viewed in tin-editing software utility. Viewing the tin allows editors to remove remaining vegetation points from the DEM. This utility also allows the editors to view the data with DOQQ imagery, providing the ability to identify, select, and run different parameters for smoothing algorithms on different terrain. LIDAR tiles are combined with road and streamlines and editors utilize the linework as flight paths to view the data in cross-section. Traveling along these paths, editors reclaim ground plane points incorrectly removed during surfacing macro or tin-editing. As a final step, the files are viewed again in tin-editing to ensure that no vegetation points were brought back into the tiles.

IV. 3-D STEREOCOMPILATION

3-D Stereocompilation is the final stage of LIDAR processing. The LIDAR tiles are viewed in a 3-D environment with a stereo image of the ground. Reference contours are generated from the LIDAR data and editors remove additional vegetation, structure or other points missed during the surfacing process. Editors collect 3-D linework including water features, drainages, roads, bridges, etc. As a final step, tiles are merged and checked for consistency of contours and linework throughout the LIDAR data set.

Summary of Quality Control Procedures for LIDAR data processing:

Preprocessing:

- Raster difference images and surface profiles were checked to determine if overlapping flight lines at the airport and in the project area meet project specifications for vertical and horizontal accuracy.
- Overlap areas were checked for sufficient overlap between project flight lines.
- Each flight line was examined for data logger gaps or areas where the post spacing exceeded the project specifications.
- LIDAR data was vertically adjusted to the airport ground control and checked for bias in the project flight lines to the project ground control.

Post- processing:

- Verified LIDAR data was projected to correct project coordinate system through use of ground control and digital boundaries.
- Checked for complete coverage within the project and ensured coverage overlapped the project boundary.

Surfacing:

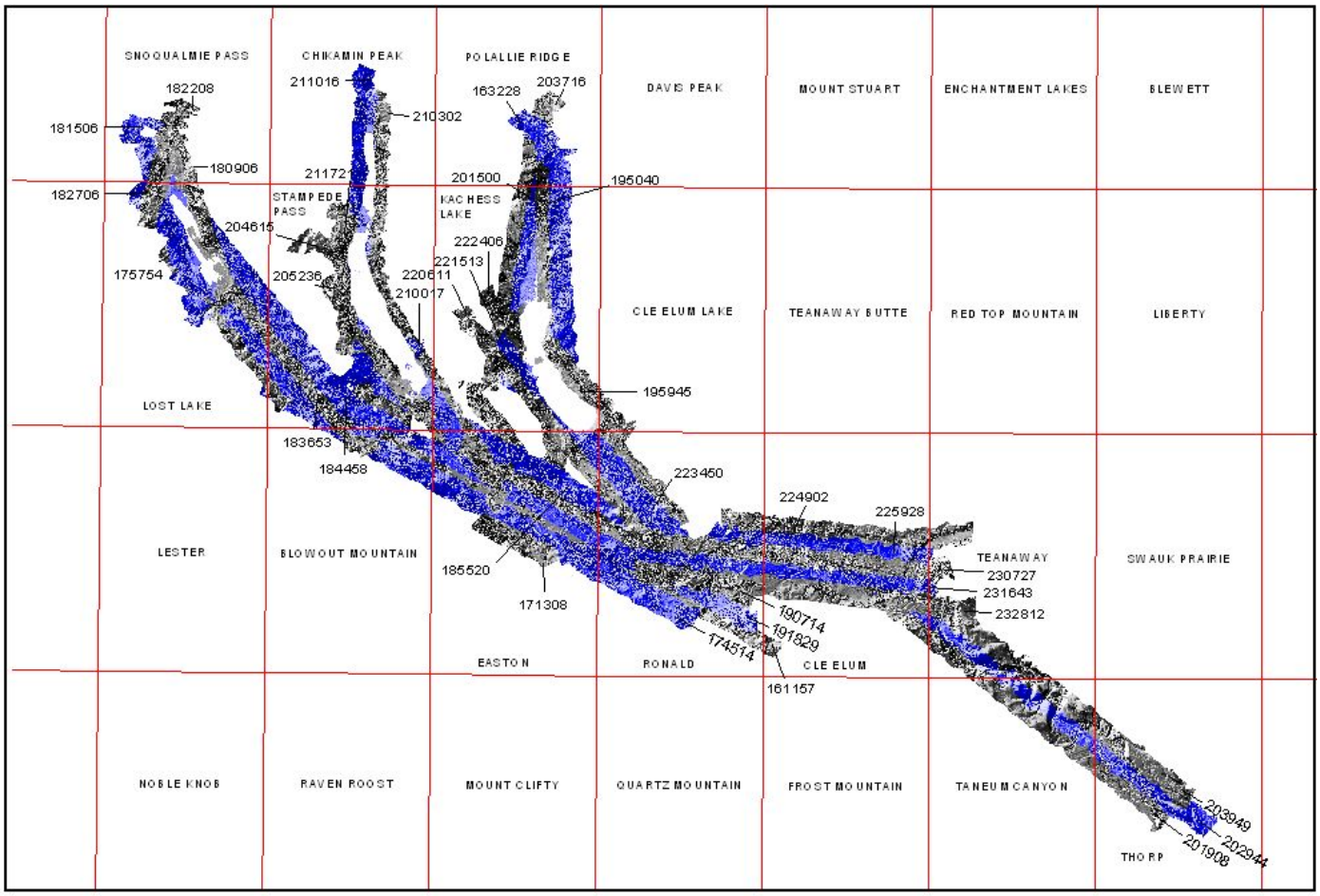
- Verified the automated macro procedure did not remove necessary ground features using road and streamlines.
- Checked for seam lines between LIDAR flight lines.
- Each LIDAR tile was checked to assure optimal vegetation and surface feature removal while maintaining ground features.

3-D Stereocompilation:

- Checked for horizontal or vertical shift in the data as compared to 3-D stereomodels of the same area.
- Verified the surfacing procedure did not remove necessary ground features.
- Checked for areas that may have been removed during the tiling process.
- LIDAR tiles were combined and checked for consistency of contours and linework throughout the LIDAR data.

Appendix 1

LIDAR Acquisition Maps
By Zones



LIDAR Scan Coverage

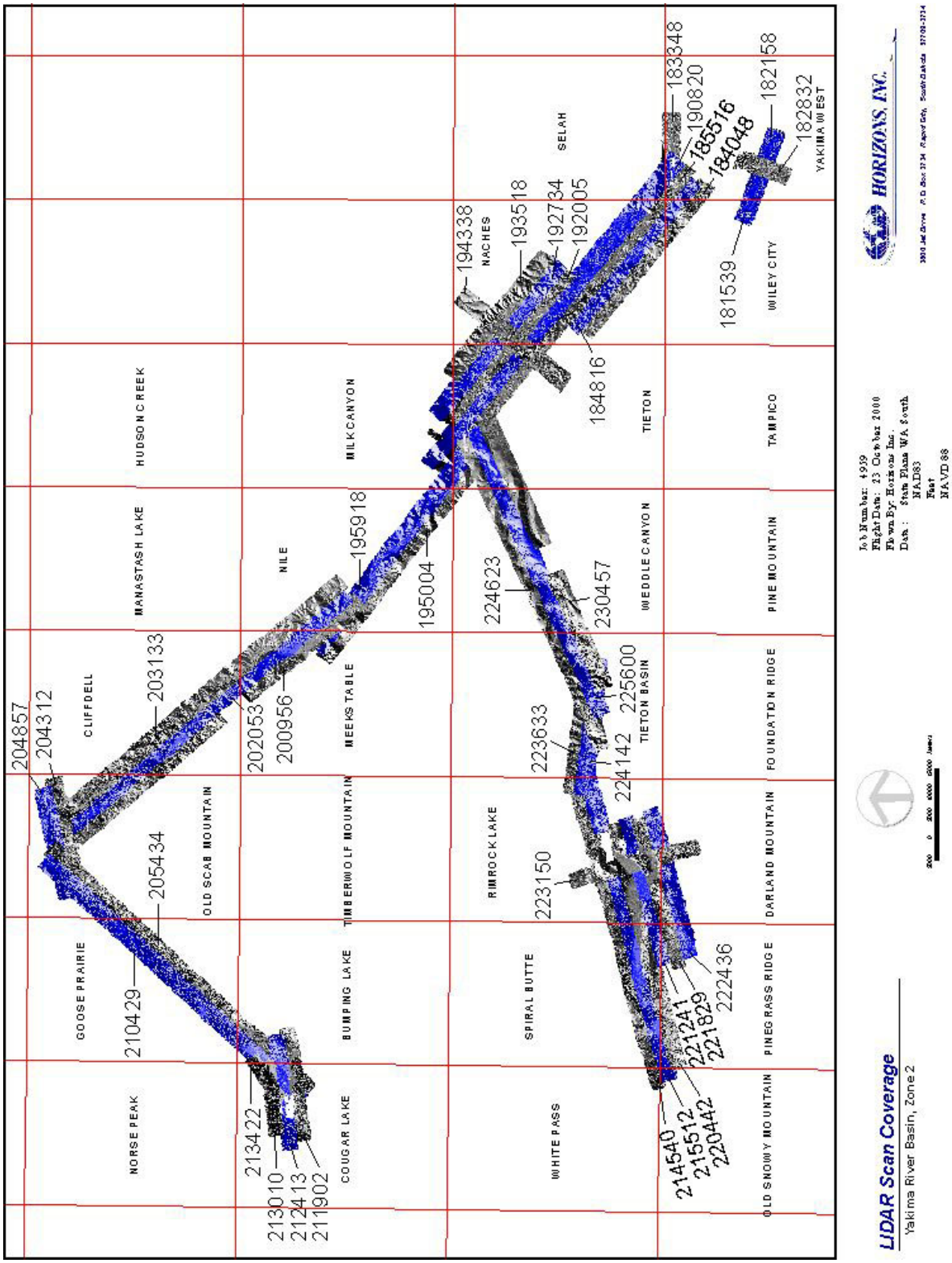
Yakima River Basin, Zone 1

Job Number: 4959
Flight Date: 8, 9, 11 October 2000
1 November 2000
Flown By: Earthdata Inter. and Horizons Inc.
Data : State Plane WA South
NAD83
Feet
NAVD88

