



Dezembro de 2002

**GOVERNO DO  
ESTADO DO CEARÁ**



**SRH** Secretaria dos Recursos Hídricos

## **Programa de Gerenciamento e Integração dos Recursos Hídricos do Estado do Ceará - PROGERIRH**

**Contrato**

**Nº 02/ PROGERIRH-PILOTO/CE/SRH 2001**

Estudos de Alternativas, EIAS/RIMAS, Projetos Executivos, Levantamentos Cadastrais, Planos de Reassentamento e Avaliação Financeira e Econômica dos Projetos das Barragens João Guerra / Umari, Riacho da Serra, Ceará e Missi, e dos Projetos das Adutoras de Madalena, Lagoa do Mato, Alto Santo e Amontada

## **BARRAGEM UMARI VOLUME I - ESTUDOS BÁSICOS Tomo 3B - Estudos Cartográficos - Memória de Cálculos**



**MONTGOMERY WATSON**





MONTGOMERY WATSON



## ÍNDICE

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## ÍNDICE

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## 1. APRESENTAÇÃO

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## 1. APRESENTAÇÃO

O consórcio **Montgomery-Watson / Engesoft** e a **Secretaria dos Recursos Hídricos do Estado do Ceará (SRH-CE)** celebraram o contrato nº 02/PROGERIRH-PILOTO/CE/SRH 2001, que tem como objetivo o Estudo de Alternativas, EIA/RIMAS, Levantamentos Cadastrais, Planos de Reassentamento e Avaliação Financeira e Econômica dos Projetos das Barragens João Guerra / Umari, Riacho da Serra, Ceará e Missi, e dos Projetos das Adutoras de Madalena, Lagoa do Mato, Alto Santo e Amontada.

A ordem de serviço foi emitida em 05 de março de 2001 e imediatamente as equipes do consórcio iniciaram as atividades previstas no cronograma aprovado.

O presente relatório, denominado **Tomo 3B – Estudos Cartográficos – Memória de Cálculo**, é parte integrante do **Volume 1 – Estudos Básicos** e diz respeito à **Barragem Umari**, a qual tem por finalidade a criação de um reservatório no rio Barrigas, para o abastecimento da população da sede municipal de Madalena, Ceará.

Este tomo apresenta os anexos referentes à memória de cálculo relativa à transporte de coordenadas e apoio básico e suplementar para o levantamento aerofotogramétrico da bacia hidráulica.



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## **2. TRANSPORTE DE COORDENADAS**

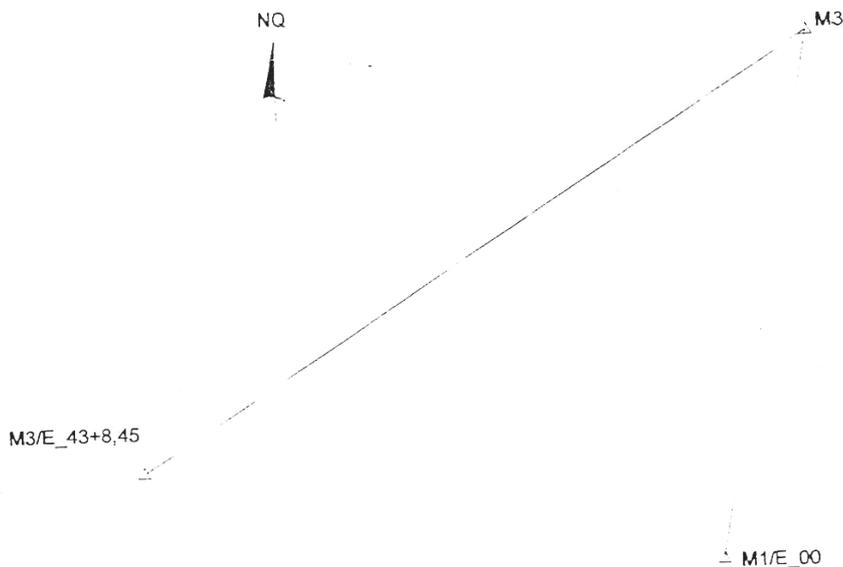
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### ENGESOFT ENGENHARIA E CONSULTORIA LTDA

Projeto: Umari	Município: Madalena	Estado: Ceará
Origem: M-03	Marco Poligonal: Marco_M1/E_00	Datum: SAD-69
Coordenada NORTE: 9.468.346,483m	Coordenada ESTE: 439.375,228m	Altitude Ortométrica: 320,772m
Latitude Geodésica: 4°48'34.87267" S	Longitude Geodésica: 39°32'48.19839" WGr	

Projeto: Umari	Município: Madalena	Estado: Ceará
Origem M-03	Marco Poligonal Marco_M3/E_43+8,45	Datum SAD-69
Coordenada NORTE 9.468.496,954m	Coordenada ESTE 438.531,131m	Altitude Ortométrica 316,368m
Latitude Geodésica: 4°48'29.95033" S	Longitude Geodésica: 39°33'15.59738" WGr	

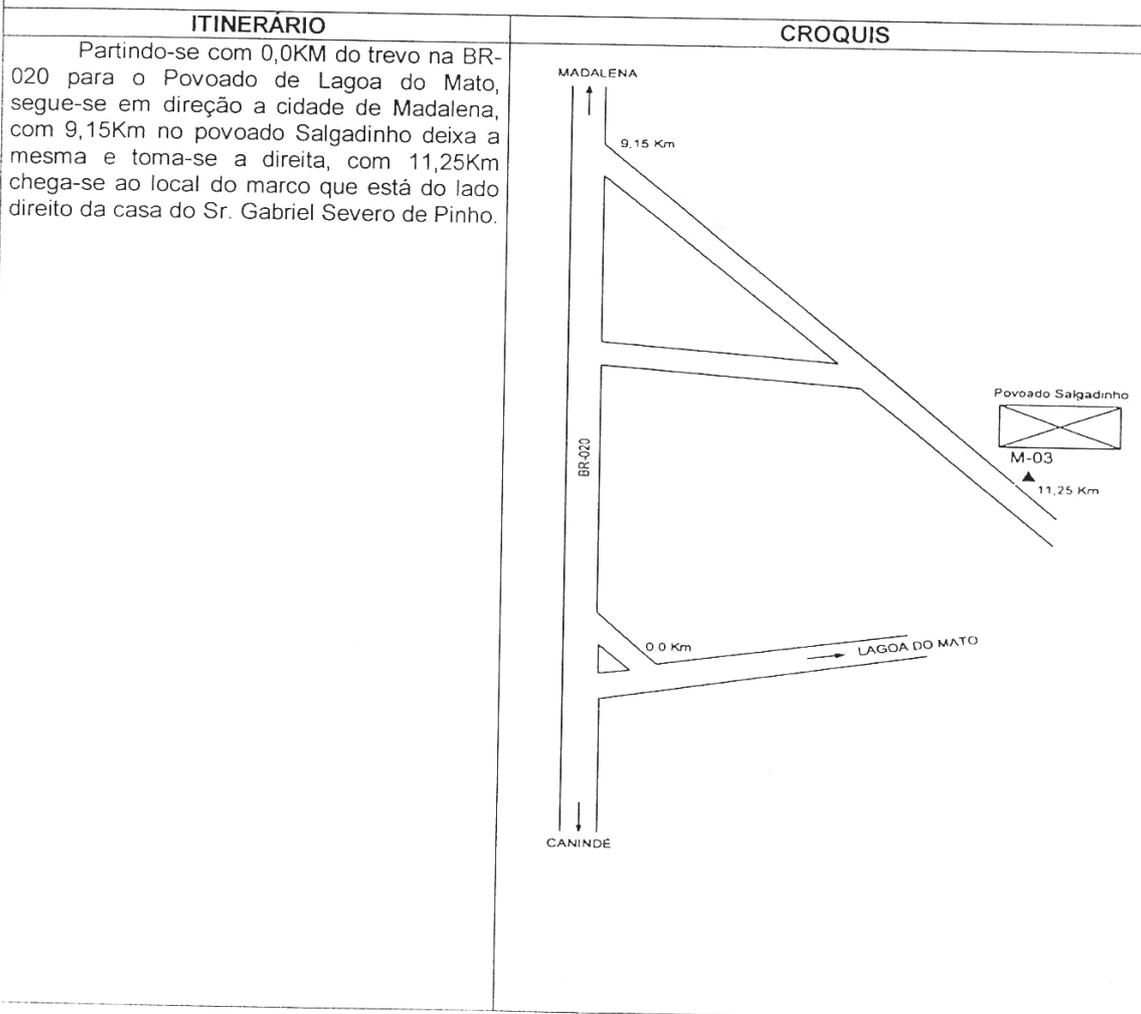




### ENGESOFT ENGENHARIA E CONSULTORIA LTDA

<b>Vértice:</b> <b>M-03</b>	<b>Ponto Visado:</b> M-04	<b>Obra/Ano:</b> O-739/2001
<b>Estado:</b> Ceará	<b>Município:</b> Madalena	<b>Local:</b> Povoado Salgadinho
<b>Origem:</b> V. Grosso (IBGE)	<b>MC:</b> 39° W	<b>Datum:</b> SAD-69
<b>Coordenada Geodésica Latitude:</b> 04° 48'09,68375"S	<b>Coordenada Geodésica Longitude:</b> 39° 32'43,58472 "W	
<b>Coordenada UTM Norte:</b> 9.469.120,061m	<b>Coordenada UTM Este:</b> 439.516,718m	<b>Altura Geométrica:</b> 324,701m
		<b>Altitude Ortométrica:</b> 325,292m

**Descrição:** Marco de concreto de formato tronco piramidal medindo, (10x12x50) cm, com chapa de bronze no centro do topo, constando: BASE S/A – São Paulo – Protegido Por Lei – Não Destruir – ENGESOFT – 06/2001 – M-03.





Ashtech, Inc. GPPS-L

Program: LINECOMP  
Wed Sep 19 20:28:19 2001

Version: 5.2.00

```

Project information
GPS Survey          |25-character project name [ The | is in column 26.
]
2611A              |5-character session name
Project information

```

```

Known-station parameters
00                 |Receiver identifier used in "LOGTIMES" file
000000            |Project station number
M-03              |4-character short name
FIXED STATION     |25-character long name
                  |25-character comment field
-----
0                 |Position extraction (0=below,1=U-file,2=proj. file)
S  4 48 11.07811 |Latitude deg-min-sec (g=good;b=bad)
E 320 27 15.14259 |E-Longitude deg-min-sec (g=good;b=bad)
W  39 32 44.85741 |W-Longitude deg-min-sec (g=good;b=bad)
    325.2920      |Ellipsoidal height (m) (g=good;b=bad)
    0.0000        |North antenna offset (m)
    0.0000        |East antenna offset (m)
    1.8500 0.1318 0.0000 |Vert antenna offset (m): slant/radius/added_offset
    20.0          |Temperature (degrees C)
    50.0          |Humidity (percent)
    1010.0        |Pressure (millibars)
UMARA01.261      |Measurement filename (restricted to 24 characters)

```

```

Known-station parameters

Unknown-station parameters
00                 |Receiver identifier used in "LOGTIMES" file
000000            |Project station number
Marco M1/E 00     |4-character short name
UNKNOWN STATION  |25-character long name
                  |25-character comment field
-----
0                 |Position extraction (0=below,1=U-file,2=proj. file)
S  4 48 36.34193 |Latitude deg-min-sec (g=good;b=bad)
E 320 27 10.62469 |E-Longitude deg-min-sec (g=good;b=bad)
W  39 32 49.37531 |W-Longitude deg-min-sec (g=good;b=bad)
    336.4632      |Ellipsoidal height (m) (g=good;b=bad)
    0.0000        |North antenna offset (m)
    0.0000        |East antenna offset (m)
    1.9530 0.1318 0.0000 |Vert antenna offset (m): slant/radius/added_offset
    20.0          |Temperature (degrees C)
    50.0          |Humidity (percent)
    1010.0        |Pressure (millibars)
UMAR1A01.261     |Measurement filename (restricted to 24 characters)

```

```

Unknown-station parameters

Run-time parameters
  1                 |First epoch to process
 -1                |Final epoch to process (-1 = last available)
15.0              |Elevation cutoff angle (degrees)
1                 |Data to process (0=Wdln;1=L1;2=L2;3=L1c;6=RpdSt)
0.010000         |Convergence criterion (meters)
00 00 00 00 00 00 |Omit these satellites (up to 7)
10               |Maximum iterations for tlsq and dlsq
00 00 00 00 00 00 |Forbidden reference SVs (up to 7)
yes              |Apply tropo delay correction
Run-time parameters

```

LINECOMP 5.2.00 7-18-94

FIXED U-File from L1 only receiver.

