When a new SBD email is received it is unpacked and appended to a XXXX.txt file (XXXX is the Spray serial number). Unpacked data are stored in ascii format, and the first characters of each line determine the line content (lines are terminated by a CR/LF= Hex 0x0d0a). This document describes the different line formats. When the line is a fixed-format type, character locations are given using the convention *s*[*m*:*n*] = characters *m*-*n* of string *s* (first character in the line is *m*=1). An example for the '!dive' line is given here:

!dive line Dive Number of the SBD message and Time-Stamp of when it was received.

```
!dive    1        999 20Jul2006 18:47:11 <---EXAMPLE LINE.
12345678901234567890123456789012345678901234567890 <---CHARACTER COUNTER LINE.
         1         2         3         4 <---CHARACTER COUNTER LINE.
!dive  209        999 25May2006 17:36:32 <---REPEAT OF THE EXAMPLE LINE.
i=       1         2      3        4     <---i = PARAMETER LIST INDEX.
i1 = dive number = s[7:10].              <---description of each parameter
i2 = OBSOLETE.
i3 = email reception Day:Mon:Yr, Day=s[23:24], Mon=s[25:27], Yr=s[28:31].
i4 = email reception time HH:MM:SS  HH=s[33:34], MM=s[36:37], SS=s[39:40].
```

INDEX OF LINE TYPES (with hyperlinks to their definitions).

Header Information

Here is an example of the start of a .txt file:

```
MOD 1.02 Convert 'E' lines to 'EC-F-N-P', drop 'M ', compact 'p', new 'G'
MD 07/01:01 LINE90   CalCOFI Line 90, deployed Jan2007, from Dana Pt.
#----start calibration coefficients --------------
VN   12  4 2 0612
VO FLUOR
VA  22747  Argos ID
CP12  -10.000   0.040    0.0000   1.0000
CT22   -5.000   0.001    0.0000   1.0000
CS32   -1.000   0.001    0.0000   1.0000
CO44    0.000   0.001  10     3.00   0.0000   1.0000
CD58      2     3    0.0000   1.0000  2.00  0.22
#----end calibration coefficients --------------
```

'MOD' line : MODify version # comment.

```
MOD 1.02 Convert 'E' lines to 'EC-F-N-P', drop 'M ', compact 'p', new 'G'
```

This is used to leave a trail of the post-processing steps done on the .txt file. This is added when an archived file is modified to a newer format for compatibility reasons.

'MD' line Mission Description line.

```
MD 07/01:01 LINE90   CalCOFI Line 90, deployed Jan2007, from Dana Pt.

12345678901234567890123456789012345678901234567890123456789012345678901234567890
0        1         2         3         4         5         6         7         8
MD 07/01:01 LINE90   CalCOFI Line 90, deployed Jan2007, from Dana Pt.
       i1      i2      i3
i1 =  yy/mm:nn = Deployment ID:
      yy =year = s[4:5], mm =month = s[7:8], nn =mission id (0..15) = s[10:11].
i2 =  E_Name   = 8-character experiment name = s[13:20].
i3 =  Description = unique description for this Spray = s[22:n].
```

The **MD** line is used to describe the Spray when the user goes to queue a shore command. This helps ensure that the user is sending the command to the correct serial number.

'V' lines : Vehicle Information

'VN' line *s/n nsensor CTD_Type EEPROM_Ver*

```
VN   12  4 2 0612
12345678901234567890
0        1         2
VN   12  4 2 0612
 i=   1  2 3   4
i1 = s/n      =  Spray serial number = s[4:7].
i2 = nsensor  = # of sensors returned, normally 4 (P, T, C, O) = s[9:10].
i3 = CTD_Type = 2 for SBE CTD = s[12]  (type=1=PME=obsolete 2004).
i4 = EEPROM_Ver = YYMM = Year and Month of EEPROM code version,
            i.e, 0608, 0610, 0612, 0702. = s[14:17].
```

'VO' line : VO *string*: *string* = 'FLUOR' for fluorometer, 'OBS' for optical backscatter.

```
VO FLUOR
      is used to describe the type of optical sensor mounted on Spray.
```

'VA' line: VA *ptt_id* = Argos PTT ID.

```
VA  22747  Argos ID = Argos PTT ID installed on this Spray.
```

CP, CT, CS Calibration Coefficients (Press, Temp, Sal).