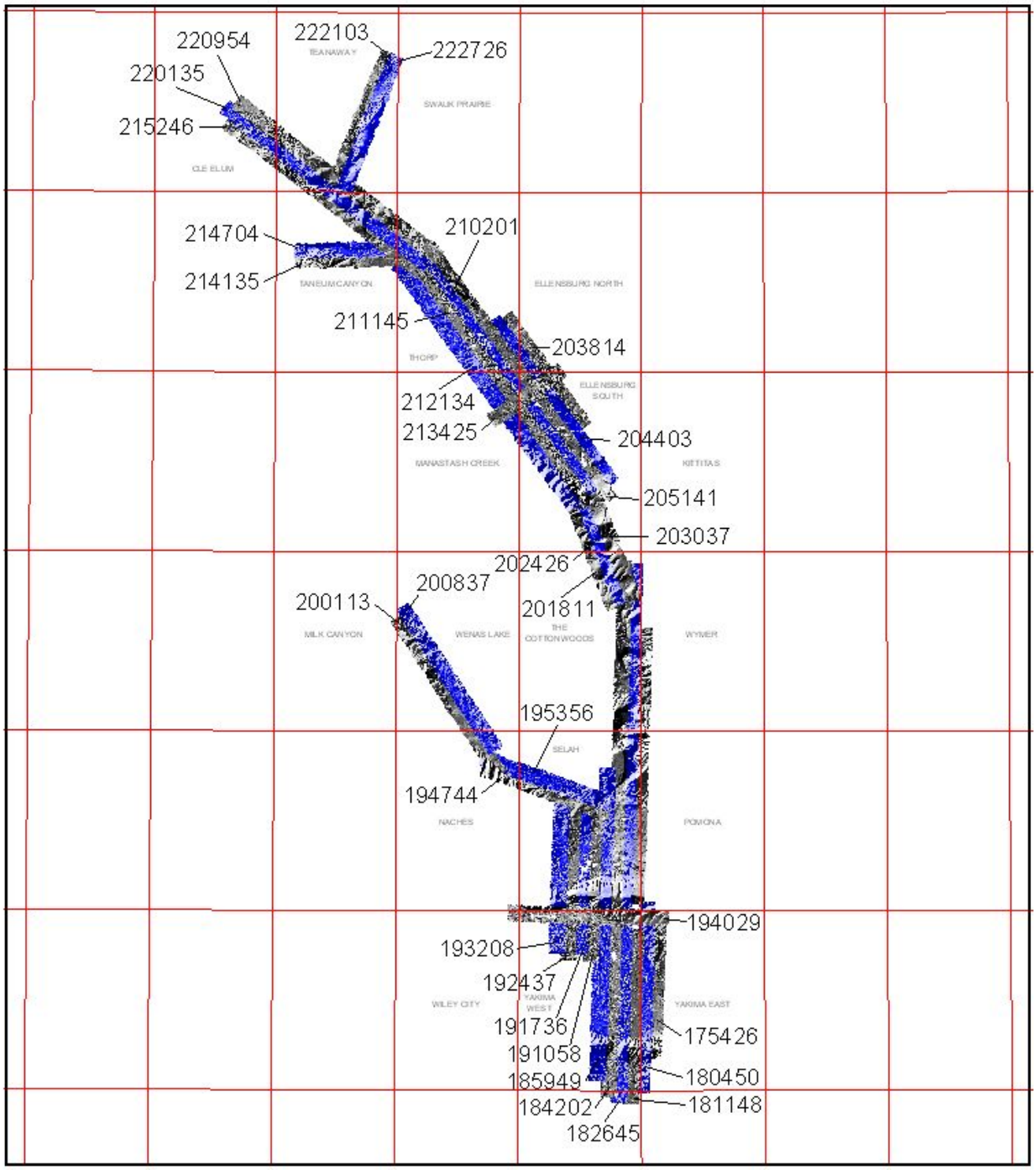
HORIZONS, INC.

3600 Jet Drive P.O. Box 3134 Rapid City, South Dakota 57709-3134

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280



Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280



LIDAR Scan Coverage

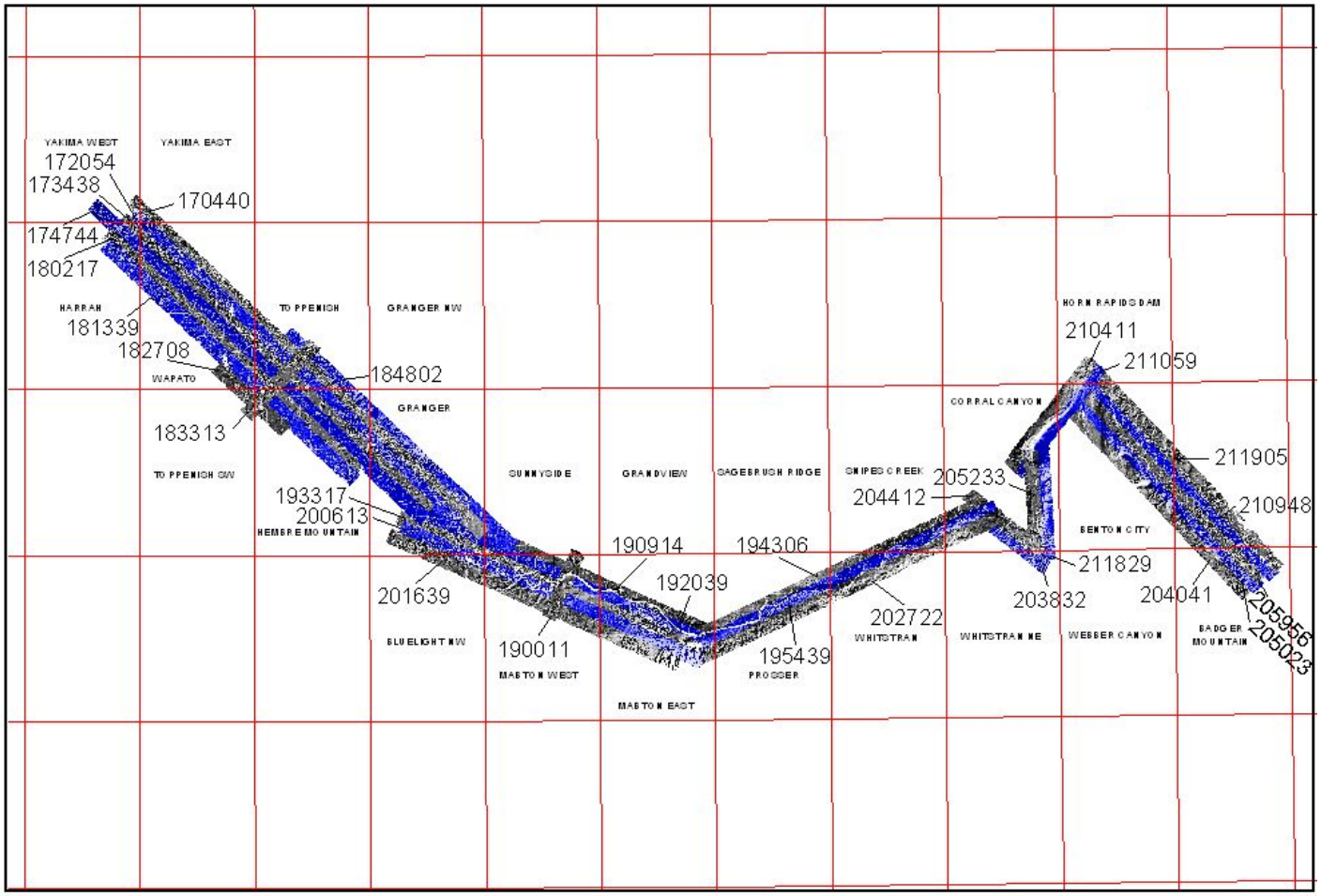
Yakima River Basin, Zone 3a

Job Number: 4959
Flight Date: 25, 27, 30 October 2000
Flown By: Horizons Inc.
Data : State Plane WA South
NAD83
Feet
NAVD 88

HORIZONS, INC.

3600 Jet Drive P.O. Box 3134 Rapid City, South Dakota 57709-3134

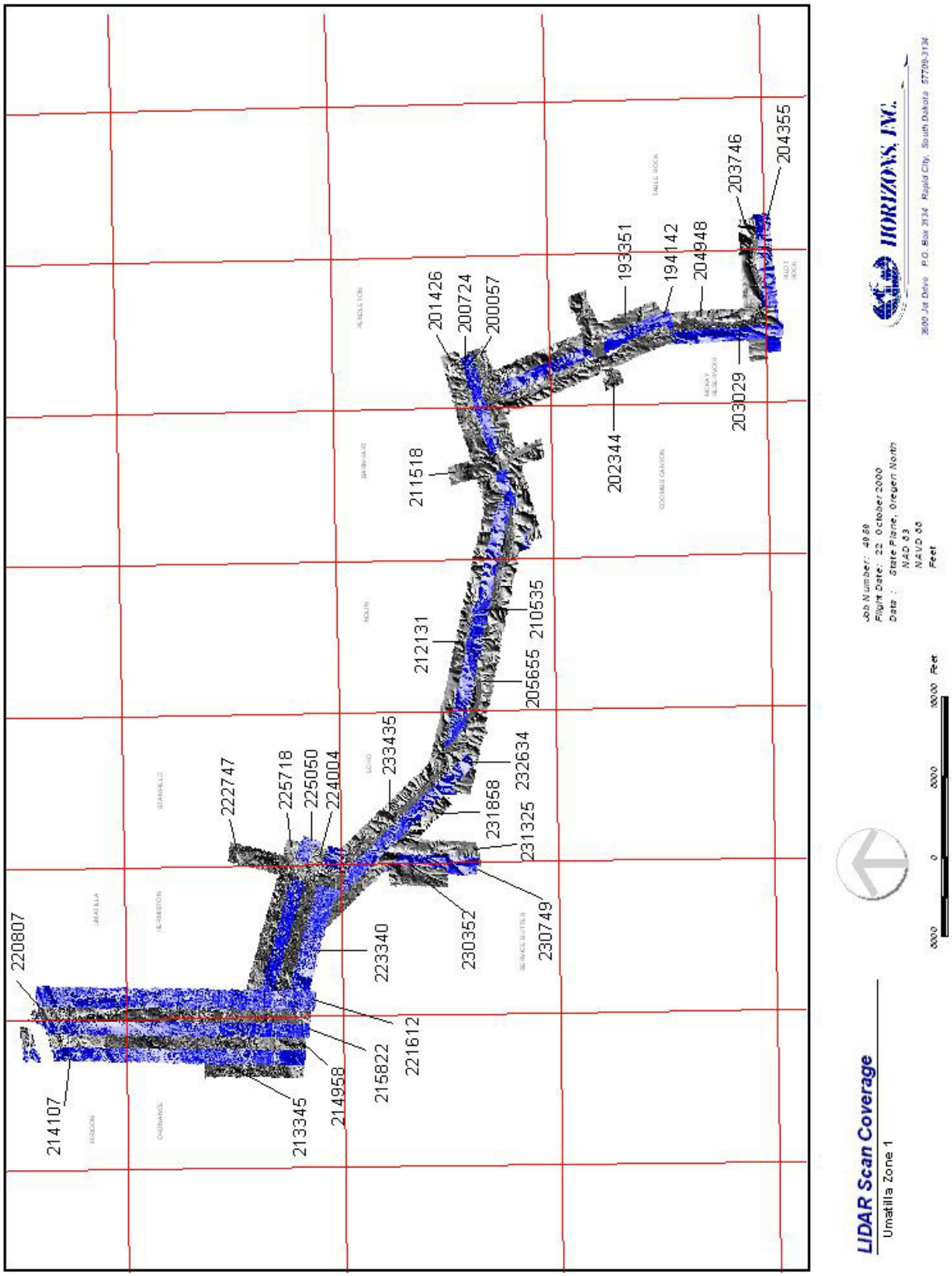
Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

