SURVEY REPORT

FOR

STATOIL

NAVIGATION AND POSITIONING OF

"ROSS RIG"

WELL 34/10-4

DECCA SURVEY NORWAY A/S
Prof. Hansteensgt. 58
Postboks 2638
5010 Møhlenpris

1979

(D.S.N. ref. no. 0/670)

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I. ABSTRACT

Drilling rig "Ross Rig" was navigated from well location 34/10 - 2 to well location 34/10 - 4 Norwegian Sector using DECCA Pulse/8 navigation system during the period 8/8 - 14/8 1979.

Final position was performed by A/S Geoteam utilizing a MAGNAVOX MX 1502 Positioning system.

Final position well 34/10 - 4 European Datum.

Lat.: 61° 12' 15.65 " N
Long: 02° 13' 55.96 " E

Number of 3D passes : 44
Position accuracy : ± 9 m
Rig heading : 317°
Devitation from intended location: 13 m in 203°.

This devitation is the difference between final Pulse/8. position and intended position.

2. LOG SUMMARY

Mobilization, Flesland	: 1655	hours	8th	August	1979
Navigation System operative	: 2300	"	8th	"	"
Start of rig move	: 0145	"	11th	"	"
First anchor dropped	: 0425	"	11th	"	"
On location	: 0500	"	11th	"	"
Last anchor dropped	: 2000	"	11th	"	"
All anchors holding for tension test	: 2330	"	11th	"	"
Start of 3-D computations	: 0130	"	12th	"	"
End 3-D computations	: 1600	"	14th	"	"

3. REQUIREMENTS

The requirements were as stated in letter dated 13th March 1979 from Statoil to Decca Survey Norway A/S.

The requirements were as follows:

a) to move the rig "Ross Rig" from Norwegian Block 34/10-2 to Norwegian Block 34/10-4 utilizing Pulse/8 as the prime navigation aid.

The intended location was: Lat.: 61° 12' 15.9" N
Long: 02° 13' 55.7" E

b) The final positioning of the rig on location was to be carried out by A/S GEOTEAM using MAGNAVOX MX 1502 satellite Positioning system.

4. PERSONNEL

The following personnel were engaged on this survey:

Decca Survey Norway A/S

Steinar Vikør	-	Surveyor - Navigation
A/S Geoteam		
Olav Trygve Egderød	-	Surveyor - Positioning

DECCA SURVEY NORWAY A/S

Harry A. Vågseth

5. RIG MOVE

The navigation system was operative from 2300 hours 8/8-79 to 13/8 1979.

The approach to the new location was planned in co-operation with the rig's capitain.

The decision was to drop anchor no. 5 when the rig was approximately 2600 feet on bearing, 165 ^{o} from location, and than move towards location whilst anchor no. 1 was being prepared.

The rig left the old location 34/10-2 on the 11th August 1979 at 0145 hours, and arrived a "turning point" S.S.E. of the new location 34/10-4 at 0250 hours the same day.

The first anchor no. 5 was dropped at 0425 hours the 11th August. The last anchor no. 3 was layed at 1342 hours the same day.

Some problems with unstable Pulse/8 occured during the anchor laying, but all "piggy backs" were layed at 2000 hours the 11th August 1979.

The position was approved for drilling at 0030 hours the 12th August 1979.

The problems that occured with Pulse/8 during the final approach and anchor laying, was due to a very high noise-level picked up via the earthing of the system and the location of the aerials onboard the rig.

On the morning of the 12th August 1979 the noise-level on receivers input was 3 V p-p, then a decision was made to move the aerial to the top of the radar mast onboard "Ross Rig. The noise-level was then reduced to 1 V p-p, but still

not sufficient to give a good stable Pulse/8 signal. Then the earthingof the system was disconnected from a common earth point in the 220 V distribution-panell on the brigde and connected to the copper-pipes for the drinking-water system. This reduced the noise-level to a minimum, and a good steady Pulse/8 signal was achieved.

6. PULSE/8 COMPUTATIONS.

The geographical co-ordinates of the location were supplied by Statoil A/S:

Lat. : 61° 12' 15.9' N
Long.: 02° 13' 55.7' E (ED - 1950)

U.T.M. Grid co-ordinates were computed as:

Eastings: 458735.3
Northings:6785960.2

U.T.M. Grid Zone 31 Central Meridan 3° east.

At location 34/10-4 pattern 1-2, 1-3 and 1-4 were used.

These patterns have the following configuration:

1 Microsecond time difference is equivalent to:

Pattern 1-2: 279 metres
Pattern 1-3: 154 metres
Pattern 1-4: 272 metres

Angel of cut:

Pattern 1-2/1-3: 70°
Pattern 1-3/1-4: 43°
Pattern 1-2/1-4: 66°

C-O applied for navigation:

~~Pattern 1-2: 0.00 microsec.~~
Pattern 1-3: 0.30 microsec.
Pattern 1-4: 0.16 microsec.

The following mean of approximately 4000 Pulse/8 fixes were obtained when the rig was fully tensioned on location:

Pattern	Observed	C-O	Corrected Observed
1-2	11737.08	0.00	11737.08
1-3	23109.68	0.30	23109.98
1-4	34752.92	0.16	34753.08

Pattern	Number of fixes	Standard devitation	Weighting factor
1-2	4000	0.04 usec	8
1-3	4000	0.06 usec	12 (see page 9
1-4	4000	0.04 usec	11 for explanation.)

This gave the following Pulse/8 antenna position obtained from pattern 1-3 and 1-4:

(Antenna) Lat. : 61° 12' 16.22 N
Long.: 02° 13' 54.56 E (ED-1950)

U.T.M. Grid co-ordinates:

(Antenna) Eastings: 458718.4
Northings:6785970.4

U.T.M. Grid Zone 31 Central Meridian 3° East.

-cont.-

- cont. -

Applying the traverse corrections (See appendix no. 7) give the derrick position:

(Well centre) Lat. : 61° 12' 15.52 N
Long.: 02° 13' 55.39 E (ED-1950)

U.T.M. Grid co-ordinate were computed as:

U.T.M. Grid Zone 31 C.M. 3° East.

(Well centre) Eastings: 458730.5
Northings: 6785948.5

This position is 13 metres on a bearing of 203° from intended position.

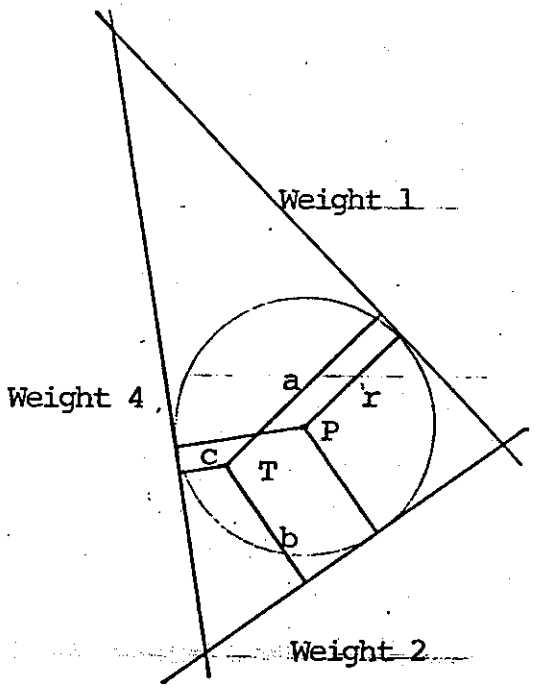
EXPLANATION OF 3 PATTERN ANALYSIS AND WEIGHTING FACTOR PROGRAM

The final Pulse/8 position of the rig was determined by using the Pulse/8 stationary 3 pattern analysis and weighting factor program 170.

This program is designed to give a 3 pattern analysis in stationary mode, based on a least square 3 pattern solution.

The program takes a continuous series of data, which is computed out. The distances in metres from the centre of the mean triangle are shown in 3 graphs, which eventually build up to show a histogram of the distribution of the 3 patterns. The program calculates the standard deviation and weighting factor for each pattern. The weighting factor is inversely proportional to standard deviation, thus a high weighting factor indicates a better quality of the data.

EXAMPLE OF WEIGHTED TRIANGLE:



Point P is the position for equally weighted solution.

Point T is the position which $\Sigma(a^2 \times 1)\ (b^2 \times 2)\ (c^2 \times 4)$ is a minimum.

EXPLANATION OF C-O (COMPUTED MINUS OBSERVED) ERRORS

A. C-O ERRORS

Fixed (Computed minus Observed) errors to be applied to the observed readings to adjust them to a value comparable with the theoretical computed readins. These fixed errors are determined normally by inter-chain Decca Chain analysis, or, inshore, by establishing the ship's position independently. In areas where no C-O readings have been obtained then a best estimated value of the C-O error is used.

B. UNCORRECTED OBSERVED

Observed readings with no fixed C-O (Computed minus Observed) errors applied. Quoted, as read, to two decimal places.

C. CORRECTED OBSERVED

Observed readings with C-O errors applied (sign of correction as quoted), and normally used to convert an observed reading into a value from which a geographical position or other Decca Chain can be computed.

D. COMPUTED

Theoretical Decca Chain readings derived from a position (normally geographicals) using the basic chain parameters. Always quoted to three decimal places of lane, although the third decimal place is not nomally significant.

E. ESTIMATED OBSERVED

A computed reading with minus C-O errors applied (opposite signs to those quoted) to provide the best readings that would be observed in the field.

7. COMPARISON BETWEEN SATTELITE AND PULSE/8 FIXED POSITION

Final well centre position derived by satellite positioning

Lat. : 61° 12' 15.65" N
Long.: 02° 13' 55.96" E (ED-1950)

Well centre position derived by Pulse/8 using patterns 1-3 (c-o=0.30) and 1-4 (c-o=0.16)

Lat. : 61° 12' 15.52" N
Long.: 02° 13' 55.39" E (ED-1950)

This gives a descrepancy between Pulse/8 and Sat. Nav. of 9 metres on a bearing of 245° from Sat.Nav. See appendix no. 8.

For comparison between the Pulse/8 c-o used for navigation and c-o derived from the final 3-D satellite fixed position, Pulse/8 readings were recorded from 1330 hours 12th of August to 1305 hours 13. August 1979.

A program for 3 pattern analysis was used, the patterns utilized were 1-2, 1-3 and 1-4.

Conversion of final well centre position (satellite) to Pulse/8 antenna (Ref. appendix no 7.)

Pulse/8 Antenna Lat.: 61° 12' 16.36 N
Long: 02° 13' 55.15 E (ED-1950)

U.T.M. Grid co-ordinates Zone 31 c.M. 3° East

Eastings : 458727
Northings: 6785974.5

- Cont. -

- cont. -

Computed Pulse/8 patterns for this position:

Pattern 1-2: 11737.06
Pattern 1-3: 23109.92
Pattern 1-4: 34753.05

Using mean observed pattern values, the c-o for location can be established as follows:

Pattern	Computed	Observed	c-o
1-2	11737.06	11737.08	-0.02
1-3	23109.92	23109.68	+0.24
1-4	34753.05	35752.92	+0.13

SATELLITE POSITIONING

The final positioning was performed by a three-dimensional solution of data from several satellite passes. The observation of satellite passes started at 0130 hours, 12 August 1979 and was completed at 1600 hours, 14 August 1979.

Number of recorded satellite passes: 66.
Number of passes accepted for 3-D computations: 44.

This means an average time of 85 minutes between each acceptable pass.

The high noise level in the rig's power supply is believed to be the main reason for this rather low percentage of acceptable passes.

Convergence of the latitude, longitude and height solutions are given as Appendices 1, 2 and 3, respectively.

Satellite antenna position determined by 44 3-D passes referred to the geodetic system WGS-72 was:

Latitude:	61°12'14.88" N
Longitude:	02°13'48.78" E
Antenna Height:	72.2 m (above the WGS-72 ellipsoid).

These co-ordinates were transformed to European Datum 1950, International Spheroid, using formulae and transformation constants given by the Naval Weapon Laboratories, U.S.A.

The main transformation constants employed were (see note):

$\Delta X = 84$ metres
$\Delta Y = 103$ metres
$\Delta Z = 127$ metres

(X, Y and Z constitute a right hand co-ordinate system fixed in the spheroid. X and Y lie in a plane parallel to the equator, X positive towards the Prime Meridian and Y positive towards 90°E Longitude. Z is positive towards the North).

This gives the following datum shift corrections:

Latitude: 1.99"
Longitude: 6.67"
Height: -29.1 metres

The antenna position referred to the European Datum 1950 is:

	Geographic Co-ordinates	UTM Co-ordinates
Latitude:	61°12'16.86" N	6785990 N
Longitude:	02°13'55.45" E	458732 E

(The UTM co-ordinates refer to Zone 31, with Central Meridian 3° East.

Note: It has recently become known that the positions obtained in the satellite system do not refer to the WGS-72, but to the slightly different NWL.10D system. As suitable transformation procedures for this system have not yet been agreed upon, and to ensure consistency with earlier positioning in the area, the constants for WGS-72 have been applied.

The distance from MX-1502 antenna to the anticipated well centre and the perpindicular from the antenna to the rig's centre line were measured by tape and checked on a rig construction drawing (scale 1:200). See Appendix 4.

The rig heading read from gyrocompass was 317 degrees. With these data, the well centre co-ordinates have been computed as:

	Geographical Co-ordinates	UTM Co-ordinates
Latitude:	61'12'15.65" N	6785952 N
Longitude:	02'13'55.96" E	458739 E

The antenna height in European Datum was 43.1 metres. The altitude from sea level to the antenna was measured to 24.0 metres, thus the geoidal height is 19.1 metres. See Appendix 5.