'CP12', 'CT22', 'CS32' all have the same format; only shown for 'CP'

```
CP12  -10.000   0.040    0.0000   1.0000
12345678901234567890123456789012345678901
0        1         2         3         4
CP12  -10.000   0.040    0.0000   1.0000
 sxy     i1       i2        i3      i4
s = sensor-type char ( P, T, S, O, D ).
x = sensor-type code ( 1=P, 2=T, 3=S, 4=O, 5=D ); sent by Spray.
y = calibration line format
      2 = linear fit, with factory-coefficients and in-lab coeff.
      4 = 2-stage linear-fit: factory-to-volts, volts-to-units.
            (required for optical, with optional gain settings).
i1 = offset = s[6:13].
i2 = gain   = s[15:21].
      y [sci-units] = offset + gain*counts.
i3 = off2 = in-lab offset correction factor = s[23:31].
i4 = gn2  = in-lab gain correction factor   = s[33:40].
      y2 = off2 + gn2*y.  Allows further correction of sensor values.
```

CO44 Optical Coefficients.

```
CO44    0.000   0.001  10     3.00   0.0000   1.0000
12345678901234567890123456789012345678901234567890123
0        1         2         3         4         5
CO44    0.000   0.001  10     3.00   0.0000   1.0000
         i1       i2   i3      i4      i5       i6
i1 = offset = s[6:13].
i2 = gain   = s[15:21].
i3 = hg = hardware-gain of Seapoint (set by technician in lab)=s[23:25].
i4 = ogain = optical gain, to convert volts to sci_units = s[27:34].
i5 = off2 = in-lab offset correction factor = s[36:43].
i6 = gn2  = in-lab gain correction factor = s[45:52].
      volts = offset + gain*counts.
      y [sci_units] = volts*ogain.
      y2 = off2 + gn2*y.  Allows further correction of sensor values.
```

CD58 Doppler Backscatter (ABS) Coefficients

```
CD58      2     3    0.0000   1.0000  2.00  0.22
12345678901234567890123456789012345678901234567
0        1         2         3         4
CD58      2     3    0.0000   1.0000  2.00  0.22
         i1    i2      i3       i4     i5    i6
i1, i2 = First and last bins used for the backscatter averaging.
i3 = off2 = in-lab offset correction factor = s[19:27].
i4 = gn2  = in-lab gain correction factor = s[29:36].
i5 = bd   = blanking distance [m], nominally 2.0 m = s[38:42].
i6 = alpha = sound absorption coeff [db/m], one-way, adjusted for
             central-axis range (nominally 0.22) = s[44:48].
```

GPS, Route, and Waypoint data

G line: GPS information (Sep2006 added decimal degrees at the end).

```
G    1 0 21 Sep 2006 19:35 1 +32 52.18 -117 15.03   50  4  22  37  48  2.4  0  0   32.8697 -117.2505
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
0        1         2         3         4         5         6         7         8         9
G    1 0 21 Sep 2006 19:35 1 +32 52.18 -117 15.03   50  4  22  37  48  2.4  0  0   32.8697 -117.2505
i=   1 2  3  4   5    6  7 8  9   10    11   12     13 14  15  16  17  18  19 20    21        22
```

