BoB

(Beacon On a Belt)

USER'S MANUAL

Draft Only

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1. System Description

1.1 User Features

The following table identifies the operational features for BoB.

ITEM	SPECIFICATION	NOTES
Beacon Receiver Antenna	Built-in	Omni-directional
Beacon Almanac	BoB must store the last recorded beacon almanac.	This is to be updated whenever a more recent almanac is received
Beacon Channel tracking	Tracks 2 channels simultaneously	
Wireless Link	Transmitter only, license free frequency band. Must be able to be used in any location where the user is capable of receiving beacon correction data.	Must be enabled/disabled by Firmware, or permanently disabled at build time. 900Mcs transmitter primarily for use in the USA.
Configuration	Must be ready 'out of the box' Also via PC based software.	Two-button UI
Battery Life	At the least the same or better on single charge.	Regular day shift.
External Antenna support	External antenna support is **NOT** required	
Wireless link	5 foot spec	Typical operational range
Operational Indications	Minimum of power status and Beacon tracking status.	
RTCM capability	SC-104, version 2	Output in standard format on cabled serial connection, supportable by any product with RTCM input ability.
Operational Modes	Best and Fixed	
Firmware Upgrade	Serial port connection.	User can upgrade.
Ergonomic	Easy to get into and out of vehicles with no requirement to detach and re-attach.	Comfortable and light to wear on hip.
Standard Accessories	Must be supplied with a pouch that enables the user to access the buttons. simple nylon belt with plastic buckle (similar to the hip pack shoulder strap). Cable for connection to PC (Null Modem)	The pouch padded to the users hip from the unit. This will probably be dependent on the final weight and shape of the product.
Optional Accessories	Vehicle kits will be available.	Not necessarily in time for release.

1.2 System Operation

1.2.1 Modes of Operation

BoB will track frequencies using one of two modes: Best and Fixed. The list of frequencies that can be tracked, plus the startup mode, can be controlled using PC-BoB software.

Normally users will either have a very short include list (e.g. one to five stations) or will have a very long include list (excluding only one or two dominant stations). Those with a short list will operate either in Best or Fixed mode depending on their situation, however those with a very long list will usually always be in Best mode.

1.2.1.1 Best

When BoB is in Best mode it will track the best frequency that it can, and will change frequencies if its current frequency becomes unsatisfactory.

The algorithm for determining the next Best channel will use the following inputs:

- The PC-BoB filter as defined by the user. This includes excluding frequencies all together and overriding default health rules.
- The almanac if one exists.
- The initial position if one exists and if beacon co-ordinate information is being broadcast.
- FFT information
- Information on whether a particular frequency has been tracked before and contains or does not contain valid RTCM information.

A frequency becomes unsatisfactory if:

- the SNR of the currently tracked frequency falls below a predetermined level
- the data stream has more than 10% parity errors

To summarize, Best mode uses the algorithms already in place in the Beast receiver called Auto-Range if BoB knows its position and has positional information on the beacons it can track; otherwise it uses Auto-Power. This is not user-selectable.

1.2.1.2 Fixed

Fixed mode means that BoB will track one frequency consistently until the user intervenes. This intervention may be in the following fashions:

- by short-pressing the beacon button (to stay in Fixed mode and move to the next frequency in the list)
- by long-pressing the beacon button (to move to Best mode)
- by long-pressing both buttons to return to the default settings

The user can go from Best mode to Fixed mode at any time by short-pressing the beacon button (see section 3.5.2 Button Control). At this point BoB will continue tracking the frequency that was last tracked in Best mode.

When the unit starts up in Fixed mode it begins to track the initial frequency as defined by PC-BoB, regardless of the availability or condition of this frequency. A short-press of the beacon tracks a new frequency as per the following rules:

- If the list of included beacons contains less than 42 frequencies, a short button press simply moves to the next frequency in the list (sorted numerically), regardless of the presence or quality of a signal at that frequency.
- If the list of included beacons contains 42 or more frequencies (or no list is provided, which means that all frequencies are enabled) then the second channel should track the next frequency in the list for which a signal can be detected.

