LAMONT DATA REDUCTION CRUISE SUMMARY

CRUISE: EW9006

START: 07/25/90 206 Reykjavik, Iceland

END: 08/22/90 234 Bergen, Norway

PURPOSE: Geophysical investigation of the AGIR Ridge & the slump area S. of Voring Plateau of the Norwegian Sea.

CHIEF SCIENTIST: Hank Fleming

DATA REDUCTION: Robert Blaes

TRUE TIME CLOCK

Instruments: Kinemetric/True Time Division model 468-DC
Logging: 1 minute intervals
Checking: visual check of plot data comparing recalibration to time embedded in Transit Satellite data.
Use: The True Time clock is used to recalibrate the logging computers CPU time tag on all the data types.
Note: Both of the true time clocks are connected to a Hewlett - Packard 5065A Rubidium Vapor frequency standard, which functions to keep the clocks correct even when the satellites aren't visible. Clock # 2 was disconnected from its antenna and ran reliably the whole cruise on the freq. standard. Clock #2 was the one used to calibrate the time tags on the logged data.

SPEED AND HEADING:

Instrument: Furuno CI-30 2-axis Doppler speed log, Sperry MK-27 gyro
Logging: 3 second intervals
Checking: visual check of plot of data
Smoothing: mean value of all good values within the same minute

TRANSIT SATELLITE FIXES:

Instrument: Magnavox MX-1107RS dual frequency Transit satellite receiver
Logging: 2 receivers logging all fixes. This cruise receiver # 1 (on the bridge) had a bad antenna and was not reliable, # 2 was used.
Checking: reject receiver flagged fixes, fixes with high drifts in navigation and fixes producing improbable track lines.

GPS SATELLITE FIXES:

Instrument: Magnavox T-Set Global Positioning System receiver
Logging: set #1 : 2 second intervals; set #2 : 20 second interval
Checking:
minimum number of sats: 2
dilution of precision maximum: north = 6.0, east = 6.0
carrier signal-noise ratio minimum: 35.0
standard deviation maximum: north = 10.0, east = 10.0
time step maximum: 3
speed maximum: 15.0
compared GPS speed and course with Furuno smooth speed and heading
compared positions with Transit-Furuno navigation
reject fixes with high drifts in navigation
reject fixes producing improbable track lines

Interpolation: interpolated positions at 00, 30 seconds of each minute
Smoothing: smoothed interpolated positions with 9 point running average

NAVIGATION:

A "1 minute navigation" is produced from the above sources. Acceptable fixes are merged at 1 per minute with priority given to GPS, then to Transit. The smooth speed and heading data is used to fill any gaps of 2 minutes or longer between fixes by computing 1 minute DR'ed positions corrected for set and drift between fixes. The DR'ed positions are produced at 00 seconds of each minute.
The final navigation for EW9006 was derived by the U.R.I. group.
Chief scientist's final data: 1 minute navigation.
Lamont database: 1 minute navigation.

Format of ascii navigation file:

```
yy+ddd:hh:mm:ss.mmm N 12 12.1234 E 123 12.1234 id 123.1 12.1
yr day   time            lat        lon        id  set  drift
```

BATHYMETRY:

Instrument: ATLAS HYDROSWEEP
Logging: The center beam of each SURVEY record of HydroSweep is used.
Intervals vary, dependent on depth: about every 6 sec. at
4000 m., more often at less depth.
Checking: visual check of plot of data
Chief scientist's final data: depth interpolated from center beam values closest to zero seconds of each minute. Depth is in meters.
Lamont database: Same as above. Depth is in fathoms.

Format of ascii bathymetry file:

```
yy+ddd:hh:mm:ss.mmm N 12 12.1234 E 123 12.1234 2222.0
yr day   time            lat        lon        depth_in_meters
```

MAGNETICS:

Instrument: Varian V75 magnetometer
Logging: 20 second intervals
Checking: visual check of plot of data
Reference field: International Geomagnetic Reference Field 1985
(IGRF 1985)
model of the main field at 1985.0 and a predictive model of the secular variation for adjusting to dates between 1985.0 and 1990.0
Residual field: Applied by bilinear interpolation across a 1 degree square.
Chief Scientist's final data: interpolated total intensity value at 00 seconds of each minute. Magnetic anomalies at 00 seconds of each minute.
Lamont Database: interpolated total intensity value at 00 seconds of each minute

Format of ascii magnetics file:

```
yy+ddd:hh:mm:ss.mmm N 12 12.1234 E 123 12.1234 99999.9   -888.8
```

yr	day	time	lat	lon	Tot_intensity anomaly

KSS-30 GRAVITY:

Instrument: Bodenseewerk KSS-30 Sea Gravity Meter System
Logging: 6 second intervals
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
Checking: visual check of plot of data to determine satisfactory Eotvos
    corrections, reject spikes of data at turns.
Velocity smoothing: 5 point running average for days 11 - 27
Note:
      The KSS-30 was the primary source of gravity on EW9006.
      It was prone to going down during rough weather.
      Incorporating the post cruise tie to calculate daily
      drift resulted in showing agreement between both meters.

