EW9409
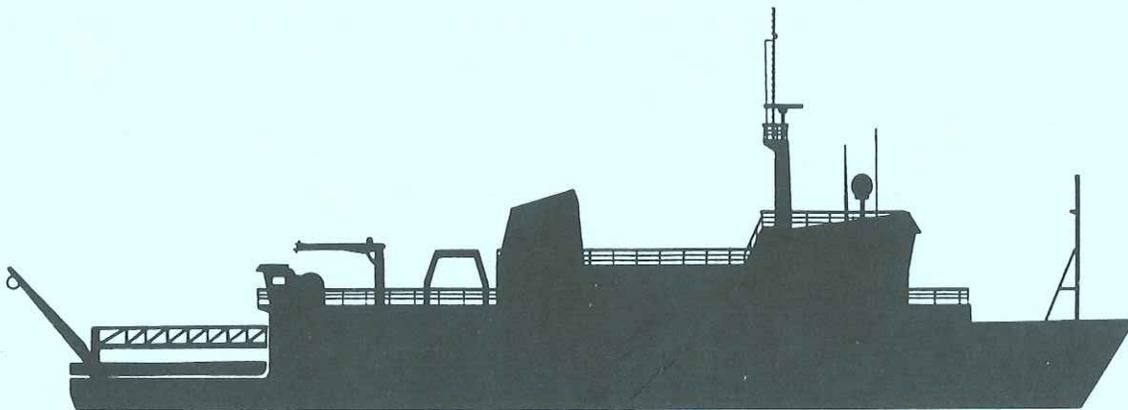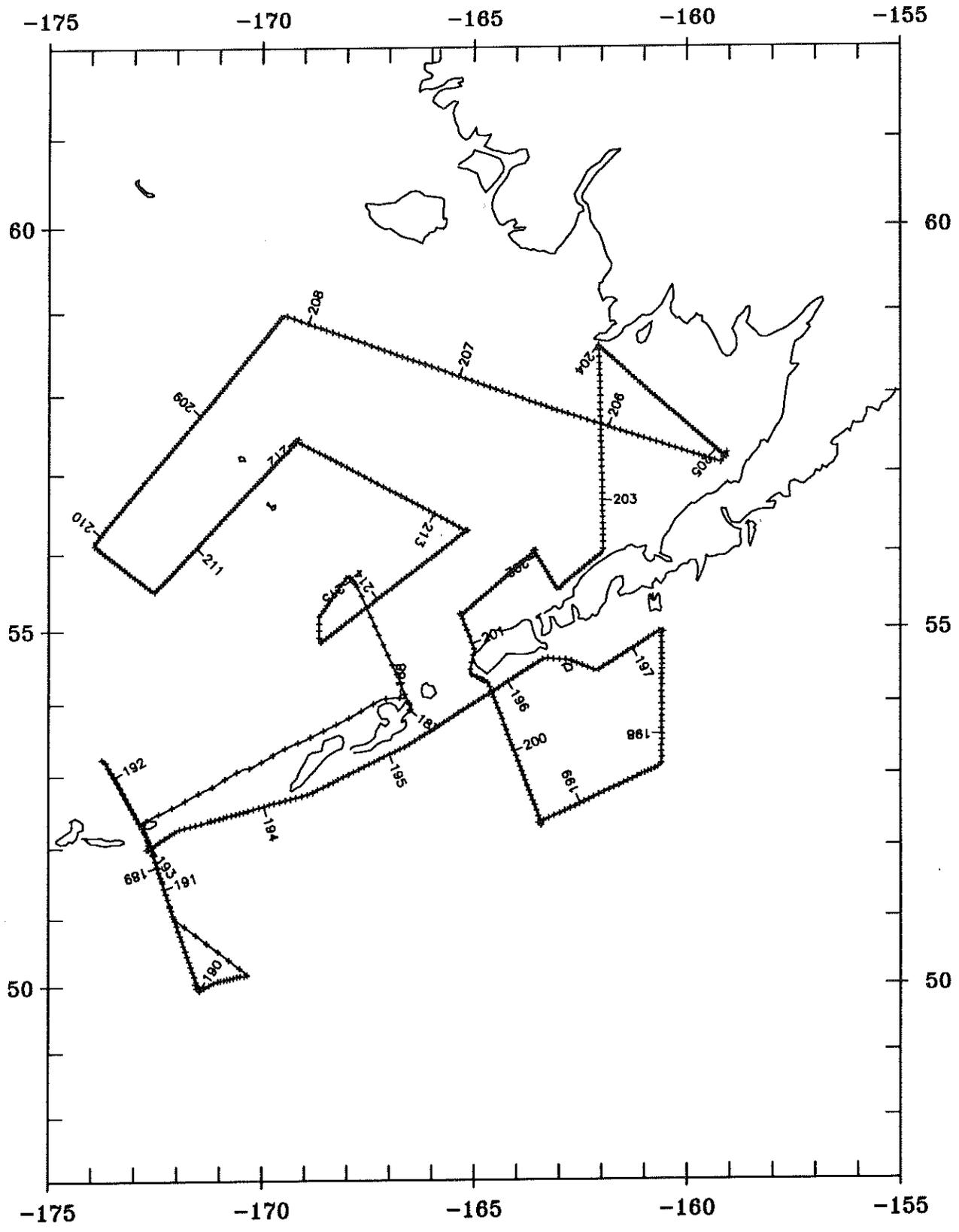
R/V MAURICE EWING