i1 = dive# = s[2:6].
i2 = mission status at time of fix = s[8].
0=start of mission, 1=start of dive, 2=end of dive, 3=in abort mode
(3,4,5) = date: dd= s[10:11], mon = s[13:15], yyyy = s[17:20].
(6:7) = time (UTC) hh = s[22:23], mm = s[25:26].
8 = valid flag: 0=bad fix, 1 = good, flag = s[28].
IF THE FIX IS BAD, the last good fix is still reported, so USE the VALID Flag!
(i9 i10) Latitude: Latd = s[30:32], Latm = s[34:38].
(i11 i12) Longitude: Lond = s[40:43], Lonm = s[45:49].
i13 = Tfix = time (s) to acquire a fix = s[51:54].
i14 = Nsat = # of satellites in view = s[56:57].
i15 = minimum SNR of Nsat = s[59:61].
i16 = mean SNR = s[63:65].
i17 = max SNR = s[67:69].
i18 = HDOP = s[71:74].
i19 = GPS Health Status = s[76:77]. **WRITTEN IN HEX (value =0..FF)**
bit 0=incomplete almanac, bit 1 =bad back-up battery,
bit 2=poor satellite coverage, bit 3=antenna fault.
WHEN in abort mode (i2=3), this is re-assigned as the Exception LSB.
(see 'EF' j9 description for the LSB : says if burn wire is activated).
i20 = Wing Index / Roll Status, operational as of JUL06 = s[79:80].
HEX FORMAT (0..FF): bit assignment is:
b0 = = the GPS wing (1=port,0=stbd): Set by Sprays w/antenna switch.
b1 = 1 = roll function timed out (slow motor/bad pot)
b2 = 1 = failure in the last 2 s of operation (slow motor/bad pot).
b3 = 1 = bad potentiometer (pot is out-of-bounds by over 200 counts).
b4 = 1 = starboard wing is not at the correct antenna comms position.
b5 = 1 = port wing " ".
b6 = 1 = zero wing (wings flat) " ".
b7 = 1 = intermittent pot behavior (the pot initially OK, and then bad).
Operationally, values = 2 (slow motor) happen frequently, and represent
hysteresis problems near zero roll.
i21 Latitude, Decimal Degrees (s[82:90]).
i22 Longitude, Decimal Degrees (s[92:100]).

W line contains the Waypoint list info

```
W    1  7
i=   1  2
```

i1 = dive number = s[3:6].
i2 = number of waypoints in the list = s[8:9].

w line contains the waypoint values: list immediately follows the 'W' line.

```
w  1  +34.325 -120.782
12345678901234567890123456789
         1         2
w  1  +34.325 -120.782
i= 1     2        3
```

i1 = Waypoint index (0=HOME waypoint) = s[3:4].
i2 = Latitude (decimal degrees) = s[6:13].
i3 = Longitude(decimal degrees) = s[15:22].

R line contains the basic route information (update starting at code 0608).

```
R    1  6  6  2  1       1     0    0    -1    0     0    0    -1    1
12345678901234567890123456789012345678901234567890123456789012345678901234567890
0        1         2         3         4         5         6         7
R    1  6  6  2  1       1     0    0    -1    0     0    0    -1    1
i=   1  2  3  4  5       6     7    8     9    10   11   12    13   14

i1 = dive number = s[2:6].
i2 = Number of points in the route = s[8:9].
i3 = Route entry that we're now heading for = s[11:12].
i4 = End-of-Route Action = s[14:15]:
      0= go to the HOME waypoint (waypoint #0).
      1= Repeat the route from the beginning.
      2= Reverse the route (trace the route back to the beginning).
      3= Stay stationed at the last waypoint.
      4= ABORT (End mission) when the waypoint is reached.
i5 = Direction that we're going through the route:
      1=forward, -1=reverse = s[17:18].

i6 = 1= current-bucking is on, 0=off (this has no dive time-out) = s[25:26].
i7 = Current-Crossing Angle (degrees, <0 steer to left of current,
      >0=to the right, 0=off) = s[28:32].
i8 = Max Dive to use the current-crossing mode
      (is not used if Dive#> Max_dive) = s[34:37].
i9 = Manual Steering; -1=off, 0..360 Heading(TRUE), -2 = do circles
      (constant roll) s[39:43].
i10= Max Dive to use the manual steering mode = s[45:48].
i11= Steering Point (km) = s[50:54].
i12= Max Dive to use the steering point mode = s[56:59].
i13= Min Correction Angle (degrees) = s[61:65].
      ( current-bucking/ current-crossing/ steering-point modes).
i14= Max Correction Angle (degrees) = s[67:70].
```

r line contains the info for each route entry (available starting code 0608).

```
r  1   1  3    0
12345678901234567890
r  1   1  3    0
i= 1   2  3    4

i1 = route entry index.
i2 = Detect-Mode parameter:
      0= Arrival is based on range only.
      1= Arrival is based on either range or bisector angle
            (finish-line approach).
      2= Based on bisector angle only.
i3 = Watch-Circle Radius [km].  If the Spray is within this range,
             then we're at the waypoint.
      0=auto-compute, based on the last dive-depth.
i4 = Approach Angle: 1..360 degrees = approaching the next waypoint at
      this angle (degrees, TRUE; 0=auto-compute ).
```

Engineering Data Lines

As of Nov2006, new, two-letter (**EC, EF, EN, EP**) lines have been added, to break out the engineering information into sub-groups. Once this format is accepted by all programs, the old 'E ' line will be removed.