BGM-3 GRAVITY:

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 second intervals
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
Checking: visual check of plot of data to determine satisfactory Eotvos
    corrections, reject spikes of data at turns.
Velocity smoothing: 5 point running average for days 11 - 27
Note:
      The BGM-3 had problems on EW9006 due to the its counts
      conversion interface randomly introducing the same data twice.
      Its data was consequently of lower quality than the KSS-30;
      generally it was more prone to spikes. Its data was in
      good agreement with the KSS-30 and on three days during
      the cruise BGM-3 data was inserted in the final data set
      when the KSS-30 was down.

BGM-3 gravity data used in the final data set:

day: 207 time interval: 00:29 to 09:19
day: 208 times (4 minutes in all!): 12:42, 12:43, 17:46, 17:49
day: 216 time interval: 12:09 to 12:53

GRAVITY IN GENERAL:

Chief scientist's final data: Observed gravity, Eotvos,
      Free Air Anomaly value at 00 seconds of each minute.
      Above calculated using the 1980 theoretical gravity formula:
            Yo = 978.0327 * (1 + a - b) where
            a = .0053024 * sin(theta) * sin(theta) and
            b = .0000059 * sin(2 * theta) * sin(2 * theta).

Lamont database: Free Air Anomaly value at 00 seconds of each minute.
      Above calculated using the 1930 theoretical gravity formula:
            Yo = 978.049 * (1 + a - b) where
            a = .0052884 * sin(theta) * sin(theta) and
            b = .0000059 * sin(2 * theta) * sin(2 * theta).

Format of ascii gravity file:

```
yy+ddd:hh:mm:ss.mmm N 12 12.1234 E 123 12.1234 1980    77.7
yr day   time            lat        lon        theo_yr  FAA

979317.5   64.1   1.5  10.2  -1.7  9.7  -1.6  9.8
raw_grav eotvos drift dc_shift raw_vel  smo_vel
```

DRIFT CALCULATION:

KSS-30: drift/day = 2.37 mgal / (235 - 204) = .07645

BGM-3: drift/day = 8.59 mgal / (235 - 204) = .2771

CRUISE GRAVITY TIE-IN: pre-9006 ** looks better with tabstop=8 **
Port: Reykjavik, Iceland
Date: July 23, 1990
Operator: Dan Chayes
Reference Station: 5450 Reykjavik AA
Datum/Reference AMS 1613 III, stamped: "OS 1970 5450"
Bench mark on Basement (room #22) of Building on
campus of Science Institute, University of Iceland.
(contact at university: Bryndis Brandsdottir
phone: work 694774 , home 628545)
Pier/Ship's position: from the Gravity Tie Report:
20 feet from Custom House Warehouse #5 door.
20 feet from waist deck entrance.
Gravity meter: L & R Model G, serial number 237.
Temperature of meter: 49 C.
Readings and Calculations:

TIME	LOCATION	L&R READING	G	Potsdam Corr?
1319Z	Pier	5736.85+- .05		
1347Z	Ref	5735.59+- .05	982279.68	NOT corrected
1428Z	Pier	5736.85+- .05		

		G READING
1444Z	BGM	982371.80
1444Z	KSS-30	2112.81

Pier reading 11 ft above waist deck. Waste deck is 18 ft. above
gravity lab. 11 + 18 = 29 ft. = 8.8 m.