ACCURACY OF FINAL POSITION FIXED BY SATELLITE

Based on the scatter of the positions derived from the different passes, a standard deviation of ±4 metres on the latitude and ±5 metres on the longitude are computed.

This method for determining the position accuracy does not include all error sources, and we believe the uncertainty of the satellite antenna position to be ±7 metres (RMS).

Correction from antenna position to well position may introduce an error of ±1 metre due to uncertainty of rig heading.

Tests performed by A/S GEOTEAM at geodetic fix points in southern Norway indicate inaccuracies of ±5 metres in the transformation from the WGS-72 geodetic system to the European Datum 1950.

This gives a total RMS error of ±9 metres on the final position

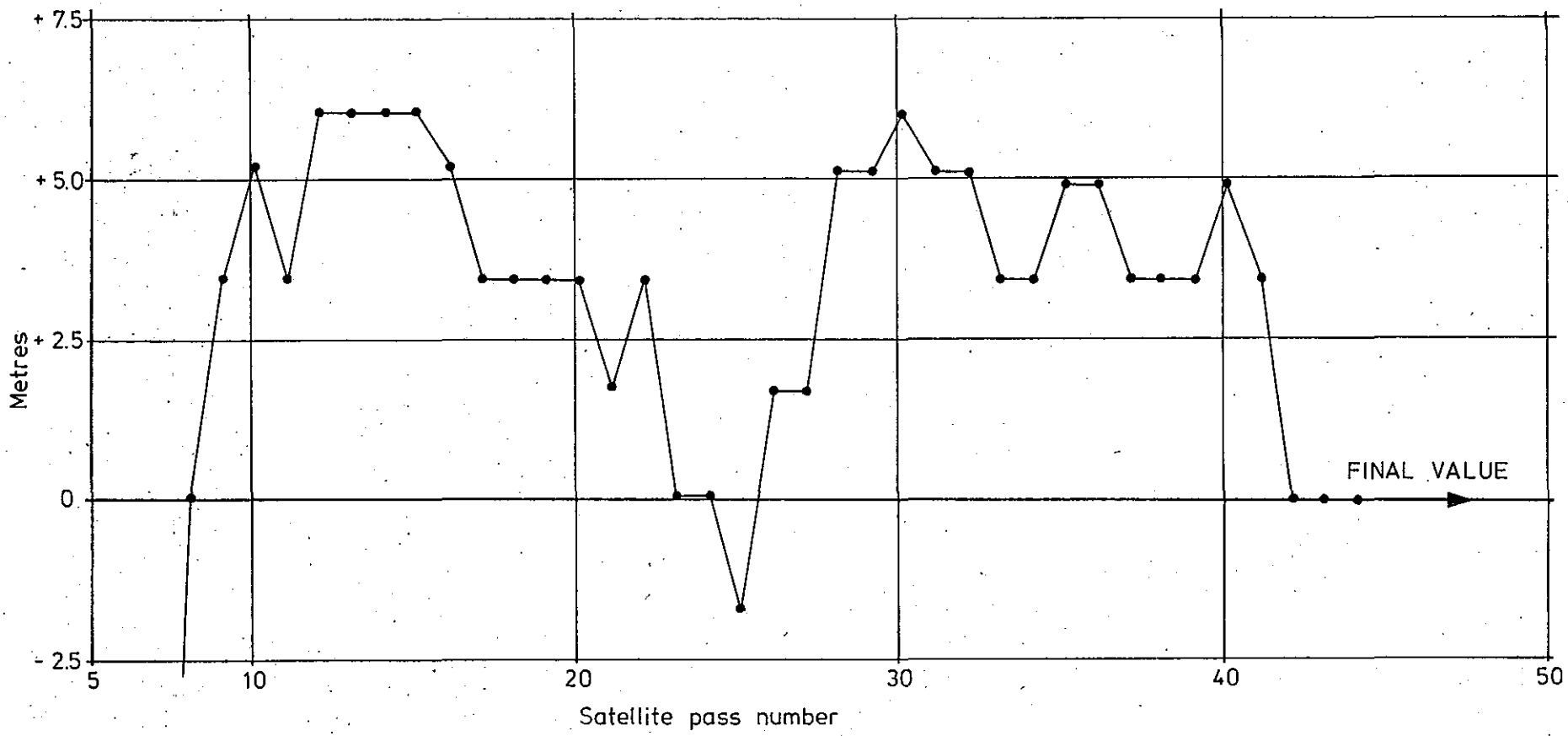
Stabekk, 17 August 1979

for A/S G E O T E A M

Jon Falkenberg

Olav Trygve Egderød

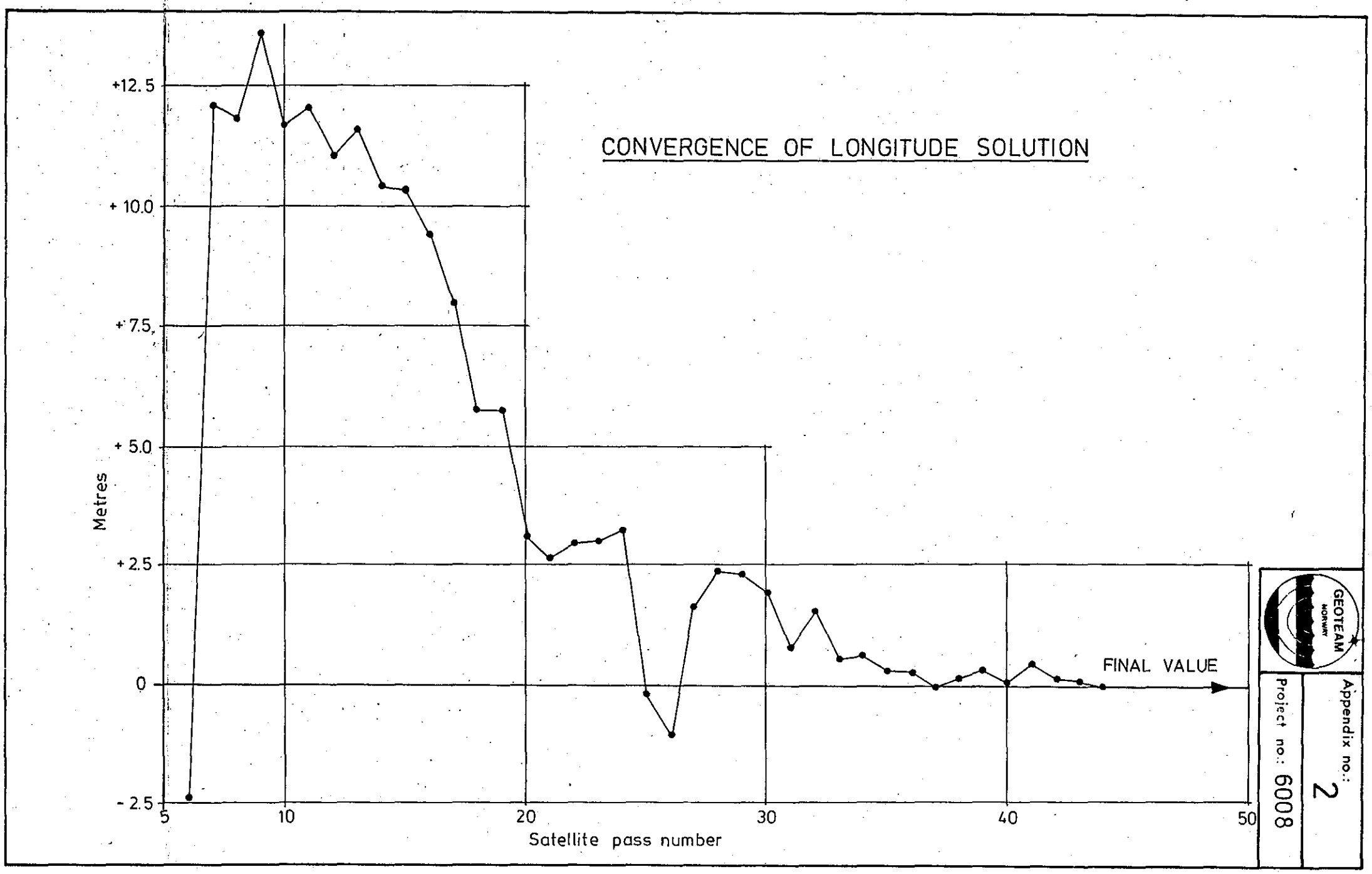
CONVERGENCE OF LATITUDE SOLUTION



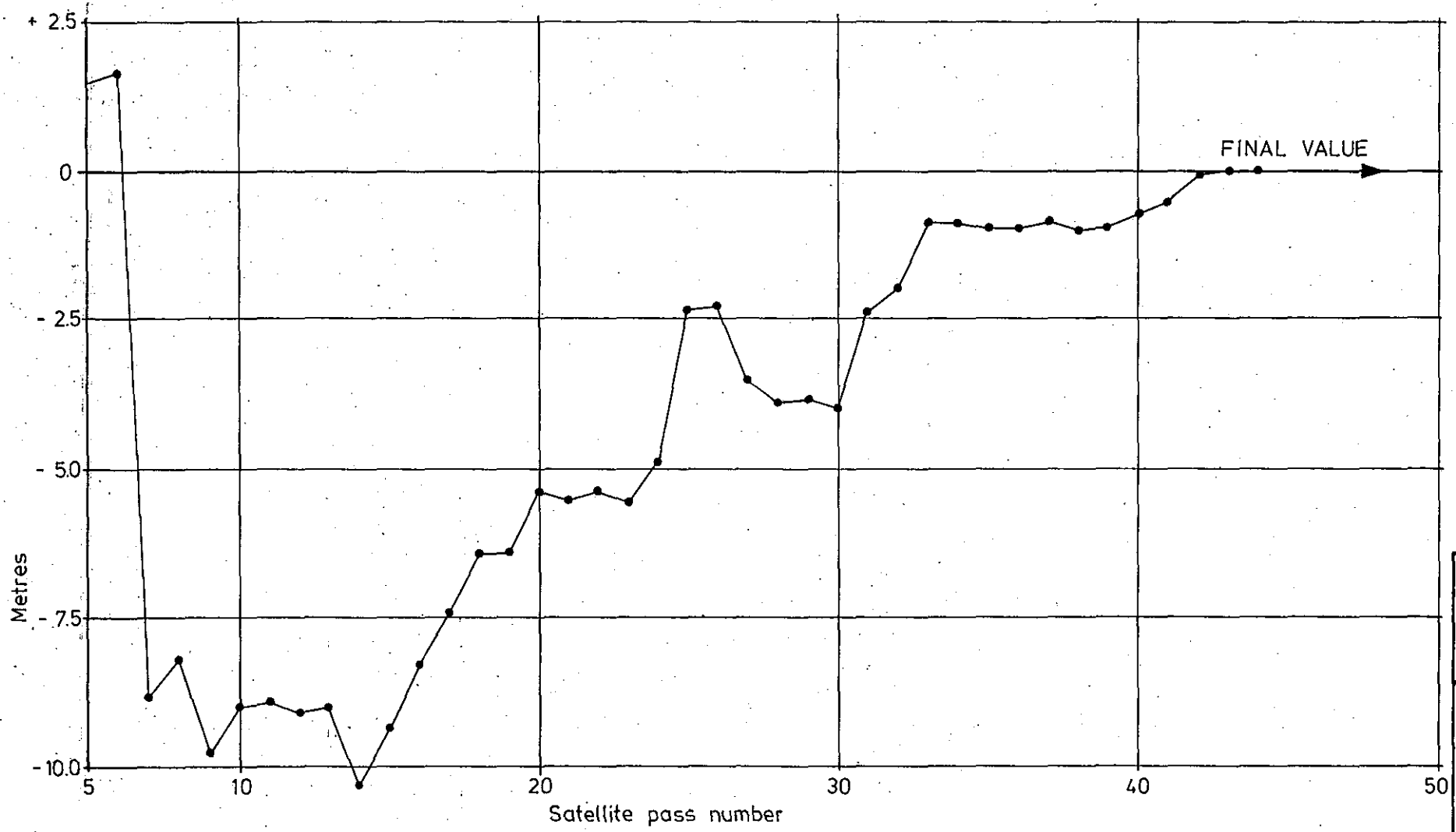
GEOTEAM NORWAY

Project no.: 6008

Appendix no.: 1


CONVERGENCE OF LONGITUDE SOLUTION
+12.5
+ 10.0
+ 7.5
+ 5.0
+ 2.5
0
- 2.5
Metres
5
10
20
30
40
50
Satellite pass number
FINAL VALUE
GEOTEAM
NORWAY
Project no.: 6008
Appendix no.: 2

