

Topics **sbdcmd.doc v0702 : Feb2007 Revision**

Version Notes: What's new with the latest mods.
Overview and Use: Includes the required files on the UNIX machine.

Sub-Command Categories:**Information Requests:**

- (R) Re-Transmit all packets for a previous dive number N.
- (@) Request all Route and Waypoint information.
- (!) Request all re-settable EEPROM values.

Exceptions:

- (0) Reset; Can also change the depth of the first dive after reset.
- (1) Abort the mission.
- (p) Exception Severity Vectors for the pump, SBD, and spurious resets.
See also Timing (M) for course to steer if GPS fails.

Mission Parameters:

- (8) Set the dive depth and profile averaging.
- (B) Set the maximum dives to perform.
- (G) Set the glide pitch angle.
See Timing below for settings (K, L) to control satellite intervals.

Route Control: ->>> Use `sbdroute.pl` to ensure proper configuration.

- (3) Add/change a value in the waypoint list.
- (7) Change an individual route entry.
- (W) Change the basic route parameters.

Steering Control/Navigation:

- (D) Current-bucking and current-crossing settings.
- (E) Steer a manual heading[TRUE].
- (T) Steering-Point distance[km] settings.

Sensor Settings:

- (A) Turn on/off using the optical sensor.
- (H) Engineering Time-Series settings (use for diagnostics).
- (F) Doppler Settings.
- (V) Compass Correction: Magnetic Variation + correction scheme.
- (Z) Turn on/off using the altimeter, plus other altimeter limits.

Hydraulics:

- (C) Change pump timing/current settings.

Timing/Iridium (SBD)/GPS Settings:

- (9) Minimum time for one 'dive cycle' (effects how data is packed).
- (K) Minimum time between SBD transmits (effects how often to surface).
- (L) Argos transmit time in abort mode.
- (M) Maximum time to try GPS and what course to steer if it fails.
- (S) Set which wing to use for GPS and SBD (antenna-switch only).
- (U) SBD time-out values.

v0608 = Sep06 = first rev of the new shore command list.
v0610 = Oct06 modifications:
 '0' Adds changing the first dive depth after reset.
 '2' Allows manually changing any EEPROM value.
 'P' Adds Max_Reset option.
 'V' Allows choosing TCM2/user-supplied compass cal coefficients.
v0612 = Dec06 modifications:
 'H' Allows engineering time-series to be sent back via SBD.
v0702 = Feb07 modifications:
 'L' Allows more control of the Argos transmitter/abort params.

Overview of Sending Shore Commands

Sprays that use the Short-Burst-Data (SBD) service receive shore commands via attached files sent by email. The attached .sbd file must be correctly formatted for proper interpretation by the Spray, and must be sent to: 'Data@sbd.iridium.com' with the modem's IMEI number in the subject line (see section 3 of the 'Iridium Short Burst Data Developers Guide', IMEI = International Mobile Equipment Identity). After the file is emailed, sbd.iridium.com emails an acknowledgement that the message has been queued. The creation and emailing of the .sbd file is handled by the perl script:

```
q0702.pl    perl script to get the Spray s/n, find the corresponding
            IMEI in imei.txt, run the sbd_q_0702 code, and finally,
            email the .sbd file to 'Data@sbd.iridium.com'.
```

Sprays deployed in the field with old code require q0607.pl to send the proper commands. The perl script uses/creates the following files as well:

```
imei.txt    cross-reference of Spray s/n XXX to IMEI number.

sbd_q_0702.c  composes the command, including header and appendix,
              and writes to a .sbd file, plus appends to a log file.

snXXX.sbd    file created by sbd_q, ready for attachment.

sbd_log.XXX  log file with date-time stamp of all commands sent
              to Spray XXX (XXX = serial number).
```

Files sbd_q_0702.c and q0702.pl will need to be slightly modified to reflect the correct directory path on your Unix machine. Likewise, imei.txt will need to be updated as new SBD modems are added, or re-allocated to other Sprays.