Height correction:

Lacoste difference in LR units:
delta_LR = pier_LR - ref_LR
1.26 = 5736.85 - 5735.59

Difference in mgal: (1 LR unit = 1.06 mGals)
delta_mgal = delta_LR * constant
1.36 = 1.26 * 1.06

Pier gravity value in mgal: G - 13.6 = ref_val if NOT Potsdam corrected
pier_grv_val = ref_val + delta_mgal
982267.44 = 982266.08 + 1.36

Height correction in mgal:
note: free-air constant of +0.31 mgal per meter going towards
the center of earth; -0.31 mgal per meter going away.
hgt_corr = hgt * constant

2.73 mGal = 8.8m * 0.31 mGal/m

Gravity at gravity lab level in mgal:

grv_at_lab_level = pier_grv_val + hgt_corr

982270.17 = 982267.44 + 2.73

BELL GRAVIMETER

Recalculation of gravity using corrected scale factor and bias:

solving for filtered counts:

filtered counts = (g(t) - bias) / scale factor

25546.99 = 982371.80 - 849128.4 / 5.215621

using the corrected scale factor and bias:

g(t) = (scale factor * filtered counts) + bias

982270.98 = 4.952164 * 25546.99 + 855758.1

DRIFT CALCULATION:

BELL GRAVIMETER:
BGM_filt_grv = (scale factor * counts) + bias = 982270.98
using s.f. 4.952164 and bias 855758.1

Mistie in mgal:
mistie = BGM_grv_val - grv_at_lab_level
0.81 = 982270.98 - 982270.17

Drift in mgal since last tie:
prev_mistie: mgal on
0.52 19 July, 1990
drift = mistie - prev_mistie
0.29 = 0.81 - 0.52

KSS-30:

KSS_grv_val = kss_unbiased_output + bias
982283.10 = 2112.81 + 980170.29

Mistie in mgal:
mistie = KSS_grv_val - grv_at_lab_level
12.93 = 982283.10 - 982270.17

Drift in mgal since last tie:
prev_mistie: 13.6 mgal on 19 July, 1990
drift = mistie - prev_mistie
-0.67 = 12.93 - 13.6

Previous tie (19/7/90) was the 1st, BIAS set on last tie. RB 12/90

CRUISE GRAVITY TIE-IN: pre ew9007 ** looks better with tabstop=8 **

Port: Bergen, Norway Date: Aug 23,90 Operator: Joe Stennett

Reference Station: ACIC 2030-1

Pier/Ship's position: Ship is docked at the very end of the pier near the custom house (Tollbodkaien) Skotegrunnaskai Pier #2.

Gravity meter: L & R Model G s/n: 237

Temperature of meter: 49 C.

TIME	LOCATION	L&R READING	G	Potsdam Corr?
0816Z	Pier	5427.632+- .05		
0857Z	Ref	5426.940+- .05	981951.1	NOT corrected
0918Z	Pier	5427.635+- .05		

READ FROM DEVICES BY DATA LOGGING COMPUTER:

0920Z BGM filtered mgals: 981949.3

0920Z KSS-30 unbiased mgals: 1784.91

Pier reading 0.3 m above waist deck. Waste deck is 5.5 m. above gravity lab. Difference between pier and gravity lab: 5.8 m. hgt.

GRAVITY AT SENSOR CALCULATION: Lacoste difference in LR units:

delta_LR = pier_LR - ref_LR

0.7 = 5427.63 - 5426.94

Difference in mgal: (1 LR unit = 1.06 mGals)

delta_mgal = delta_LR * constant

0.7 = 0.7 * 1.06

Pier gravity value in mgal: G - 13.6 = ref_val if NOT Potsdam corrected

pier_grv_val = ref_val + delta_mgal

981938.2 = 981937.5 + 0.7

Height correction in mgal: (constant is + if meter is below pier)

hgt_corr = hgt * constant

1.7 mGal = 5.8 m * (+/-) 0.31 mGal/m

Gravity at gravity lab level in mgal:

grv_at_lab_level = pier_grv_val + hgt_corr

981939.9 = 981938.2 + 1.7

DRIFT CALCULATION:

BELL GRAVIMETER:

BGM_filt_grv = (scale factor * counts) + bias = 981949.3

using s.f. 4.952164 and bias 855758.1, filter width 480. (8 minutes)

Mistie in mgal:

mistie = BGM_filt_grv - grv_at_lab_level

9.4 = 981949.3 - 981939.9

Drift in mgal since last tie:

prev_mistie: 0.81 mgal on date 23 July, 1990

drift = mistie - prev_mistie

8.59 = 9.4 - 0.81

KSS-30:

KSS_grv_val = kss_unbiased_output + bias

981955.20 = 1784.91 + 980170.29

Mistie in mgal:

```
      mistie = KSS_grv_val - grv_at_lab_level
       15.3  =   981955.2  -  981939.9

Drift in mgal since last tie:
prev_mistie:  12.93 mgal on date   23 July, 1990
      drift = mistie - prev_mistie
       2.37 =  15.3  -  12.93
```