CONVERGENCE OF HEIGHT SOLUTION



GEOTEAM NORWAY

Project no.: 6008

Appendix no.: 3

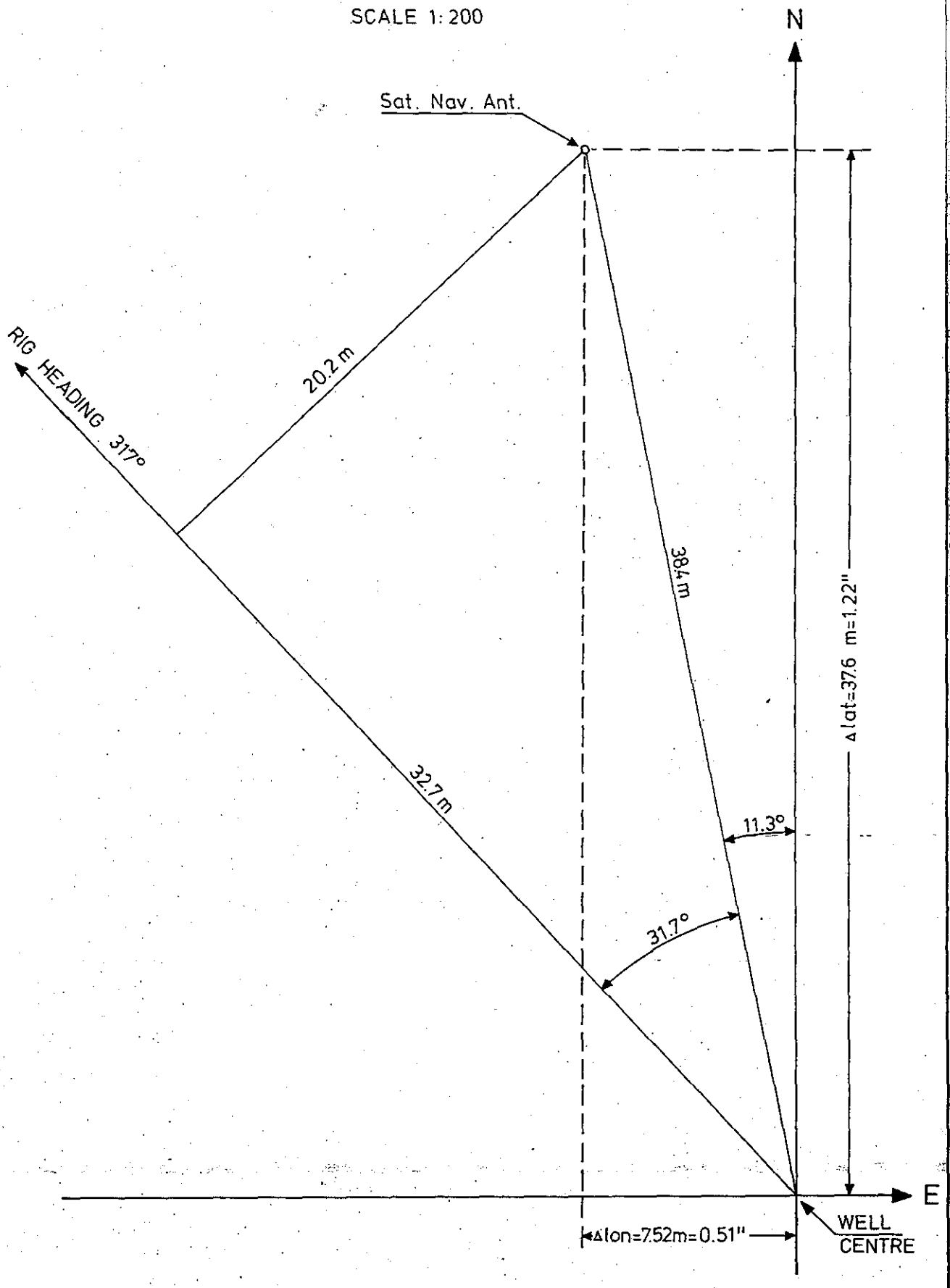
GEOTEAM NORWAY

Appendix no.: 4

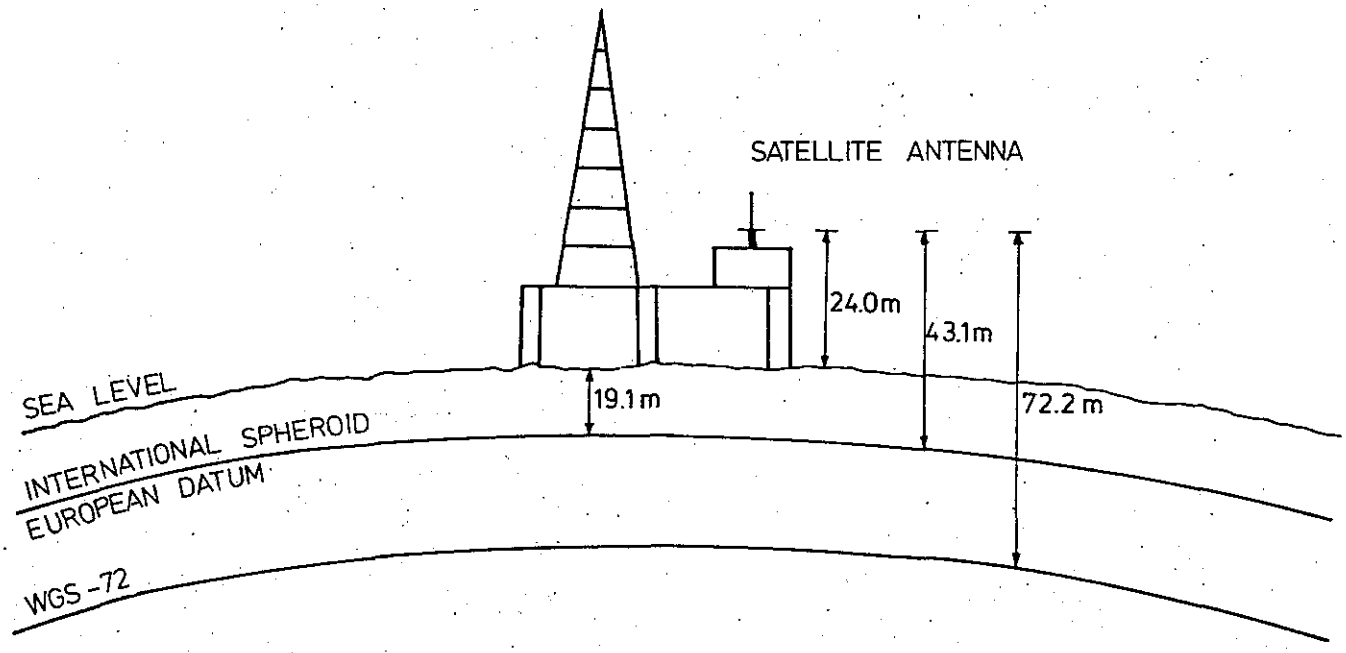
Project no.: 6008

CONVERSION FROM THE ANTENNA POSITION TO WELL CENTRE

SCALE 1: 200



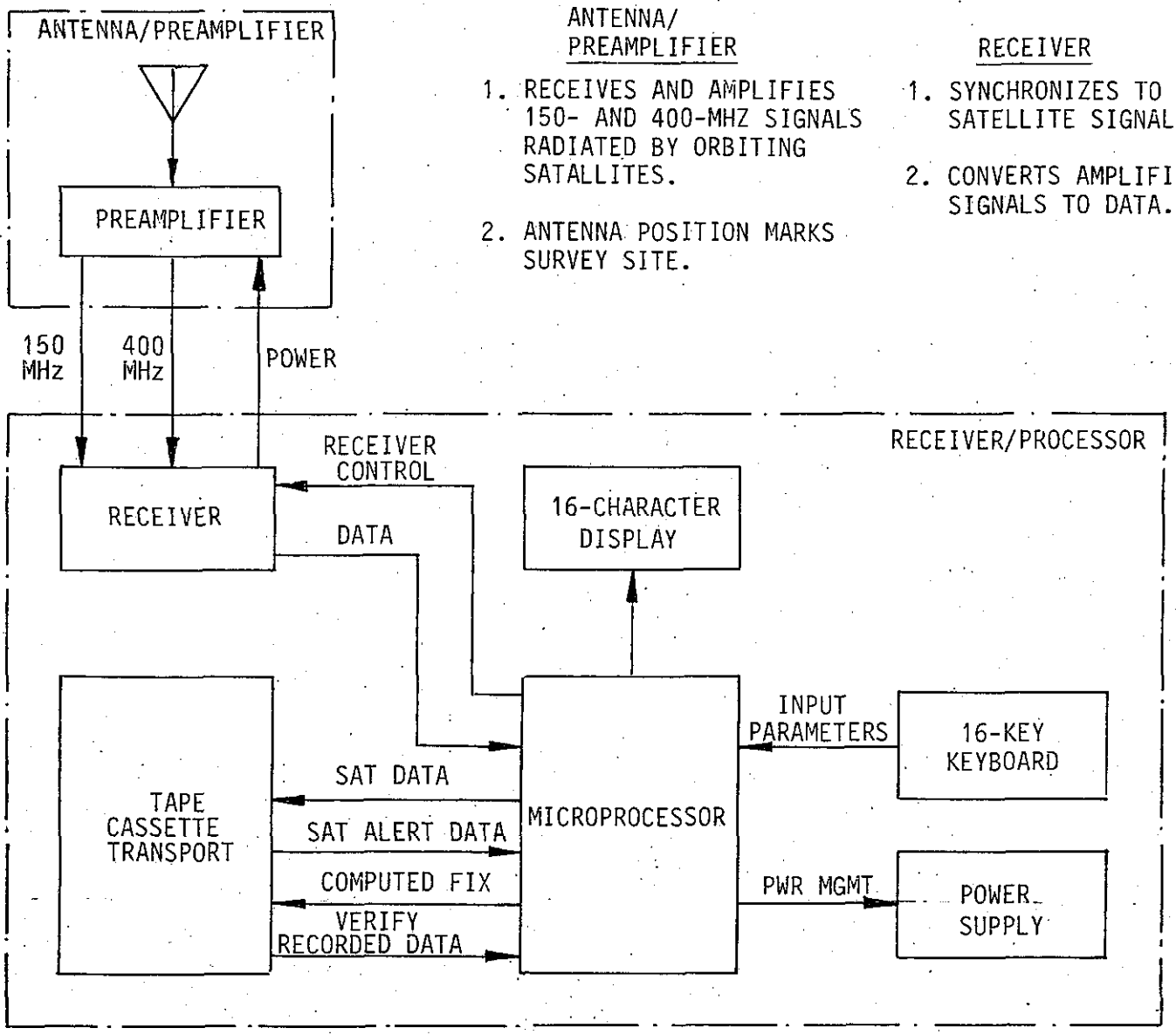
GEOIDAL HEIGHT



Appendix 6

MS 2.11 MAGNAVOX MX 1502 POSITIONING SYSTEM

SIMPLIFIED FUNCTIONAL BLOCK DIAGRAM



ANTENNA/ PREAMPLIFIER

1. RECEIVES AND AMPLIFIES 150- AND 400-MHZ SIGNALS RADIATED BY ORBITING SATALLITES.
2. ANTENNA POSITION MARKS SURVEY SITE.

RECEIVER

1. SYNCHRONIZES TO SATELLITE SIGNAL
2. CONVERTS AMPLIFIED SIGNALS TO DATA.

MICROPROCESSOR

1. MANAGES POWER SUPPLIED TO ALL PARTS OF SYSTEM.
2. COLLECTS AND STORES POSITION DATA FROM SATELLITE.
3. COMPUTES POSITION.

TAPE CASSETTE

1. STORES SATELLITE PASS DATA.
2. STORES POSITION FIX COMPUTED BY MICROPROCESSOR.
3. LOADS SATELLITE ALERT DATA INTO MICROPORCESSOR.

KEYBOARD/DISPLAY

1. ENTER INPUT PARAMETERS.
2. DISPLAY INITIALIZATION PARAMETERS.
3. DISPLAY PARAMETERS REQUESTED BY USER.

Appendix 6

MS 2.11 MAGNAVOX MX 1502 POSITIONING SYSTEM

SPECIFICATIONS

Antenna/Preamplifier:

Model No.	:	MX 1502 Dual frequency vertically polarized omnidirectional azimuth coverage.

Receiver/Processor/Tape Cassette Transport:

Type	:	Magnavox Geoceiver/Satellite Surveyor
Model No.	:	MX 1502

Power:

Internal		
Standard Battery	:	12 V DC, 2.5 Ampere/hour with charging circuit.
Optional Battery	:	12 V DC, 5.0 Ampere/hour with charging circuit.
External	:	12 V DC internally regulated.
Typical Power Consumption at 25°C:		
Average	:	12 Watts with a 25% satellite pass duty cycle.
Peak	:	48 Watts
Standby	:	5 Watts
Tracking Satellite (Display off)	:	33 Watts

Environmental:

Temperature		
Operating	:	-20°C to +55°C
Storage	:	-55°C to +100°C
Antenna	:	-40°C to +85°C

Appendix 6

Humidity - operating and storage	:	Up to 100% from 0°C to +35°C
Altitude:		
Operating	:	Up to 4,600 meters
Transporting/storage	:	Up to 15,240 meters
Weather	:	Operates in wind-driven rain, sleet, snow and sand.
Shock:		
Operating	:	Capable of withstanding 15g peak, 11 ms half-sine pulse along three mutually perpendicular axes.
Transporting	:	Capable of withstanding a flat corner or edge drop from 0.6 meter.
Vibration:		
Operating	:	0.25 cm double-amplitude displacement from 5 to 20 Hz 2 g from 20 to 55 Hz.
Transporting	:	0.- cm double-amplitude displacement from 5 to 20 Hz 2 g from 20 to 2000 Hz.
Tape Cassette Transport:		
Recording Technique	:	Biphase Level (Fully ANSI/ECMA/ ISO compatible)
Read/Write Speed	:	25.4 cm/second
Rewind Speed	:	152.4 cm/second
Bit Density	:	315 bits/cm
Data Transfer Rate	:	8000 bits/second
Close Track	:	630 flux changes/cm
Power Consumption:		
Standby	:	3.25 Watts
Running	:	9.75 Watts

Appendix 6

WORKING PRINCIPLE

The Magnavox Mx 1502 system is designed for accurate point positioning based on the transmissions from the TRANSIT satellites.