UNKW N U-File from L1 only receiver.

FIXED U-File used BROADCAST orbits.



UNKWN U-File used BROADCAST orbits.

Common start of two UFILES: 2001/09/18 20:35:10.00
Common end of two UFILES: 2001/09/18 21:08:15.00

Selected first epoch: 1
Selected last epoch: 398
For SV 3 there are 397 triple-difference measurements.
For SV 6 there are 353 triple-difference measurements.
For SV 14 there are 397 triple-difference measurements.
For SV 15 there are 397 triple-difference measurements.
For SV 17 there are 395 triple-difference measurements.
For SV 18 there are 208 triple-difference measurements.
For SV 21 there are 397 triple-difference measurements.
For SV 22 there are 397 triple-difference measurements.
For SV 25 there are 397 triple-difference measurements.
For SV 29 there are 397 triple-difference measurements.
Epoch interval (seconds): 5.000000

THE TRIPLE DIFFERENCE SOLUTION (L1)

Measure of geometry: 6.423252
num\_meas = 3338 num\_used = 3338 rms\_resid = 0.002494(m)
Post-Fit Chisq = 7750.454 NDF = 7.727

Sigmax (m): 3.611150
Sigmay (m): 3.421019
Sigmaz (m): 1.058934
x y z
x 1.00
y 0.38y 1.00
z-0.52z-0.47z 1.00

del\_station: -0.000064 -0.000007 0.000009

Station1: FIXED STATION
M-03

Station2: UNKNOWN STATION
Marco\_M1/E\_00

Latitude: -4.80307725 -4 48 11.07811 -4.81007436 -4 48 36.26770
E-Long : 320.45420628 320 27 15.14259 320.45292521 320 27 10.53075
W-Long : 39.54579372 39 32 44.85741 39.54707479 39 32 49.46925
E-Height: 325.2920 320.8059

Baseline vector: -143.9303 -65.4586 -770.6969

Mark1\_xyz : 4901376.9269 -4046967.1267 -530514.6566
Az1\_E11 D1 : 190.40702 -0.3303 786.7493
E1 N1 U1 : -142.1174 -773.7942 -4.4861
Mark2\_xyz : 4901232.9966 -4047032.5853 -531285.3535
Az2\_E12 D2 : 10.40713 0.3231 786.7493
E2 N2 U2 : 142.1158 773.7939 4.4861

Double-Difference Epochs:

Prn: 3 Start epoch: 2 End epoch: 398
Prn: 6 Start epoch: 2 End epoch: 354
Prn: 14 Start epoch: 2 End epoch: 398
Prn: 15 Start epoch: 2 End epoch: 398
Prn: 17 Start epoch: 4 End epoch: 398
Prn: 18 Start epoch: 2 End epoch: 209
Prn: 21 Start epoch: 2 End epoch: 398
Prn: 22 Start epoch: 2 End epoch: 398
Prn: 25 Start epoch: 2 End epoch: 398
Prn: 29 Start epoch: 2 End epoch: 398

THE FLOAT DOUBLE DIFFERENCE SOLUTION (L1)

Measure of geometry: 0.160892 Wavelength = 0.190294 (m/cycle)
num\_meas = 3339 num\_used = 3334 rms\_resid = 0.006837(m)
Post-Fit Chisq = 4651.083 NDF = 7.718



Reference SV: 14

SV	Ambiguity	FIT	Meas	SV	Ambiguity	FIT	Meas
3	-7822647.993f	0.017	397	6	-16644394.019f	0.041	353
15	-5459330.056f	0.026	397	17	-7982582.064f	0.040	396
18	-17464833.052f	0.058	207	21	-12609437.016f	0.030	397
22	-6293827.957f	0.039	397	25	-2529947.966f	0.049	393
29	4317412.023f	0.016	397				

Sigma<sub>x</sub> (m): 0.070240  
 Sigma<sub>y</sub> (m): 0.063312  
 Sigma<sub>z</sub> (m): 0.028432  
 Sigma<sub>N</sub> (cy): 0.270274  
 Sigma<sub>N</sub> (cy): 0.259157  
 Sigma<sub>N</sub> (cy): 0.287437  
 Sigma<sub>N</sub> (cy): 0.366366  
 Sigma<sub>N</sub> (cy): 0.289617  
 Sigma<sub>N</sub> (cy): 0.205533  
 Sigma<sub>N</sub> (cy): 0.407254  
 Sigma<sub>N</sub> (cy): 0.243322  
 Sigma<sub>N</sub> (cy): 0.138233

x y z N N N N N N N N N  
 x 1.00  
 y 0.37y 1.00  
 z -0.12z -0.10z 1.00  
 N -0.92N -0.49N -0.21N 1.00  
 N 0.14N 0.87N 0.35N -0.40N 1.00  
 N 0.37N 0.94N -0.40N -0.37N 0.70N 1.00  
 N 0.42N 0.98N -0.24N -0.48N 0.80N 0.98N 1.00  
 N -0.03N 0.81N -0.49N 0.05N 0.59N 0.90N 0.84N 1.00  
 N -0.68N 0.08N -0.56N 0.78N -0.03N 0.26N 0.13N 0.62N 1.00  
 N -0.96N -0.56N 0.28N 0.87N -0.26N -0.59N -0.61N -0.23N 0.48N 1.00  
 N -0.77N -0.03N 0.62N 0.49N 0.38N -0.20N -0.14N 0.03N 0.30N 0.77N 1.00  
 N -0.82N -0.63N 0.48N 0.70N -0.25N -0.70N -0.69N -0.43N 0.22N 0.93N 0.76N 1.00

del\_station: -0.003024 -0.001052 0.000322

Station1: FIXED STATION

Station2: UNKNOWN STATION

M-03 Marco M1/E\_00  
 Latitude: -4.80307725 -4 48 11.07811 -4.81007425 -4 48 36.26728  
 E-Long : 320.45420628 320 27 15.14259 320.45292472 320 27 10.52899  
 W-Long : 39.54579372 39 32 44.85741 39.54707528 39 32 49.47101  
 E-Height: 325.2920 320.7735

Baseline vector: -143.9890 -65.4807 -770.6816

Mark1\_xyz : 4901376.9269 -4046967.1267 -530514.6566  
 Az1 E1 D1 : 190.41109 -0.3326 786.7469  
 E1 N1 U1 : -142.1719 -773.7816 -4.5185  
 Mark2\_xyz : 4901232.9379 -4047032.6074 -531285.3382  
 Az2 E2 D2 : 10.41120 0.3255 786.7469  
 E2 N2 U2 : 142.1703 773.7812 4.5185

AMBIGUITY RESOLUTION

	1	2	3	4
Abs Contrast	43.691	0.000	0.000	0.000
Contrast		100.000	100.000	100.000
Change Chi2	156.260	149670.429	153641.695	159559.521
Bias S14: 3	-7822648	-7822648	-7822648	-7822649
Bias S14: 6	-16644394	-16644395	-16644393	-16644395
Bias S14:15	-5459330	-5459330	-5459330	-5459331
Bias S14:17	-7982582	-7982582	-7982582	-7982583
Bias S14:18	-17464833	-17464833	-17464833	-17464834
Bias S14:21	-12609437	-12609437	-12609437	-12609438
Bias S14:22	-6293828	-6293829	-6293827	-6293829
Bias S14:25	-2529948	-2529949	-2529947	-2529949
Bias S14:29	4317412	4317412	4317412	4317412



NDF=92.3500 Chi2=4651.0831

THE FIXED DOUBLE DIFFERENCE SOLUTION (L1)

Measure of geometry: 0.014419 Wavelength = 0.190294 (m/cycle)
num\_meas = 3339 num\_used = 3334 rms\_resid = 0.006949(m)
Post-Fit Chisq = 4807.346 NDF = 7.718

Reference SV: 14 Integer Search Ratio = 100.000
Table with columns: SV, Ambiguity, FIT, Meas, SV, Ambiguity, FIT, Meas

Sigmax (m): 0.006981
Sigmay (m): 0.004945
Sigmaz (m): 0.002785

x 1.00
y-0.65y 1.00
z 0.01z 0.15z 1.00

del\_station: 0.000000 0.000000 -0.000000
Station1: FIXED STATION M-03
Station2: UNKNOWN STATION Marco\_M1/E\_00
Latitude: -4.80307725 -4 48 11.07811 -4.81007429 -4 48 36.26745
E-Long : 320.45420628 320 27 15.14259 320.45292481 320 27 10.52932
W-Long : 39.54579372 39 32 44.85741 39.54707519 39 32 49.47068
E-Height: 325.2920 320.7718

Baseline vector: -143.9841 -65.4714 -770.6866

Mark1\_xyz : 4901376.9269 -4046967.1267 -530514.6566
Az1 El1 D1 : 190.41028 -0.3327 786.7501
E1 N1 U1 : -142.1614 -773.7868 -4.5202
Mark2\_xyz : 4901232.9429 -4047032.5980 -531285.3432
Az2 El2 D2 : 10.41039 0.3256 786.7501
E2 N2 U2 : 142.1599 773.7864 4.5202
Wed Sep 19 20:28:30 2001



```

Project information
GPS Survey          |25-character project name [ The | is in column 26.
]
2611A              |5-character session name
Project information

```

```

Known-station parameters
00                |Receiver identifier used in "LOGTIMES" file
000000           |Project station number
M-03             |4-character short name
FIXED STATION    |25-character long name
-----          |25-character comment field
0                |Position extraction (0=below,1=U-file,2=proj. file)
S  4 48 11.07811 |Latitude deg-min-sec (g=good;b=bad)
E 320 27 15.14259 |E-Longitude deg-min-sec (g=good;b=bad)
W  39 32 44.85741 |W-Longitude deg-min-sec (g=good;b=bad)
    325.2920      |Ellipsoidal height (m) (g=good;b=bad)
    0.0000        |North antenna offset (m)
    0.0000        |East antenna offset (m)
    1.8500 0.1318 0.0000 |Vert antenna offset (m): slant/radius/added_offset
    20.0          |Temperature (degrees C)
    50.0          |Humidity (percent)
    1010.0        |Pressure (millibars)
UUMARA01.261     |Measurement filename (restricted to 24 characters)
Known-station parameters