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY
COLUMBIA UNIVERSITY

EW9409 Dutch Harbor – Dutch Harbor July 6 – August 3 1994

```
                  LAMONT DATA REDUCTION CRUISE SUMMARY
                  ======================================


CRUISE: EW9409

START: 6 July 1994    [187]    Dutch Harbor, Alaska

END:   3 August 1994   [215]    Dutch Harbor, Alaska

TITLE: Pacific to Bering Shelf Deep Seismic Experiment

CHIEF SCIENTIST(S): John Diebold - Lamont-Doherty Earth Observatory
                    Sue McGeary - University of Delaware


DATA REDUCTION: William J. Robinson


****************************************************************************


TIME:
-----
Instrument: Kinemetrics GPS Synchronized clock, Model GPS-DC
Logging: 60 second intervals


SPEED AND HEADING:
------------------
Instrument: Furuno CI-30 2-axis doppler speed log
Logging: 3 second intervals
Checking: visual check of plot of data
Smoothing: mean value of all good values within the same minute
Notes:
     (1) day    time       comment
         ---    ---------  ----------
         192    1629-1656  gap: power failure
         192    1704-1720  gap: bring down computers due to power instablilty


TRANSIT SATELLITE FIXES:
------------------------
Instrument: Magnavox MX-1107RS dual frequency Transit satellite receiver
Logging: all fixes from Transit #2 (bridge)


GPS SATELLITE FIXES:
--------------------
Instrument: Magnavox MX-4200D Global Positioning System receiver
Logging: 10 second intervals
Checking:
     minimun number of sats: 3
     dilution of precision (DOPs) maximum: north = 4.0, east = 4.0
     compared GPS speed and course with Furuno smooth speed and heading
     compared positions with Transit-Furuno navigation
     reject fixes producing Eotvos correction errors in gravity
Interpolation: interpolated positions at 00, 30 seconds of each minute
Smoothing: smoothed interpolated positions with 41 point running average
Notes:
     (1) The GPS data has a sinusoidal-like wave in it which is assumed to come
         from some degrading of the GPS quality for civilian users. This wave
         seems to vary in period and shape and is not a perfect sine curve. The
         periods are less than 20 minutes. The amplitudes and period will
         vary over 24 hours but always seem to be present in the data.
         This degrading produces a false ship's track for realtime navigation
         and introduces large errors, up to 4-5 mGals, in the Eotvos
         correction for the gravity. To handle this problem the following steps
```

have been used to process the GPS:
1. the smoothing has been increased from a 9 point (4 minute) running
   average of the interpolated positions to a 41 point (20 minute)
   running average.
2. this smooth GPS data is deleted at turns because the heavy smoothing
   greatly "widens" the turns.
3. the remaining smooth GPS data is decimated to 20 minute intervals