Using q0702.pl

Entering the desired Spray s/n should result with the corresponding IMEI (if not, you need to edit imei.txt). Desired commands are entered from the following list of commands. The command will be subject to some minimal error/bounds checking, and you will be given the opportunity to reject the command before it is added to the output message. Finally you will be given one last opportunity to not send the sbd message. Otherwise the log file is update, the snXXX.sbd file is created, and then emailed.

Route/Waypoint Management should be executed through sbd_route.pl to ensure the proper commands are issued.

Commands are sent to the Spray and parsed in the parse_GS_cmd function. The first character determines the command type, proceeded by the desired action. Here is a summary of allowed commands:

- 0 P z RESET the Spray.** This forces a RESET, causing the mission to restart.
P = password.
z = (optional) Dive depth[m] for the first dive after reset.
(20 <= z <= 1100).
- 1 P END MISSION.** Go to the end-mission/abort code. PASSWORD PROTECTED.
- 2 A N Set EEPROM[A] = N.** USE WITH CAUTION !!!!!
A = eeprom address (consult the XXXX.CFG file, where XXXX=s/n).
(4 < A < 82).
N = new value.
This allows repairing values not normally accessible via shore commands.
- 3 i lat lon Changes waypoint[i] to decimal degrees lat, lon.**
i = index into the waypoint list: 0 <= i <= 19.
The 'HOME' waypoint can be changed as well (i=0).
- 4 (obsolete)**
5 (obsolete) see cmd 'W'.
6 (obsolete) see cmd 'W'.
- 7 ir iw a d r Changes the settings for a single route entry index 'ir'.**
The route list consists of N sequential entries (1..N),
where the basic route info (including N) is set using cmd 'W'.
- ir** = route entry to change (1 <= ir <= N).
iw = waypoint index to use for this route entry.
(if ir=2, iw = 5, then the 2nd entry in the route will use waypt#5).
a = Approach Angle (True) for this route entry.
0 <= a <=360. This is the expected approach angle to this entry.
This is used to define the 'finish line' when heading to this entry.
The finish line intersects the waypt and is perpendicular to the approach angle. If a = 90 (approaching the waypt from the west), then the finish will be a N-S line; if we are E of the finish, we are past the waypt.
If a=0, then the approach angle is automatically computed, based on the Spray's position at the time that the Spray switches to this waypt.
d = Waypoint arrival detection mode:
d=0 : arrival is based on range only (inside the watch-circle radius).
d=1 : arrival is either range OR crossing the finish line.
d=2 : Finish-line only (rarely used).
r = Range [km] (0 <= r <10) to use for the watch-circle radius.
If r=0, then the maximum depth reached during the last dive is used to calculate a watch-circle radius (but always limited to be 1<=r<=4 km).
- 8 z t n Change max depth to z [dBar]. Valid range is 40 < z < 1001.**
Change max glide time[minutes]to t allowed for descent, & also ascent...
maximum total dive time = 2t. NO action is take if t<10 or t>600.
Set number of points to average= n for the time series data compaction.
Data points are taken every 8 s, and n points are averaged for each output datum in the satellite packet.
Valid range is 0 < n < 50.
- 9 t t = minimum time [minutes] for one 'dive cycle': Valid for 0<t<60.**
The Spray will continue doing down-up cycles, counted as being the same dive, until dive time is greater than t. Data from all cycles are sent as one dive. This is meant for shallow water cycling.
- A n Turns on/off using the optical sensor: n=0 =off, n=1 =on.**
When off the optical sensor isn't sampled, and the data's not sent.

B n Change the number of dives before ending the mission to n.

C t1 t2 dt wmin a f Change the Pump Parameters.

t1 = max time[s] to pump. $400 < t1 < 1800$.

The oil sensor is still monitored. This allows extending the total pump time if the pump slows down.

t2 = Deep pump time [s]. $60 < t2 < 300$.

When turning around at the bottom of the dive, the pump runs until the Spray is just past neutrally-buoyant (it starts to rise).

At this time the pump runs for an extra **t2** s. This sets the initial ascent speed out of the bottom turn.

dt = Incremental pump time [s]. $20 < dt < 100$.

On ascent, when the Spray vertical speed, *w*, falls below **wmin**, the pump is run for **dt** s to get the Spray back up to speed.

wmin = The minimum allowed ascent rate [cm/s]. $4 < wmin < 20$.