The Mx 1502 automatically tracks the 150 MHz and 400 MHz phase-modulated satellite signals, enabling the processor to correct for ionospheric refraction and read the satellite's true position. The droppler-shift is measured over 23 seconds signal periodes.

When a satellite passes above the horizon, data will be received during a periode of up to 16 minutes. Each 23 second periode defines a hyperboloid, and the intersection between two hyperboloids and the earth spheroid gives the position of the receiving antenna. Each satellite pass thus gives redundant data for position determination.

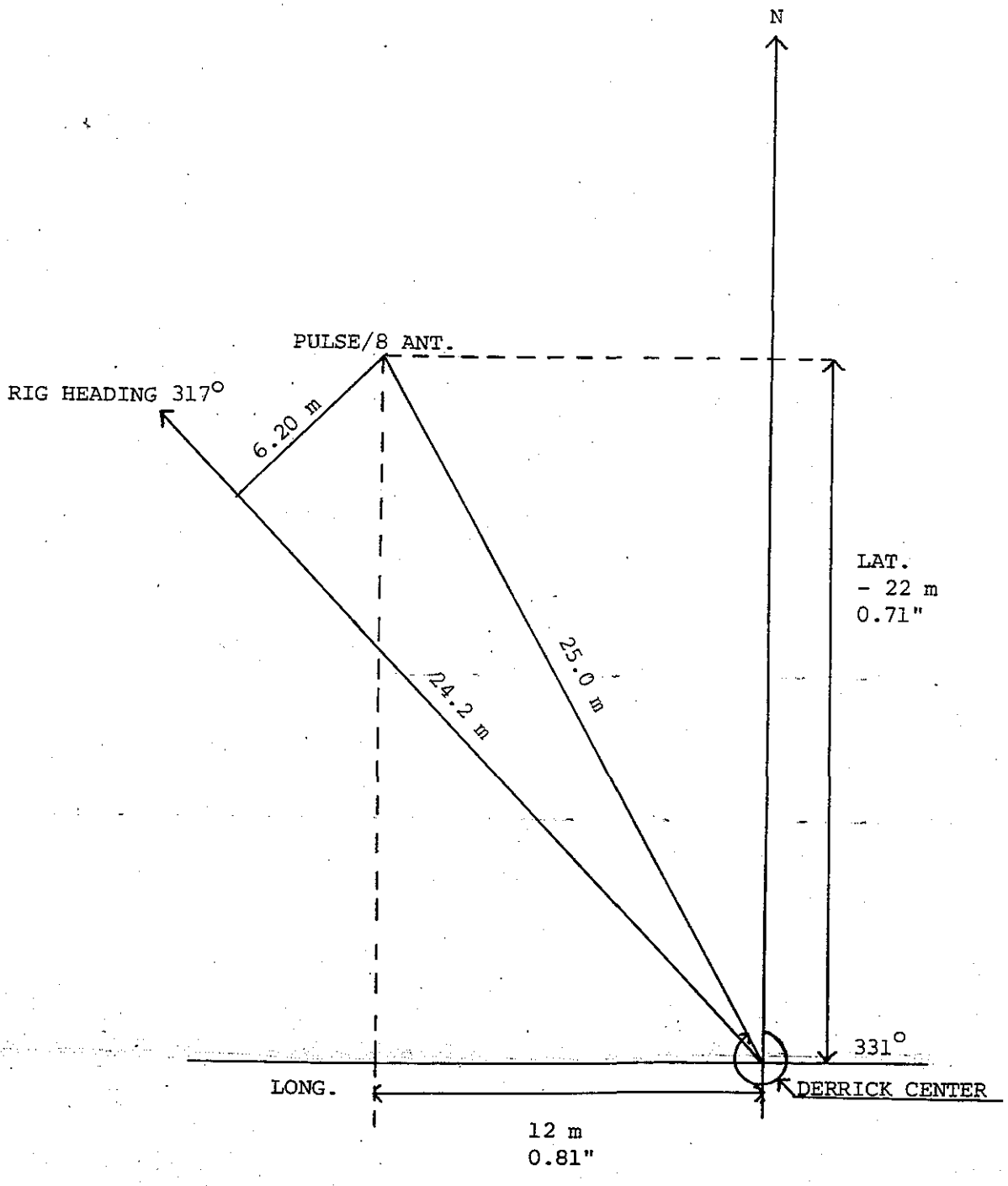
On a stationary point, the Magnavox 1502 Satellite Surveyer collects and process data from a number of satellite passes to provide a three-dimensional, 3-D, position (latitude, longitude and height). The least-squares solution automatically evaluate each droppler count according to its geometric effect on each component of the position. The number of available satellite passes, which are accepted for 3-D computations are varying from about 10 fixes per day around equator, to about 20 fixes at 60 degrees latitude.

Two-dimensional and three-dimensional positions are automatically calculated by the MX 1502 in World Geodetic System (WGS-72) co-ordinates.
The MX 1502 have built in programs for conversion to local datum, and for calculation of UTM coordinates.

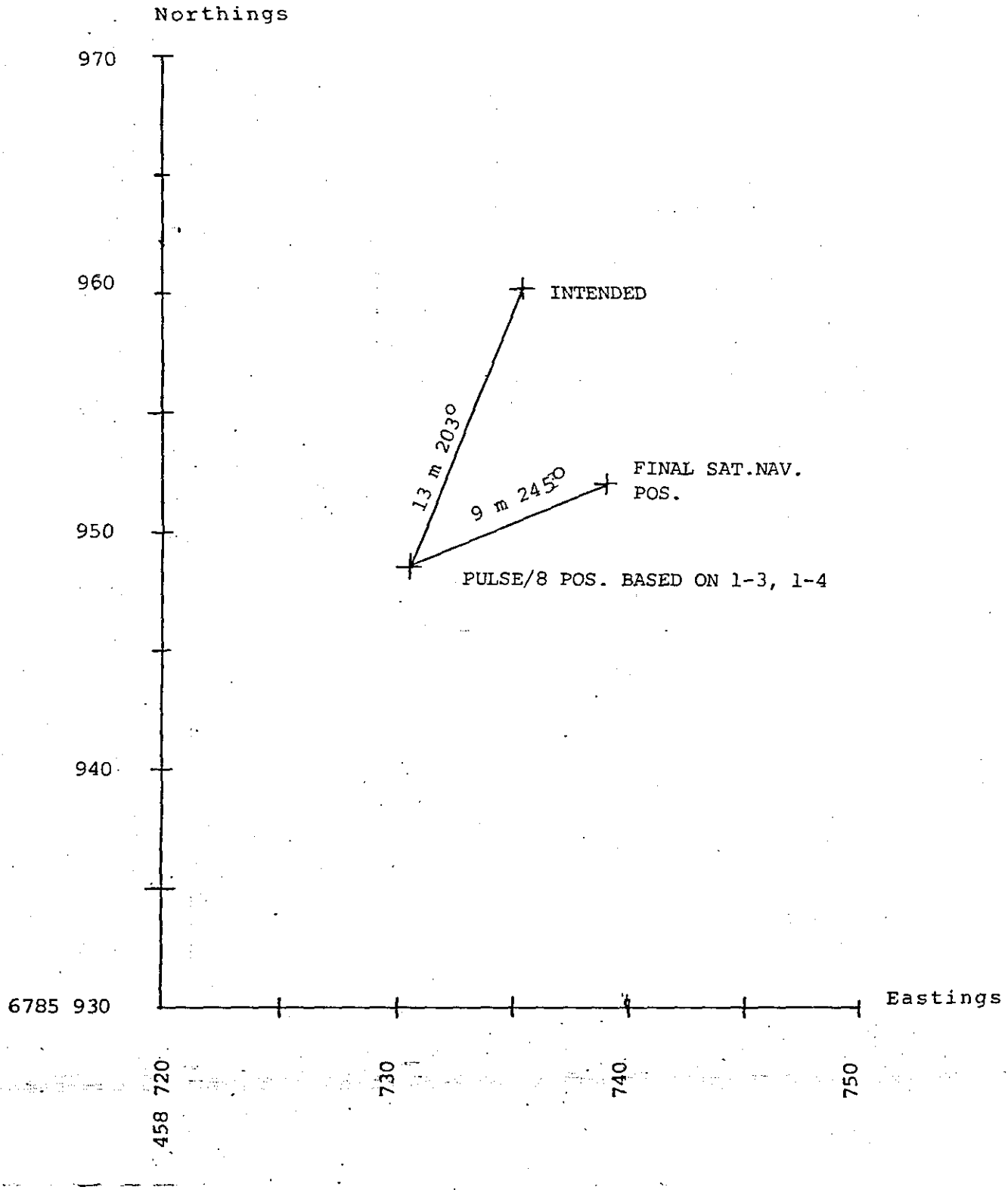
APPENDIX NO. 7

CONVERTION PULSE/8 ANTENNA POSITION
TO WELL CENTER

SCALE 1 : 200



APPENDIX NO. 8
COMPARISON BETWEEN INTENDED, FINAL
SATELLITE POSITION AND PULSE/8 SYSTEM POSITION.



Appendix no. 9.

LIST OF EQUIPMENT

Pulse/8 and minicomputer system:

2	Pulse/8 receivers	Type	90080	MK 4
1	H.P. Computer	"	9810	A
1	H.P. Plotter	"	9862	A
1	Pulse/8 Interface	"	90110	

SAT.NAV.
Magnavox Geoceiver MX 1502

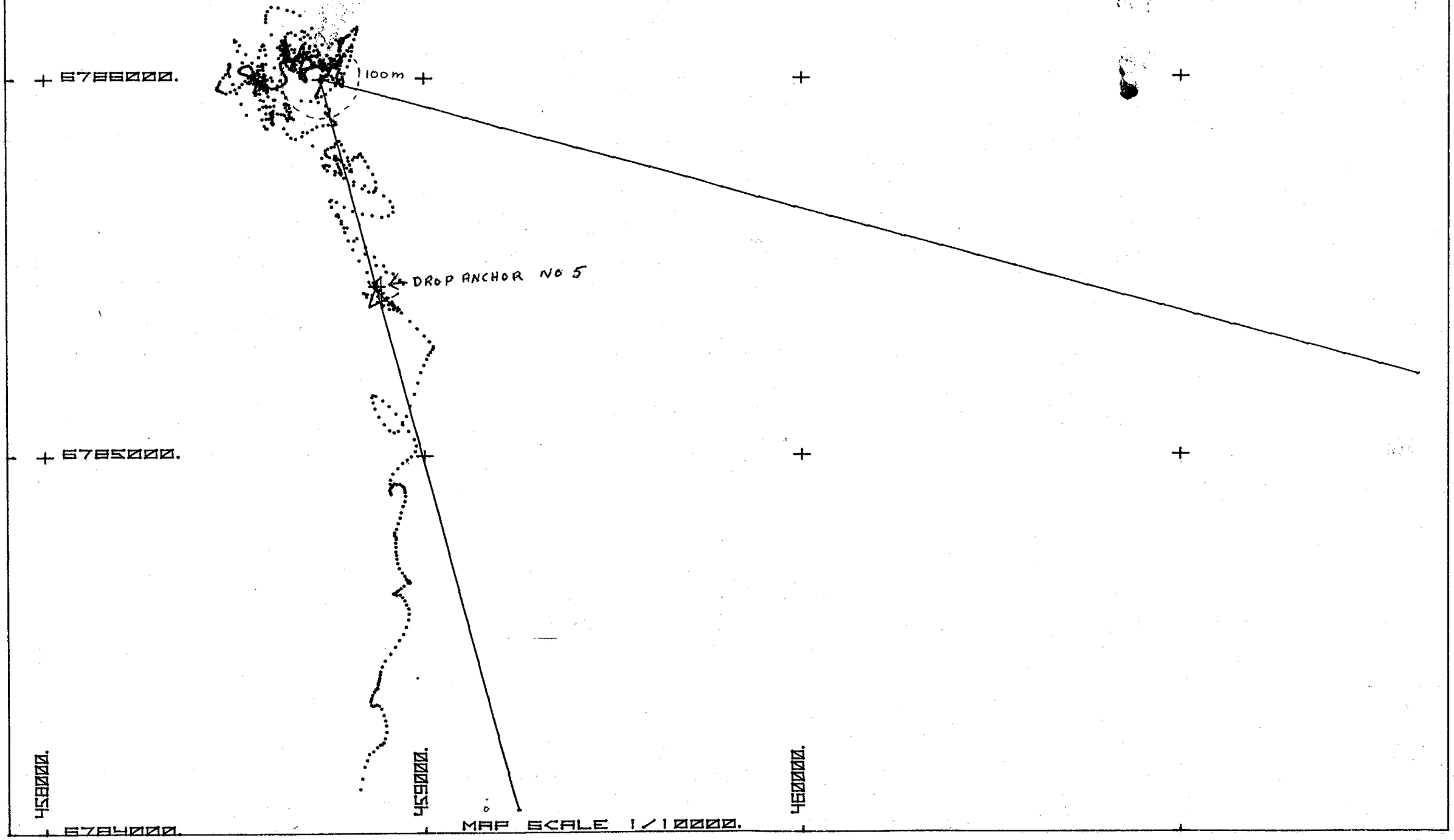
APPENDIX NO 10

FIELD LOG

Date	Time	Events
8/8-79	1655 hrs	Decca personnel and equipment left Bergen.
	1900 "	Arrived Ross Rig.
	2300 "	Pulse/8 equipment operational.
9/8-79	-	Recording of data on old location. Preparing charts for rig move.
10/8-79	1950 "	Deballasting.
	2050 "	Picking up anchors.
11/8-79	0120 "	All anchors onboard.
	0145 "	Heading for location 34/10-4.
	0330 "	Arrived 2 km from new location, preparing anchors.
	0400 "	Moving towards location.
	0425 "	Anchor no 5 on sea bed. (Pulse/8 unstable. Very high noise-level.)
	0556 "	Anchor no 1 on sea bed.
	0851 "	" " 6 " " "
	1000 "	" " 4 " " "
	1053 "	" " 8 " " "
	1152 "	" " 2 " " "
	1214 "	" " 7 " " "
	1342 "	" " 3 " " "
	1605 "	Ballasted to 70 feet.
	2000 "	Piggy-backs on all anchors.
	2330 "	Anchors holding for tension test.
12/8-79		Pulse/8 signals very unstable. Moved the antenna position and changed the earthing point. This improved the signal to noise ratio drasticly and the Pulse/8 signal are now normal.