These GPS processing steps, together with using the smooth speed and
heading data from the Furuno for DR'ing between the decimated GPS
positions produces good navigation and gravity data.

```
(2) day     time        comment
    ---   ----------  ----------
    192   1629-1656   gap: power failure
    192   1704-1720   gap: bring down computers due to power instablilty
```


NAVIGATION:

A "1 minute navigation" is produced from the GPS and Furuno sources.
The smooth speed and heading data is used to fill the gaps between the
processed GPS positions by computing 1 minute DR'ed positions corrected
for set and drift. The DR'ed positions are produced at 00 seconds of each
minute.

BATHYMETRY:

Instrument: Atlas Hydrosweep DS
Logging: every ping
Checking: visual check of plot of data. Bad data points removed with
    an interactive graphics editor.
Sound Velocity: All days use a sound velocity of 1500 meters per second
Final data: interpolated depth value (meters) at 00 seconds of each minute
Notes:
```
    (1) day     time        comment
        ---   ----------  ----------
        192   1629-1656   gap: power failure
        192   1704-1720   gap: bring down computers due to power instablilty
        199   1512-1610   gap: Hydrosweep problem
        212   1432-1508   gap: problem with realtime network
        213   0500-0508   gap: Hydrosweep computer crash
```


MAGNETICS:

Instrument: Varian V75 magnetometer
Logging: 6 second intervals
Checking: visual check of plot of data. Bad data points removed with
    an interactive graphics editor.
Reference field: International Geomagnetic Reference Field 1990 (IGRF 1990)
    model of the main field at 1990.0 and a predictive model of the
    secular variation for adjusting to dates between 1990.0 and 1995.0
Final data: median values at 00 seconds of each minute calculated from
    the values +-30 seconds of this time.
Notes:
```
    (1) day     time        comment
        ---   ----------  ----------
        187        -2359   no data collected
        188   0000-2359   no data collected
        189   0000-2359   no data collected
```

```
190        0021   magnetometer deployed
192   1629-1656   gap: power failure
192   1704-1720   gap: bring down computers due to power instablilty
198   0544-1118   gap: magnetometer onboard; streamer work
214   2229-2359   gap: magnetometer onboard; streamer recovery
215   0000-2359   no data collected
```

GRAVITY:

Instrument: Bell Aerospace BGM-3 marine gravity meter
Logging: 1 second counts
Filtering: an observed gravity value in mGal is calculated by filtering
     the 1 second counts with a 360 second Gaussian filter, scaling the result
     and adding a bias. A value in mGal is calculated at 00 seconds of
     each minute.
Smoothing: mean gravity values at 00 seconds of each minute calculated from
     the values +-30 seconds of this time.
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
     The velocities, from the navigation, used in the Eotvos
     correction are smoothed with a 5 point running average for all days
Checking: visual check of plot of data to determine satisfactory Eotvos
     corrections, delete spikes of data at turns
Dc shift: 9.5 mGal from pre-cruise tie
Drift rate: 0.0129 mGal per day
Pre-cruise Tie date: 06 July 1994 (day 187) at 2042 Z
Post-cruise Tie date: 06 August 1994 (day 218) at 0227 Z
Final data: Free Air Anomaly value at 00 seconds of each minute. 1980
     theoretical gravity formula.
Notes:
     (1) day   time   comment
         ---   ---------   ----------
         192   1629-1656   gap: power failure
         192   1704-1720   gap: bring down computers due to power instablilty