```

```

Unknown-station parameters
00                |Receiver identifier used in "LOGTIMES" file
000000           |Project station number
Marco_M3/E_43+8,45 |4-character short name
UNKNOWN STATION   |25-character long name
-----          |25-character comment field
0                |Position extraction (0=below,1=U-file,2=proj. file)
S  4 48 31.49976 |Latitude deg-min-sec (g=good;b=bad)
E 320 26 43.19842 |E-Longitude deg-min-sec (g=good;b=bad)
W  39 33 16.80158 |W-Longitude deg-min-sec (g=good;b=bad)
    339.2703      |Ellipsoidal height (m) (g=good;b=bad)
    0.0000        |North antenna offset (m)
    0.0000        |East antenna offset (m)
    1.9690 0.1318 0.0000 |Vert antenna offset (m): slant/radius/added_offset
    20.0          |Temperature (degrees C)
    50.0          |Humidity (percent)
    1010.0        |Pressure (millibars)
UMAR3A01.261     |Measurement filename (restricted to 24 characters)
Unknown-station parameters

```

```

Run-time parameters
1                |First epoch to process
-1              |Final epoch to process (-1 = last available)
15.0            |Elevation cutoff angle (degrees)
1               |Data to process (0=Wdln;1=L1;2=L2;3=L1c;6=RpdSt)
0.010000       |Convergence criterion (meters)
00 00 00 00 00 00 00 |Omit these satellites (up to 7)
10             |Maximum iterations for tlsq and dlsq
00 00 00 00 00 00 00 |Forbidden reference SVs (up to 7)
yes            |Apply tropo delay correction
Run-time parameters

```

LINECOMP 5.2.00 7-18-94

FIXED U-File from L1 only receiver.

UNKWKN U-File from L1 only receiver.

FIXED U-File used BROADCAST orbits.



UNKWN U-File used BROADCAST orbits.

Common start of two UFILES: 2001/09/18 19:53:10.00
Common end of two UFILES: 2001/09/18 20:22:30.00
Selected first epoch: 1
Selected last epoch: 353
For SV 6 there are 352 triple-difference measurements.
For SV 14 there are 352 triple-difference measurements.
For SV 15 there are 352 triple-difference measurements.
For SV 17 there are 352 triple-difference measurements.
For SV 18 there are 352 triple-difference measurements.
For SV 21 there are 352 triple-difference measurements.
For SV 22 there are 352 triple-difference measurements.
For SV 29 there are 352 triple-difference measurements.
Epoch interval (seconds): 5.000000

THE TRIPLE DIFFERENCE SOLUTION (L1)

Measure of geometry: 7.886520
num\_meas = 2464 num\_used = 2464 rms\_resid = 0.002500 (m)
Post-Fit Chisq = 5061.562 NDF = 5.704

Sigma\_x (m): 4.392072
Sigma\_y (m): 3.587503
Sigma\_z (m): 1.528494
x y z
x 1.00
y 0.42y 1.00
z 0.20z-0.50z 1.00

del\_station: 0.000013 0.000012 -0.000001
Station1: FIXED STATION Station2: UNKNOWN STATION
M-03 Marco\_M3/E\_43+8,45
Latitude: -4.80307725 -4 48 11.07811 -4.80870723 -4 48 31.34605
E-Long : 320.45420628 320 27 15.14259 320.44531429 320 26 43.13146
W-Long : 39.54579372 39 32 44.85741 39.55468571 39 33 16.86854
E-Height: 325.2920 316.3334

Baseline vector: -675.2264 -721.7148 -619.6671

Mark1\_xyz : 4901376.9269 -4046967.1267 -530514.6566
Az1 El1 D1 : 237.74103 -0.4453 1166.5291
El N1 U1 : -986.4484 -622.6070 -8.9586
Mark2\_xyz : 4900701.7005 -4047688.8414 -531134.3236
Az2 El2 D2 : 57.74177 0.4348 1166.5291
E2 N2 U2 : 986.4389 622.6062 8.9586

Double-Difference Epochs:

Prn: 6 Start epoch: 2 End epoch: 353
Prn: 14 Start epoch: 2 End epoch: 353
Prn: 15 Start epoch: 2 End epoch: 353
Prn: 17 Start epoch: 2 End epoch: 353
Prn: 18 Start epoch: 2 End epoch: 353
Prn: 21 Start epoch: 2 End epoch: 353
Prn: 22 Start epoch: 2 End epoch: 353
Prn: 29 Start epoch: 2 End epoch: 353

THE FLOAT DOUBLE DIFFERENCE SOLUTION (L1)

Measure of geometry: 0.210239 Wavelength = 0.190294 (m/cycle)
num\_meas = 2464 num\_used = 2452 rms\_resid = 0.007445 (m)
Post-Fit Chisq = 3574.277 NDF = 5.676

Reference SV: 14

SV Ambiguity FIT Meas SV Ambiguity FIT Meas
6 -5932699.916f 0.033 352 15 -2934700.915f 0.033 352



17	-3791068.894F	0.051	343	18	-6952771.935f	0.038	352
21	-4646103.023f	0.040	352	22	-2303967.099f	0.039	349
29	1175673.991f	0.037	352				

```

Sigmax (m):      0.092891
Sigmay (m):      0.083876
Sigmaz (m):      0.041622
SigmaN (cy):     0.314346
SigmaN (cy):     0.393001
SigmaN (cy):     0.477312
SigmaN (cy):     0.382214
SigmaN (cy):     0.358790
SigmaN (cy):     0.555325
SigmaN (cy):     0.175400

```

```

x      y      z      N      N      N      N      N      N
x 1.00
y 0.41y 1.00
z 0.22z-0.05z 1.00
N 0.61N 0.96N 0.10N 1.00
N-0.02N 0.68N-0.74N 0.52N 1.00
N 0.25N 0.88N-0.51N 0.78N 0.93N 1.00
N-0.24N 0.51N-0.83N 0.31N 0.96N 0.83N 1.00
N-0.78N-0.33N-0.76N-0.54N 0.41N 0.07N 0.61N 1.00
N-0.96N-0.62N-0.29N-0.78N-0.09N-0.39N 0.15N 0.83N 1.00
N-0.90N-0.54N 0.14N-0.64N-0.32N-0.51N-0.12N 0.52N 0.88N 1.00

```

```

del_station: 0.000000 -0.000000 0.000000
  Station1: FIXED STATION
            M-03
Latitude:  -4.80307725  -4 48 11.07811
E-Long   : 320.45420628 320 27 15.14259
W-Long   : 39.54579372 39 32 44.85741
E-Height: 325.2920
  Station2: UNKNOWN STATION
            Marco M3/E 43+8,45
Latitude: -4.80870700  -4 48 31.34520
E-Long   : 320.44531413 320 26 43.13087
W-Long   : 39.55468587 39 33 16.86913
E-Height: 316.3646

```

Baseline vector: -675.2121 -721.7498 -619.6440

```

Mark1_xyz : 4901376.9269 -4046967.1267 -530514.6566
Az1 E1 D1 : 237.74257 -0.4437 1166.5303
E1 N1 U1 : -986.4663 -622.5811 -8.9274
Mark2_xyz : 4900701.7148 -4047688.8765 -531134.3005
Az2 E2 D2 : 57.74332 0.4332 1166.5303
E2 N2 U2 : 986.4568 622.5804 8.9274

```

AMBIGUITY RESOLUTION

	1	2	3	4
Abs Contrast	33.396	0.000	0.000	0.000
Contrast		100.000	100.000	100.000
Change Chi2	386.794	38155.673	50308.573	71550.655
Bias S14: 6	-5932700	-5932700	-5932700	-5932701
Bias S14:15	-2934701	-2934702	-2934700	-2934701
Bias S14:17	-3791069	-3791070	-3791068	-3791070
Bias S14:18	-6952772	-6952773	-6952771	-6952772
Bias S14:21	-4646103	-4646104	-4646102	-4646102
Bias S14:22	-2303967	-2303968	-2303966	-2303966
Bias S14:29	1175674	1175674	1175674	1175674
NDF=68.3000	Chi2=3574.2772			

THE FIXED DOUBLE DIFFERENCE SOLUTION (L1)

```

Measure of geometry: 0.025843 Wavelength = 0.190294 (m/cycle)
num_meas = 2464 num_used = 2458 rms resid = 0.007941(m)
Post-Fit Chisq = 4076.249 NDF = 5.690

```

```

Reference SV: 14 Integer Search Ratio = 100.000
SV Ambiguity FIT Meas SV Ambiguity FIT Meas
6 -5932700.000X 0.035 352 15 -2934701.000X 0.038 352

```



```

17      -3791069.000X  0.054  349      18      -6952772.000X  0.041  352
21      -4646103.000X  0.040  352      22      -2303967.000X  0.040  349
29      1175674.000X  0.042  352

Sigmax (m):      0.012928
Sigmay (m):      0.010352
Sigmaz (m):      0.004975
  x      y      z
x 1.00
y-0.84y 1.00
z-0.60z 0.68z 1.00

del_station: -0.000074 0.000131 0.000016
  Station1: FIXED STATION
            M-03
Latitude: -4.80307725 -4 48 11.07811
E-Long   : 320.45420628 320 27 15.14259
W-Long   : 39.54579372 39 32 44.85741
E-Height: 325.2920
  Station2: UNKNOWN STATION
            Marco M3/E 43+8,45
Latitude: -4.80870698 -4 48 31.34514
E-Long   : 320.44531391 320 26 43.13009
W-Long   : 39.55468609 39 33 16.86991
E-Height: 316.3677

Baseline vector:      -675.2250      -721.7705      -619.6424

Mark1_xyz : 4901376.9269 -4046967.1267 -530514.6566
Az1 El1 D1 :      237.74328      -0.4436      1166.5496
E1 N1 U1   :      -986.4904      -622.5793      -8.9243
Mark2_xyz : 4900701.7019 -4047688.8971 -531134.2989
Az2 El2 D2 :      57.74403      0.4331      1166.5496
E2 N2 U2   :      986.4809      622.5785      8.9243
Wed Sep 19 20:28:41 2001

```



MONTGOMERY WATSON



### **3. APOIO BÁSICO E SUPLEMENTAR PARA O LEVANTAMENTO AEROFOTOGRAMÉTRICO**

---



## ENGESOFT ENGENHARIA E CONSULTORIA LTDA

<b>Vértice:</b> <b>M-01</b>	<b>Ponto Visado:</b>	<b>Obra/Ano:</b> O-739/2001
<b>Estado:</b> Ceará	<b>Município:</b> Madalena	<b>Local:</b> Fazenda Vargem Comprida
<b>Origem:</b> V. Grosso (IBGE)	<b>MC:</b> 39° W	<b>Datum:</b> SAD-69
<b>Coordenada Geodésica Latitude:</b> 04° 48'07,96941"S		<b>Coordenada Geodésica Longitude:</b> 39° 31'44,33401"W
<b>Coordenada UTM Norte:</b> 9.469.174,135m	<b>Coordenada UTM Este:</b> 441.341,799m	<b>Altura Geométrica:</b> 327,755m <b>Altitude Ortométrica:</b> 328,249m
<b>Descrição:</b> Marco de concreto de formato tronco piramidal medindo, (10x12x50) cm, com chapa de bronze no centro do topo, constando: BASE S/A – São Paulo – Protegido Por Lei – Não Destruir – ENGESOFT – 06/2001 – M-01.		