Date	Time	Events
12/8-79	1330 hrs	Commenced recording of Pulse/8 readings for final Pulse/8 position.
13/8-79	1600 "	Pulse/8 equipment demobilised.
14/8-79	1700 "	Decca personnel and equipment arrived Bergen

APPROACH WELL LOCATION 34/10-4



458000.

458500.

459000.

8785300.

8785800.

8786300.

MAP SCALE 1/5000.

DECCA SURVEY

3 PATTERN ANALYSIS

OBSERVED DATE 12/8-79

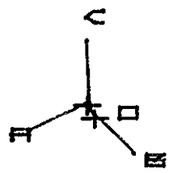
TIME 1600 → 1805

PATT A
<-O 0.00
STNS 1-2
WEIGHT 1.

PATT B
<-O 0.30
STNS 1-3
WEIGHT 1.

PATT C
<-O 0.15
STNS 1-4
WEIGHT 1.

SCALE
1/100000



500. READINGS

MEAN PATTERNS
A 11737.08
B 23109.70 R=1.
C 34752.81

MEAN POS.N→ WEIGHTS 13./18./16.
E 458720.7 N 6785962.0

OFFSET POS.N→ B 151. / D 25.
E 458732.7 N 6785940.1

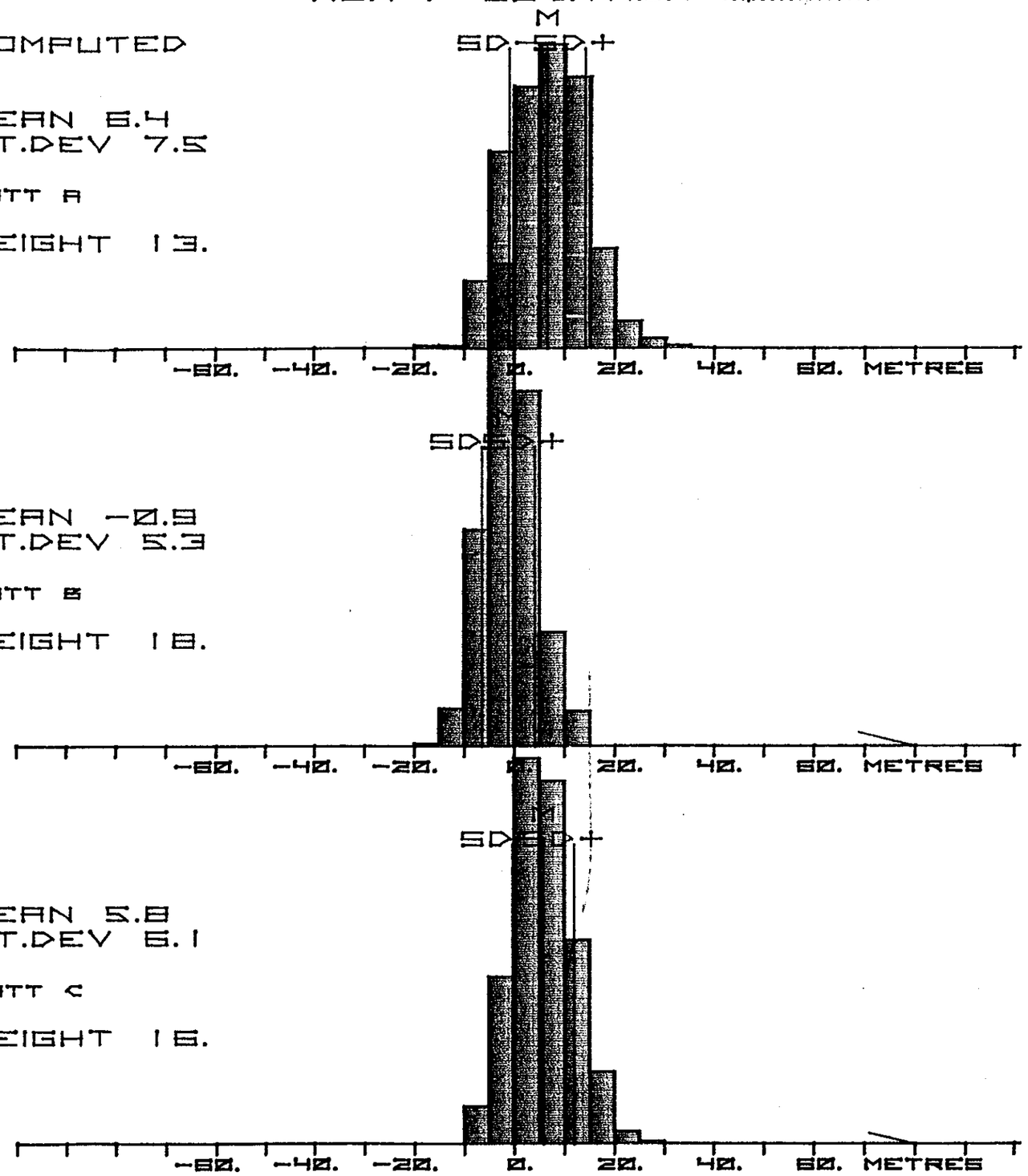
RUN / LOCATION 34/10-4.....

COMPUTED

MEAN 6.4
ST.DEV 7.5

PATT A

WEIGHT 13.



MEAN -0.9
ST.DEV 5.3

PATT B

WEIGHT 18.

MEAN 5.8
ST.DEV 6.1

PATT C

WEIGHT 16.

DECCA SURVEY

3 PATTERN ANALYSIS

OBSERVED DATE 12/8-79

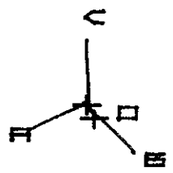
TIME 1330-1545

PATT A
C-O 0.00
STNS 1-2
WEIGHT 1.

PATT B
C-O 0.30
STNS 1-3
WEIGHT 1.

PATT C
C-O 0.18
STNS 1-4
WEIGHT 1.

SCALE
1/10000



500. READINGS

MEAN PATTERNS
A 11737.07
B 23108.71 R=2..
C 34752.81

MEAN POS.N→ WEIGHTS 12./17./15.
E 458719.5 N 6785964.7

OFFSET POS.N→ B 151. / D 25.
E 458731.5 N 6785942.8

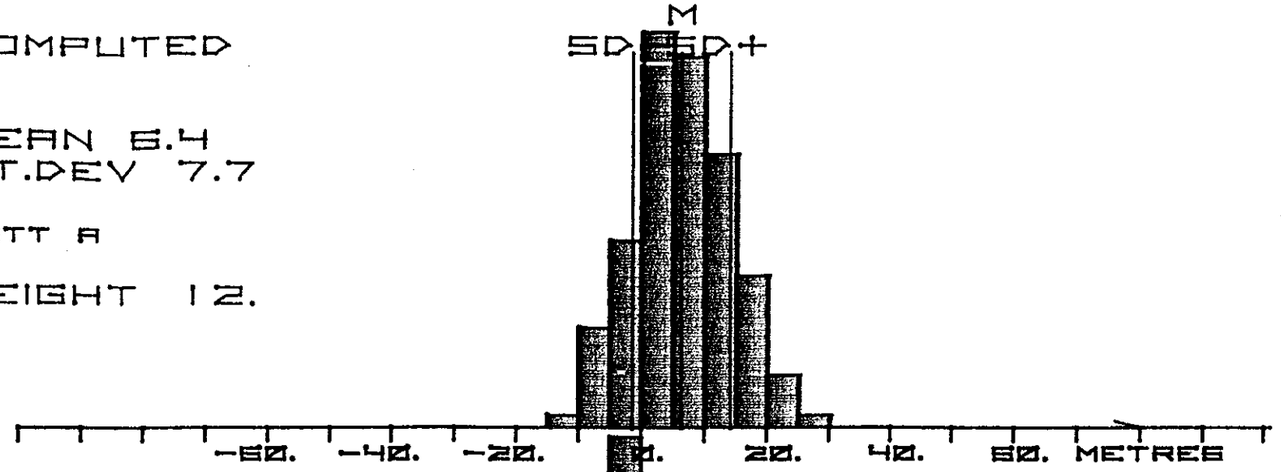
RUN / LOCATION 34/10-4....

COMPUTED

MEAN 6.4
ST.DEV 7.7

PATT A

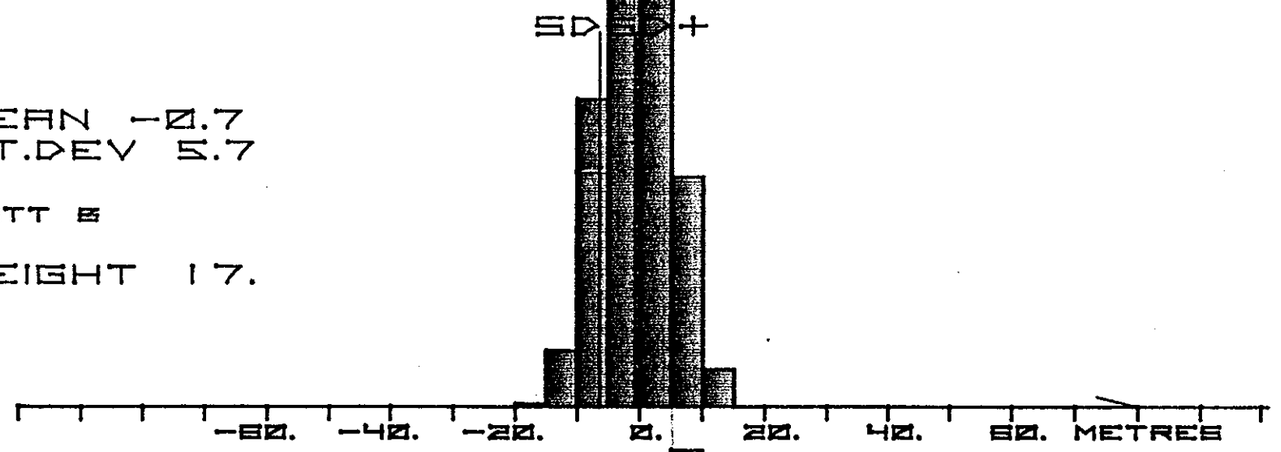
WEIGHT 12.



MEAN -0.7
ST.DEV 5.7

PATT B

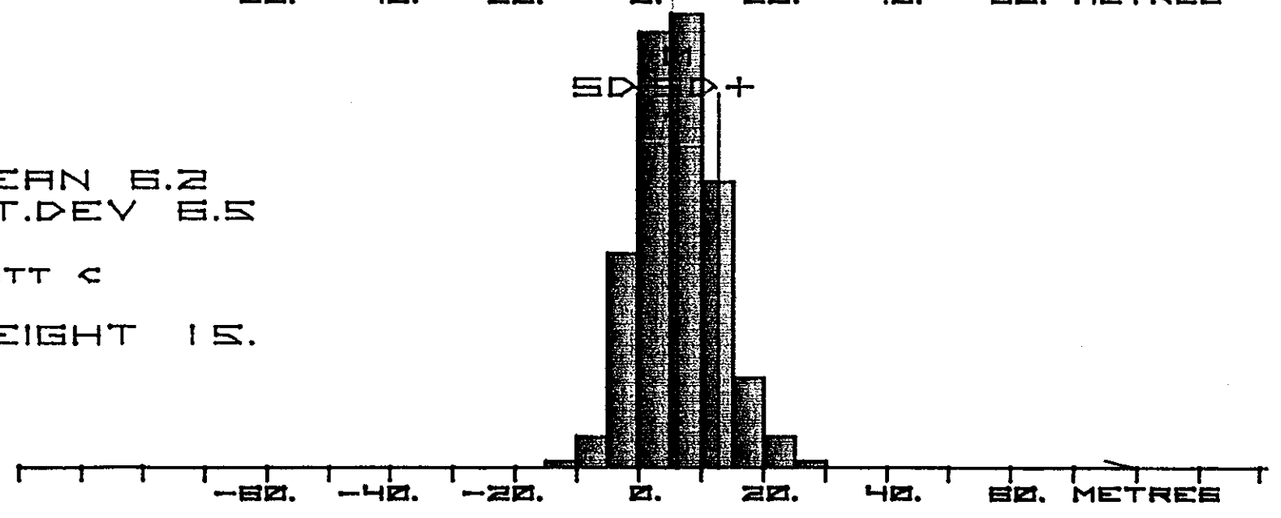
WEIGHT 17.