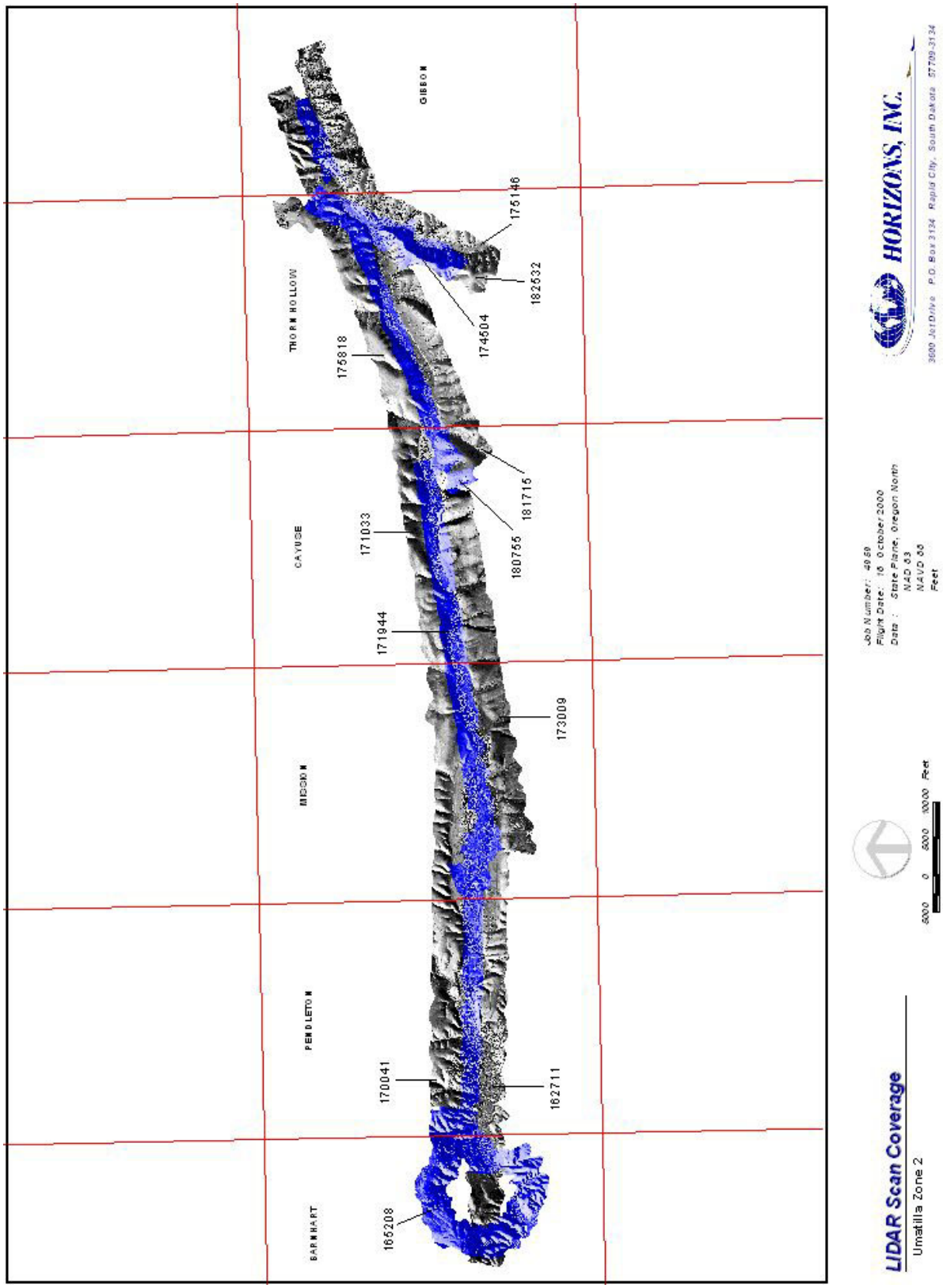


LIDAR Scan Coverage
Yakima River Basin, Zone 3b

Job Number: 4959
Flight Date: 25, 27, 30 October 2000
Flown By: Horizons Inc.
Data: State Plane WA South
NAD83
Feet
NAVD88

HORIZONS, INC.
3600 Jet Drive P.O. Box 3134 Rapid City, South Dakota 57709-3134


220807
214107
213345
214958
215822
221612
223340
222747
225718
225050
224004
233435
230352
230749
231325
231858
232634
205655
210535
212131
211518
201426
200724
200057
202344
193351
194142
204948
203029
203746
204355
HORIZONS, INC.
3600 Jet Drive P.O. Box 3134 Rapid City, South Dakota 57709-3134
Job Number: 4968
Flight Date: 22 October 2000
Data : State Plane, Oregon North
NAD 83
NAVD 88
Feet
6000 0 6000 12000 Feet
LIDAR Scan Coverage
Umatilla Zone 1


GIBBON
THORN HOLLOW
CAYUSE
MISSION
PENDLETON
BARNHART
175146
182532
174504
175818
181715
171033
180765
171944
173009
170041
182711
165208
HORIZONS, INC.
3600 Jet Drive P.O. Box 3134 Rapid City, South Dakota 57709-3134
Job Number: 4969
Flight Date: 16 October 2000
Data : State Plane, Oregon North
NAD 83
NAVD 88
Feet
-5000 0 5000 10000 Feet
LIDAR Scan Coverage
Umatilla Zone 2

Appendix 2

LIDAR Flight Log Sheets

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 08 OCT PG 1/3

Job # 99615

Location: YAKIMA, WA

GPS Info

IMU Recording start: 1919

Flight Date: | Operator:

Aircraft: | Pilot:

Attenuator [YES] [NO]

RG: 4000' DRIVE: HOLLAND
AGC: 3(32)

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Outdoor Temp	Pressure	
15° \ 01°	30.05	Altimeter setting at airport (1760)

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
39	E	194829	1950	10500	30°/13HZ	135\128	(8000' AGL)
34	NW	195945	2002	10500	30°/13	105\100	
33	SE	200637	2012	10500	30°/13	102\118	RAN LONG 1-4 CLDS
38	N	201500	2018	10400	30°/13	120\112	
37	S	202337	2027	10500		90\115	ROLL @ NORTH END
* 36	N	203007	2033	"		140\116\	MINOR HIGH THIN CLD. NO. END
35	S	203716	2042	"		100\110\108	
27	NW	204615	2050	"		130\120\108\114	
25	SE	205236	2055	"		110\104\108	BUMPY NO. END
26	NW	210017		"		100\120\	
30	N	210302	2108	"		110\118	SHAKEY SO. END
29	S	211016	2115	"		112\104	TURBULENT
28	N	211721	2119		30°/13HZ	127\116	
					30°/13HZ		

2.0

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 08 OCT PG 2/3

Job # 99615

Location: Yakima

GPS Info	Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
	/				
	/				
IMU Recording start:	/				
	/				
	LIDAR Info:				
	Outdoor Temp	Pressure			
			Altimeter setting at airport		

Flight Date:	Operator:
Aircraft:	Pilot:
Attenuator [YES] [NO]	

RG:4000
AGC:3(32)

	Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
2:00	23	N	212505	2127	10500	30°/1 3HZ	120\114	OKAY
	24	S	213214		10100		85\	RAN LONG \ CLDS So. END
	19	S	215610	2201			98\120	CLDS N. END (7-9 ONLY)
	20	N	214850	2152	10400		112\	TURBULENT CLDS N. END (LAST PHOTO)
	21	S	213951	2144	10400		100\112	SHAKEY OKAY W. END
	31	SE	220611	2211	10400		110\108	OKAY
3:00	32	NW	221513	2220	"	V	120\112	MINOR CLDS @ 5
	33	SE	222406	2229	"	30°/13HZ	110\102\110	OKAY
	32	NW	223450	2236	10400		115	1-6 ONLY
	2	SW	002438		9400		95	AIRPORT AGC:3
	1	NW	001228		9400		122\106	
5:00	1	SE	001738		9400	30°/13HZ	106\	

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 08 OCT PG 3/3

Job # 99615

Location: YAKIMA, WA

Flight Date: | Operator:

Aircraft: | Pilot:

Attenuator [YES] [NO]

RG : 4000
AGC: 1(1)

GPS Info

IMU Recording start:

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Outdoor Temp	Pressure	Altimeter setting at airport

1:25400

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
10	W	224902	2253	9500	30°/13HZ	120\108	OKAY
9	E	225928	2302	"		126\119	OKAY / SHAKEY START
8	W	230727	2312	"		108\116\112	~~OKAY~~ OFF LINE @8 SHAKEY START
7	E	231643	2322	"		120\117	OKAY
6	W	232812	2333	"		108\114\112	OKAY
11	N	233911	2341	"		130\125	OKAY
5	E	234417	2351	9500	30°/13HZ	116\108	OKAY
2	NE	235438		9300		139\140\130	OKAY
1	NW	000022		"		108	OKAY
1	SE	000720		"		100	OKAY

3:35
3:50
4:20
4:30
4:40

AIRPORT AGC: 1

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 09 OCT PG 1/2

Job # 99615

Location: YAKIMA, WA

GPS Info:

IMU Recording start: 172000

Flight Date:

Operator:

Aircraft:

Pilot:

Attenuator [YES] [NO]

RG 3000
AGC 3(32)

Airport Ident: / / / /

Clock Time | Hobbs Time | Clock Time | Hobbs Time

LIDAR Info:

Outdoor Temp: 09°/05°

Pressure: 29.75

Altimeter setting at airport (1760D)

-5°

@ 10500

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
12	NW	174514	1753	10200	30\13	120\120	OKAY
18	NW	175754		10350		128\125	OKAY
24	N	180115	1803	10500		108\	GOOD DATA MISSED SW. END: 1-2
23	SE	180906	1812	10500		110\108	OKAY
22	NW	181506	1818	10700		125\130	OKAY SHAKEY SW. END
1:00 24	S	182208		10600		105\112	OKAY
19	SE	182706	1833	10600		106\98	OKAY
20	NW	183653	1841	10400		135\125\	OKAY
21	SE	184456		10400		102\106	
36	S	195926		10500		100/	6+
37	N	195040		10500		125/122	OK
1	NW	210950		9300		118/121	AIRPORT
1	SE	211633		9000		108/	

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 09OCT PG 2/2

Job # 99615

Location: YAKIMA, WA

GPS Info

IMU Recording start:

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Outdoor Temp	Pressure	Altimeter setting at airport

Flight Date: | Operator:

Aircraft: | Pilot:

Attenuator [YES] [NO]

AGC 1(1)
RG 3000

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed KTS	Conditions / Comments
16	E	185520	1903	10000	30°/13HZ	102/120	OKAY
15	W	190714	1914	9900		133/119	OKAY
14	E	191824	1926	9900		104/112	OKAY SHAKEY W/ WIND
13	W	193041		9900		118/	CLDS 17-21
17	E	194516		10000		102	OKAY MINOR CLDS NO END
8	E	200805	2013	9500		106/116	OKAY
3	E	201908	2026	9500		114/116	OKAY
4	W	202944	2036	9500		125/123	OKAY
5	E	203949		9300		127/110	NO REASON ( )
2	N	204955		9300		120/119	AIRPORT
1	NW	205719		9300		120/116	AIRPORT
1	SE	210327		9300		108	AIRPORT
					30°/13HZ		

2:00

3:40

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 11 OCT PG 1/2

Job # 99615

Location: YAKIM, AWA

GPS Info

IMU Recording start: 154815

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Outdoor Temp	Pressure	
10/7	29.88	Altimeter setting at airport (1760)
+1° C		@ 10600

Flight Date: | Operator:

Aircraft: | Pilot:

Attenuator [YES] [NO]

RG: 5000
WINDS: CALM

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
13	W	161157	1620	10100	30°/13 HZ.	120/114	AGC 1(1) GOOD COMPLETE LINE
14	E	162443	1627	"		104	" " ONLY GOOD WEST END
36	N	163228	1636	10600		95/120	AGC 3(32) COMPLETE LINE
29	S	164026	1641	"		118/	" " RAN LONG COMP. LINE
30	N	165037		"		104/110	" "
12	E	170413	1710	10500		100/114	W 1/2 21-9
17	W	171308	1714	10200		114	COMP. LINE
12	E	171829	1723	10200		105/114	E 1/2 9-1
					30°/13HZ		

AGC 1

AGC 3

AGC 1

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 11 OCT PG 2/2

Job # 99615

Location: YAKIMA, WA

GPS Info

IMU Recording start:

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Outdoor Temp	Pressure	Altimeter setting at airport

Flight Date: | Operator:

Aircraft: | Pilot:

Attenuator [YES] [NO]

LRG: 4,000

1:40

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
2	NE	173320		9300	30/13	106	AGC 1(1)
1	NW	173838		"	"	124/118	" "
1	SE	174419				114	" "
1		174914		9300		120	AGC 3(32)
1		175506		"		110	" "

HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

Date 11-1-00 GPS Day 00-306 Time Zone GMT Job # 1-5040

Pilot Cliff Plane N310U FMS CONS Mission Yakima - Z1 - 001101

Operator TJ Range Gate 1,000 m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)

Session A HD # 1 START: Time 16:00 Temp -10°C Pressure 30.26 @ Gm

Airborne GPS POS STOP: Time 17:32 Temp -10°C Pressure 30.25 @ Gm

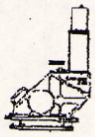
BASE: Receiver Gold Station ID X ELN HI 2.066 Start 15:37 Stop 23:32

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
		001101 -					+/-	
15	E	18	163021	1	1636	30°/13	115	Yakima Zone #1
14	W	1	164040	18	1647	"	115	
14	E	18	165228	15	1653	"	115	Low Haze / Clouds
1	SE	4	170533	1	1707	"	110	
1	NW	1	171222	4	1713	"	110	
2	SW	3	171749	1	1919	"	115	

\HORIZONS\FLT_DEPT\FLTCOL.CCR 10/11/2000 AJLH

Page 1 / 1

10/24/2000 08:45 5092481375 NOLAND DECOTO PAGE 02



HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

Date 10-23-00 GPS Day 00-297 Time Zone GMT Job # 1-5040

Pilot Cliff Plane N310U FMS CCNS Mission Yakima — 001023

Operator TJ Range Gate 1,000 m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)

Session A HD # 3 START: Time 17:59 Temp +6°C Pressure 30.32 Gnd.