Instrument: Bodenseewerks KSS-30 Marine Gravity meter
Logging: mGal values at 6 second intervals
Smoothing: mean values at 00 seconds of each minute calculated from
     the logged values +-30 seconds of this time. This stage also adjusts
     the times of the smoothed values for a 75 second delay due to the
     filtering of the gravity by the KSS-30.
Merge with navigation: calculate Eotvos correction and Free Air Anomaly.
     The velocities, from the navigation, used in the Eotvos
     correction are smoothed with a 5 point running average for all days
Checking: visual check of plot of data to determine satisfactory Eotvos
     corrections, delete spikes of data at turns
Dc shift: -980158.76 mGal from pre-cruise tie
Drift rate: 0.0100 mGal per day
Pre-cruise Tie date: 06 July 1994 (day 187) at 2042 Z
Post-cruise Tie date: 06 August 1994 (day 218) at 0227 Z
Final data: data was not finalized; see Note 1 below
Notes:
     (1) There are 6 or more tares in the KSS-30 gravity data of 8 mGals
         and other smaller jumps of 3-4 mGals. These tares will persist
         for varying lengths of time of several hours to a couple of days.
         The KSS-30 recovers from these events and resumes agreement with
         the BGM-3 data but the tares have been repeating. DO NOT USE THE
         KSS-30 data; use the data from the BGM-3.

     (2) day   time   comment
         ---   ---------   ----------
         192   1629-1656   gap: power failure
```

192   1704-1720   gap: bring down computers due to power instablilty

EW9409
======

```
185 -- July   4  1994    Arrive Dutch Harbor
187 -- July   6          pre-cruise gravity tie; Departure
188 -- July   7
189 -- July   8
190 -- July   9
191 -- July  10
192 -- July  11
193 -- July  12
194 -- July  13
195 -- July  14
196 -- July  15
197 -- July  16
198 -- July  17
199 -- July  18
200 -- July  19
201 -- July  20
202 -- July  21
203 -- July  22
204 -- July  23
205 -- July  24
206 -- July  25
207 -- July  26
208 -- July  27
209 -- July  28
210 -- July  29
211 -- July  30
212 -- July  31
213 -- Aug    1
214 -- Aug    2
215 -- Aug    3          Arrive Dutch Harbor
218 -- Aug    6          post-cruise gravity tie
```

Lamont Gravity Tie Report
======================================

R/V Ewing gravity meters:
        Bell Aerospace BGM-3 marine gravity meter
                scale factor = 5.0940744
                bias   = 852680.0

        Bodenseewerk KSS-30 marine gravimeter

Port: Dutch Harbor, Alaska

Date: July 6, 1994   (day 187)

Operator: Bruce Francis

Reference Station:
        ACIC 2178-1

        reference value = 981552.07 mgals

Pier/Ship's position:
        R/V Ewing is at the pier by the Delta Western
        warehouse. Moved here on July 6th to take on
        fresh water.

Portable gravity meter:
        LaCoste & Romberg model
        Temperature of meter:

Readings and calculations:

        Time   Location   L-R Reading
        2015Z   Pier   5046.64
        2032Z   Ref   5046.43
        2042Z   Pier   5046.62

        Lacoste difference in LR units:
                delta_LR = pier_LR - ref_LR
                delta_LR = 5046.62 - 5046.43
                delta_LR = 0.19

        Difference in mgal:
                note: 1 LR unit = 1.06 mGals
                delta_mgal = delta_LR * constant
                delta_mgal = 0.19 * 1.06
                delta_mgal = 0.20

        Pier gravity value:
                pier_grv_val = ref_val + delta_mgal
                pier_grv_val = 981552.07 + 0.20
                pier_grv_val = 981552.27 mgal

        Height correction:
                At 2042Z Pier reading is 2.8 m above "C" deck
                "C" deck is 5.5 m above gravity lab.
                Difference between pier and gravity lab = 8.3 meters

                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

```
        hgt_corr = 8.3 m * 0.31 mGal/m
        hgt_corr = 2.57 mGal

Gravity at BGM/KSS level:
        grv_at_BGM/KSS_level =  pier_grv_val + hgt_corr
        grv_at_BGM/KSS_level =  981552.27 + 2.57
        grv_at_BGM/KSS_level =  981554.84 mgal


BGM-3 reading:
        On July 6, 1994 (day 187) at 2042 Z
        BGM_grv_val = 981564.3 mgal