Exvv <data>, represents the new Engineering Line, where
E First character '**E**' signifies that engineering information follows.
x Second character is the type of engineering data:
- **C** Communication (SBD) data.
- **F** Flight information.
- **N** Navigation information.
- **P** Pump information.
- ' ' ('space') Old engineering format line; there is no **vv**.

vv Characters 3-4 = version number (Version 1 = '01')...allows future expansion.

EC = Communication line

```
EC01  135  2  1  1  00  26  1
12345678901234567890123456789
         1         2
EC01  135  2  1  1  00  26  1
      j1  j2 j3 j4  j5  j6  j7
j1  = Dive number = s[6:9].
j2  = Ntries =#tries sending an SBD message during the LAST surfacing =s[11:12].
j3  = Nsent  =# of SBD messages sent during the LAST surfacing =s[14:15].
j4  = SBDI_STAT = status of the last attempt to send a message =s[17:18].
j5  = SBD_SHORE_STAT = status of parsing the last shore command =s[21:22]=HEX.
j6  = T_SBD = time[s] that the modem actively tried to send a message =s[24:26].
j7  = Wing used to send the SBD message = s[29].
```

EF = Flight line.

```
EF01  135  5 241  506 17  99   0  -2.1 4000
123456789012345678901234567890123456789123
         1         2         3         4
EF01  135  5 241  506 17  99   0  -2.1 4000
      j1  j2  j3   j4 j5  j6  j7   j8   j9
j1  = Dive number = s[6:9].
j2  = Navg =# of 8s samples avg'd for each datum in the SBD message =s[11:12].
j3  = Psurf = Surface pressure counts = s[14:16].
j4  = Zmax = Maximum depth [dBar] recorded in the bottom turn = s[18:21].
j5  = Pitch = pitch angle [degrees] = s[23:24].
j6  = Altimeter minimum depth to the bottom [m] = s[26:28].
j7  = ADP altimeter bottom intensity level [dB] ( =0 for Tritech) =s[30:32].
j8  = ROLL_ERR =  Integrated roll error[degrees], from the PI loop = s[34:38].
j9  = EXC_STATUS = Exception Status bit settings(HEX FORMAT), s[40:43].
```

Let b0 = bit[0] = Lsbit, b15 = bit[15] = Msbit.

```
b0 = Pump Recovery was required.          b8 = CF1 Close File error.
b1 = Drop Weight Activated.               b9 = High pump amps @ 50 m safety pump.
b2 = Pressure>20 m 'at the surface.'      b10= Press=0 (broken) 'at the surface.'
b3 = Depth>1500 m detected.               b11= No SBD sent in last 48 hrs.
b4 = The Altimeter triggered turn-around. b12= Cannot overcome the current.
b5 = Backed off the surface.              b13= Spurious Reset Detected.
b6 = Extra pumps req'd at end of ascent.  b14= Altimeter reading is from an ADP.
b7 = Took >700 s to leave the surface.    b15= Not Used.

b12=1 means that although current correction is applied, the current is too
strong to maintain course.
b14 is used to help interpret the altimeter reading in the 'E' line.
```

EN = Navigation Line

```
EN01  135 -2296 -1608    31.084  -122.662 290 100   0 235 T
12345678901234567890123456789012345678901234567890123456789012345678901234567890
         1         2         3         4         5         6
EN01  135 -2296 -1608    31.084  -122.662 290 100   0 235 T
      j1    j2    j3       j4        j5    j6  j7  j8  j9 F
```

j1 = Dive number = s[6:9].
j2 = DRx [m] = dead-reckoning x distance traveled during the dive =s[11:15].
j3 = Dry [m] = dead-reckoning y distance traveled during the dive =s[17:21].
j4 = WLAT [decimal degrees] = Waypoint Latitude = s[23:31].
j5 = WLON [decimal degrees] = Waypoint Longitude = s[33:41].
j6 = Tleave[s]= Time at start-of-dive to leave the surface (P>2 m) =s[43:45].
j7 = Tend [s] = Time at end-of-dive since p<2 m until GPS is on = s[47:49].
j8 = Tslow [s]= Time off of the surface where |w|< 5 cm/s = s[51:53].
(not sent for version <=0610)
j9 = Desired Heading [degrees] = what we tried to steer = s[55:57].
F = T=TRUE for heading (v0608, 0610) = s[59].
M=Magnetic for heading (< 0608).