Airborne GPS POS STOP: Time 23:51 Temp 4°C Pressure 30.17 @ Gnd.

BASE: Receiver Gold Station ID XYKM Ht 2.066 Start 17:23 Stop 00:08

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001023				+/-	Yakima Zone # 2
1	W	1	181539	5	1817	30°/13	115	
1	E	5	182158	1	1823	"	110	Low Haze
2	N	31	182832	3	1829	"	110	
3	W	1	183348	5	1835	"	110	
4	NW	1	184048	10	1844	"	115	Clear
5	SE	10	184816	1	1852	"	110	
6	NW	1	185516	20	1902	"	115	
7	SE	20	190820	1	1916	"	110	
8	NW	1	192005	11	1924	"	115	
9	SE	10	192734	1	1931	"	110	
10	NW	1	193518	8	1938	"	115	
11	SW	7	194338	1	1946	"	110	
12	NW	1	195004	14	1955	"	115	
13	SE	14	195918	1	2004	"	110	
14	NW	1	200956	20	2017	"	115	
15	SE	20	202053	1	2028	"	110	
16	NW	1	203133	19	2038	"	115	
17	SW	1	204312	6	2045	"	110	
18	NE	6	204857	1	2051	"	110	
19	SW	1	205434	18	2101	"	115	
20	NE	18	210429	1	2111	"	110	
21	W	1	211902	6	2121	"	110	
22	E	6	212413	1	2126	"	115	
24	W	1	213010	4	2131	"	115	+3°C / 30.24 Gnd.
23	NE	3	213422	1	2135	"	110	
35	E	17	214540	1	2152	"	115	
34	W	1	215512	17	2201	"	115	

\HORIZONS\FLD_DEPT\FLDWKBL.CDR 10/11/2000 e.Hal

Page 1 / 2

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

10/24/2000 08:45 5092481375 NOLAND DECOTO PAGE 01

HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

Date 10-23-00 GPS Day 00-297 Time Zone GMT Job # 1-5040
Pilot Cliff Plane N3104 FMS CCNS Mission Yakima — 001023
Operator TJ Range Gate 1,000m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)
Session A HD # 3 START: Time 17:59 Temp 6°C Pressure 30.32 Gnd
Airborne GPS POS STOP: Time 23:51 Temp 4°C Pressure 30.17 @ Gnd
BASE: Receiver Gold Station ID XYKM Ht 2.066 Start 17:23 Stop 00:08

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
								Yakima Zone 2
33	E	13	220442	1	2209	30°/13	110	
32	W	1	221241	8	2215	"	115	
31	E	8	221829	1	2221	"	110	4°c / 30.18 Gnd
30	W	1	222436	8	2227	"	115	
36	N	1	223150	7	2234	"	115	
29	E	7	223633	1	2239	"	110	Low Haze Clear
28	W	1	224142	7	2244	"	115	
27	NE	17	224623	1	2253	"	110	
26	SW	1	225600	16	2302	"	110	
25	NE	15	230457	1	2310	"	110	
	*	Mt RAINIER		—		Aprox	7,000' AMT	
							14,600 ASL	
		—	232335		2328		30° FOV	
							13 Hz Scan Rate	
		Little Tahoma Glacier					Shutter Open	
							-3°c/30.16 Gnd	
							117 kut ground speed	
							210° Heading	
						Aprox	3 miles from Peak	

Page 2 of 2

HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

Date 10-25-00 GPS Day 00-299 Time Zone GMT Job # 1-5040

Pilot Cliff Plane 310U FMS CCNS Mission Yakima_Z3_001025

Operator TJ Range Gate 1,000m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)

Session A HD #4 START: Time 17:12 Temp 0°C Pressure 30.08 Gnd.

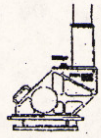
Airborne GPS POS STOP: Time 22.50 Temp -5°C Pressure 29.97 @ Gnd.

BASE: Receiver Gold Station ID XYKM Ht 2.066 Start 16:45 Stop 23:03

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001025_				+/-	
33	W	1	173624	7	1738	30°/13	110	Yakima Zone #3
33	E	7	174201	1	1743	"	110	
34	S	5	174725	1	1748	"	110	Mod. Haze
44	N	1	175726	16	1800	"	115	
43	S	20	180450	1	1809	"	110	Overcast
42	N	1	181148	50	1822	"	115	
41	S	57	182645	1	1839	"	110	
40	N	1	184202	56	1854	"	115	
39	S	33	185949	1	1907	"	110	-2°c / 30.04 @ Gnd.
38	N	1	191058	17	1914	"	115	
37	S	17	191736	1	1921	"	110	
36	N	1	192437	18	1928	"	115	
35	S	18	193208	1	1936	"	110	
45	E	17	194029	1	1944	"	110	
46	W	1	194744	14	1950	"	110	
47	E	14	195356	1	1957	"	110	
48	NW	1	200113	20	2005	"	115	
49	SE	20	200837	1	2013	"	110	
50	NW	1	201811	14	2021	"	110	
51	SE	14	202426	1	2027	"	110	
52	NW	1	203037	14	2033	"	110	
58	NW	1	203814	14	2041	"	115	
57	SE	21	204403	1	2048	"	110	
56	NW	1	205141	32	2058	"	115	
55	SE	32	210201	1	2108	"	110	
54	NW	1	211145	31	2118	"	115	

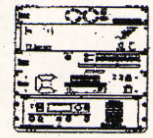
\HORIZONS\FLT_DEPT\FLTCRDL.CDR 10/11/2000 VJLP

Page 1 / 2



HORIZONS, INC.
3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

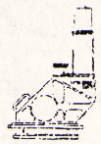


Date 10-25-00 GPS Day 00-299 Time Zone GMT Job # 1-5040
Pilot Cliff Plane 310U FMS CCNS Mission Yakima_Z3_001025
Operator TJ Range Gate 1,000m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] [None]
Session A HD #4 START: Time 17:12 Temp 0°C Pressure 30.08 @ Gnd.
Airborne GPS POS STOP: Time 22:50 Temp -5°C Pressure 29.97 @ Gnd
BASE: Receiver Gold Station ID XYKM HI 2006 Start 16:45 Stop ~~22:50~~ 23:03

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001025_				+/-	
53	SE	35	_212134	1	2129	30°/13	110	Yakima Zone #3
59	NE	1	213425	9	2136	"	110	
62	W	1	214135	11	2144	"	110	
63	E	10	214704	1	2149	"	110	
64	NW	1	215246	26	2158	"	115	-4°C/30.00 Gnd.
65	SE	27	220135	1	2207	"	115	-4°C/29.97 Gnd
66	NW	1	220954	27	2215	"	115	
67	N	1	222103	15	2224	"	115	-5°C/29.96 Gnd.
68	S	15	222726	1	2230	"		
		Static XYKM						
1YKM			17:47	-	18:03	Tripod Ht.		2.061 m
2YKM			18:13	-	18:28	GPS Day		00.298
						Date		10-24-00
3YKM			18:38	-	18:53			
4YKM			19:05	-	19:20			
5YKM			19:33	-	19:48			

\HORIZONS\FLT_DEPT\FLTCROL.CDR 10/11/2000 JLH

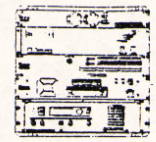
Page 2/2



HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET



Date 10-27-00 GPS Day 00-301 Time Zone GMT Job # 1-5040

Pilot Cliff Plane N310U FMS CCNS Mission Yakima - Z3 - 001027

Operator TJ Range Gate 1,000.- AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] None

Session A HD #1 START: Time 19:37 Temp -5°C Pressure 29.78 @ G

Airborne GPS POS STOP: Time 21:55 Temp -4°C Pressure 29.75 @ G

BASE: Receiver Gold Station ID XYKM HI 2.066 Start 14:55 Stop 22:12

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001027-				+/-	
33	W	1	195720	7	1959	30°/13	110	Yakima Zone #3
33	E	7	200304	1	2004	"	110	
34	N	1	200826	5	2009	"	115	Heavy Haze
* 30	SE	55	201433	43	2017	"	110	* Clou
13	NW	1	203832	10	2040	"	115	
14	SE	10	204412	1	2046	"	115	
12	N	13	205233	1	2055	"	120	
10	NE	15	210411	1	2107	"	120	
9	SW	1	211059	15	2114	"	110	
11	S	1	211829	14	2121	"	110	-4°C/29.75 @ G
4	SE			Clouded Out		"		

\HORIZONS\TLZ_DEPT\FLTCROL.CDR 4/11/2000 4:14

Page 1 / 1

HORIZONS, INC.
3600 Jet Drive, Rapid City, South Dakota 57703
LIDAR COLLECTION LOGSHEET

ate 10-30-00 GPS Day 00-304 Time Zone GMT Job # 1-5040
lot Cliff Plane N310U FMS CCNS Mission Yakima_Z3_001030
perator TJ Range Gate 1,000 m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)
ession A HD # 1 START: Time 16:24 Temp -8°C Pressure 30.13 @ G
ricorne GPS POS STOP: Time 21:58 Temp -6°C Pressure 30.16 @ Gr
ASE: Receiver Gold Station ID XYKM Hi 2.066 Start 16:02 Stop 23:35

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001030 –				+/–	
33	W	1	–164740	7	1649	30°/13	110	Yakima Zone #3
33	E	7	165306	1	1654	"	115	
34	N	1	165910	5	1700	"	110	
30	SE	55	170440	1	1716	"	110	
29	NW	1	172054	51	1731	"	110	
28	SE	48	173438	1	1744	"	115	
27	NW	1	174744	52	1759	"	110	
26	SE	39	180217	1	1810	"	110	
25	NW	1	181339	39	1822	"	110	wp/31-36 Cloud
24	SE	11	182708	1	1829	"	110	
32	NE	1	183313	11	1835	"	110	
25	NW	29	184015	37	1842	"	110	wp/29-37 Re-Flight
31	SE	35	184802	1	1855	"	110	
23	S	8	190011	1	1902	"	110	
22	E	38	190914	1	1917	"	115	
21	W	1	192039	37	1928	"	110	
20	E	37	193117	1	1939	"	115	
17	NE	38	194306	1	1951	"	110	-7°C / 30.16 @ G
16	SW	1	195439	39	2003	"	110	
19	W	1	200613	37	2014	"	110	
18	E	36	201639	1	2024	"	115	
15	NE	39	202722	1	2035	"	110	
4	SE	31	204041	1	2047	"	110	
5	NW	1	205023	31	2057	"	110	
6	SE	31	205956	1	2106	"	110	

ORIZONS\FLT_OPT\FLTCFG...CER 30/11/2000 8:FLN

Page 1 / 2

HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

ate 10-30-00 GPS Day 00-304 Time Zone GMT Job # 1-5040

lot Cliff Plane N310U FMS CCNS Mission Yakima_Z3_001030

perator TJ Range Gate 1,000m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] [None]

ession A HD #1 START: Time 16:24 Temp -8°C Pressure 30.13 @ Gnd

rborne GPS POS STOP: Time 21:58 Temp -6°C Pressure 30.16 @ Gn

ASE: Receiver Gold Station ID XYKM HI 2.066 Start 16:02 Stop 23:35

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001030_				+/-	
7	NW	1	_210948	31	2116	30°/13	110	Yakima Zone #3
8	SE	32	_211905	1	2126	"	110	
3	SW	8	213149	1	2133	"	110	

HORIZONS\FLT_DEPT\FLTCRDL.COM 10/11/2000 EJLH

Page 2 / 2

HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET

Date 10-22-00 GPS Day 00-296 Time Zone GMT Job # 1-5040

Pilot Cliff Plane N310U FMS CCNS Mission Umatilla – 001022

Operator TJ Range Gate 1000 m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)

Session A HD # 2 START: Time 19:01 Temp -1°C Pressure 30.46 Gd.