Every 5 minutes on ascent, *w* is calculated. If it is $< wmin$ then the pump is run for **dt** s.

a = max amps*100 allowed. $100 < a < 400$.

If the pump current exceeds *a*, then it is shut off. The next action taken is determined by the value of **f**:

f = Amp-Action Flag $0 \leq f \leq 2$.

This is the action to take if we exceed the max amps limit.

0= Take no action (no changes are made to the mission).

1= Change to 100m depth dives (but maintain the route).

2= Abort the mission.

D n Ndive cmin cmax Determine the type of Set Correction to apply.

n = Set correction type to use.

0 = turn off set correction.

1 = use set correction to maintain the Course-Over-Ground heading (current-bucking mode, correct so we still head for the waypt).

ANY OTHER VALUE of **n**, steer angle **n** to the present current.

Also known as 'current-crossing' mode.

If $n = -90$, steer left 90 degrees to the current, or if

$n = 90$, steer right 90 degrees to the current.

Ndive = If using the current-crossing mode, then it will be automatically turned off when the Spray dive# $> Ndive$. Note that no time-out is applied if we're in the current-bucking mode ($n=1$).

cmin, **cmax** are course correction limits for the set correction.

Let *B* = present bearing to the next waypoint.

Let *H* = course heading to steer after applying set correction, (in either current-bucking or current-crossing mode).

H is kept bounded such that $B + cmin < H < B + cmax$.

E n Ndive Steer a Manual Heading.

n = manual heading to steer (True) if $0 \leq n \leq 360$.

If **n** = -1, then the manual steering is turned off.

If **n** = -2, then the Spray will just do circles (constant 30 degree roll).

Ndive = Use the manual heading until the Spray dive # $> Ndive$.

F zmax ncell cellsize pulse_length minsnr Set Doppler Settings (Mar05).

zmax [dBar] = max depth of ADP profile: $0 < zmax < 1000$ (integer)

ncell = # of cells in each ensemble. $1 < ncell < 6$.

cellsize [m] = cell vertical extent. $1 < cellsize < 11$ (integer).

pulse_length [m] = pulse vertical length, $1 < x < 11$ (integer).

minsnr = minimum SNR: average only for $SNR > minsnr$. $-2 < x < 10$ (int).

if **minsnr** = -1, ignore SNR.

G n Change the glide pitch angle. Valid range is $5 < n < 41$ degrees.

This is the absolute value used to glide both up and down.

H n b Engineering Time-Series Settings

n = decimate the raw 8 sec engineering data by every nth point and send back.
 n=0 = off (send NO time-series).

b = Bit-mask of what engineering parameters to send:

b =0 = do NOT send any.

b =255 = send ALL sensors.

b[i] = bit i : if =1, send, if =0, do not.

b[0] = time [s] of every nth point.

b[1] = Pressure [counts].

b[2] = Heading [degrees*10].

b[3] = Pitch Angle [degrees*10] from the compass tilt-meter.

b[4] = Roll Angle [degrees*10] from the compass tilt-meter.

b[5] = Pitch Potentiometer [counts].

b[6] = Roll Potentiometer [counts].

Example: H 8 3 send every 8th point (every 64 s) the time-series of b[0] = time and b[1] = Pressure.

I (obsolete, see cmd 'C').

J (obsolete, see cmd 'C').

K n Set next_xmit = n [minutes]. Valid range = 10 < n < 600.

n = the minimum time [m] between satellite transmissions.

If we're doing multiple shallow water dives and we don't want to transmit every cycle, then next_xmit can be adjusted so we only transmit every 3 hours, for instance.

L n1 n2 n3 Set The Argos Transmit Time to n [minutes]. -1 < n < 61.

n1 = The time in end-mission mode to wait with the argos beacon on.

In the End-of-Mission mode, the Argos transmitter is on for **n1** minutes, followed by NGPS minutes of trying to get a GPS fix (see cmd 'M'), followed by NSBD minutes of trying to send a SBD message (see cmd 'U').

n2 = Multiplier for using Argos during each normal dive surfacing.