ITINERÁRIO	CROQUIS
<p>Partindo-se com 0,0Km do trevo na BR-020 para o Povoado de Lagoa do Mato, segue-se em direção a cidade de Madalena, com 6,8Km e +/- 50m à direita chega-se na porteira da Fazenda Vargem Comprida, propriedade do Sr. Wilson do Pinho, onde o marco está localizado à esquerda da mesma.</p>	



## ENGESOFTE ENGENHARIA E CONSULTORIA LTDA

<b>Vértice:</b> <b>M-02</b>	<b>Ponto Visado:</b>	<b>Obra/Ano:</b> O-739/2001
<b>Estado:</b> Ceará	<b>Município:</b> Madalena	<b>Local:</b> Santana
<b>Origem:</b> V. Grosso (IBGE)	<b>MC:</b> 39° W	<b>Datum:</b> SAD-69
<b>Coordenada Geodésica Latitude:</b> 04° 44'26,43393"S	<b>Coordenada Geodésica Longitude:</b> 39° 34'03,68065 "W	
<b>Coordenada UTM Norte:</b> 9.475.973,281m	<b>Coordenada UTM Este:</b> 437.043,836m	<b>Altura Geométrica:</b> 346,909m <b>Altitude Ortométrica:</b> 347,432m
<b>Descrição:</b> Marco de concreto de formato tronco piramidal medindo, (10x12x50) cm, com chapa de bronze no centro do topo, constando: BASE S/A – São Paulo – Protegido Por Lei – Não Destruir – ENGESOFTE – 06/2001 – M-02.		

ITINERÁRIO	CROQUIS
<p>Partindo-se com 0,0Km do trevo na BR-020, para o Povoado de Lagoa do Mato segue-se pela CE-366, com 10,4Km e +/- 50m à esquerda chega-se ao marco localizado no canto da cerca na Comunidade de Santana.</p>	



## ENGESOFT ENGENHARIA E CONSULTORIA LTDA

<b>Vértice:</b> <b>M-03</b>	<b>Ponto Visado:</b> M-04	<b>Obra/Ano:</b> O-739/2001
<b>Estado:</b> Ceará	<b>Município:</b> Madalena	<b>Local:</b> Povoado Salgadinho
<b>Origem:</b> V. Grosso (IBGE)	<b>MC:</b> 39° W	<b>Datum:</b> SAD-69
<b>Coordenada Geodésica Latitude:</b> 04° 48'09,68375"S		<b>Coordenada Geodésica Longitude:</b> 39° 32'43,58472 "W
<b>Coordenada UTM Norte:</b> 9.469.120,061m	<b>Coordenada UTM Este:</b> 439.516,718m	<b>Altura Geométrica:</b> 324,701m <b>Altitude Ortométrica:</b> 325,292m
<b>Descrição:</b> Marco de concreto de formato tronco piramidal medindo, (10x12x50) cm, com chapa de bronze no centro do topo, constando: BASE S/A – São Paulo – Protegido Por Lei – Não Destruir – ENGESOFT – 06/2001 – M-03.		
<b>ITINERÁRIO</b>		<b>CROQUIS</b>
<p>Partindo-se com 0,0KM do trevo na BR-020 para o Povoado de Lagoa do Mato, segue-se em direção a cidade de Madalena, com 9,15Km no povoado Salgadinho deixa a mesma e toma-se a direita, com 11,25Km chega-se ao local do marco que está do lado direito da casa do Sr. Gabriel Severo de Pinho.</p>		



## ENGESOFT ENGENHARIA E CONSULTORIA LTDA

<b>Vértice:</b> <b>M-04</b>	<b>Ponto Visado:</b> M-03	<b>Obra/Ano:</b> O-739/2001
<b>Estado:</b> Ceará	<b>Município:</b> Madalena	<b>Local:</b> Povoado Salgadinho
<b>Origem:</b> V. Grosso (IBGE)	<b>MC:</b> 39° W	<b>Datum:</b> SAD-69
<b>Coordenada Geodésica Latitude:</b> 04° 47'50,15862"S	<b>Coordenada Geodésica Longitude:</b> 39° 32'40,85352"W	
<b>Coordenada UTM Norte:</b> 9.469.719,675m	<b>Coordenada UTM Este:</b> 439.600,372m	<b>Altura Geométrica:</b> 311,887m <b>Altitude Ortométrica:</b> 312,450m
<b>Descrição:</b> Marco de concreto de formato tronco piramidal medindo, (10x12x50) cm, com chapa de bronze no centro do topo, constando: BASE S/A – São Paulo – Protegido Por Lei – Não Destruir – ENGESOFT – 06/2001 – M-04.		

ITINERÁRIO	CROQUIS
<p>Partindo-se com 0,0Km do trevo para o Povoado de Lagoa do Mato na BR-020, segue-se em direção a cidade de Madalena, com 9,15Km deixa-se a BR entrando à direita para o Povoado Salgadinho, com 11,25Km passa-se pelo M-03, com 11,75Km chega-se ao M-04 que está no canto da cerca na margem direita da estrada.</p>	



ENGESOFT Engenharia e Projetos S/A  
MAPEAMENTO AEROFOTOGRAMÉTRICO  
APOIO BÁSICO

Cliente: ENGESOFT Local: UMARI e JOÃO GUERRA/CE  
Obra: O-739 Operador: WIVEAR Data: 19-Jul-2001

**Transformação de Sistemas Geodésicos**

Elipsóide de origem: WGS\_84 a=6378137.000 b=6356752.314  
Elipsóide de destino: SAD\_69 a=6378160.000 b=6356774.719  
Parâmetros para transformação: dX = 66.870 dY = -4.370 dZ = 38.520

**Coordenadas referidas ao Sistema WGS\_84**

Ponto	Latitude	Longitude	h
M01	4°48'09.36388"S	39°31'45.60577"W	299.808
M01A	4°39'25.39024"S	39°39'33.77348"W	359.193
M02	4°44'27.82659"S	39°34'04.95348"W	318.942
M02A	4°39'36.44596"S	39°39'14.65464"W	361.345
M03	4°48'11.07821"S	39°32'44.85698"W	296.766
M04	4°47'51.55293"S	39°32'42.12575"W	283.947
RN1678Z	4°41'43.53226"S	39°26'49.48755"W	331.517
RN515G	4°44'19.24633"S	39°34'39.05452"W	312.509
VBARRA	4°31'44.57964"S	39°23'56.35491"W	538.240
VGROSSO	4°38'50.10834"S	39°25'47.92469"W	453.870



ENGESOFT Engenharia e Projetos S/A  
MAPEAMENTO AEROFOTOGRAMÉTRICO  
APOIO BÁSICO

Cliente: ENGESOFT Local: UMARI e JOÃO GUERRA/CE  
Obra: O-739 Operador: WIVEAR Data: 19-Jul-2001

**Transformação de Sistemas Geodésicos**

Elipsóide de origem: WGS\_84 a=6378137.000 b=6356752.314  
Elipsóide de destino: SAD\_69 a=6378160.000 b=6356774.719  
Parâmetros para transformação: dX = 66.870 dY = -4.370 dZ = 38.520

**Coordenadas referidas ao Sistema SAD\_69**

Ponto	Latitude	Longitude	h
M01	4°48'07.96941"S	39°31'44.33401"W	327.755
M01A	4°39'24.00013"S	39°39'32.49800"W	387.159
M02	4°44'26.43393"S	39°34'03.68065"W	346.909
M02A	4°39'35.05575"S	39°39'13.37932"W	389.313
M03	4°48'09.68375"S	39°32'43.58472"W	324.701
M04	4°47'50.15862"S	39°32'40.85352"W	311.887
RN1678Z	4°41'42.14066"S	39°26'48.21853"W	359.600
RN515G	4°44'17.85375"S	39°34'37.78140"W	340.471
VBARRA	4°31'43.19273"S	39°23'55.08770"W	566.480
VGROSSO	4°38'48.71811"S	39°25'46.65631"W	482.000



ENGESOFT Engenharia e Projetos S/A  
MAPEAMENTO AEROFOTOGRAMÉTRICO  
APOIO BÁSICO

Cliente: ENGESOFT Local: UMARI e JOÃO GUERRA/CE  
Obra: O-739 Operador: WIVEAR Data: 19-Jul-2001

**Transformação de Coordenadas Geodésicas em Planoretangulares TM**

Elipsóide: SAD\_69 a=6378160.000 b=6356774.719

Meridiano Central: 39°00'00.00"W Hemisfério Sul

**Coordenadas UTM**

Ponto	N(m)	E(m)	h(m)	Convergência	kapa
M01	9469174.135	441341.799	327.755	0°02'39.43"	0.99964259
M01A	9485251.148	426905.361	387.159	0°03'12.62"	0.99966613
M02	9475973.281	437043.836	346.909	0°02'48.91"	0.99964906
M02A	9484912.212	427494.731	389.313	0°03'11.19"	0.99966507
M03	9469120.061	439516.718	324.701	0°02'44.41"	0.99964528
M04	9469719.675	439600.372	311.887	0°02'43.99"	0.99964515
RN1678Z	9481027.870	450455.442	359.600	0°02'11.64"	0.99963038
RN515G	9476235.881	435993.099	340.471	0°02'51.64"	0.99965071
VBARRA	9499422.163	455778.904	566.480	0°01'53.31"	0.99962420
VGROSSO	9486354.135	452348.780	482.000	0°02'05.30"	0.99962811

OBS.: Alturas Geométricas, referidas ao elipsóide.