MEAN 6.2
ST.DEV 6.5

PATT C

WEIGHT 15.



DECCA SURVEY

3 PATTERN ANALYSIS

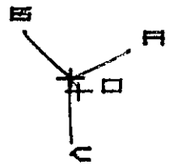
OBSERVED DATE 12/9-79.

TIME 1900-2100

PATT A
<-D 0.00
STNS 1-2.
WEIGHT 1.

PATT B
<-D 0.30
STNS 1-3.
WEIGHT 1.

PATT C
<-D 0.16
STNS 1-4.
WEIGHT 1.



SCALE

1/10000

500. READINGS

MEAN PATTERNS
A 11737.07
B 23109.68 R=0.
C 34752.81

MEAN POS.N→ WEIGHTS 9./13./11.

E 458720.6 N 6785966.2

OFFSET POS.N→ B 151. / D 25.

E 458732.6 N 6785944.2

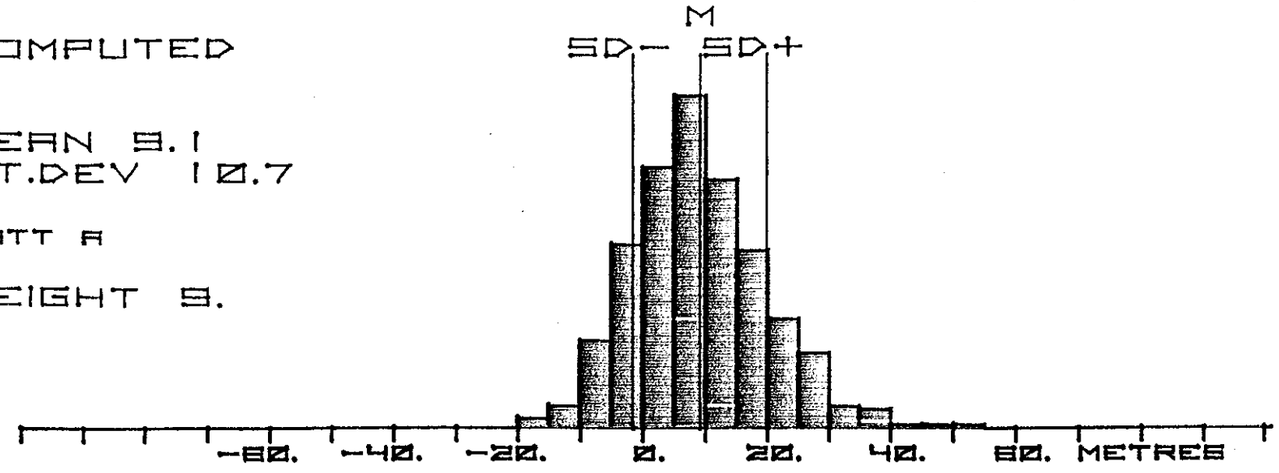
RUN / LOCATION 34/10-4.

<COMPUTED

MEAN 9.1
ST.DEV 10.7

PATT A

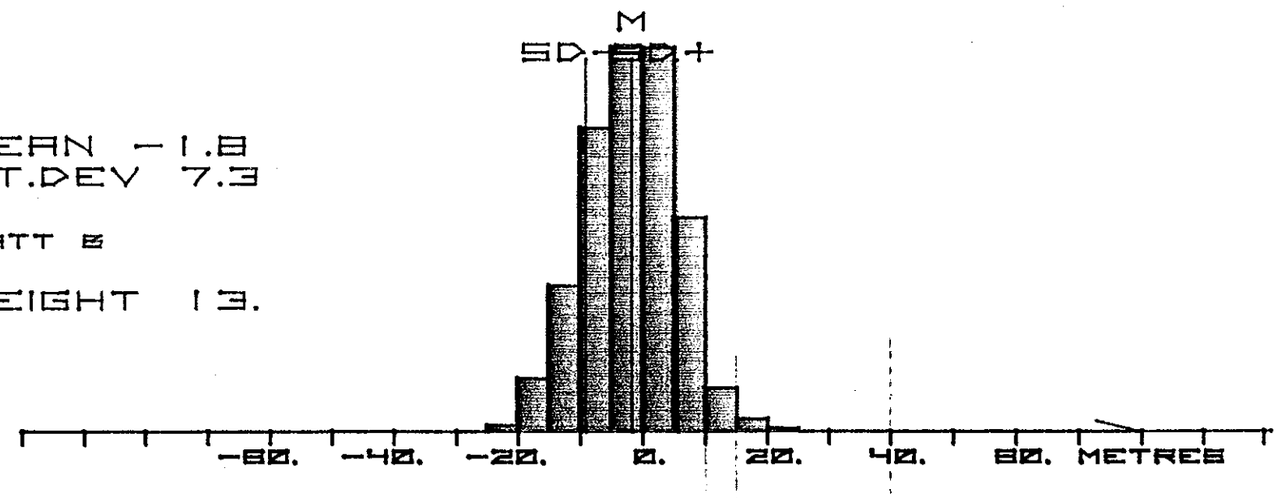
WEIGHT 9.



MEAN -1.8
ST.DEV 7.3

PATT B

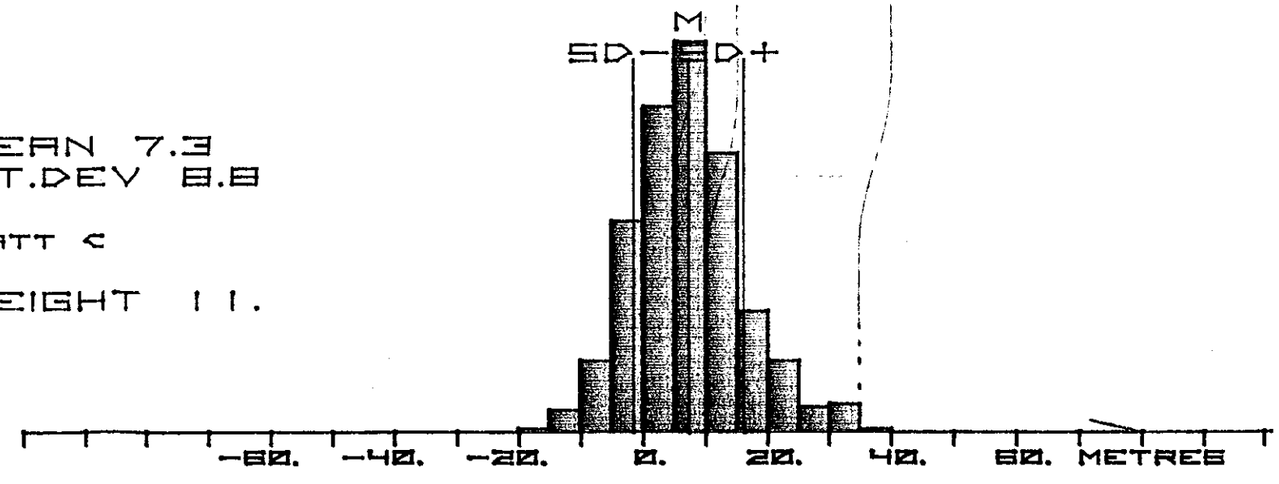
WEIGHT 13.



MEAN 7.3
ST.DEV 8.8

PATT C

WEIGHT 11.



DECCA SURVEY

3 PATTERN ANALYSIS

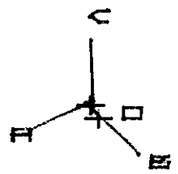
OBSERVED DATE 12/8-7.9.

TIME 2145-2330

PATT A
C-O 0.00
STNS. 1-2
WEIGHT 1.

PATT B
C-O 0.30
STNS. 1-3
WEIGHT 1.

PATT C
C-O 0.15
STNS. 1-4
WEIGHT 1.



SCALE
1/10000

500. READINGS

MEAN PATTERNS
A 11737.04
B 23108.66 R=4.
C 34752.88

MEAN POS.N→ WEIGHTS 5./8./7.
E 458725.4 N 6785973.5

OFFSET POS.N→ B 151. / D 25.
E 458737.4 N 6785951.5

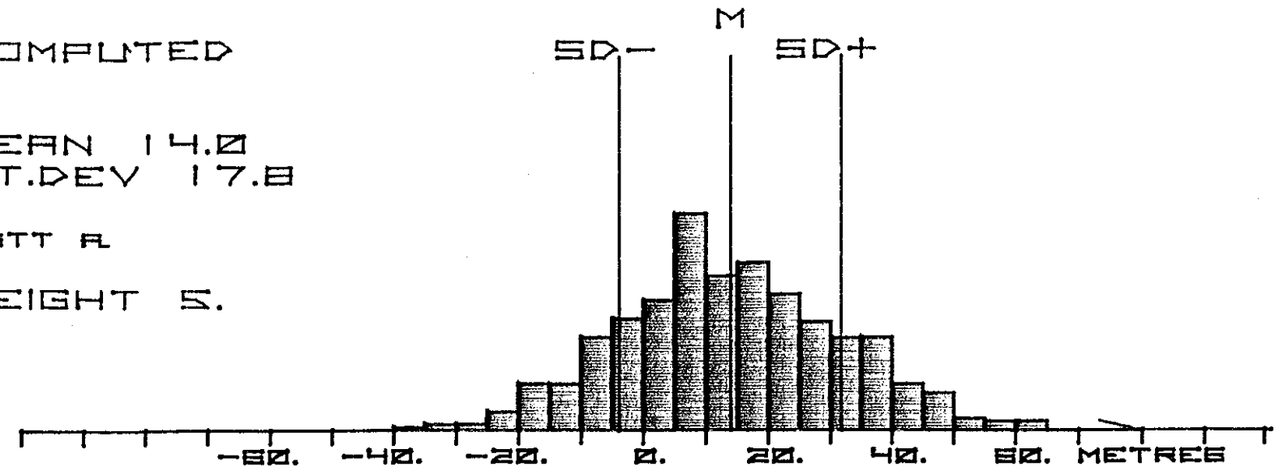
RUN / LOCATION 34/10-4

COMPUTED

MEAN 14.0
ST.DEV 17.8

PATT A

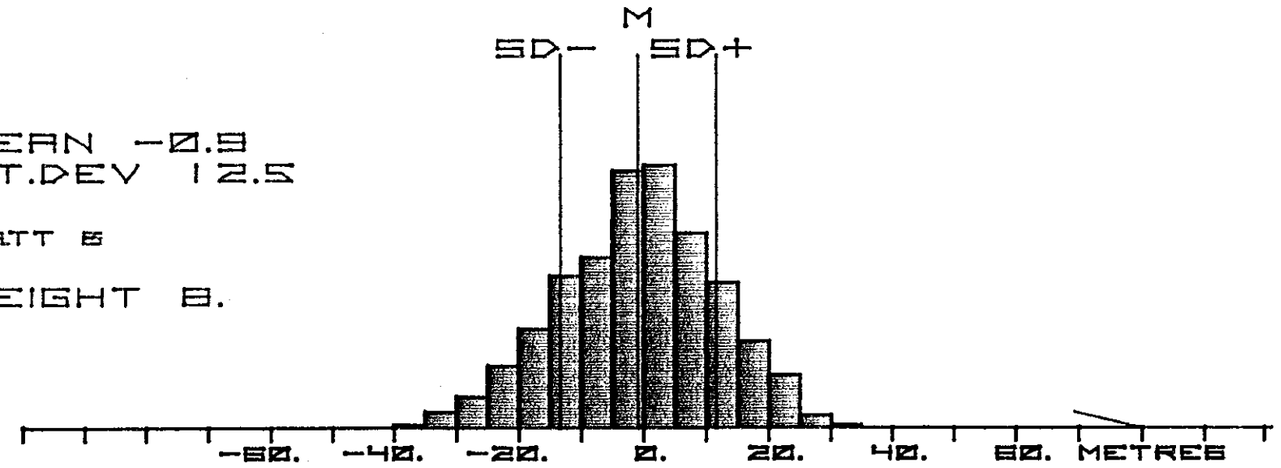
WEIGHT 5.



MEAN -0.9
ST.DEV 12.5

PATT B

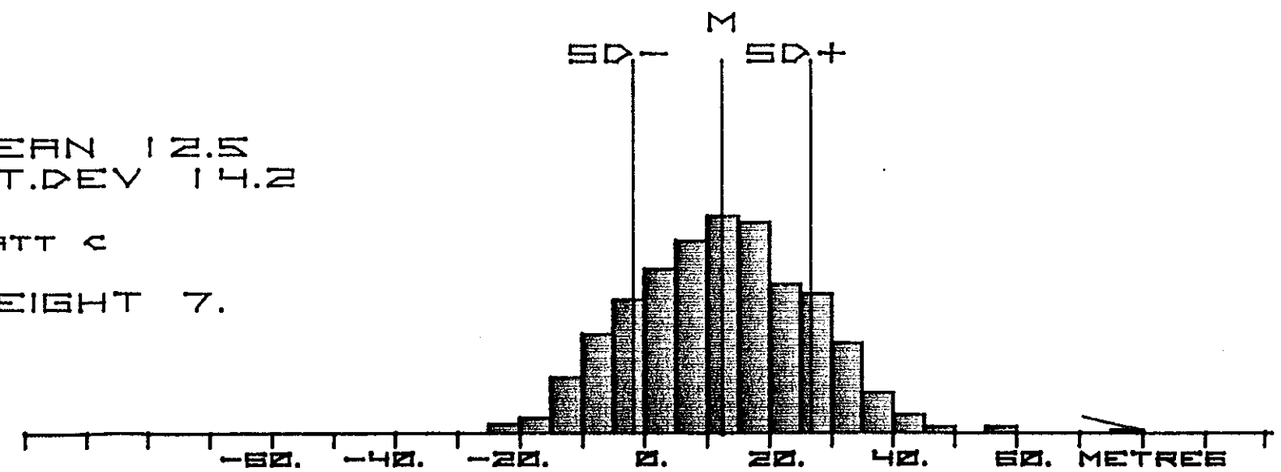
WEIGHT 8.