EP = Pump Line

```
EP01  135  506 14.29 1.05  0   0 1.18 10.32  15  25
12345678901234567890123456789012345678901234567890123456789012345678901
         1         2         3         4         5
EP01  135  506 14.29 1.05  0   0 1.18 10.32  15  25
      j1    j2   j3   j4  j5  j6  j7    j8   j9  j10
```

j1 = Dive number = s[6:9].
j2 = Max Depth[dBar]: redundant with EF, but helps interpret pump info =s[11:14]
j3 = Volts = Average battery Volts during the bottom turn pumping = s[16:20].
j4 = Amps = Average pump current during the bottom turn = s[22:25].
j5 = NBAD_AMP = # of times that pump current exceeded the max allowed =s[27:28].
j6 = T_max_amp [s/10]=time when Max_Amps occurred during bottom turn= s[30:32].
j7 = Max_Amps [amps] = Max pump current recorded in the bottom turn = s[34:37].
j8 = Vacuum [in-Hg] inside the Spray pressure case = s[39:43].
j9 = T_PUMP_1 [s/10] =time pumped until Spray was neutral =s[45:47].
j10= T_PUMP_2 [s/10]= remaining pump time; includes ascent+surface pump time.
T_PUMP_1 + T_PUMP_2 = total pump time.

ETxx : ET = Engineering Time-Series

```
ET00    2   20  12  0
  xx   j1   j2  j3  j4
  xx = Sensor ID:
       00 = time [s] since start-of-dive (wing down and valve opened).
       01 = Pressure [counts]  (process the same as the profile data).
       02 = Heading [degrees*10] from the compass.
       03 = Pitch Angle [degrees*10] from the compass tilt sensor.
       04 = Roll Angle [degrees*10] from the compass tilt sensor.
       05 = Pitch potentiometer [counts].
       06 = Roll potentiometer [counts].
j1 = Dive number.
j2 = Number of datum in the time series.
j3 = Number of datum per output line (# of columns per line).
j4 = Packet ID (SBD message # for Dive j1 ).
```

This is followed by N=ceiling (j2/j3) lines of ET data, where each data line begins with ‘e ‘:

```
e     10    11    12    13    14    15    16    17    18    19    20    21
e     22    23    24    25    26    27    28    29
```

The time-series is a decimated sub-sample of the 8-s raw scans, where the decimation = ndec, and the selection of the desired returned sensors, are controlled by the shore command ‘H’ (refer to that documentation for further details). These time-series allow further diagnosis of:

- Descent speed.
- Heading control.
- Health of pitch and roll sensors.
- Health of pitch and roll mechanisms.

Profile Data Lines

D Line — Start of the Sensor Profile Data

```
D    1  49 npts
i=   1   2
i1 = Dive number;
i2 = npts = # of scans in the profile (npts ‘p’ lines immediately follow)
```

p Line — Sensor profile data

The *npts* lines of profile data immediately follow the ‘D’ line, with format:

```
p    1 0  2928 13845 34961    46
12345678901234567890123456789012
         1         2         3
p    1 0  2928 13845 34961    46
i=   1 2    3    4     5       6
i1 = dive number = s[3:6].
i2 = packet index (0=First SBD packet; 1=Second SBD packet) = s[8].
For gain and offset coefficients, see the calibration section (CP,CT,CS,CO).
i3 = pressure counts :     dBar = (Pgain*counts) + Poff.    s[10:14]
i4 = Temperature counts:  deg C = (Tgain*counts) + Toff.    s[16:20]
i5 = Salinity counts:       PSU = (Sgain*counts) + Soff.    s[22:26]
i6 = Optical counts:      VOLTS = (Ogain*counts) + Ooff.    s[28:32]
```

If no data is available for a sensor, its place in the profile listing is filled with a zero.

Doppler Data Lines

See the Spray_ADP.doc for the complete description of the ADP and its data set.