BGM-3 Mistie:
        BGM_mistie = BGM_grv_val - grv_at_BGM_level
        BGM_mistie = 981564.3 - 981554.84
        BGM_mistie = 9.5 mgal

BGM-3 DC shift:
        BGM_dc_shift = 9.5 mgal

BGM-3 Drift:
        prev_BGM_mistie: 9.83 mgal on May 20, 1994 (day 140)

        BGM_drift = BGM_mistie - prev_BGM_mistie
        BGM_drift = 9.5 - 9.8
        BGM_drift = -0.3 mgal

        num_days = day - pre_day
        num_days = 187 - 140
        num_days = 47

        BGM_drift_per_day = BGM_drift / num_days
        BGM_drift_per_day = -0.3 / 47
        BGM_drift_per_day = -0.0064 mGal / day


KSS-30 reading:
        On July 6, 1994 (day 187) at 2042 Z
        KSS_grv_val = 1396.08 mgal

KSS-30 DC shift:
        KSS_dc_shift = KSS_grv_val - grv_at KSS_level
        KSS_dc_shift = (1396.08) - (981554.84)
        KSS_dc_shift = -980158.76 mgal

KSS-30 Mistie:
        BIAS = 980170.29
        KSS_mistie = BIAS + KSS_grv_val - grv_at_KSS_level
        KSS_mistie = (980170.29 + (1396.08)) - 981554.84
        KSS_mistie = 11.53 mgal

KSS-30 drift:
        prev_KSS_mistie: 15.60 mgal on May 20, 1994 (day 140)

        KSS_drift = KSS_mistie - prev_KSS_mistie
        KSS_drift = 11.53 - 15.60
        KSS_drift = -4.07 mgal

        num_days = day - pre_day
        num_days = 187 - 140
        num_days = 47

        KSS_drift_per_day = KSS_drift / num_days
```

```
KSS_drift_per_day = -4.07 / 47
KSS_drift_per_day = -0.0866 mGal / day
```

Lamont Gravity Tie Report
===========================

R/V Ewing gravity meters:
    Bell Aerospace BGM-3 marine gravity meter
        scale factor = 5.0940744
        bias = 852680.0

    Bodenseewerk KSS-30 marine gravimeter

Port: Dutch Harbor, Alaska

Date: August 6, 1994   (day 218)

Operator: Joe Stennett

Reference Station:
    ACIC 2178-1

    reference value = 981552.07 mgals

Pier/Ship's position:
    R/V Ewing is at the City fuel pier opposite the
    "Latitude 54" - "Petro Marine" building.

Portable gravity meter:
    LaCoste & Romberg model G 237
    Temperature of meter: 49 degrees

Readings and calculations: Pier & Ref readings taken on August 5, 1994

        Time   Location   L-R Reading
        1626Z   Pier   5044.10
        1732Z   Ref   5046.45

    Lacoste difference in LR units:
        delta_LR = pier_LR - ref_LR
        delta_LR = 5044.10 - 5046.45
        delta_LR = -2.35

    Difference in mgal:
        note: 1 LR unit = 1.06 mGals
        delta_mgal = delta_LR * constant
        delta_mgal = -2.35 * 1.06
        delta_mgal = -2.49

    Pier gravity value:
        pier_grv_val = ref_val + delta_mgal
        pier_grv_val = 981552.07 + (-2.49)
        pier_grv_val = 981549.58 mgal

    Height correction:
        At 0227 Z on August 6, 1994 (day 218) Pier reading is 8.5 m
        above gravity lab.

        Difference between pier and gravity lab = 8.5 meters

        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
        hgt_corr = 8.5 m * 0.31 mGal/m
        hgt_corr = 2.64 mGal

```
Gravity at BGM/KSS level:
        grv_at_BGM/KSS_level =  pier_grv_val + hgt_corr
        grv_at_BGM/KSS_level =  981549.58 + 2.64
        grv_at_BGM/KSS_level =  981552.22 mgal