MEAN 12.5
ST.DEV 14.2

PATT C

WEIGHT 7.



DECCA SURVEY

3 PATTERN ANALYSIS

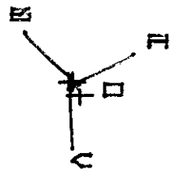
OBSERVED DATE 13/8-79

TIME 2350-2005

PATT A
<-D 0.00
STNS 1-2
WEIGHT 1.

PATT B
<-D 0.30
STNS 1-3
WEIGHT 1.

PATT C
<-D 0.15
STNS 1-4
WEIGHT 1.



SCALE
1/10000

500. READINGS

MEAN PATTERNS
A 11737.14
B 23108.68 R=6.
C 34752.82

MEAN POS.N→ WEIGHTS 4./6./6.

E 458724.2 N 6785956.2

OFFSET POS.N→ B 151. / D 25.

E 458736.3 N 6785934.4

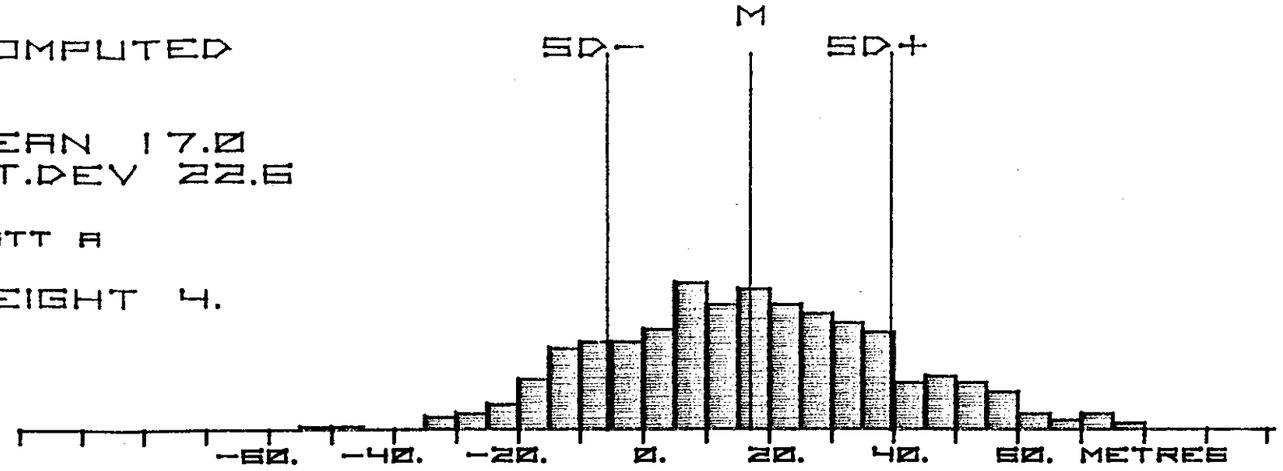
RUN / LOCATION 34/10-4

COMPUTED

MEAN 17.0
ST.DEV 22.6

PATT A

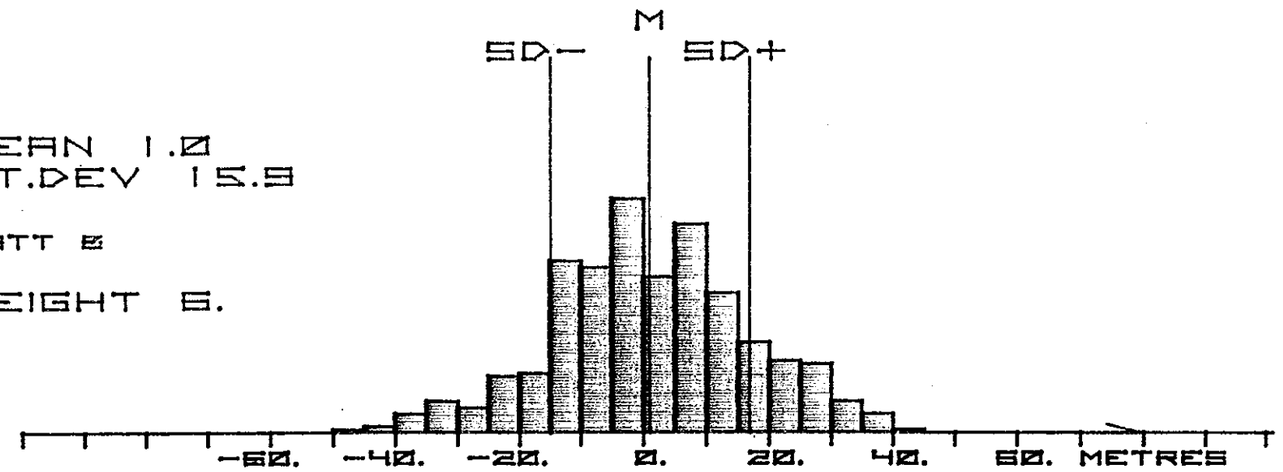
WEIGHT 4.



MEAN 1.0
ST.DEV 15.9

PATT B

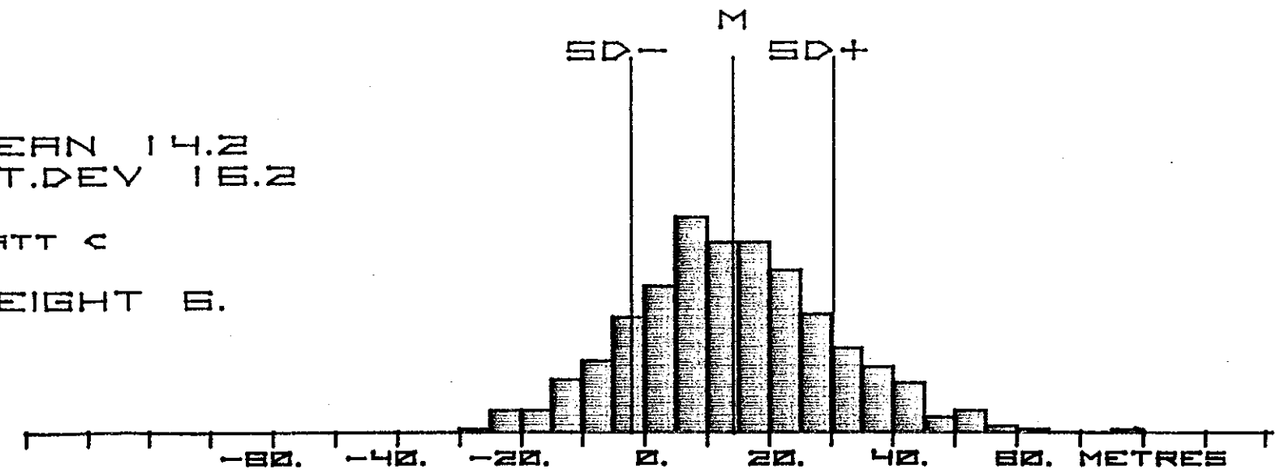
WEIGHT 6.



MEAN 14.2
ST.DEV 16.2

PATT C

WEIGHT 6.



0530

DECCA SURVEY

3 PATTERN ANALYSIS

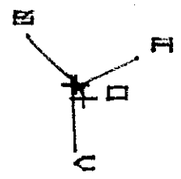
OBSERVED DATE 13-8-79

TIME 0330-0530

PATT A
C-O 0.00
STNS. 1-2.
WEIGHT 1.

PATT B
C-O 0.30
STNS. 1-3.
WEIGHT 1.

PATT C
C-O 0.16
STNS. 1-4.
WEIGHT 1.



SCALE

1/10000

500. READINGS

MEAN PATTERNS
A 11737.07
B 23105.63 R=6.
C 34752.85

MEAN POS.N→ WEIGHTS 5./5./8.

E 458716.1 N 6785975.3

OFFSET POS.N→ B 151. / D 25.

E 458728.2 N 6785953.4

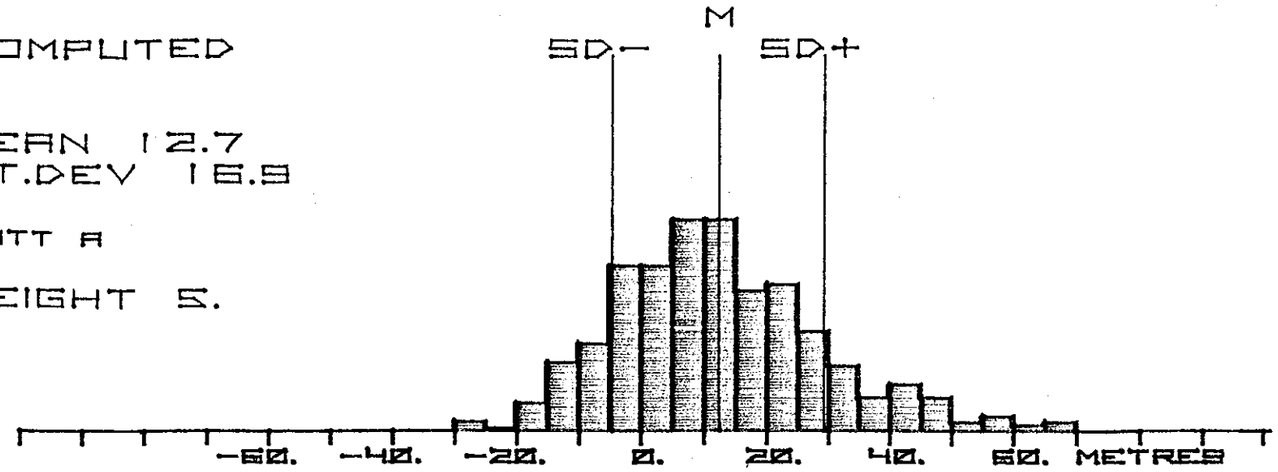
RUN / LOCATION 34/10-4

COMPUTED

MEAN 12.7
ST.DEV 16.9

PATT A

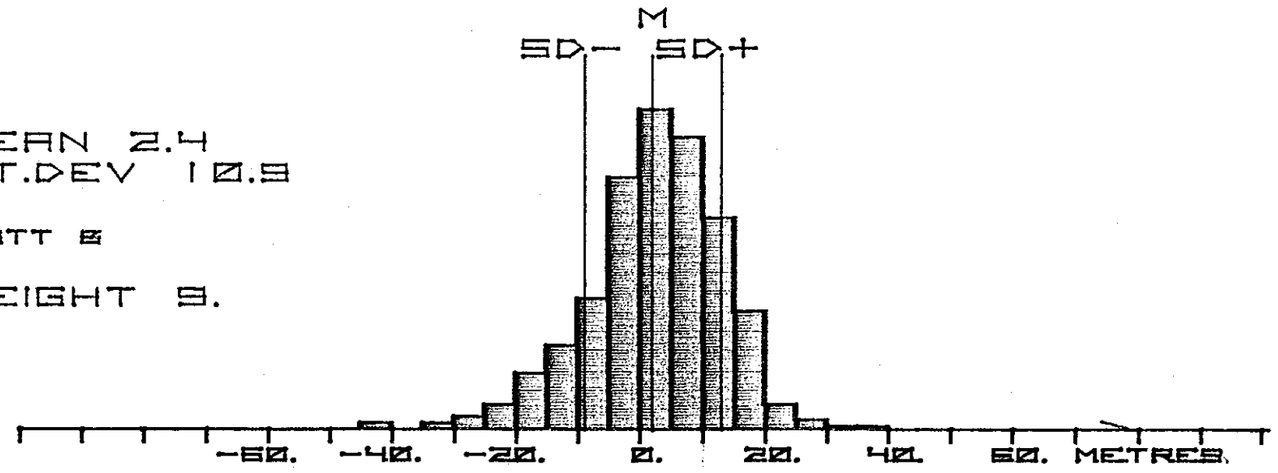
WEIGHT 5.