**ENGESOFT Engenharia e Projetos S/A**  
**MAPEAMENTO AEROFOTOGRAMÉTRICO**  
**APOIO BÁSICO**

Cliente: ENGESOFT Local: UMARI e JOÃO GUERRA/CE  
Obra: O-739 Operador: WIVEAR Data: 19-Jul-2001

**Coordenadas Geodésicas Planoretangulares - UTM**

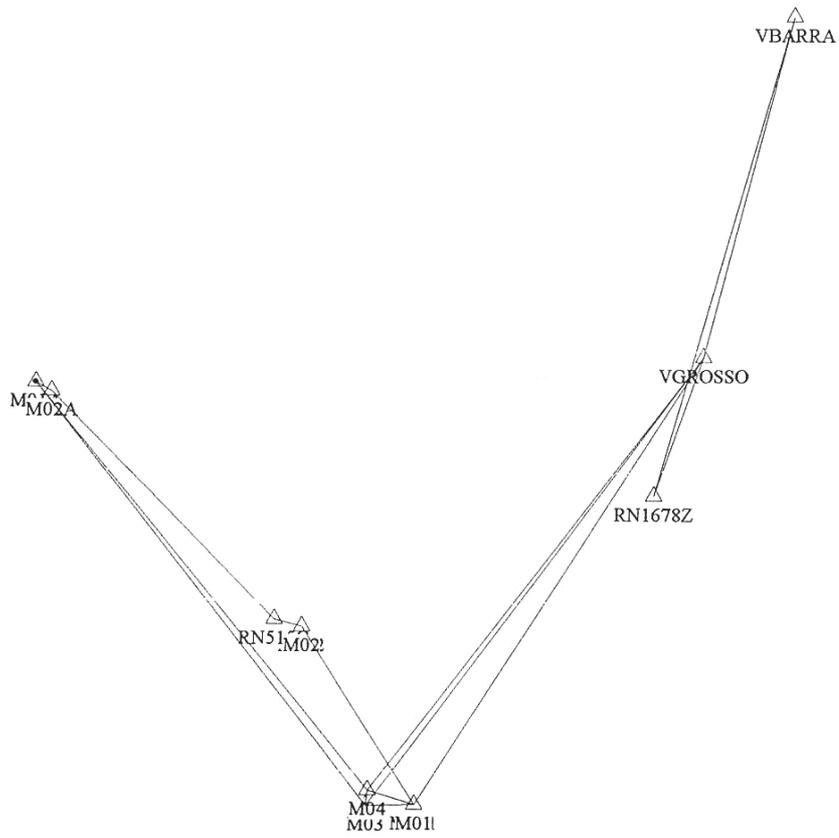
Elipsóide: SAD\_69 a=6378160.000 b=6356774.719  
Meridiano Central: 39°00'00.00"W Hemisfério Sul

Ponto	N (m)	E (m)	H (m)
M01	9469174.135	441341.799	328.249
M01A	9485251.148	426905.361	387.956
M02	9475973.281	437043.836	347.432
M02A	9484912.212	427494.731	390.089
M03	9469120.061	439516.718	325.292
M04	9469719.675	439600.372	312.450
RN1678Z	9481027.870	450455.442	359.850
RN515G	9476235.881	435993.099	340.77
VBARRA	9499422.163	455778.904	566.53
VGROSSO	9486354.135	452348.780	482.00

OBS.: Altitudes Ortométricas, com milímetros, obtidas  
por nivelamento geométrico e com centímetros,  
obtidas por diferença geoidal.



# Network Map: UMJG





COORDINATE ADJUSTMENT SUMMARY  
NETWORK = UMJG  
TIME = Thu Jul 19 15:38:24 2001

Datum = WGS-84  
Coordinate System = Geographic  
Zone = Global

Network Adjustment Constraints:  
1 fixed coordinates in y  
1 fixed coordinates in x  
1 fixed coordinates in H

POINT	NAME	OLD COORDS	ADJUST	NEW COORDS	1.00σ
1	M01				
	LAT=	4° 48' 09.363913"	+0.000031"	4° 48' 09.363882"	0.009373m
	LON=	39° 31' 45.605882"	+0.000115"	39° 31' 45.605768"	0.020653m
	ELL HT=	299.8109m	-0.0026m	299.8083m	0.034936m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
2	M01A				
	LAT=	4° 39' 25.390272"	+0.000033"	4° 39' 25.390239"	0.010251m
	LON=	39° 39' 33.773593"	+0.000117"	39° 39' 33.773476"	0.021113m
	ELL HT=	359.1957m	-0.0032m	359.1926m	0.035471m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
3	M02				
	LAT=	4° 44' 27.826623"	+0.000031"	4° 44' 27.826593"	0.009990m
	LON=	39° 34' 04.953591"	+0.000116"	39° 34' 04.953476"	0.020957m
	ELL HT=	318.9448m	-0.0026m	318.9422m	0.035089m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
4	M02A				
	LAT=	4° 39' 36.445992"	+0.000034"	4° 39' 36.445958"	0.010439m
	LON=	39° 39' 14.654749"	+0.000113"	39° 39' 14.654636"	0.021198m
	ELL HT=	361.3479m	-0.0032m	361.3447m	0.035506m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
5	M03				
	LAT=	4° 48' 11.078242"	+0.000034"	4° 48' 11.078208"	0.009969m
	LON=	39° 32' 44.857105"	+0.000123"	39° 32' 44.856982"	0.020890m
	ELL HT=	296.7669m	-0.0011m	296.7658m	0.035378m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
6	M04				
	LAT=	4° 47' 51.552962"	+0.000030"	4° 47' 51.552932"	0.009961m
	LON=	39° 32' 42.125873"	+0.000123"	39° 32' 42.125750"	0.020989m
	ELL HT=	283.9506m	-0.0031m	283.9474m	0.035440m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
7	RN1678Z				
	LAT=	4° 41' 43.532255"	+0.000000"	4° 41' 43.532255"	0.003022m
	LON=	39° 26' 49.487551"	+0.000000"	39° 26' 49.487551"	0.003022m
	ELL HT=	331.5173m	+0.0000m	331.5173m	0.002015m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
8	RN515G				



	LAT=	4° 44'	19.246362"	+0.000030"	4° 44'	19.246332"	0.010333m
	LON=	39° 34'	39.054634"	+0.000120"	39° 34'	39.054515"	0.021125m
	ELL HT=		312.5116m	-0.0026m		312.5091m	0.035188m
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN
9	VBARRA						
	LAT=	4° 31'	44.579642"	+0.000000"	4° 31'	44.579642"	0.003022m
	LON=	39° 23'	56.354906"	+0.000000"	39° 23'	56.354906"	0.003022m
	ELL HT=		538.2401m	+0.0000m		538.2401m	0.002016m
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN
10	VGROSSO						
	LAT=	4° 38'	50.108336"	+0.000000"	4° 38'	50.108336"	FIXED
	LON=	39° 25'	47.924690"	+0.000000"	39° 25'	47.924690"	FIXED
	ELL HT=		453.8700m	+0.0000m		453.8700m	FIXED
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN



SUMMARY OF COVARIANCES
NETWORK = UMJG
TIME = Thu Jul 19 15:38:27 2001

Definition of precision (E x S)^2 = C^2 + P^2:

Horizontal:

Precision (P) expressed as: ratio
Propagated linear error (E): U.S.
(standard error of adjusted horizontal distance)
Scalar (S) on propagated linear error: 1.0000
Constant error term (C): 0.0000

3-Dimensional:

Precision (P) expressed as: ratio
Propagated linear error (E): U.S.
(standard error of adjusted slope distance)
Scalar (S) on propagated linear error: 1.0000
Constant error term (C): 0.0000
Using orthometric height errors

Table with 7 columns: FROM/TO, AZIMUTH/DELTA H, 1.00σ, DISTANCE/DELTA h, 1.00σ, HOR PREC/3-D PREC. Rows include station pairs like M0/M01A, M01/M02, etc., with associated azimuth, distance, and precision values.



M04	-75.2451m	0.0025m	---	---	1: 6036804
M01A RN1678Z	100°13'14" -27.6753m	0.11" 0.0355m	23934.320m ---	0.0204m ---	1: 1173165 1: 1173165
M01A RN515G	134°49'29" -46.6835m	0.08" 0.0066m	12805.293m ---	0.0046m ---	1: 2757320 1: 2757320
M01A VBARRA	63°54'41" +179.0475m	0.07" 0.0355m	32175.247m ---	0.0213m ---	1: 1513011 1: 1513011
M01A VGROSSO	87°34'16" +94.6774m	0.08" 0.0355m	25476.453m ---	0.0213m ---	1: 1198400 1: 1198400
M02 M02A	313°09'22" +42.4025m	0.07" 0.0065m	13084.681m ---	0.0046m ---	1: 2814194 1: 2814194
M02 M03	160°12'22" -22.1764m	0.14" 0.0066m	7288.327m ---	0.0047m ---	1: 1543098 1: 1543098
M02 M04	157°48'43" -34.9948m	0.14" 0.0063m	6758.409m ---	0.0045m ---	1: 1509515 1: 1509515
M0 RN1678Z	69°23'46" +12.5751m	0.14" 0.0351m	14337.716m ---	0.0214m ---	1: 669095 1: 669095
M02 RN515G	284°04'44" -6.4332m	0.65" 0.0028m	1083.439m ---	0.0034m ---	1: 314445 1: 314445
M02 VBARRA	38°40'12" +219.2979m	0.11" 0.0351m	30025.277m ---	0.0179m ---	1: 1679053 1: 1679053
M02 VGROSSO	55°53'55" +134.9278m	0.13" 0.0351m	18500.113m ---	0.0202m ---	1: 916952 1: 916952
M02A M03	142°46'24" -64.5789m	0.06" 0.0083m	19854.363m ---	0.0052m ---	1: 3797519 1: 3797519
M02A M04	141°30'20" -77.3973m	0.05" 0.0036m	19432.542m ---	0.0044m ---	1: 4430049 1: 4430049
M0 RN1678Z	99°39'19" -29.8274m	0.11" 0.0356m	23295.291m ---	0.0206m ---	1: 1133459 1: 1133459
M02A RN515G	135°38'50" -48.8356m	0.07" 0.0066m	12149.209m ---	0.0040m ---	1: 3022590 1: 3022590
M02A VBARRA	62°53'40" +176.8954m	0.07" 0.0356m	31800.378m ---	0.0213m ---	1: 1494351 1: 1494351
M02A VGROSSO	86°43'58" +92.5253m	0.08" 0.0355m	24904.784m ---	0.0214m ---	1: 1164521 1: 1164521
M03 M04	7°59'16" -12.8184m	1.44" 0.0080m	605.639m ---	0.0038m ---	1: 158031 1: 158031
M03 RN1678Z	42°36'59" +34.7515m	0.19" 0.0354m	16175.398m ---	0.0185m ---	1: 874238 1: 874238
M03	333°42'06"	0.14"	7943.284m	0.0052m	1: 1515776



RN515G	+15.7433m	0.0070m	-*-	-*- 1: 1515776
M03 VBARRA	28°15'56" +241.4743m	0.10" 0.0354m	34402.797m -*-	0.0158m 1: 2173707 -*- 1: 2173707
M03 VGROSSO	36°42'56" +157.1042m	0.15" 0.0354m	21494.539m -*-	0.0172m 1: 1249080 -*- 1: 1249080
M04 RN1678Z	43°52'26" +47.5699m	0.19" 0.0355m	15680.823m -*-	0.0188m 1: 835822 -*- 1: 835822
M04 RN515G	331°04'37" +28.5616m	0.14" 0.0065m	7450.700m -*-	0.0048m 1: 1551342 -*- 1: 1551342
M04 VBARRA	28°37'15" +254.2927m	0.11" 0.0355m	33835.344m -*-	0.0159m 1: 2124198 -*- 1: 2124198
M04 VGROSSO	37°30'39" +169.9226m	0.15" 0.0354m	20965.467m -*-	0.0174m 1: 1204843 -*- 1: 1204843
RN1678Z RN515G	251°42'16" -19.0083m	0.14" 0.0352m	15241.120m -*-	0.0217m 1: 703184 -*- 1: 703184
RN1678Z VBARRA	16°10'37" +206.7228m	0.03" 0.0020m	19156.360m -*-	0.0030m 1: 6339396 -*- 1: 6339396
RN1678Z VGROSSO	19°36'19" +122.3527m	0.11" 0.0020m	5654.895m -*-	0.0030m 1: 1871394 -*- 1: 1871394
RN515G VBARRA	40°31'20" +225.7311m	0.10" 0.0352m	30492.059m -*-	0.0184m 1: 1657355 -*- 1: 1657355
RN515G VGROSSO	58°18'17" +141.3609m	0.12" 0.0352m	19239.491m -*-	0.0206m 1: 934036 -*- 1: 934036
VBARRA VGROSSO	194°44'21" -84.3701m	0.05" 0.0020m	13515.817m -*-	0.0030m 1: 4472795 -*- 1: 4472795