BGM-3 reading:
        On August 6, 1994 (day 218) at 0227 Z
        BGM_grv_val = 981562.10 mgal

BGM-3 Mistie:
        BGM_mistie = BGM_grv_val - grv_at_BGM_level
        BGM_mistie = 981562.10 - 981552.22
        BGM_mistie = 9.88 mgal
        BGM_mistie = 9.9 mgal

BGM-3 DC shift:
        BGM_dc_shift = 9.9 mgal

BGM-3 Drift:
        prev_BGM_mistie: 9.5 mgal on July 6, 1994 (day 187)

        BGM_drift = BGM_mistie - prev_BGM_mistie
        BGM_drift = 9.9 - 9.5
        BGM_drift = 0.4 mgal

        num_days = day - pre_day
        num_days = 218 - 187
        num_days = 31

        BGM_drift_per_day = BGM_drift / num_days
        BGM_drift_per_day = 0.4 / 31
        BGM_drift_per_day = 0.0129 mGal / day


KSS-30 reading:
        On August 6, 1994 (day 218) at 0227 Z
        KSS_grv_val = 1393.77 mgal

KSS-30 DC shift:
        KSS_dc_shift = KSS_grv_val - grv_at KSS_level
        KSS_dc_shift = (1393.77) - (981552.22)
        KSS_dc_shift = -980158.45 mgal

KSS-30 Mistie:
        BIAS = 980170.29
        KSS_mistie = BIAS + KSS_grv_val - grv_at_KSS_level
        KSS_mistie = (980170.29 + (1393.77)) - 981552.22
        KSS_mistie = 11.84 mgal

KSS-30 drift:
        prev_KSS_mistie: 11.53 mgal on July 6, 1994 (day 187)

        KSS_drift = KSS_mistie - prev_KSS_mistie
        KSS_drift = 11.84 - 11.53
        KSS_drift = 0.31 mgal

        num_days = day - pre_day
        num_days = 218 - 187
        num_days = 31

        KSS_drift_per_day = KSS_drift / num_days
        KSS_drift_per_day = 0.31 / 31
```

KSS_drift_per_day = 0.0100 mGal / day

Files:

Daily files:
         The logged and reduced data are organized as sets of daily files.
         A filename is composed of 3 parts:
                   (1) cruise id "ew9409" or NULL
                   (2) data id   "mg.n"
                   (3) dayofyear   "204"

         example:
                   ew9409mg.n204

         Note: The cruise id is NULL for the data files for ew9409.

Directories:

LOGGER - contains the data files logged during the cruise with some
         minor editing or cleaning. These are referred to as the
         ".d" files.

SCCS - the directory holds the reduced files in the "sccs" format.
         The Source Code Control System (SCCS) that is used for program
         source files is also used for maintaining the data files. The
         SCCS facility serves as a backup and history mechanism for
         the data reduction process.

ADCP - Acoustic Doppler Current Profiler data

REPORT - cruise report files

shells - shell scripts that drive the data reduction

Time tagging:

During the logging process each record is tagged with the CPU's time.
This tag appears at the beginning of the record as

        yy+ddd:hh:mm:ss:mmm

where "yy" is the year, "ddd" is the day of year, "hh" is the hour,
"mm" is the minute, "ss" is the second and "mmm" is the millisecond
of the CPU time.

One of the preocesses on the logging computer logs the GPS True Time
clock once a minute and continuously sets the CPU clock to UTC time
from the true time clock.

The following data sets use this CPU time tag as their "offical"
time: magnetics, Furuno, Hydrosweep center beam, BGM-3 gravity,
KSS-30 gravity, sea temperature, wire/streamer data.

These data sets include their own internal times: GPS and Transit sat.

Flag field:

The third column is used as a flag field to indicate a bad or rejected
record.
        "+" = initial field
        "-" = rejected record

```
GPS MX-4200 Sat Fix (gp):
-------------------------

gp3 = GPS MX-4200D "3"
gp4 = GPS MX-4200D "4"

gp3.d - logged data (multiple records)