MEAN 2.4
ST.DEV 10.9

PATT B

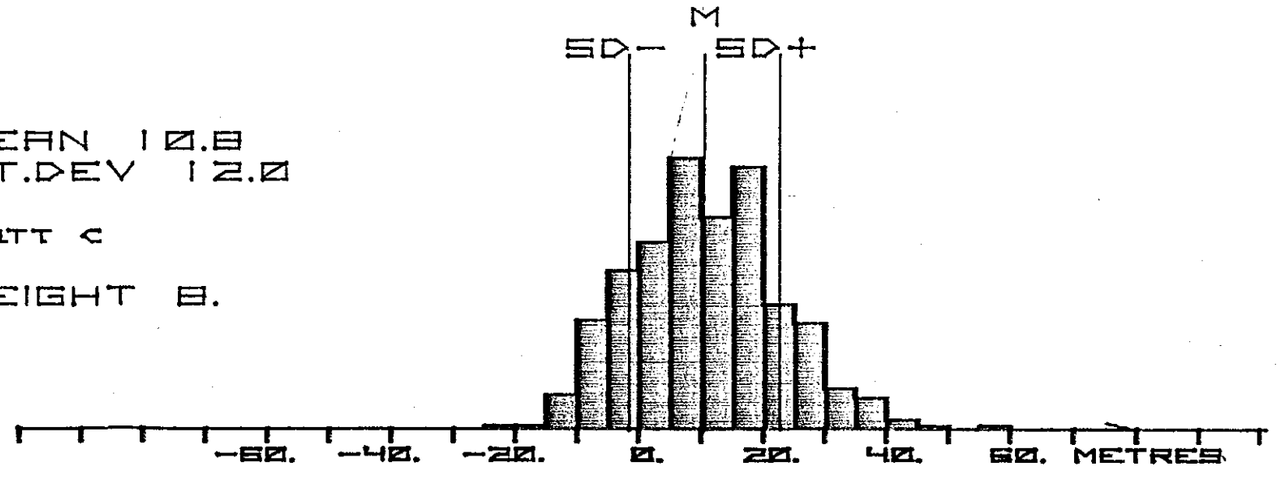
WEIGHT 9.



MEAN 10.8
ST.DEV 12.0

PATT C

WEIGHT 8.



DECCA SURVEY

3 PATTERN ANALYSIS

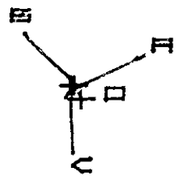
OBSERVED DATE 13/8/79

TIME 0845-1035

PATT A
<-O 0.00
STNS 1-2
WEIGHT 1.

PATT B
<-O 0.30
STNS 1-3
WEIGHT 1.

PATT C
<-O 0.16
STNS 1-4
WEIGHT 1.



SCALE

1/100000.

500. READINGS

MEAN PATTERNS
A 11737.07
B 23108.67 R=4.
C 34752.54

MEAN POS.N→ WEIGHTS 8./13./12.

E 458716.7 N 6785969.9

OFFSET POS.N→ B 151. / D 25.

E 458728.9 N 6785948.0

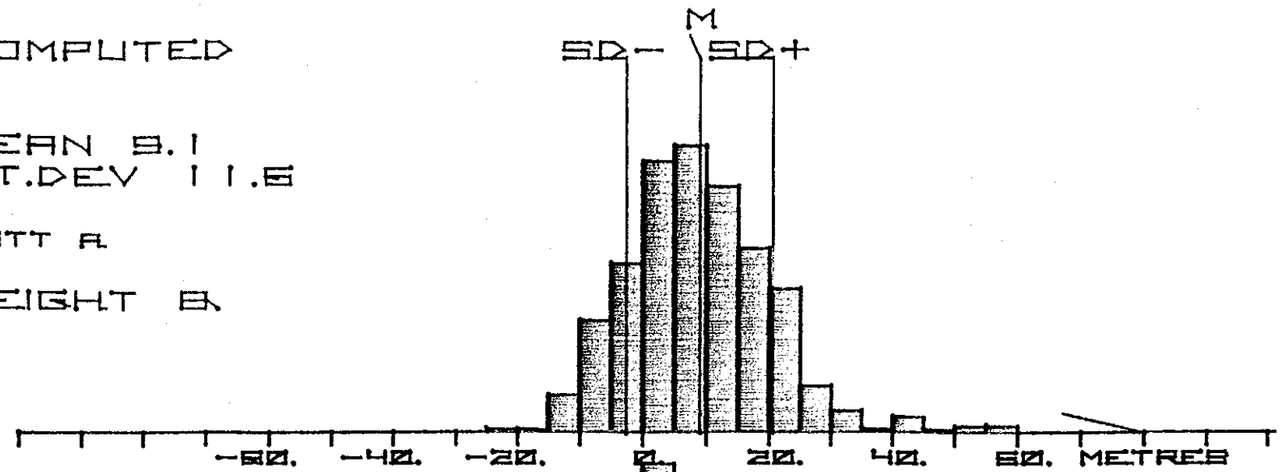
RUN / LOCATION 34/10-4

COMPUTED

MEAN 9.1
ST.DEV 11.6

PATT A

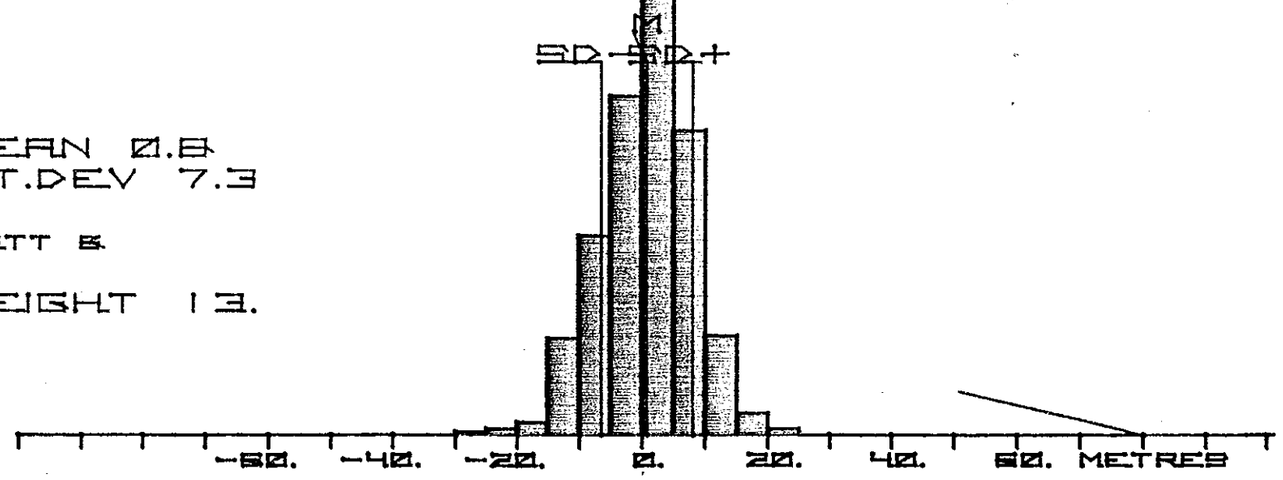
WEIGHT 8.



MEAN 0.8
ST.DEV 7.3

PATT B

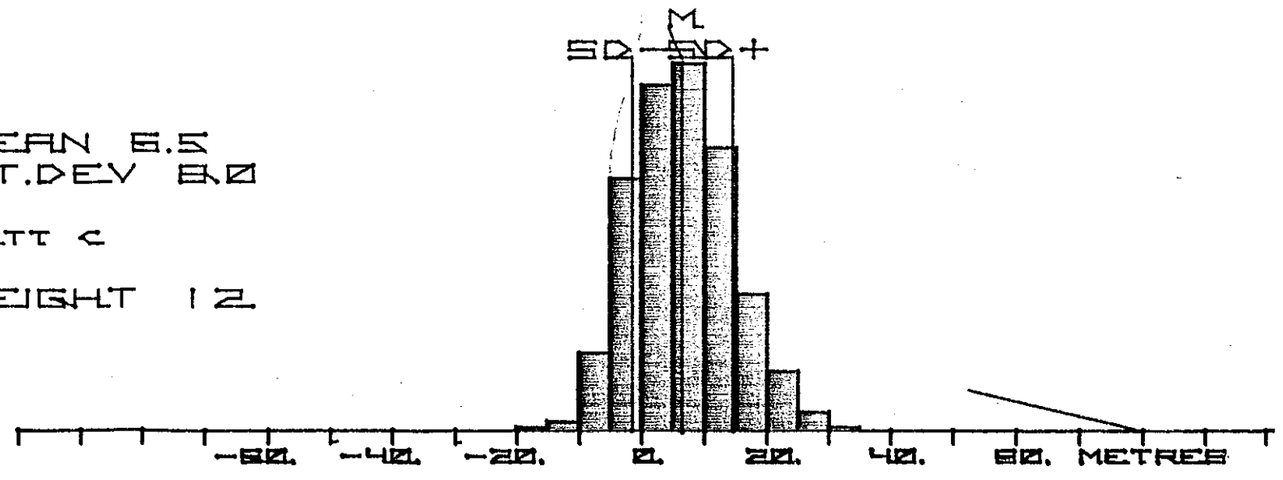
WEIGHT 13.



MEAN 6.5
ST.DEV 8.0

PATT C

WEIGHT 12.



DECCA SURVEY

3 PATTERN ANALYSIS

RUN / LOCATION 34/10-4

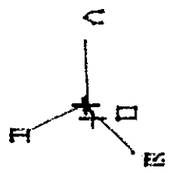
OBSERVED DATE 13/8-79

TIME 1100-1305

PATT A
C-O 0.00
STNS 1-2
WEIGHT 1.

PATT B
C-O 0.30
STNS 1-3
WEIGHT 1.

PATT C
C-O 0.15
STNS 1-4
WEIGHT 1.



SCALE

1/100000

500. READINGS

MEAN PATTERNS
A 11737.08
B 23108.57 R=4.
C 34752.93

MEAN POS.N→ WEIGHTS 5./12./11.

E 458718.5 N 6785966.6

OFFSET POS.N→ B 151. / D 25.

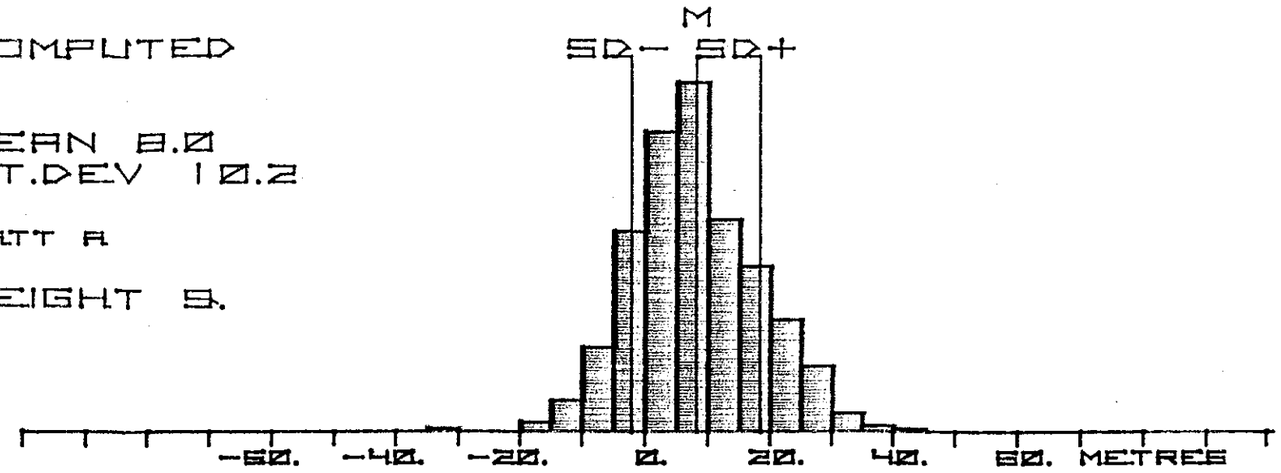
E 458730.6 N 6785944.8

COMPUTED

MEAN 8.0
ST.DEV 10.2

PATT A

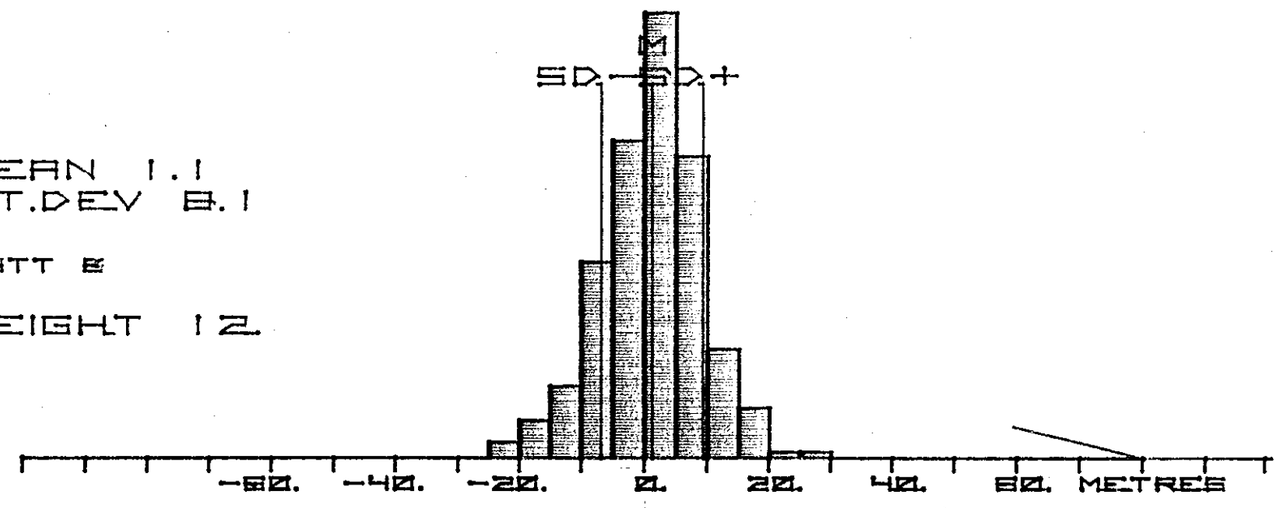
WEIGHT 5.



MEAN 1.1
ST.DEV 8.1

PATT B

WEIGHT 12.



MEAN 7.3
ST.DEV 8.4

PATT C

WEIGHT 11.