If n2=0, Argos is always off (default value).

if n2>0, the Argos is on for 5* n2 minutes.

n3 = PUMP_AGAIN flag (Legal values = 0,1).

If n3=1, then the hydraulic pump is run for one full cycle in the abort mode (used in case there is a worry the bladders aren't full). After one pump try, the code automatically resets it to 0=false.

M n h GPS Settings.

n = The max time [minutes] to try to get a GPS fix: -1<n<21.

This applies for both mission mode and end-mission/abort mode.

h = Heading to steer if there is no GPS fix.

If 0<= **h** <=360, then will steer this heading (True).

If **h** = -1, then the Spray will just do circles.

If **h** = -2, then it will steer the last valid direction.

If **h** = -3, then it will head for the last valid direction to the HOME waypoint.

N (obsolete).

P nPMP nSBD Max_Rst Severity Level for Exception Recovery Action

nPMP= Pump Exception Level to take when there is a deep pump failure.

0 = No changes are made to the Spray mission (ignore).

1 = Go to shallow (100 m) dives.

2 = Do shallow dives AND head for the HOME waypt.

3 = Abort the mission.

nSBD= SBD Exception Level when there has been no SBD comms in 48 hrs.

0 = No changes are made to the Spray mission (ignore).

1 = Head for the HOME waypoint.

2 = Do shallow (100m) dives AND head for HOME.

3 = Abort the mission.

Max_Rst = Max spurious resets allowed before going to the abort code.

If=0, then goes directly to abort.
Every time 'P' is sent the reset counter (N_Reset) is cleared.
If N_Reset<Max_Rst, then Spray gets to surface, does comms, & continues.

R n Re-transmit all satellite packets associated with dive n.

The LIFO buffer is searched for dive=*n* packets, and if found, their status flags are reset to 3 = 'not previously sent'.

S n_GPS n_SBD Set wing to use. range -1<n<3. (antenna switch option)

n=0 = STBD wing, *n*=1 = PORT wing, *n*=2 = Alternate between wings.
These values have no effect if there is no antenna switch.

T n Ndive Steering Point Distance (advanced navigation command).

n = Distance [km] further up the route line to steer towards.
=0 = turn off using the steering-point mode.

Ndive = Use the steering point mode until the Spray dive # > **Ndive**.
Instead of steering towards the waypoint, this will compute a 'steering point' *n* km down the route line to steer for. This will get the Spray more quickly back on the route line.

U t1 t2 SBD Timing Parameters.

t1 = Max surface time [s] to try SBD comms. Valid for 59 < **t1** < 1800 s.
t2 = Time to wait [s] before trying to re-send an SBD message.
Valid for 30 < *j* < 200 s. =wait time if there no satellite is in view.

V n1 n2 Change Compass Settings:

n1 = Local variation: *n1*<0 for East, *n1*>0 for West (-180<*n1*<180).
Magnetic course = True + *n*.
n2 = Flag to decide which compass calibration to use:
n2=0 = use the TCM2 on-board calibration coefficients.
n2=1 = uset the Spray EEPROM calibration offsets.

W num new end dir : Route Settings (May06)

num = Total number of waypoints in the route (1<= num <= 19).
new = New Route index to head for (1 <= new <= num).
end = Action to take at the end-of-route.
0 = go HOME.
1 = repeat the route.
2 = reverse the route.
3 = stay stationed at the last waypoint in the route.
4 = END the mission when the waypoint is reached (not advised).
dir = direction to go through the route (1= forward, -1 = reverse)

Route/Waypoint Management should be executed through sbd_route.pl to ensure the proper commands are issued.

Z n z0 z1 Altimeter Settings

n=0 : don't use altimeter. *n*=1: use the altimeter.
z0 [m] = first depth on descent to start sampling the altimeter.
This is to avoid shallow false-bottom detections. Valid for -1<*z0* < 2000.
z1 [m] = When the altimeter says we're within *z1* of the bottom,
then turn around and ascend. Valid for 0<*z1*<50.

@ (no other variables) : Request Route

Requests the Spray to return all of the route/waypoint info.

! (no other variables) : Request the mission parameters.

The Spray will return with an EEPROM/RAM parameter list, used to help verify the present configuration.