    93+258:00:22:12.282 $PMVXG,000,NAV,9,6,0000,0*02
    yy day    time_tag              status

    93+258:00:22:20.834 $PMVXG,001,002220,1832.421,S,03837.602,W,00026.1,2*4E
    yy day    time_tag              time       lat         lon

    93+258:00:22:21.066 $PMVXG,011,233.5,012.3,,,,,,,,,*4F
    yy day    time_tag              course speed

    93+258:00:22:21.467 $PMVXG,022,260539.67,00.8,00.8,00.0,20,17,03,16,25,23*74
    yy day    time_tag              fix time   EDOP NDOP VDOP PRN 1-6

gp3.r - gps 4200 after cleaning

    same as gp3.d


gp3.i - interpolated positions at 00,30 sec of each minute

    yy+ddd:hh:mm:ss.mmm N 12 12.1234 W 123 12.1234  gp3
    yy day    time            lat           lon         id


gp3.s - smoothed postions at 00,30 sec of each minute

    yy+ddd:hh:mm:ss.mmm N 12 12.1234 W 123 12.1234  gp3
    yy day    time            lat           lon         id
```

```
Transit Sat Fix (sf):
---------------------

sf2 = Transit Sat fix receiver #2



Furuno Speed and Heading (fu):
------------------------------

fu.d - speed & heading logged data (before cleaning stage)

        yy+ddd:hh:mm:ss.mmm - 12.1 123.1 123.1
        yr day    time        trk spd  cse  gyro

        trk: "-" = water track, "+" = bottom track

fu.r - speed & heading data after cleaning stage

        yy+ddd:hh:mm:ss.mmm - 12.1 123.1 123.1
        yr day    time        trk spd  cse  gyro

        trk: "-" = water track, "+" = bottom track

fu.s - smooth speed and heading data

        yy+ddd:hh:mm:ss.mmm - 12.1 123.1 20
        yr day    time        trk spd  cse  number_pts
                                            in minute


hv.r - Hydrosweep sound velocity values C-mean and C-keel

        yy+ddd:hh:mm:ss.mmm 1499.0 1544.0
        yr day    time       C-mean C-keel
```

```
Fix File (x):
--------------

x.   - fix file

        yy+ddd:hh:mm:ss.mmm N 12 12.1234 W 123 12.1234  id
        yy day    time             lat          lon           id_string

        id strings: "gp3" = GPS



One Minute Navigation (n):
--------------------------

n.   - 1 minute navigation from the "x." file and "fu.s" 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


        id strings: "gp3" = GPS #1
                    "dr"  = Dead Reckoned position
```

```
Magnetics (mg):
----------------


mg.d - total intensity logged data

        same as mg.r below

mg.r - total intensity magnetics after cleaning stage

        yy+ddd:hh:mm:ss.mmm 41200.8
        yr day   time        total_intensity

mg.m - median total intensity magnetics values at 00 seconds.
        (median of values +-30 seconds)

        yy+ddd:hh:mm:ss.mmm 41200.8
        yr day   time        total_intensity

mg.n - median values merged with navigation; anomalies 1990 IGRF

        yy+ddd:hh:mm:ss.mmm N 12 12.1234 E 123 12.1234 41200.8  -367.1
        yr day   time              lat          lon          total     anomaly
                                                             intensity




Hydrosweep center beam bathymetry (hb):
----------------------------------------

hb.d - center beam logged data

        same as hb.r below

hb.r - center beam data after "cleaning" of hb.d file

        yy+ddd:hh:mm:ss.mmm hh:mm:ss.mmm S 3445
        yr day   time           2nd_time   mode depth_in_meters

        mode: "S" for survey
        note: 2nd time is ignored

hb.i - interpolated center beam depth at 00 sec of each minute
        (some days include PDR depth readings - see cruise summary.)

        yy+ddd:hh:mm:ss.mmm 3445
        yr day   time        depth_in_meters

hb.n - interpolated center beam merged with navigation
        (some days include PDR depth readings - see cruise summary.)

