

G line**GPS information Sep2006 added decimal degrees at the end.**

```
G 1 1 22 Sep 2006 18:38 1 +33 26.08 -117 43.36 60 7 27 49 75 1.4 1 1 33.4347 -117.7227
i= 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
```

i=1 = dive#

2 = mission status at time of fix

0=start of mission, 1=start of dive, 2=end of dive, 3=in abort mode

(3,4,5) = date

(6:7) = time (UTC)

8 = valid flag: 0=bad fix, 1 = good

(9 10) Latitude

(11 12) Longitude

13 = Tfix = time (s) to acquire a fix

14 = Nsat = # of satellites in view

15 = minimum SNR of Nsat

16 = mean SNR

17 = max SNR

18 = HDOP

19 = GPS Health Status :

1=incomplete almanac, 2=bad back-up battery, 4=poor satellite coverage, 8=antenna fault.

20 = Wing Index / Roll Status, operational as of **JUL06**

bit assignment is:

b0 = is set to the GPS wing (1=port,0=stbd): Used by Sprays outfitted with an 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 reads in-bounds, and then bad).

Operationally, values = 2 (slow motor) happen frequently, and represent hysteresis problems near zero roll.

21, 22 = Decimal Degrees Lat and Lon. (Added Sep 2006)

If the fix is bad, the position reported is the last valid position. The longitude will always be positive if the fix is invalid.

E line Engineering Data Parameters 26, 27, 28 added Sep2006

```

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
E 171 507 14.28 1.08 104.016 228 17 -2056 -1844 +31.084 -122.662 1 1 5 1 1 00 240 16 25 -1029 2 57 -4 19 360 100 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 at the 50 m safety pump.
 b2 = Pressure>20 m 'at the surface.' b10= Press=0 counts (broken) 'at the surface.'
 b3 = Depth>1500 m detected. b11= No SBD message sent in the last 48 hrs.
 b4 = The Altimeter triggered turn-around. b12= Cannot overcome the current (current-bucking mode).
 b5 = Backed off the surface. b13= Spurious Reset Detected (added OCT06).
 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.

M Line Mission Identifier Line

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

D Line Start of the Sensor Profile Data

D 1 49 npts
 i= 1 2 : i=1 = Dive number; i=2 = npts = # of scans in the profile (npts lines immediately follow)

p Line Sensor profile data The npts lines of profile data immediately follow the 'D' line, with format:

p 1 0 2859 14267 35043 27
 i= 1 2 3 4 5 6
 i=1 = dive number.
 i=2 = packet index (normally =0; if the profile takes 2 SBD messages, the 2nd SBD's index = 1).
 i=3 = pressure counts : dBar = (Pgain*counts) + Poff (see calibration lines for Pgain, Poff).
 i=4 = Temperature counts: deg C = (Tgain*counts) + Toff.
 i=5 = Salinity counts: PSU = (Sgain*counts) + Soff.
 i=6 = Optical counts: VOLTS = (Ogain*counts) + Ooff.

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

Doppler Data

B line Contains the Doppler parameters (values can be changed via shore command).

```
B 1 5 4 8 255
i= 1 2 3 4 5
i=1 =dive number.
i=2 =NCELL = number of cells (bins) for each ensemble-average.
i=3 =CELLSIZE = cell size [m], as measured along the central axis of the three-beam system.
i=4 =PULSE_LENGTH = pulse length [m], as measured along the central axis.
i=5 =MIN_SNR = Minimum Signal-to-Noise-Ratio [counts] to use to decide if the data is 'good'.
    one count = 0.43 dB. If = 255 (= -1 unsigned byte), then MIN_SNR criteria is NOT used.
```

A line Doppler profiler data follows: This line tells you type of data, and number of points.

```
A 1 23 npts 0
i= 1 2 3
i=1 = dive number;
i=2 = npts = number of profile points that follow in the 'a' lines.
i=3 = Doppler sensor type.
0 = ADP_P = pressure values for each ensemble-average sample.
1 = ADP_E = east component of velocity ( units = mm/s, >0 for East flow).
2 = ADP_N = north component of velocity ( mm/s, >0 for North flow).
3 = ADP_W = vertical component of velocity (mm/s, >0 for upwards flow).
4 = ADP_I = the 3-beam average intensity for the last cell in the ensemble (1 count = 0.43 dB).
5 = Pitch = measured pitch at each ensemble, 1 count = 0.4 degrees.
6 = Roll = measured roll at each ensemble, 1 count = 0.4 degrees.
7 = Heading = measured compass heading, 1 count = 0.1 degrees.
8 = ADP_ABS = 3-beam average back-scatter (corrected for spreading plus absorption).
```

a line Immediately follows the 'A' line, with *npts* lines of data.

```
a 1 0 381
i= 1 2 3
i=1 = dive number.
i=2 = packet index (if data is split into two SBD messages, the second message i2=1 ).
i=3 = sensor data for the Doppler Sensor Type, as defined in the 'A' line.
```

See the file 'ADP_SBD_format.doc' for further description of the Doppler data.

Sep 2006: Updates for code version 0608: same for 0610**R line** contains the basic route information

```
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
```

i=1 = dive number;

i=2 = Number of points in the route

i=3 = Route entry that we're now heading for.

i=4 = End-of-Route Action:

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.

i=5 = Direction that we're going through the route: 1=forward, -1=reverse

i=6 = 1= current-bucking is on, 0=off (this has no dive time-out).

i=7 = Current-Crossing Angle (degrees, <0 steer to left of current, >0=to the right, 0=off).

i=8 = Max Dive to use the current-crossing mode (is not used if Dive#> Max_dive).

i=9 = Manual Steering; -1=off, 0..360 Heading(TRUE), -2 = do circles (constant roll).

i=10= Max Dive to use the manual steering mode.

i=11= Steering Point (km).

i=12= Max Dive to use the steering point mode.

i=13= Min Correction Angle(current-bucking/ current-crossing / steering-point modes).

i=14= Max Correction Angle (degrees).

r line contains the info for each route entry

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

i=1 = route entry index.

i=2 = 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.

i=3 = 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.

i=4 = Approach Angle: 1..360 degrees = approaching the next waypoint at this angle.

0=auto-compute.

W line contains the Waypoint list info

```
W 1 7
i= 1 2
i=1 = dive number.
i=2 = number of waypoints in the list.
```

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

```
w 1 +34.325 -120.782
i= 1 2 3
i=1 = Waypoint index ( 0=HOME waypoint).
i=2 = Latitude (decimal degrees).
i=3 = Longitude(decimal degrees).
```

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;
```

each command is delimited by ';'. See the sbd_cmd.doc for each command description.

X line header line to the list of parameter values

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

i=1 = Dive number.
i=2 = Code version ('0608' = year 2006, month 08 )
i=3 = Number of parameters that follow.
```

x line contains the parameter values.

```
x 28 600
i= 1 2
i=1 = address.
i=2 = value.
```