Airborne GPS POS STOP: Time 23:53 Temp 0°C Pressure 30.35 Gd.

BASE: Receiver Gold Station ID X PDT HI 2.066 Start 18:34 Stop 01:32

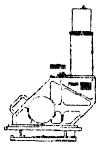
Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001022				+/-	
15	W	1	191625	4	1918	30°/13	115	Umatilla Zone #1
16	N	1	192252	3	1924	"	110	
16	S	3	192809	1	1929	"	110	Mod-Lo
45	SE	11	193351	1	1938	"	110	Haze
46	NW	1	194142	11	1945	"	115	
47	SE	11	195000	1	1954	"	110	
17 ~~48~~	SW	~~8~~ 1	200057	10	2004	"	110	
18	NE	10	200724	1	2011	"	115	
19	SW	1	201426	10	2018	"	110	
48	NE	1	202344	5	2025	"	110	
43	S	8	203029	1	2033	"	110	
42	E	7	203746	1	2040	"	110	
41	W	1	204355	7	2046	"	110	
44	N	1	204948	8	2052	"	115	
23	W	1	205655	15	2102	"	110	
22	E	15	210535	1	2111	"	115	
20	NW	1	211518	5	2117	"	115	
21	W	1	212131	15	2127	"	110	
40	N	1	213345	5	2135	"	110	
39	N	1	214107	14	2146	"	115	
38	S	14	214958	1	2155	"	110	
37	N	1	215822	14	2203	"	115	
36	S	14	220807	1	2213	"	110	
35	N	1	221612	14	2221	"	110	
30	S	6	222747	1	2230	"	110	
31	W	1	223340	9	2237	"	110	
32	E	10	224004	1	2244	"	110	

\HORIZONS\FLT_DEPT\FLTCADL.COR 10/11/2000 RJLH

Page 1 / 2

HORIZONS, INC.

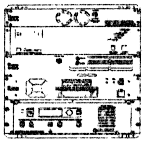
Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280



HORIZONS, INC.

3600 Jet Drive, Rapid City, South Dakota 57703

LIDAR COLLECTION LOGSHEET



Date 10-22-00 GPS Day 00-296 Time Zone GMT Job # 1-5040

Pilot Cliff Plane N310U FMS CCNS Mission Umatilla – 001022

Operator TJ Range Gate 1000 m AGC: #1 3 #2 1 Attenuator: [1.5] [0.7] (None)

Session A HD #2 START: Time 19:01 Temp -1°C Pressure 30.46 Gd.

Airborne GPS POS STOP: Time 23:53 Temp 0°C Pressure 30.35 Gd.

BASE: Receiver Gold Station ID XPDT Hi 2.066 Start 18:34 Stop 01:32

Line	Dir	Start Way	Start Time	End Way	End Time	Scan Angle/Rate	Ground Speed	Comments
			001022 –				+/–	
33	W	1	~~2246~~ 37	10	X	30°/13	X	Umatilla Zone #1
33	W	1	225050	10	2254	"	115	
34	E	8	225718	1	2300	"	110	
29	S	3	230352	1	2305	"	110	
28	N	1	230749	6	2310	"	110	
27	S	5	231325	1	2315	"	115	
24	NW	1	231858	11	2323	"	115	
25	SE	12	232634	1	2331	"	110	
26	NW	1	233435	12	2339	"	110	
			Ant. Ht.		2.061 m		Static Survey ↓	
1 PDT			00:14		00:29			
2 PDT			00:35		00:50			
3 PDT			00:55		01:10			
4 PDT			01:15		01:28			

\HORIZONS\FLT_DEPT\FLTCRDL.CER 10/11/2000 FJLH

Page 2 / 2

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 16 OCT PG 1/2

Job # 00466

Location: PEDLETON, OR \ UMATILLA RIVER

GPS Info

IMU Recording start: 16:0:930

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Flight Date:	Operator:
Aircraft:	Pilot:
Attenuator [YES] [NO]	

RG:4000
AGC:1(1)

HIGH HUMIDITY MOD. HAZE

Outdoor Temp	Pressure	
11° 07° C	30.10	Altimeter setting at airport (1450)
TEMP DEW		
+3°C		

	Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
	13	E	162711		9400	30°/13 cy/s	112/	
	10	S	163830		9400		114	
	14	N	164450		9400		125/115	
	12	W	165208	1656	9200		104/108	RANLONG
	11	E	170041	1707	9200		114/120	
	7	E	171033	1715	9300		116/120	
1:15	8	W	171944	1725	9300		106/108	STARTED EARLY
	9	E	173009	1735	9300		123/120	
	6	N	173956	1741	9300		106/	
2:00	3	W	175818	1803	9700		108/110	
	4	E	180755	1812	9650		125/119	
	5	W	181715	1822	9650		106/	
1:40	1	S	174504	1747	9700		112	ROLL & (OFFLINE)
	2	N	175146		9700	30°/13 HZ	118	

45-43-18.8/118-18-12.7 1:25:[illegible]

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

HORIZONS, INC.

Flight Log 16 OCT

Job # 00466 PG 2/2

Location: UMATILLA RIVER

GPS Info

IMU Recording start:

Airport Ident:	Clock Time	Hobbs Time	Clock Time	Hobbs Time
/				
/				
/				
/				

LIDAR Info:

Flight Date: Operator:

Aircraft: Pilot:

Attenuator [YES] [NO]

RG: 4000
AGC 1 (1)

Outdoor Temp	Pressure	Altimeter setting at airport

Line	DIR	Start	Stop	Altitude	Scan Angle / Rate	Speed	Conditions / Comments
1	SW	182532	1827	9650	30° 12.9	118	
15	W	185548		9000		106	
245 16	S	184323		9000		106	
16	N	184808		9000		104	
							45 41 23 ~~83565~~ 83572
							118 50 28. ~~19802~~ 19839
							582 467 ~~836~~ 860

Appendix 3

NGS Data Sheets

HORIZONS, INC.