        yy+ddd:hh:mm:ss:mmm N 12 12.1234 E 123.1234  2222.0
        yr day   time            lat          lon       depth_in_meters
```

```
BGM-3 Gravity (vt):
--------------------

vc.d - BGM-3 "counts" logged data

        same as vc.r below

vc.r - BGM-3 "counts" after "cleaning" of vc.d file

        yy+ddd:hh:mm:ss.mmm 01:025069 00
        yr day       time     int count  status

        int - count interval; 01 = 1 second

vt.r - mGal gravity values calculated from the counts

        yy+ddd:hh:mm:ss.mmm 979171.448000
        yr day       time       grav

vt.s - smooth BGM-3 values at 00 secs of each minute.
        (mean of values +-30 secs)

        yy+ddd:hh:mm:ss.mmm 979171.448000
        yr day       time       grav

vt.n - "vt.s" merged with nav with EOTVOS correction and FAA
        Note: "vt30.n" is merged data using 1930 theoretical formula

        yy+ddd:hh:mm:ss.mmm N 10 20.1234 W 120 23.1234 1980  77.1
        yr day       time        lat            lon        theog  FAA

        979317.5   64.1   1.5  10.2  -1.7  9.7  -1.6  9.8
        raw_grav eotvos drift   dc    raw_vel   smo_vel
                              shift  N    E     N     E
```

```
KSS-30 Gravity (vk):
---------------------

vk.d - logged data

        same as vc.r below

vk.r - data after "cleaning" of vk.d file

        yy+ddd:hh:mm:ss.mmm 90 365 2358 27C 3 -1018.25  0.0014  0.0046
        yr day       time      yr  day time  sea  grav   velocity velocity
                               (grv clock)   state

        note: grv clock not used

vk.s - smooth KSS-30 values at 00 secs of each minute. time adjusted
       for filter lag. (mean of values +-30 secs)

        yy+ddd:hh:mm:ss.mmm  0468.18
        yr day       time       grav

vk.n - "vk.s" merged with nav with EOTVOS correction and FAA
       Note: "vk30.n" is merged data using 1930 theoretical formula

        yy+ddd:hh:mm:ss.mmm N 10 20.1234 W 120 23.1234 1980   77.1
        yr day       time          lat          lon         theog ·FAA

        0317.5   64.1   1.5  -980164.0  -1.7  9.7  -1.6  9.8
        raw_grav eotvos drift    dc      raw_vel     smo_vel
                              shift     N    E     N    E
```

```
Gun depths (dg):
-----------------

dg.d - gun depths logged data

        same as dg.r below

dg.r - gun depths after cleaning stage

        yy+ddd:hh:mm:ss.mmm  63  72  74  ...  76  74  61  68  59
        yr day   time          gun depths


Shot times (ts):
-----------------

ts.d - shot times logged data

        same as ts.r below

ts.r - shot times after cleaning stage

        yy+ddd:hh:mm:ss.mmm 00:02:30.113
        yr day cpu_time      shot time


Partial Nav Block data (nb):
-------------------------------

nb.d - nav block logged data

        same as nb.r below

nb.r - nav block after cleaning stage

        yy+ddd:hh:mm:ss.mmm 15913 N 53 17.4460 W 166 59.4243 MCS1234c
        yr day shot time      shot #  latitude   longitude      line

        latitude and longitude are those rough values at shot time


Shot time/Nav Block data remerged with final nav (ts.n):
----------------------------------------------------------

ts.n -

        94+195:00:02:50.371 15913 N 53 17.4459 W 166 59.4171 MCS1234c
        yr day shot time     shot #  latitude   longitude      line
```

```
Streamer tension (wi):
-----------------------

wi.d - streamer tension logged data

        same as wi.r below

wi.r - streamer tension after cleaning stage

        94+195:00:01:54.775 +3020.
        yr day cpu_time      tension


Sea temperature (ct):
---------------------

ct.d - sea temperature logged data

        same as ct.r below

ct.r - sea temperature after cleaning stage

        yy+ddd:hh:mm:ss.mmm 0007.6 00
        yr day    time         temp (C)
```