From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance	Entered Ant. Ht. (From)	Entered Ant. Ht. (To)
M001	M002	L1 fixed	8047.016	9.5	7.171	1.410	2.460
M01	M03	L1 fixed	1826.635	6.3	12.395	1.410	1.400
M01	M04	L1 fixed	1825.691	1.6	7.064	1.410	1.420
M02A	M01A	L1 fixed	680.155	22.3	2.067	1.410	1.390
M03	M01A	L1 fixed	20484.150	1.6	74.197	1.390	1.410
M03	M04	L1 fixed	605.812	2.0	5.910	1.390	1.410
M04	M01A	L1 fixed	20067.888	1.6	70.302	1.410	1.410
RN1678Z	VBARRA	L1 fixed	19158.853	2.3	64.214	1.620	2.460
RN515G	M02	L1 fixed	1083.518	26.7	3.426	1.410	1.310
RN515G	M02A	L1 fixed	12149.997	2.5	37.329	1.410	1.410
VGROSSO	M001	L1 float	20412.989		29.901	2.460	1.410
VGROSSO	M03	L1 fixed	21496.382	2.5	23.627	1.410	1.390
VGROSSO	M04	L1 fixed	20967.686	1.6	46.161	1.410	1.410
VGROSSO	RN1678Z	L1 fixed	5656.590	28.7	9.630	2.460	1.620
VGROSSO	VBARRA	L1 fixed	13517.187	2.7	46.279	2.460	2.460

\*\*\*\*\* End of Report \*\*\*\*\*



ENGESOFT Engenharia e Projetos S/A  
MAPEAMENTO AEROFOTOGRAMÉTRICO  
APOIO SUPLEMENTAR

Cliente: ENGESOFT Local: UMARI/CE  
Obra: O-739 Operador: WIVEAR Data: 26-Jun-2001

**Coordenadas Geodésicas Planoretangulares - UTM**

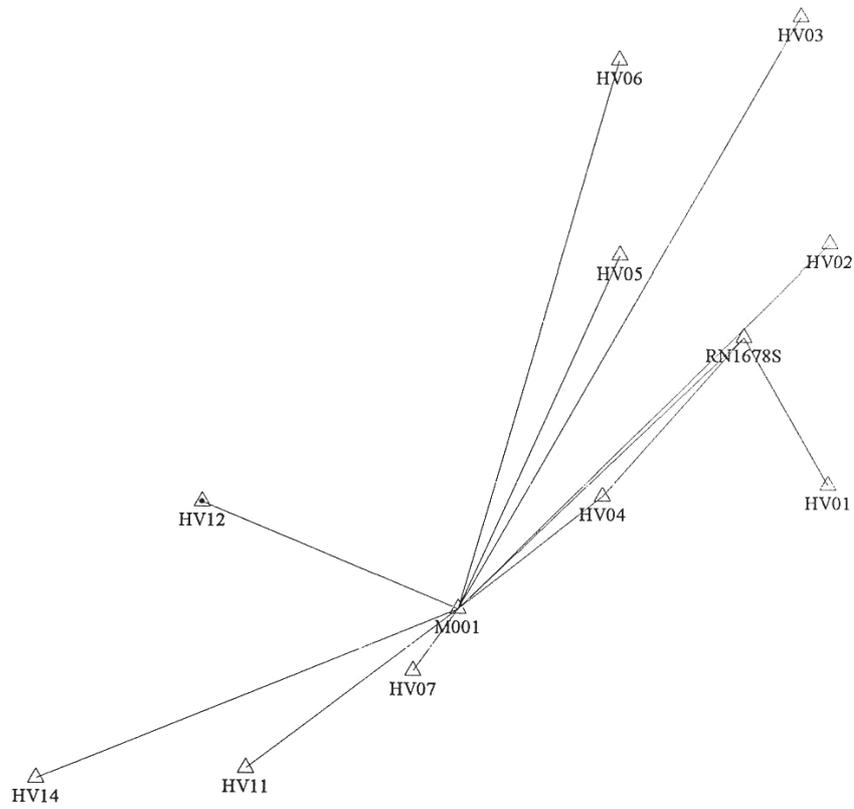
Elipsóide: SAD\_69 a=6378160.000 b=6356774.719  
Meridiano Central: 39°00'00.00"W Hemisfério Sul

Ponto	N (m)	E (m)	h (m)
HV01	9470672.395	445672.093	341.91
HV02	9473518.884	445681.586	336.22
HV03	9476193.599	445321.571	369.80
HV04	9470516.362	443033.986	334.95
HV05	9473366.979	443223.698	320.27
HV06	9475670.809	443201.228	341.62
HV07	9468433.955	440820.757	338.22
HV08	9470327.674	440542.878	325.60
HV09	9473524.374	441021.209	349.95
HV10	9475526.920	440784.502	331.68
HV11	9467269.091	438869.815	299.41
HV12	9470412.141	438334.310	320.02
HV13	9475670.899	438170.337	346.56
HV14	9467123.528	436423.348	316.92
HV15	9471996.042	435791.601	320.04
HV16	9475405.103	435631.022	366.85
M001	9469174.131	441341.785	328.06
M002	9475973.278	437043.821	347.22
RN1678S	9472408.938	444679.419	315.833
RN1678Z	9481027.870	450455.442	359.850
RN515G	9476235.879	435993.082	340.78

OBS.: Altitudes Ortométricas, com milímetros, obtidas  
por nivelamento geométrico e com centímetros,  
obtidas por diferença geoidal.



# Network Map: UMAH1





COORDINATE ADJUSTMENT SUMMARY  
 NETWORK = UMAH1  
 TIME = Tue Sep 4 14:57:12 2001

Datum = WGS-84  
 Coordinate System = Geographic  
 Zone = Global

Network Adjustment Constraints:  
 1 fixed coordinates in y  
 1 fixed coordinates in x  
 1 fixed coordinates in H

POINT	NAME	OLD COORDS	ADJUST	NEW COORDS	1.00 $\sigma$
1	HV01				
	LAT=	4° 47' 20.675100"	+0.000001"	4° 47' 20.675099"	0.005304m
	LON=	39° 29' 24.990718"	+0.000000"	39° 29' 24.990718"	0.005343m
	ELL HT=	313.6236m	-0.0001m	313.6235m	0.005006m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
-	HV02				
	LAT=	4° 45' 47.973702"	+0.000000"	4° 45' 47.973702"	0.004009m
	LON=	39° 29' 24.616712"	+0.000000"	39° 29' 24.616712"	0.004010m
	ELL HT=	307.9226m	+0.0000m	307.9226m	0.002673m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
3	HV03				
	LAT=	4° 44' 20.857867"	+0.000000"	4° 44' 20.857867"	0.004009m
	LON=	39° 29' 36.241805"	+0.000000"	39° 29' 36.241805"	0.004009m
	ELL HT=	341.4852m	+0.0000m	341.4852m	0.002673m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
4	HV04				
	LAT=	4° 47' 25.693759"	+0.000000"	4° 47' 25.693759"	0.003355m
	LON=	39° 30' 50.637396"	-0.000001"	39° 30' 50.637397"	0.003355m
	ELL HT=	306.6822m	+0.0001m	306.6823m	0.003096m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
5	HV05				
	LAT=	4° 45' 52.862651"	+0.000000"	4° 45' 52.862651"	0.004009m
	LON=	39° 30' 44.409706"	+0.000000"	39° 30' 44.409706"	0.004009m
	ELL HT=	291.9858m	+0.0000m	291.9858m	0.002673m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
6	HV06				
	LAT=	4° 44' 37.833438"	+0.000000"	4° 44' 37.833438"	0.017137m
	LON=	39° 30' 45.083677"	+0.000000"	39° 30' 45.083677"	0.043109m
	ELL HT=	313.3227m	+0.0000m	313.3227m	0.024646m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
7	HV07				
	LAT=	4° 48' 33.455953"	+0.000000"	4° 48' 33.455953"	0.004074m
	LON=	39° 32' 02.539751"	+0.000000"	39° 32' 02.539751"	0.004087m
	ELL HT=	309.9856m	+0.0000m	309.9856m	0.003266m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
8	HV11				



	LAT=	4° 49'	11.341211"	+0.000000"	4° 49'	11.341211"	0.004080m
	LON=	39° 33'	05.906684"	+0.000000"	39° 33'	05.906684"	0.004090m
	ELL HT=		271.1946m	+0.0000m		271.1946m	0.003467m
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN
9	HV12						
	LAT=	4° 47'	28.968503"	+0.000000"	4° 47'	28.968503"	0.004112m
	LON=	39° 33'	23.208809"	+0.000000"	39° 33'	23.208809"	0.004236m
	ELL HT=		291.7809m	+0.0000m		291.7809m	0.003591m
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN
10	HV14						
	LAT=	4° 49'	16.015944"	+0.000000"	4° 49'	16.015944"	0.013345m
	LON=	39° 34'	25.334966"	+0.000000"	39° 34'	25.334966"	0.037207m
	ELL HT=		288.7146m	+0.0000m		288.7146m	0.019842m
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN
11	M001						
	LAT=	4° 48'	09.364002"	+0.000000"	4° 48'	09.364002"	FIXED
	LON=	39° 31'	45.606205"	+0.000000"	39° 31'	45.606205"	FIXED
	ELL HT=		299.8177m	+0.0000m		299.8177m	FIXED
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN
--	RN1678S						
	LAT=	4° 46'	24.097878"	+0.000001"	4° 46'	24.097877"	0.003344m
	LON=	39° 29'	57.175740"	+0.000000"	39° 29'	57.175739"	0.003331m
	ELL HT=		287.4957m	-0.0001m		287.4956m	0.002900m
	ORTHO HT=		0.0000m	+0.0000m		0.0000m	NOT KNOWN



SUMMARY OF COVARIANCES  
NETWORK = UMAH1  
TIME = Tue Sep 4 14:57:14 2001

Definition of precision  $(E \times S)^2 = C^2 + P^2$ :

Horizontal:

Precision (P) expressed as: ratio

Propagated linear error (E): U.S.

(standard error of adjusted horizontal distance)

Scalar (S) on propagated linear error: 1.0000

Constant error term (C): 0.0000

3-Dimensional:

Precision (P) expressed as: ratio

Propagated linear error (E): U.S.