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280

The NGS Data Sheet

Station ID: XELN = NGS PID: SX1548

```
DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 6.51
1        National Geodetic Survey,   Retrieval Date = AUGUST  2, 2001
 SX1548
***********************************************************************
 SX1548  PACS        -  This is a Primary Airport Control Station.
 SX1548  DESIGNATION -  BOWERS AZ MK
 SX1548  PID         -  SX1548
 SX1548  STATE/COUNTY-  WA/KITTITAS
 SX1548  USGS QUAD   -  ELLENSBURG NORTH (1978)
 SX1548
 SX1548                        *CURRENT SURVEY CONTROL
 SX1548  ___________________________________________________________________
 SX1548* NAD 83(1998)-  47 02 01.94969(N)    120 31 56.12343(W)     ADJUSTED
 SX1548* NAVD 88     -       531.90   (meters)    1745.1    (feet)  GPS OBS
 SX1548  ___________________________________________________________________
 SX1548  X           -  -2,212,584.774 (meters)                     COMP
 SX1548  Y           -  -3,751,392.514 (meters)                     COMP
 SX1548  Z           -   4,644,706.798 (meters)                     COMP
 SX1548  LAPLACE CORR-           -1.66  (seconds)                   DEFLEC99
 SX1548  ELLIP HEIGHT-          511.75  (meters)                    GPS OBS
 SX1548  GEOID HEIGHT-          -20.18  (meters)                    GEOID99
 SX1548
 SX1548  HORZ ORDER  -  B
 SX1548  ELLP ORDER  -  THIRD     CLASS II
 SX1548
 SX1548.This mark is at Bowers Field Airport (ELN)
 SX1548
 SX1548.The horizontal coordinates were established by GPS observations
 SX1548.and adjusted by the National Geodetic Survey in July 2001.
 SX1548.This is a SPECIAL STATUS position.  See SPECIAL STATUS under the
 SX1548.DATUM ITEM on the data sheet items page.
 SX1548
 SX1548.The orthometric height was determined by GPS observations and a
 SX1548.high-resolution geoid model.
 SX1548
 SX1548.GPS derived orthometric heights for airport stations designated as
 SX1548.PACS or SACS are published to 2 decimal places.  This maintains
 SX1548.centimeter relative accuracy between the PACS and SACS.  It does
 SX1548.not indicate centimeter accuracy relative to other marks which are
 SX1548.part of the NAVD 88 network.
 SX1548
 SX1548.The X, Y, and Z were computed from the position and the ellipsoidal
ht.
 SX1548
 SX1548.The Laplace correction was computed from DEFLEC99 derived deflections.
 SX1548
 SX1548.The ellipsoidal height was determined by GPS observations
```

```
SX1548.and is referenced to NAD 83.
SX1548
SX1548.The geoid height was determined by GEOID99.
SX1548
SX1548;                    North         East     Units   Scale      Converg.
SX1548;SPC WA S     -   189,019.370   497,548.384   MT  0.99994526 -0 01 24.4
SX1548;UTM  10      - 5,211,883.943   687,488.966   MT  1.00003205 +1 48 22.7
SX1548
SX1548:                Primary Azimuth Mark                     Grid Az
SX1548:SPC WA S     -  BOWERS                                   111 03 43.2
SX1548:UTM  10      -  BOWERS                                   109 13 56.1
SX1548
SX1548|-----------------------------------------------------------------------|
SX1548| PID    Reference Object                     Distance      Geod. Az   |
SX1548|                                                           dddmmss.s |
SX1548| SX1547 BOWERS                              APPROX. 0.9 KM 1110218.8 |
SX1548|-----------------------------------------------------------------------|
SX1548
SX1548                          SUPERSEDED SURVEY CONTROL
SX1548
SX1548  NAD 83(1998)-  47 02 01.94934(N)    120 31 56.12468(W) AD(       ) B
SX1548  ELLIP HT    -         511.78  (m)                      GP(       ) 3
1
SX1548  NAD 83(1991)-  47 02 01.94840(N)    120 31 56.12209(W) AD(       ) 1
SX1548  ELLIP HT    -         511.80  (m)                      GP(       ) 4
1
SX1548  NAD 83(1986)-  47 02 01.95101(N)    120 31 56.10461(W) AD(       ) 1
SX1548  NGVD 29     -       530.9    (m)         1742.     (f) GPS OBS
SX1548
SX1548.Superseded values are not recommended for survey control.
SX1548.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
SX1548.See file dsdata.txt to determine how the superseded data were derived.
SX1548
SX1548_MARKER: DZ = AZIMUTH MARK DISK
SX1548_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
SX1548_STAMPING: BOWERS 1986
SX1548_MARK LOGO: NGS
SX1548_PROJECTION: FLUSH
SX1548_MAGNETIC: N = NO MAGNETIC MATERIAL
SX1548_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
SX1548+STABILITY: SURFACE MOTION
SX1548_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
SX1548+SATELLITE: SATELLITE OBSERVATIONS - August 28, 1997
SX1548
SX1548  HISTORY     - Date     Condition        Report By
SX1548  HISTORY     - 1986     MONUMENTED       NGS
SX1548  HISTORY     - 19920615 GOOD             NGS
SX1548  HISTORY     - 19960802 GOOD             CHANCE
SX1548  HISTORY     - 19970828 GOOD             NGS
SX1548
SX1548                          STATION DESCRIPTION
SX1548
SX1548'DESCRIBED BY NATIONAL GEODETIC SURVEY 1986 (DAW)
SX1548'THE STATION IS LOCATED AT THE NORTHEAST EDGE OF THE CITY OF
```

```
SX1548'ELLENSBURG AT BOWERS FIELD AT THE WEST EDGE OF THE TAXIWAY NEAR THE
SX1548'WIND SOCK.  THE PROPERTY IS CONTROLLED BY KITTITAS COUNTY.
SX1548'
SX1548'TO REACH THE STATION FROM THE COURTHOUSE IN ELLENSBURG AT THE CORNER
SX1548'OF FIFTH AVENUE AND MAIN STREET GO NORTH ON MAIN STREET FOR 0.32 KM
SX1548'(0.2 MI) TO A CROSSROAD.  CONTINUE NORTH ON A STREET FOR 0.80 KM
SX1548'(0.5 MI) TO A T-INTERSECTION.  TURN RIGHT AND GO EAST ON FOURTEENTH
SX1548'STREET FOR 0.32 KM (0.2 MI) TO A CROSSROAD.  TURN LEFT AND GO NORTH
SX1548'ON D STREET FOR 0.48 KM (0.3 MI) TO A T-INTERSECTION.  TURN RIGHT
SX1548'AND GO EAST ON EIGHTEENTH AVENUE FOR 0.32 KM (0.2 MI) TO A
SX1548'CROSSROAD.  TURN LEFT AND GO NORTH ON WALNUT STREET FOR FOR 2.09 KM
SX1548'(1.3 MI) TO A SIDE ROAD RIGHT.  TURN RIGHT AND GO EAST ON BOWERS
SX1548'ROAD FOR 0.48 KM (0.3 MI) TO A SIDE ROAD LEFT.  TURN LEFT AND GO
SX1548'NORTH ON PIPER ROAD FOR 0.08 KM (0.05 MI) TO A GATE.  PERMISSION
SX1548'TO PROCEED MUST BE OBTAINED AT MID STATES AVIATION ON THE RIGHT.
SX1548'PASS THROUGH THE GATE TURN RIGHT AND GO EASTERLY ALONG THE TAXIWAY
SX1548'FOR 0.80 K (0.5 MI) TO THE END OF THE TAXIWAY.  CONTINUE EASTERLY,
SX1548'CROSSING RUNWAY 29 FOR 0.16 KM (0.1 MI) TO STATION BOWERS ON THE
SX1548'RIGHT.  CONTINUE EASTERLY ALONG THE TAXIWAY, CROSSING RUNWAY 25 FOR
SX1548'0.16 KM (0.1 MI) TO A TAXIWAY ON THE LEFT.  TURN LEFT AND GO
SX1548'WESTERLY ALONG THE TAXIWAY FOR 1.77 KM (1.1 MI) TO THE WEST END OF
SX1548'RUNWAY 25.  TURN LEFT AND GO EASTALONG THE SOUTH SIDE OF THE RUNWAY
SX1548'FOR 0.97 KM (0.6 MI) TO A TAXIWAY ON THE RIGHT.  TURN RIGHT AND GO
SX1548'SOUTH ON THE TAXIWAY FOR 0.24 KM (0.15 MI) TO THE STATION ON THE
SX1548'RIGHT.
SX1548'
SX1548'THE STATION MARK IS A STANDARD NGS AZIMUTH MARK DISK STAMPED---
SX1548'---BOWERS 1986---SET IN THE TOP OF A ROUND CONCRETE MONUMENT THAT
SX1548'IS 36 CM (14 INCHES) IN DIAMETER AND IS FLUSH WITH THE GROUND
SX1548'SURFACE.  IT IS 52.0 M (173.9 FT) EAST OF THE NORTH-SOUTH FENCE
SX1548'LINE, 17 M (55.8 FT) WEST OF THE CENTER OF THE TAXIWAY AND 1.8 M
SX1548'(5.9 FT) EAST OF A WITNESS POST.
SX1548'THE UNDERGROUND MARK IS A STANDARD NGS DISK STAMPED---
SX1548'---BOWERS 1986---SET IN THE TOP OF AN IRREGULAR MASS OF CONCRETE
SX1548'THAT IS 0.91 M (3 FT) BELOW THE GROUND SURFACE.
SX1548'
SX1548'THIS STATION IS SUITABLE FOR GPS OBSERVATIONS.
SX1548'
SX1548'DESCRIBED BY DA WEGENAST.
SX1548
SX1548                          STATION RECOVERY (1992)
SX1548
SX1548'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1992
SX1548'THE STATION IS LOCATE IN THE CENTER OF THE AIRPORT WEST OF THE N/S
SX1548'TAXIWAY.  IT IS 201.4 FT (61.4 M) WEST OF ARP 1959, 57.4 FT (17.5 M)
SX1548'WNW OF THE CL OF THE TAXIWAY, 37.0 FT (11.3 M) NW OF THE CENTER OF A
SX1548'ROUND STEEL DRAIN IN THE EDGE OF THE TAXIWAY (THIRD DRAIN NORTH OF RWY
SX1548'7-25) , AND 4 FT (1.2 M) SOUTHEAST OF A FIBERGLASS WITNESS POST. IT IS
SX1548'AN NGS AZIMUTH MARK DISK STAMPED BOWERS 1986 AND SET IN THE TOP OF A
SX1548'TWELVE INCH CONCRETE POST FLUSH WITH THE GROUND.  NOTE, GHPS POSITION
SX1548'BY NGS (PID, SX1548) , ELEVATION BY AIRPORT PARTY.
SX1548
SX1548                          STATION RECOVERY (1996)
SX1548
```

```
SX1548'RECOVERY NOTE BY JE CHANCE AND ASSOCIATES 1996 (KAL)
SX1548'THE STATION LOCATED 28 MILES (45.1 KM) NORTH OF YAKIMA, 22 MILES (35.4
SX1548'KM) SOUTHEAST OF CLE ELUM, IN NORTHEAST ELLENSBURG, AT BOWERS FIELD,
SX1548'ELLENSBURG, MARLA PARSEL - PUBLIC WORKS ADMINISTRATOR, 509-962-7523
SX1548'TO REACH THE STATION FROM THE JUNCTION OF INTERSTATE 90 AND CANYON
SX1548'ROAD SOUTH OF ELLENSBURG, PROCEED NORTH ON CANYON ROAD 2.25 MILES
SX1548'(3.62 KM) TO A T INTERSECTION WITH 14TH AVENUE, TURN RIGHT AND PROCEED
SX1548'EAST ALONG 14TH AVE 0.25 MILES (0.40 KM) TO D STREET, TURN LEFT AND
SX1548'PROCEED NORTH ON D STREET 0.3 MILES (0.5 KM) TO 18TH AVE, TURN RIGHT
SX1548'AND PROCEED EAST 0.15 MILES (0.24 KM) TO WALNUT STREET, TURN LEFT AND
SX1548'PROCEED NORTH 1.25 MILES (2.01 KM) ALONG WALNUT ST /AIRPORT ROAD TO A
SX1548'90 DEGREE TURN TO THE EAST WHERE BOWERS ROAD BEGINS, PROCEED EAST ON
SX1548'BOWERS RD 0.3 MILES (0.5 KM) TO AN ENTRANCE RD, TURN LEFT AND PROCEED
SX1548'NORTH 0.1 MILES (0.2 KM) THROUGH ENTRANCE GATE TO A HANGAR ACCESS
SX1548'ROAD, TURN RIGHT AND PROCEED EAST 0.05 MILES (0.08 KM) TO THE RAMP
SX1548'AREA, TURN LEFT AND PROCEED NORTH 0.05 MILES (0.08 KM) ON RAMP TO
SX1548'JUNCTION WITH TAXIWAY A, TURN LEFT AND PROCEED WEST 0.05 MILES (0.08
SX1548'KM) TO TAXIWAY D, TURN RIGHT AND PROCEED NORTH ON TAXWAY D 0.1 MILES
SX1548'(0.2 KM) TO RUNWAY 7-25, CROSS RUNWAY 7-25 ONTO TAXIWAY F AND CONTINUE
SX1548'0.15 MILES (0.24 KM) TO THE STATION ON THE LEFT OPPOSITE THE WEATHER
SX1548'STATION  THE STATION IS A STANDARD NGS AZIMUTH MARK DISK SET IN THE
SX1548'TOP OF A ROUND CONCRETE MONUMENT SET FLUSH WITH THE GROUND.  THE
SX1548'STATION IS LOCATED 17.5 M (57.4 FT) WEST OF THE CENTERLINE OF TAXIWATY
SX1548'F, 1.7 M (5.6 FT) EAST OF A CARSONITE WITNESS POST, 11.3 METERS (37.1
SX1548'FT) NORTHWEST OF A ROUND DRAIN INLET, 61.4 M (201.4 FT) WEST OF SURVEY
SX1548'MONUMENT -ARP 1959-, 72.9 M (239.2 FT) WEST OF THE RED AND WHITE
SX1548'WEATHER TOWER  THE STATION IS DESIGNATED AS A PRIMARY AIRPORT CONTROL
SX1548'STATION (PACS) - WASHINGTON ANA SURVEYS 1996
SX1548
SX1548                          STATION RECOVERY (1997)
SX1548
SX1548'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1997 (AJL)
SX1548'RECOVERED AS DESCRIBED.
```