'B1' line Contains the following Doppler parameters

```
B1   17 5 4 8 255   8.0  0  1  4
12345678901234567890123456789012
         1         2         3
B1   17 5 4 8 255   8.0  0  1  4
i=    1 2 3 4  5    6    7  8  9
i1 =dive number = s[4:7].
i2 =NCELL = number of cells (bins) for each ensemble-average = s[9].
i3 =CELL_SIZE = cell size [m], as measured along the central axis = s[11].
i4 =PULSE_LENGTH = pulse length [m], as measured along the central axis =s[13].
i5 =MIN_SNR = Minimum Signal-to-Noise-Ratio [counts] to use to decide if the data is
'good'. One count = 0.43 dB.  If = 255, then MIN_SNR is NOT used. =s[15:17].
   New 1/26/07
i6 = DP1 [m] : Depth offset from Spray to the center of the first bin = s[20:23].
i7 = V_off : #bins offset from DP1 to the first returned velocity value =s[25:26].
i8 = ABS_off : #bins offset from DP1 to the first returned ABS value = s[28:29].
i9 = AMP_off : #bins offset from DP1 to the first returned ADP_A value = s[31:32].
```

'AT' Doppler profiler data follows: The 'AT' line gives the type of data and number of points.

```
AT07  289  15 12  0
  xx   i1  i2 i3 i4
  xx = Sensor Type:
   Here is the quick summary (see the Spray_ADP.doc for the complete description):
   0      ADP_P          Pressure of Spray at each scan ensemble.
   1      AUU            East velocity [ mm/s] , >0 for east flow. First bin is set=0.
   2      AVV            North velocity [mm/s], > for north flow.  First bin is set=0.
   3      AWW            Vertical velocity [mm/s], > 0 for upwards flow.
   4      ADP_A          Avg. amp of the last bin of each scan [counts; 1 count = 0.43 dB].
   5      ADP_Pitch      Pitch at each scan [counts: 1 count = 0.4 degrees].
   6      ADP_Roll       Roll at each scan [ counts: 1 count = 0.4 degrees].
   7      ADP_Head       Compass Heading, magnetic [ counts: 1 count = 0.1 degrees].
   8      ABS            Acoustic Back-Scatter [ counts: 1 count = 0.1 dB ].
i1 = dive number;
i2 = number of datum that follow in the 'a' lines.
i3 = number of columns per 'a' line.
i4 = SBD packet ID (=0 if sent in the first packet, 1 if sent in a second packet).
```

The 'AT' line is immediately followed by NLINES = ceiling (i2 / i3) lines of the profile data, with each line beginning with an 'a'.

```
a    523   558   590   607   587   567   537   493   470   412   377   346
a    352   402   428
```

Miscellaneous Lines

 # comment line. '#' allows comment lines to be added anywhere in the file.

'!dive' Dive Line: Dive Number of the SBD message & Time-Stamp of when it was received.

```
!dive    1        999 20Jul2006 18:47:11
12345678901234567890123456789012345678901
         1         2         3         4
!dive  209        999 25May2006 17:36:32
i=      1         2      3        4
i1 = dive number = s[7:10].
i2 = OBSOLETE.
i3 = email reception Day:Mon:Yr, Day=s[23:24], Mon=s[25:27], Yr=s[28:31]
i4 = email reception time HH:MM:SS  HH=s[33:34], MM=s[36:37], SS=s[39:40].
```

NOTE: 'Dive 0' marks the initial GPS/SBD message for either a start-of-mission, or for a remote reset. There are no 'dive 0' profile data.

'M ' Line **Mission Identifier Line, Now Obsolete (now in 'MD')**

```
M    1 06/05:01
i=   1  2  3  4
i1 = dive number
i2 = year
i3 = month
i4 = mission identifier number:
yr/mo:id are set in the Spray EEPROM by the user before the mission.
```

'S ' line is the echo of the string of shore commands received.

```
S    1 3  1  33.6254 -118.5118;3  2  33.4799 -118.5150;
    i1 sc[1].................;sc[2]
i1= dive # = s[3:6].
sc[1] = 1st shore-command, starts at s[8], and goes until first ';'.
sc[i] = shore-command string #i.  Each sc[i] is delimited by a ';'.
See the sbd_comd.doc for each command description.
```