(standard error of adjusted slope distance)

Scalar (S) on propagated linear error: 1.0000

Constant error term (C): 0.0000

Using orthometric height errors

	FROM/ TO	AZIMUTH/ DELTA H	1.00σ 1.00σ	DISTANCE/ DELTA h	1.00σ 1.00σ	HOR PREC/ 3-D PREC
	HV01	0°13'55"	0.48"	2847.552m	0.0066m	1: 428304
	HV02	-5.7009m	0.0057m	***-	***-	1: 428304
	HV01	356°24'29"	0.25"	5534.354m	0.0067m	1: 832163
	HV03	+27.8618m	0.0057m	***-	***-	1: 832163
	HV01	266°39'22"	0.42"	2643.685m	0.0054m	1: 491346
	HV04	-6.9411m	0.0054m	***-	***-	1: 491346
	HV01	317°46'53"	0.38"	3642.132m	0.0067m	1: 545402
	HV05	-21.6377m	0.0057m	***-	***-	1: 545402
	HV01	333°44'10"	1.59"	5577.822m	0.0189m	1: 295599
	HV06	-0.3007m	0.0251m	***-	***-	1: 295599
	HV01	245°16'20"	0.26"	5344.800m	0.0067m	1: 795945
	HV07	-3.6378m	0.0060m	***-	***-	1: 795945
	HV01	243°27'41"	0.18"	7608.909m	0.0067m	1: 1134373
	HV08	-42.4288m	0.0061m	***-	***-	1: 1134373
	HV01	268°00'35"	0.19"	7345.060m	0.0068m	1: 1077570
	HV12	-21.8426m	0.0062m	***-	***-	1: 1077570
	HV01	249°02'55"	0.31"	9909.827m	0.0374m	1: 264804
	HV14	-24.9089m	0.0205m	***-	***-	1: 264804
	HV01	250°57'20"	0.24"	4583.851m	0.0053m	1: 860467
	M001	-13.8058m	0.0050m	***-	***-	1: 860467
	HV01	330°17'13"	0.43"	2000.980m	0.0042m	1: 481862
	RN1678S	-26.1279m	0.0041m	***-	***-	1: 481862
	HV02	352°22'29"	0.43"	2699.828m	0.0057m	1: 476155
	HV03	+33.5626m	0.0038m	***-	***-	1: 476155
	HV02	221°26'47"	0.27"	4004.580m	0.0052m	1: 765784



HV04	-1.2403m	0.0041m	-*-	-*- 1:	765784
HV02 HV^5	266°30'15" -15.9369m	0.47" 0.0038m	2463.480m -*-	0.0057m 1: -*- 1:	434462 434462
HV02 HV06	310°59'06" +5.4001m	2.28" 0.0248m	3284.944m -*-	0.0294m 1: -*- 1:	111915 111915
HV02 HV07	223°45'00" +2.0630m	0.17" 0.0042m	7037.063m -*-	0.0057m 1: -*- 1:	1228009 1228009
HV02 HV11	227°30'17" -36.7280m	0.13" 0.0044m	9247.823m -*-	0.0057m 1: -*- 1:	1616300 1616300
HV02 HV12	247°07'12" -16.1417m	0.15" 0.0045m	7980.006m -*-	0.0058m 1: -*- 1:	1374679 1374679
HV02 HV14	235°24'19" -19.2080m	0.36" 0.0200m	11256.424m -*-	0.0348m 1: -*- 1:	323549 323549
HV02 M001	225°00'30" -8.1049m	0.13" 0.0027m	6143.149m -*-	0.0040m 1: -*- 1:	1532180 1532180
HV RN1678S	222°07'10" -20.4270m	0.72" 0.0039m	1495.982m -*-	0.0052m 1: -*- 1:	286730 286730
HV03 HV04	201°59'15" -34.8029m	0.18" 0.0041m	6123.030m -*-	0.0052m 1: -*- 1:	1171010 1171010
HV03 HV05	216°37'23" -49.4995m	0.33" 0.0038m	3521.353m -*-	0.0057m 1: -*- 1:	621047 621047
HV03 HV06	256°11'25" -28.1625m	1.46" 0.0248m	2184.640m -*-	0.0441m 1: -*- 1:	49543 49543
HV03 HV07	210°09'22" -31.4996m	0.13" 0.0042m	8973.742m -*-	0.0057m 1: -*- 1:	1566886 1566886
HV03 HV11	215°54'19" -70.2906m	0.11" 0.0044m	11016.354m -*-	0.0057m 1: -*- 1:	1925893 1925893
HV^3 HV_	230°26'08" -49.7043m	0.13" 0.0045m	9072.306m -*-	0.0058m 1: -*- 1:	1570489 1570489
HV03 HV14	224°29'35" -52.7707m	0.40" 0.0200m	12710.672m -*-	0.0316m 1: -*- 1:	402092 402092
HV03 M001	209°35'34" -41.6675m	0.10" 0.0027m	8072.121m -*-	0.0040m 1: -*- 1:	2013342 201332
HV03 RN1678S	189°40'15" -53.9897m	0.28" 0.0039m	3840.161m -*-	0.0052m 1: -*- 1:	735553 735553
HV04 HV05	3°51'01" -14.6966m	0.38" 0.0041m	2857.964m -*-	0.0052m 1: -*- 1:	546662 546662
HV04 HV06	1°54'04" +6.6404m	1.72" 0.0248m	5159.040m -*-	0.0181m 1: -*- 1:	284247 284247
HV04	226°47'15"	0.36"	3039.984m	0.0053m 1:	574099



HV07	+3.3033m	0.0045m	-*-	-*- 1:	574099
HV04	232°05'44"	0.21"	5282.541m	0.0053m 1:	999380
HV11	-35.4877m	0.0046m	-*-	-*- 1:	999380
HV04	268°46'21"	0.23"	4702.528m	0.0054m 1:	870340
HV12	-14.9014m	0.0047m	-*-	-*- 1:	870340
HV04	242°52'28"	0.45"	7433.139m	0.0363m 1:	204790
HV14	-17.9678m	0.0201m	-*-	-*- 1:	204790
HV04	231°37'19"	0.32"	2160.675m	0.0034m 1:	643585
M001	-6.8646m	0.0031m	-*-	-*- 1:	643585
HV04	41°02'49"	0.28"	2508.763m	0.0034m 1:	735789
RN1678S	-19.1868m	0.0035m	-*-	-*- 1:	735789
HV05	359°29'01"	3.88"	2304.781m	0.0174m 1:	132253
HV06	+21.3370m	0.0248m	-*-	-*- 1:	132253
HV05	206°00'51"	0.21"	5489.144m	0.0057m 1:	958669
HV07	+17.9999m	0.0042m	-*-	-*- 1:	958669
HV	215°34'11"	0.16"	7495.407m	0.0057m 1:	1310364
HV11	-20.7911m	0.0044m	-*-	-*- 1:	1310364
HV05	238°53'48"	0.21"	5714.959m	0.0058m 1:	986845
HV12	-0.2048m	0.0045m	-*-	-*- 1:	986845
HV05	227°29'15"	0.52"	9235.082m	0.0326m 1:	283459
HV14	-3.2712m	0.0200m	-*-	-*- 1:	283459
HV05	204°12'54"	0.18"	4597.490m	0.0040m 1:	1146703
M001	+7.8319m	0.0027m	-*-	-*- 1:	1146703
HV05	123°23'32"	0.62"	1743.326m	0.0052m 1:	334286
RN1678S	-4.4902m	0.0039m	-*-	-*- 1:	334286
HV06	198°15'02"	1.05"	7621.078m	0.0258m 1:	294877
HV07	-3.3371m	0.0249m	-*-	-*- 1:	294877
HV	207°18'56"	0.78"	9455.930m	0.0303m 1:	311811
HV	-42.1281m	0.0249m	-*-	-*- 1:	311811
HV06	222°49'37"	0.82"	7167.815m	0.0371m 1:	193224
HV12	-21.5418m	0.0249m	-*-	-*- 1:	193224
HV06	218°27'24"	0.76"	10912.437m	0.0457m 1:	238986
HV14	-24.6081m	0.0316m	-*-	-*- 1:	238986
HV06	196°00'52"	1.20"	6759.996m	0.0244m 1:	277185
M001	-13.5050m	0.0246m	-*-	-*- 1:	277185
HV06	155°39'50"	2.48"	3582.489m	0.0177m 1:	202537
RN1678S	-25.8272m	0.0248m	-*-	-*- 1:	202537
HV07	239°12'16"	0.52"	2273.059m	0.0058m 1:	392978
HV11	-38.7910m	0.0048m	-*-	-*- 1:	392978
HV07	308°33'00"	0.38"	3178.505m	0.0059m 1:	542533



HV12	-18.2047m	0.0049m	-***-	-***-	1:	542533
HV07	253°27'03"	0.60"	4590.152m	0.0377m	1:	121838
HV14	-21.2710m	0.0201m	-***-	-***-	1:	121838
HV07	35°11'15"	0.93"	905.496m	0.0041m	1:	221303
M001	-10.1679m	0.0033m	-***-	-***-	1:	221303
HV07	44°11'38"	0.20"	5541.850m	0.0053m	1:	1049069
RN1678S	-22.4901m	0.0044m	-***-	-***-	1:	1049069
HV11	350°22'38"	0.38"	3189.483m	0.0058m	1:	549667
HV12	+20.5863m	0.0050m	-***-	-***-	1:	549667
HV11	266°38'29"	1.11"	2451.667m	0.0377m	1:	65019
HV14	+17.5200m	0.0201m	-***-	-***-	1:	65019
HV11	52°25'35"	0.27"	3121.991m	0.0041m	1:	764667
M001	+28.6231m	0.0035m	-***-	-***-	1:	764667
HV11	48°32'47"	0.14"	7759.714m	0.0053m	1:	1471744
RN1678S	+16.3010m	0.0045m	-***-	-***-	1:	1471744
HV14	210°12'25"	1.64"	3804.872m	0.0262m	1:	145348
HV14	-3.0663m	0.0202m	-***-	-***-	1:	145348
HV12	112°25'15"	0.26"	3253.488m	0.0042m	1:	767713
M001	+8.0368m	0.0036m	-***-	-***-	1:	767713
HV12	72°34'40"	0.16"	6654.296m	0.0054m	1:	1239425
RN1678S	-4.2853m	0.0046m	-***-	-***-	1:	1239425
HV14	67°24'57"	0.55"	5330.698m	0.0368m	1:	144698
M001	+11.1031m	0.0198m	-***-	-***-	1:	144698
HV14	57°25'16"	0.39"	9806.508m	0.0352m	1:	278641
RN1678S	-1.2190m	0.0201m	-***-	-***-	1:	278641
M001	45°56'26"	0.15"	4649.680m	0.0033m	1:	1393098
RN1678S	-12.3221m	0.0029m	-***-	-***-	1:	1393098