The NGS Data Sheet

Station ID: XYKM = NGS PID: SB1129

```
DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 6.51
1        National Geodetic Survey,   Retrieval Date = AUGUST  2, 2001
 SB1129
***********************************************************************
 SB1129  DESIGNATION -  NSTW
 SB1129  PID         -  SB1129
 SB1129  STATE/COUNTY-  WA/YAKIMA
 SB1129  USGS QUAD   -  YAKIMA WEST (1985)
 SB1129
 SB1129                        *CURRENT SURVEY CONTROL
 SB1129  ___________________________________________________________________
 SB1129* NAD 83(1991)-  46 34 07.92206(N)    120 32 01.85342(W)     ADJUSTED
 SB1129* NAVD 88     -       320.9    (meters)    1053.     (feet)  GPS OBS
 SB1129  ___________________________________________________________________
 SB1129  X           -  -2,231,761.545 (meters)                     COMP
 SB1129  Y           -  -3,783,666.131 (meters)                     COMP
 SB1129  Z           -   4,609,164.320 (meters)                     COMP
 SB1129  LAPLACE CORR-           -3.40  (seconds)                   DEFLEC99
 SB1129  ELLIP HEIGHT-          299.68  (meters)                    GPS OBS
 SB1129  GEOID HEIGHT-          -21.26  (meters)                    GEOID99
 SB1129
 SB1129  HORZ ORDER  -  FIRST
 SB1129  ELLP ORDER  -  FOURTH    CLASS I
 SB1129
 SB1129.This mark is at Yakima Air Terminal Airport (YKM)
 SB1129
 SB1129.The horizontal coordinates were established by GPS observations
 SB1129.and adjusted by the National Geodetic Survey in June 1999.
 SB1129
 SB1129.The orthometric height was determined by GPS observations and a
 SB1129.high-resolution geoid model.
 SB1129
 SB1129.The X, Y, and Z were computed from the position and the ellipsoidal
ht.
 SB1129
 SB1129.The Laplace correction was computed from DEFLEC99 derived deflections.
 SB1129
 SB1129.The ellipsoidal height was determined by GPS observations
 SB1129.and is referenced to NAD 83.
 SB1129
 SB1129.The geoid height was determined by GEOID99.
 SB1129
 SB1129;                    North         East     Units   Scale      Converg.
 SB1129;SPC WA S     -   137,329.838   497,405.231   MT  0.99991464 -0 01 28.5
 SB1129;UTM  10      - 5,160,210.276   688,990.306   MT  1.00003905 +1 47 29.2
 SB1129
 SB1129                          SUPERSEDED SURVEY CONTROL
```

```
SB1129
SB1129  NAD 83(1991)-  46 34 07.92201(N)    120 32 01.85894(W) AD(       ) 1
SB1129  ELLIP HT    -         299.76  (m)                      GP(       ) 4
1
SB1129  NAD 83(1986)-  46 34 07.93267(N)    120 32 01.84243(W) AD(       ) 1
SB1129  NGVD 29     -       318.5    (m)         1045.     (f) GPS OBS
SB1129
SB1129.Superseded values are not recommended for survey control.
SB1129.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
SB1129.See file dsdata.txt to determine how the superseded data were derived.
SB1129
SB1129_MARKER: DH = HORIZONTAL CONTROL DISK
SB1129_SETTING: 31 = SET IN TAXIWAY
SB1129_STAMPING: NSTW 1986
SB1129_MARK LOGO: NGS
SB1129_MAGNETIC: N = NO MAGNETIC MATERIAL
SB1129_STABILITY: D = MARK OF QUESTIONABLE OR UNKNOWN STABILITY
SB1129_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
SB1129+SATELLITE: SATELLITE OBSERVATIONS - September 16, 1997
SB1129
SB1129  HISTORY     - Date     Condition        Report By
SB1129  HISTORY     - 1986     MONUMENTED       NGS
SB1129  HISTORY     - 19860615 GOOD             NGS
SB1129  HISTORY     - 19960803 GOOD             CHANCE
SB1129  HISTORY     - 19970916 GOOD             NGS
SB1129
SB1129                          STATION DESCRIPTION
SB1129
SB1129'DESCRIBED BY NATIONAL GEODETIC SURVEY 1986 (DAW)
SB1129'THE STATION IS LOCATED ON A SECTION OF NORTH-SOUTH TAXIWAY AT THE
SB1129'YAKIMA MUNICIPAL AIRPORT.
SB1129'
SB1129'TO REACH THE STATION FROM THE POST OFFICE IN YAKIMA AT THE
SB1129'INTERSECTION OF WASHINGTON STREET AND THIRD AVENUE GO WEST ON
SB1129'WASHINGTON STREET FOR 2.25 KM (1.4 MI) TO THE AIRPORT.  PERMISSION
SB1129'TO VISIT THE STATION MUST BE OBTAINED FROM THE AIRPORT MANAGER.
SB1129'TURN LEFT, PASS THROUGH THE GATE AND GO SOUTH ACROSS THE AIRPORT TO
SB1129'THE STATION ON A LITTLE USED PIECE OF NORTH-SOUTH TAXIWAY A DISTANCE
SB1129'OF 0.48 KM (0.3 MI).
SB1129'
SB1129'THE STATION MARK IS A STANDARD NGS DISK STAMPED---NSTW 1986---SET
SB1129'IN A DRILLHOLE IN THE ASPHALT COVERED CONCRETE TAXIWAY.  IT IS
SB1129'5.5 M (18 FT) WEST OF THE EAST EDGE OF THE TAXIWAY, 34.8 M (114 FT)
SB1129'SOUTHWEST OF A NO TRESPASSING SIGN AND 4.9 M (16 FT) EAST OF A
SB1129'DOUBLE YELLOW STRIP ACROSS THE TAXIWAY.
SB1129'
SB1129'THIS STATION IS SUITABLE FOR GPS OBSERVATIONS.
SB1129'
SB1129'DESCRIBED BY DA WEGENAST.
SB1129
SB1129                          STATION RECOVERY (1986)
SB1129
SB1129'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1986
SB1129'THE STATION IS LOCATED ON THE NORTH PORTION OF TAXIWAY C SOUTH OF
```

```
SB1129'TAXIWAY B AND EAST OF RUNWAY END 22.  THE STATION IS LOCATED ON THE CL
SB1129'OF TAXIWAY C AT THE HOLD BAR AND 33.0 FT (10.1 M) WEST OF THE WEST END
SB1129'OF THE C SIGN ON THE EAST SIDE OF THE TAXIWAY.  THE STATION IS A
SB1129'STANDARD NGS DISK, STAMPED NSTW 1986, SET IN A DRILL HOLE IN THE
SB1129'CONCRETE BASE OF THE TAXIWAY THAT HAS BEEN COVERED BY ASPHALT.
SB1129
SB1129                          STATION RECOVERY (1996)
SB1129
SB1129'RECOVERY NOTE BY JE CHANCE AND ASSOCIATES 1996 (KAL)
SB1129'THE STATION IS LOCATED 30 MILES (48.3 KM) SOUTH OF ELLENSBURG, 17
SB1129'MILES (27.4 KM) NORTHWEST OF TOPPENISH, IN SOUTH YAKIMA AT THE YAKIMA
SB1129'AIRPORT, BOB CLEM - AIRPORT MANAGER, PHONE 509-575-6149  TO REACH THE
SB1129'STATION FROM THE JUNCTION OF INTERSTATE 82 AND VALLEY MALL BOULEVARD
SB1129'IN SOUTH YAKIMA, PROCEED WEST ON VALLEY MALL BOULEVARD, 0.35 MILES
SB1129'(0.56 KM) TO JUNCTION OF SOUTH 1ST STREET, TURN RIGHT AND PROCEED WEST
SB1129'ON S.  1ST ST 0.65 MILES (1.05 KM) TO W. WASHINGTON AVE., 2.3 MILES
SB1129'(3.7 KM) TO A SMALL DRIVEWAY WEST OF A CESSNA PILOT CENTER BLDG, TURN
SB1129'LEFT INTO THIS DRIVEWAY, THEN TURN IMMEDIATELY RIGHT AND PROCEED WEST
SB1129'0.05 MILES (0.08 KM) TO AN ENTRANCE GATE, TURN LEFT AND PROCEED SOUTH
SB1129'THROUGH THE GATE ACROSS THE RAMP 0.1 MILES (0.2 KM) TO JUNCTION WITH
SB1129'TAXIWAY B, TURN LEFT AND PROCEED NORTHEAST ON TAXIWAY B 0.2 MILES (0.3
SB1129'KM) TO JUNCTION WITH RUNWAY 4-22, TURN RIGHT AND PROCEED SOUTH ACROSS
SB1129'RUNWAY 4-22 0.1 MILES (0.2 KM) TO THE HOLD SHORT LINE ON TAXIWAY C AND
SB1129'THE STATION ON THE LEFT  THE STATION IS A STANDARD NATIONAL GEODETIC
SB1129'SURVEY HORIZONTAL CONTROL MARK DISK SET IN THE CONCRETE FOUNDATION OF
SB1129'TAXIWAY C, SET FLUSH WITH THE PAVED SURFACE.  THE STATION IS LOCATED
SB1129'9.65 M (31.66 FT) WEST OF THE EAST END OF A HOLD SHORT SIGN, 6.9 M
SB1129'(22.6 FT) WEST OF THE EAST EDGE OF THE TAXIWAY, 29.45 M (96.62 FT)
SB1129'NORTHWEST OF THE WEST END OF THE BASE OF A TAXIWAY INFORMATION SIGN
SB1129'AND 17.75 M (58.23 FT) EAST OF A NAIL AND WASHER SET IN THE CENTER OF
SB1129'THE TAXIWAY
SB1129
SB1129                          STATION RECOVERY (1997)
SB1129
SB1129'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1997 (KRN)
SB1129'RECOVERED AS DESCRIBED.
```

The NGS Data Sheet:

Station ID: XPDT=NGS PID:AD9177

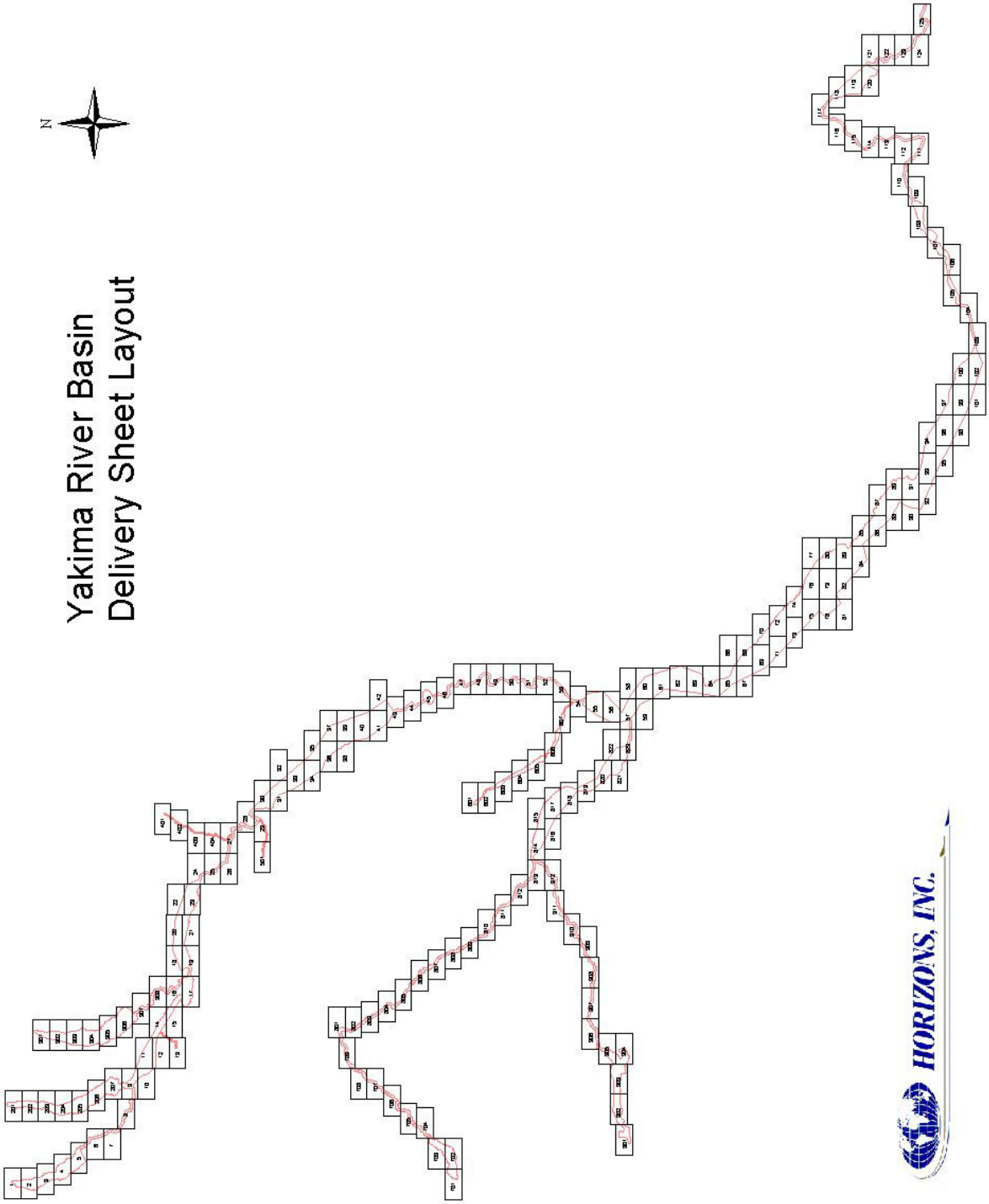
```
DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 6.28
Starting Datasheet Retrieval...
1        National Geodetic Survey,   Retrieval Date = NOVEMBER  1, 2000
 AD9177
***********************************************************************
 AD9177  SACS        -  This is a Secondary Airport Control Station.
 AD9177  DESIGNATION -  PDT C
 AD9177  PID         -  AD9177
 AD9177  STATE/COUNTY-  OR/UMATILLA
 AD9177  USGS QUAD   -  PENDLETON (1976)
 AD9177
 AD9177                        *CURRENT SURVEY CONTROL
 AD9177  ___________________________________________________________________
 AD9177* NAD 83(1998)-  45 41 40.06781(N)    118 51 09.53903(W)     ADJUSTED
 AD9177* NAVD 88     -       453.19   (meters)    1486.8    (feet)  GPS OBS
 AD9177  ___________________________________________________________________
 AD9177  X           -  -2,153,653.637 (meters)                     COMP
 AD9177  Y           -  -3,908,968.589 (meters)                     COMP
 AD9177  Z           -   4,541,901.328 (meters)                     COMP
 AD9177  LAPLACE CORR-           4.36  (seconds)                    DEFLEC99
 AD9177  ELLIP HEIGHT-         432.26  (meters)                     GPS OBS
 AD9177  GEOID HEIGHT-         -20.94  (meters)                     GEOID99
 AD9177
 AD9177  HORZ ORDER  -  FIRST
 AD9177  ELLP ORDER  -  THIRD     CLASS I
 AD9177
 AD9177.This mark is at Eastern Oregon Regional At Pendleton Airport (PDT)
 AD9177
 AD9177.The horizontal coordinates were established by GPS observations
 AD9177.and adjusted by the National Geodetic Survey in July 1997.
 AD9177.This is a SPECIAL STATUS position.  See SPECIAL STATUS under the
 AD9177.DATUM ITEM on the data sheet items page.
 AD9177
 AD9177.The orthometric height was determined by GPS observations and a
 AD9177.high-resolution geoid model.
 AD9177
 AD9177.GPS derived orthometric heights for airport stations designated as
 AD9177.PACS or SACS are published to 2 decimal places.  This maintains
 AD9177.centimeter relative accuracy between the PACS and SACS.  It does
 AD9177.not indicate centimeter accuracy relative to other marks which are
 AD9177.part of the NAVD 88 network.
 AD9177
 AD9177.The X, Y, and Z were computed from the position and the ellipsoidal
ht.
 AD9177
 AD9177.The Laplace correction was computed from DEFLEC99 derived deflections.
 AD9177
```