'SBD' line has extra information extracted from the parsed email message.

```
SBD  172  11 300124010600070  30.9259 1 1946  532    33.4968  -119.5150 259
12345678901234567890123456789012345678901234567890123456789012345678901234567
         1         2         3         4         5         6         7
SBD  172  11 300124010600070  30.9259 1 1946  532    33.4968  -119.5150 259
     i1   i2   i3               i4    i5 i6    i7      i8         i9    i10

i1  = dive # = s[5:8].
i2  = Spray s/n = s[10:12].
i3  = SBD imei # = s[14:28]  (the SBD modem's unique identifier).
i4  = Year-day (01Jan 0000 UTC = 1.00) = s[30:37].
i5  = valid flag: 1=good, 0=transfer incomplete = s[39].
i6  = MOMSN = SBD message number = s[41:44].
             MOMSN is incremented for each new message queued by the modem.
i7  = # of bytes in the message = s[46:49].
i8  = Latitude of the satellite's Doppler-derived fix = s[51:60].
i9  = Longitude of the fix = s[62:71].
i10 = Standard Deviation [km] error of the fix = s[73:75].
```

X line header line to the list of parameter values

```
X    1 0608  37
i=   1   2   3

i1 = Dive number.
i2 = Code version ('0608' = year 2006, month 08 )
i3 = Number of parameters that follow.
```

x line contains the parameter values, immediately follows the 'X' line above.

```
x  28   600
i= 1     2
i1 = address.  SEE the 'config_file.doc' for address descriptions.
i2 = value.
```

NOW OBSOLETE:

'E' line **Engineering Data Parameters : 'E ' = old format**

```
E  170  505 14.31 1.07 104.016 225  17 -1931 -1940 +31.084 -122.662  1  1  5 0 1 00  240 13
29 -1033   0  58  -4  25 350 100 4020
i   1   2   3    4     5    6   7    8    9     10     11   12 13 14  16 17 18
19  20  21  22  23  24 25 26  27  28
```

```
i=1 = dive #
2 = max depth [dBar].
3 = Battery Volts (while pumping down deep).
4 = Pump current [amps] (while pumping down deep).
5 = altimeter reading at max depth [dBar].
6 = computed heading to steer (desired heading) [degrees].
7 = pitch angle (degrees).
8, 9 = dead-reckoning East and North component [m].
10, 11 = waypoint latitude and longitude
12 = Ntries = # of tries sending an Iridium SBD message.
13 = Nsent = # of messages sent.
14 = Navg = # of points averaged for each output point in the SBD profile.
15 = Wing used (used for Sprays with antenna switches).
16 = SBD status of last message sent.
17 = Status of Shore-based command.
18 = Surface pressure counts (gives idea of pressure sensor drift).
19 = Tpump1 = time to pump deep(seconds = Tpump1*10) to get to neutral buoyancy.
20 = Tpump2 = remaining time pumped (s = Tpump2*10); includes ascent and surface
pump times.
                Tpump = Tpump1 + Tpump2 = total time pumping.
21 = Internal vacuum ( in-Hg *100 ).
22 = Time ( seconds/10) until the max amps was observed during the deep pump.
23 = max amps (ampere = x*0.02) during the deep pump.
24 = JUL06 = Integrated error used in PI loop for heading control.
                counts/1.92 = [degrees] roll required to go straight.
25 = time (s) required to send the last message via SBD.
26 = Time (s) to leave the surface (after GPS is off, until P>2 dBar ).
27 = Time (s) From time at surface (P<2) until the GPS is turned on.
28 = Exception Status Word (printed in hexadecimal)..
Let b0 = bit[0] = Lsbit, b15 = bit[15] = Msbit.
b0 = Pump Recovery was required.          b8 = CF1 Close File error.
b1 = Drop Weight Activated.               b9 = High pump amps @ 50 m safety pump.
b2 = Pressure>20 m 'at the surface.'      b10= Press=0 (broken) 'at the surface.'
b3 = Depth>1500 m detected.               b11= No SBD message sent in 48 hrs.
b4 = The Altimeter triggered turn-around. b12= Cannot overcome the current.
b5 = Backed off the surface.              b13= Spurious Reset Detected.
b6 = Extra pumps req'd at end of ascent.  b14= Altimeter reading is from an ADP.
b7 = Took >700 s to leave the surface.    b15= Not Used.
```