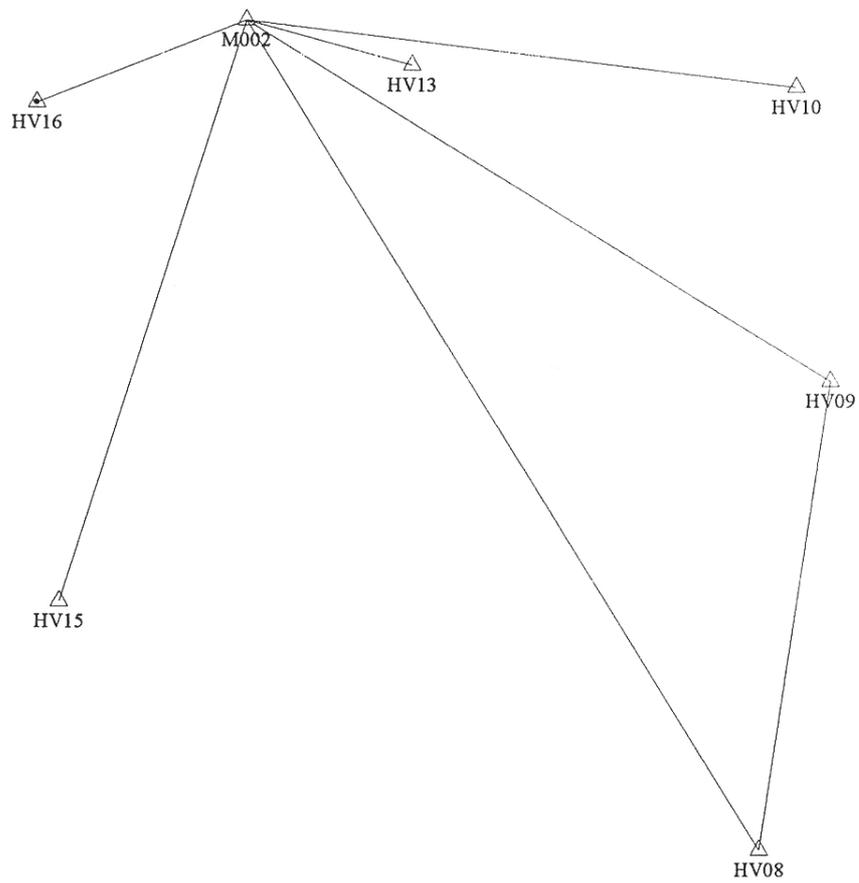


From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance	Entered Ant. Ht. (From)	Entered Ant. Ht. (To)
HV04	RN1678S	L1 fixed	2508.961	1.9	6.860	2.460	1.620
M001	HV02	L1 float	6143.469		5.586	2.460	3.560
M001	HV03	L1 float	8072.664		30.175	2.460	3.560
M001	HV04	L1 fixed	2160.794	2.7	13.034	2.460	2.460
M001	HV05	L1 fixed	4597.727	2.2	21.749	2.460	3.560
M001	HV06	L1 float	6760.359		15.765	2.460	3.560
M001	HV07	L1 fixed	905.600	8.5	3.891	2.460	1.580
M001	HV11	L1 fixed	3122.273	5.5	11.206	2.460	1.600
M001	HV12	L1 fixed	3253.660	2.9	7.985	2.460	1.610
M001	HV14	L1 float	5330.974		11.469	2.460	1.650
M001	RN1678S	L1 fixed	4649.928	2.6	10.048	2.460	1.620
RN1678S	HV01	L1 fixed	2001.252	5.6	9.243	1.620	2.460

\*\*\*\*\* End of Report \*\*\*\*\*



## Network Map: UMAH2





COORDINATE ADJUSTMENT SUMMARY  
NETWORK = UMAH2  
TIME = Tue Jun 26 16:05:51 2001

Datum = WGS-84  
Coordinate System = Geographic  
Zone = Global

Network Adjustment Constraints:  
1 fixed coordinates in y  
1 fixed coordinates in x  
1 fixed coordinates in H

POINT	NAME	OLD COORDS	ADJUST	NEW COORDS	1.00σ
1	HV08				
	LAT=	4° 47' 31.776619"	-0.000001"	4° 47' 31.776620"	0.004256m
	LON=	39° 32' 11.512815"	+0.000001"	39° 32' 11.512814"	0.004302m
	ELL HT=	297.3489m	+0.0000m	297.3489m	0.011290m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
2	HV09				
	LAT=	4° 45' 47.682482"	+0.000000"	4° 45' 47.682482"	0.004293m
	LON=	39° 31' 55.904112"	+0.000000"	39° 31' 55.904112"	0.004371m
	ELL HT=	321.6796m	+0.0000m	321.6795m	0.011298m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
3	HV10				
	LAT=	4° 44' 42.459985"	+0.000000"	4° 44' 42.459985"	0.004383m
	LON=	39° 32' 03.537921"	+0.000000"	39° 32' 03.537921"	0.004551m
	ELL HT=	303.3952m	+0.0000m	303.3952m	0.005331m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
4	HV13				
	LAT=	4° 44' 37.703966"	+0.000000"	4° 44' 37.703966"	0.004288m
	LON=	39° 33' 28.393821"	+0.000000"	39° 33' 28.393821"	0.004254m
	ELL HT=	318.2907m	+0.0000m	318.2907m	0.003772m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
5	HV15				
	LAT=	4° 46' 37.317775"	+0.000000"	4° 46' 37.317775"	0.004393m
	LON=	39° 34' 45.710769"	+0.000000"	39° 34' 45.710769"	0.004437m
	ELL HT=	291.8135m	+0.0000m	291.8135m	0.004719m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
6	HV16				
	LAT=	4° 44' 46.292044"	+0.000000"	4° 44' 46.292044"	0.004290m
	LON=	39° 34' 50.830461"	+0.000000"	39° 34' 50.830461"	0.004303m
	ELL HT=	338.6006m	+0.0000m	338.6006m	0.003761m
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN
7	M002				
	LAT=	4° 44' 27.826688"	+0.000000"	4° 44' 27.826688"	FIXED
	LON=	39° 34' 04.953973"	+0.000000"	39° 34' 04.953973"	FIXED
	ELL HT=	318.9506m	+0.0000m	318.9506m	FIXED
	ORTHO HT=	0.0000m	+0.0000m	0.0000m	NOT KNOWN



SUMMARY OF COVARIANCES
NETWORK = UMAH2
TIME = Tue Jun 26 16:05:53 2001

Definition of precision (E x S)^2 = C^2 + P^2:

Horizontal:

Precision (P) expressed as: ratio
Propagated linear error (E): U.S.
(standard error of adjusted horizontal distance)
Scalar (S) on propagated linear error: 1.0000
Constant error term (C): 0.0000

3-Dimensional:

Precision (P) expressed as: ratio
Propagated linear error (E): U.S.
(standard error of adjusted slope distance)
Scalar (S) on propagated linear error: 1.0000
Constant error term (C): 0.0000
Using orthometric height errors

Table with 7 columns: FROM/TO, AZIMUTH/DELTA H, 1.00 sigma, DISTANCE/DELTA h, 1.00 sigma, HOR PREC/3-D PREC. It lists various station pairs and their associated measurements and errors.



HV15	-11.5816m	0.0071m	---	---	1:	971803
HV10	268°41'24"	0.25"	5156.761m	0.0063m	1:	823537
HV16	+35.2055m	0.0065m	---	---	1:	823537
HV10	276°50'56"	0.24"	3768.568m	0.0046m	1:	827453
M002	+15.5554m	0.0053m	---	---	1:	827453
HV13	212°57'41"	0.29"	4379.107m	0.0061m	1:	712098
HV15	-26.4771m	0.0060m	---	---	1:	712098
HV13	264°04'14"	0.49"	2554.094m	0.0060m	1:	422243
HV16	+20.3100m	0.0053m	---	---	1:	422243
HV13	285°04'17"	0.76"	1166.808m	0.0043m	1:	274282
M002	+0.6599m	0.0038m	---	---	1:	274282
HV15	357°21'05"	0.37"	3414.047m	0.0061m	1:	555943
HV16	+46.7871m	0.0060m	---	---	1:	555943
HV15	17°31'28"	0.22"	4171.185m	0.0044m	1:	947500
M002	+27.1371m	0.0047m	---	---	1:	947500
HV15	68°08'24"	0.58"	1523.307m	0.0043m	1:	355201
M002	-19.6500m	0.0038m	---	---	1:	355201



From Station Short Name	To Station Short Name	Solution Type	Slope	Ratio	Reference Variance	Entered Ant. Ht. (From)	Entered Ant. Ht. (To)
HV09	HV08	L1 fixed	3233.713	4.3	5.600	2.460	2.460
M002	HV08	L1 fixed	6644.769	2.7	14.505	1.400	2.460
M002	HV09	L1 fixed	4672.760	3.8	11.715	1.400	2.460
M002	HV10	L1 fixed	3768.796	2.1	14.668	1.400	2.460
M002	HV13	L1 fixed	1166.870	9.1	2.705	1.400	1.410
M002	HV15	L1 fixed	4171.488	2.9	14.743	1.400	2.460
M002	HV16	L1 fixed	1523.518	3.0	5.347	1.400	2.460

\*\*\*\*\* End of Report \*\*\*\*\*



Geométrico ✓							
Trigonométrico							
Aqueométrico							
Cliente: <u>ENGESOFT ENGENHARIA &amp; PROJETOS S/A</u>				Folha: _____			
Local: <u>UMARI e JOÃO GUERRA/CE</u>				Obra: <u>0-739</u>			
Estacas	Desnível		Desnível Médio	Comp.	Desnível Compens.	Atitudes	Estacas
	Ida	Volta					
RN1678P (BGE)						336,8183	
MØ1	-8,567			-0,0028	-8,5698	328,2485	1.298,77
PSØ1	+8,568			-0,0027	+8,5653	336,8138	1.289,04
MØ3	-11,517			-0,0044	-11,5214	325,2924	2.056,46
MØ4	-12,841			-0,0013	-12,8423	312,4501	624,54
PSØ2	+7,662			-0,0033	+7,6587	320,1088	1.556,07
PSØ3	-7,900			-0,0045	-7,9045	312,2043	2.110,00
PSØ4	+24,662			-0,0050	+24,6570	336,8613	2.374,39
PSØ5	-1,502			-0,0037	-1,5057	335,3556	1.749,02
PSØ6	-5,706			-0,0030	-5,7090	329,6466	1.410,94
PSØ1	+1,255			-0,0022	+1,2528	330,8994	1.041,41
MØ2	+16,534			-0,0018	+16,5322	347,4316	859,38
PSØ2	+8,984			-0,0030	+8,9810	356,4126	1.405,48
PSØ3	+8,335			-0,0037	+8,3313	364,7439	1.732,34
PSØ4	-35,702			-0,0022	-35,7042	329,0397	1.040,14
PSØ5	+6,938			-0,0054	+6,9326	335,9723	2.530,22
PSØ6	-1,187			-0,0045	-1,1915	334,7808	2.098,39
PSØ7	-6,388			-0,0028	-6,3908	328,3900	1.316,12
RN1678P (BGE)	-1,896			-0,0011	-1,8971	326,4929	517,05
	$\Sigma \Delta = -10,268$		$f = +0,0574m$	$P = 11mm$		$\Delta h = -10,3254$	$D = 27,009,76m$
PSØ6						329,6466	
PSØ7	+10,475	-10,473	+10,474	1mm		340,1206	1.994,42m
PSØ8	+35,960	-35,961	+35,961	1mm		376,0816	2.989,82m
PSØ9	+10,973	-10,965	+10,969	5mm		387,0506	2.348,635m
PSØ10	-24,724	+24,724	-24,724	Ømm		362,3266	1.653,215m
PSØ11	+4,043	-4,036	+4,040	6mm		366,3666	1.268,12m
PSØ12	+1,349	-1,348	+1,349	1mm		367,7156	1.914,385m
MØ2A	+22,376	-22,369	+22,373	6mm		390,0886	1.437,965m
MØ1A	-2,132	+2,134	-2,133	2mm		387,9556	738,85m

Calculado por:

Verificado por:

Data: 03/08/2001

**Consórcio**

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**MONTGOMERY WATSON**