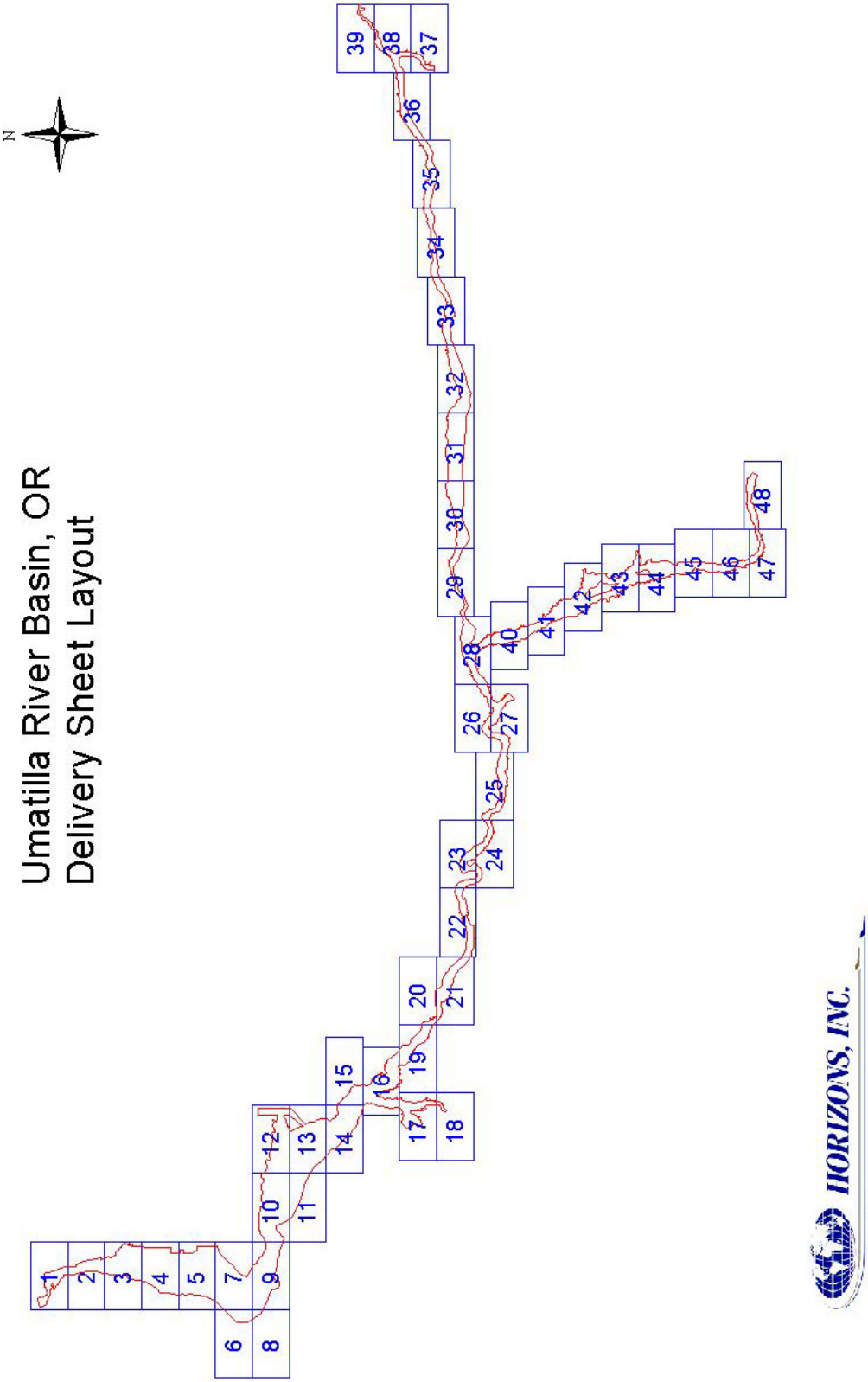
```
 AD9177.The ellipsoidal height was determined by GPS observations
 AD9177.and is referenced to NAD 83.
 AD9177
 AD9177.The geoid height was determined by GEOID99.
AD9177
 AD9177;                    North         East     Units   Scale      Converg.
 AD9177;SPC OR N     -   226,643.991 2,628,292.725   MT  0.99993667 +1 10 05.8
 AD9177;UTM  11      - 5,061,770.320   355,758.072   MT  0.99985579 -1 19 33.7
 AD9177
 AD9177                          SUPERSEDED SURVEY CONTROL
 AD9177
 AD9177.No superseded survey control is available for this station.
 AD9177
 AD9177_MARKER: DD = SURVEY DISK
 AD9177_SETTING: 17 = SET INTO TOP OF METAL PIPE DRIVEN INTO GROUND
 AD9177_STAMPING: PDT C 1996
 AD9177_PROJECTION: FLUSH
 AD9177_MAGNETIC: N = NO MAGNETIC MATERIAL
 AD9177_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
 AD9177+STABILITY: SURFACE MOTION
 AD9177_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 AD9177+SATELLITE: SATELLITE OBSERVATIONS - October 16, 1999
 AD9177_ROD/PIPE-DEPTH: 1.0  meters
 AD9177
 AD9177  HISTORY     - Date     Condition        Recov. By
 AD9177  HISTORY     - 1996     MONUMENTED       CHANCE
 AD9177  HISTORY     - 19971109 GOOD             NGS
 AD9177  HISTORY     - 19991016 GOOD             NGS
 AD9177
 AD9177                          STATION DESCRIPTION
 AD9177
 AD9177'DESCRIBED BY JE CHANCE AND ASSOCIATES 1996 (SDC)
 AD9177'THE STATION IS LOCATED ABOUT 25 MILES (40.2 KM) EAST OF HERMISTON, 3
 AD9177'MILES (4.8 KM) NORTHWEST OF HERMISTON AND 1 MILE (1.6 KM) NORTH OF
 AD9177'INTERSTATE 84 AT THE EASTERN OREGON REGIONAL AIRPORT, LARRY DALRYMPLE
 AD9177'- AIRPORT MANAGER, PHONE 541-276-7754  TO REACH THE STATION FROM THE
 AD9177'OLD PENDLETON RIVER ROAD AND INTERSTATE 84 (EXIT 207) WEST OF
 AD9177'PENDLETON, PROCEED NORTHEAST ON OLD PENDLETON RIVER ROAD 0.25 MILES
 AD9177'(0.40 KM) TO AIRPORT ROAD ON THE LEFT, TURN LEFT AND PROCEED NORTH 1.2
 AD9177'MILES (1.9 KM) TO NORTHWEST A AVENUE, TURN LEFT AND PROCEED WEST ON NW
 AD9177'A AVE 0.15 MILES (0.24 KM) TO AN ENTRANCE GATE ON THE RIGHT, TURN
 AD9177'RIGHT AND PROCEED 100 FT (30.5 M) NORTH TO THE GATE, OBTAIN
 AD9177'PERMISSION, PROCEED NORTH THROUGH THE GATE 0.2 MILES (0.3 KM) TO THE
 AD9177'NORTH END OF THE RAMP AT TAXIWAY E AT JUNCTION WITH TAXIWAY A, BEAR
 AD9177'LEFT AND ONTO TAXIWAY A AND PROCEED NORTHWEST AND THEN WEST ON TAXIWAY
 AD9177'A 0.6 MILES (1.0 KM) TO THE STATION ON THE RIGHT  THE STATION IS THE
 AD9177'CENTER OF A 5 CM SURVEY DISK SET INTO THE TOP OF A 1.0 M (3.3 FT) LONG
 AD9177'FENO PIPE, RECESSED 10 CM BELOW GROUND LEVEL AND ENCASED IN A 12.7 CM
 AD9177'DIA PVC PIPE WITH AN NGS LOGO CAP SURROUNDED BY CONCRETE.  THE LOGO
 AD9177'CAP AND CONCRETE ARE SET FLUSH WITH THE SURFACE. THREE CIRCULAR ANCHOR
 AD9177'PRONGS EXTEND FROM THE BOTTOM OF THE PIPE.  THE STATION IS LOCATED
AD9177'14.1 M (46.3 FT) NORTHEAST OF THE 8TH TAXI LIGHT SOUTHWEST OF THE
 AD9177'RUNWAY, 11.5 M (37.7 FT) NORTH OF 9TH TAXI LIGHT SOUTHWEST OF THE
 AD9177'RUNWAY, 57.65 M (189.14 FT) EAST OF THE EAST END OF A -HOLD SHORT-
```

```
AD9177'SIGN, 94.15 M (308.89 FT) SOUTHWEST OF THE FIRST RUNWAY LIGHT, 24.5 M
AD9177'(80.4 FT) NORTH OF THE PROJECTED CENTERLINE OF TAXIWAY A AND 0.5 M
AD9177'(1.6 FT) SOUTHEAST OF A CARSONITE WITNESS POST  THE STATION IS
AD9177'DESIGNATED AS A SECONDARY AIRPORT CONTROL STATION (SACS) - OREGON ANA
AD9177'SURVEYS 1996
AD9177
AD9177                          STATION RECOVERY (1997)
AD9177
AD9177'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1997 (AJL)
AD9177'RECOVERED AS DESCRIBED.
AD9177
AD9177                          STATION RECOVERY (1999)
AD9177
AD9177'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1999 (RJH)
AD9177'RECOVERED AS DESCRIBED.
```

HORIZONS, INC.

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280



HORIZONS, INC.

Aerial Mapping Professionals
3600 Jet Drive • PO Box 3134
Rapid City, SD 57709 • (605) 343-0280