1.2.1.3 Default operation

By default, all frequencies are enabled and the mode is Best. The method of modifying this default behaviour is to:

- select a list of frequencies and an initial mode using PC-BoB and download this information to the BoB unit OR
- control BoB using the Beacon button.

The default behaviour can be restored with a dual button press (see section 3.5.2 Button Control).

1.2.1.4 Other operational

It the Beacon Almanac (Type 7) is retained in the BoB non-volatile data system.

It BoB will accept an NMEA –GGA message from any device (including PC-BoB) over an RS-232 connection to specify its initial position, to which it will then use to determine the range to the tracked beacons in order to determine the nearest station.

{Note baud rates fixed for GGA strings}

1.3 User Interface

the user interface on BoB

- Power on and off
- Switch between best and fixed modes
- Total power off
- Reset unit to defaults
- To scan through either a user list of frequencies, or through the range of beacon transmissions available at the time.
- The user feedback showing the following
  - Whether the unit is on or off.
  - Battery charge status
  - Beacon tracking status

1.3.1 LED interface

It is a dual colour, green and orange.

The blinking of the LED's shall be at a rate of 1Hz (i.e. 0.5 secs on, 0.5 sec's off etc). The strobe flash is a very quick blink every 3 seconds.

Power Source	BoB on/off	Low battery	Charging battery	Full/not charging
External	On		Orange flash	Orange steady
External	Off		Orange strobe	Off
Internal	On	Green flash		Green steady
Internal	Off	Off	Off	Off

- If the battery has adequate charge and power is on, the LED is steady. The colour indicates the power source.
- If the battery has adequate charge and power is off, the LED is off.
- If the battery is low or charging and the unit is on, the LED will flash, and the colour indicates the power source. If the unit is charging and is off, the unit will strobe orange.
- The  indicates a non-applicable situation. When external power is applied the unit will always start charging, therefore it can never be defined as "low". Also, on internal power the unit can never be charging.

The following table contains the same information but the axes are colour states.

Power LED

Color	Off	On	Blinking	Strobe Flash
Green (no external power)	Unit is off	Unit is on and battery not low	Unit is on and battery low (<5% energy remaining)	N/A
Orange (no external power)	Unit is off Internal battery Is not being charged[1]	Unit is on , is fully charged	Unit is on and is charging the internal battery	Unit is off, and is charging the internal battery

1. The reason why the battery is not being charged is because it is fully charged, or if the battery is out of temperature or time specs. If the unit is off and connected to external power, and the battery is low the strobe flash will be used to indicate charging is taking place. Once the unit is fully charged, the strobe light will cease to flash.

Beacon LED

Colour	Off	On	Blinking
Green (Best Mode)	Failure condition (if BoB is powered on)	Locked onto Signal and Good RTCM data being sent to GPS receiver	Unit is either searching the frequency band, or is tracking a signal, but not using the signal
Orange (Fixed Mode)	Failure condition (if BoB is powered on)	Locked onto Signal and Good RTCM data being sent to GPS receiver	Unit is either searching the frequency band, or is tracking a signal, but not using the signal

Note that the Beacon status LED is reporting the status of the Primary channel only.

1.3.1.1 LED Events

In addition to the above LED states, the LEDs will flash to indicate events. The events and LED codes are outlined in the following table.

Event	LED Code
Wireless enabled (see section 1.3.2.2)	Beacon LED flashes green at 4Hz for 1 second
Wireless disabled (see section 1.3.2.2)	Beacon LED flashes orange at 4Hz for 1 second
Reset to Factory Defaults initiated (see section 1.3.4.1)	Both LEDs flash green at 2Hz for 2 seconds

1.3.2 Button Control

there be two buttons on the BoB unit (One for power, the other for Beacon operations). These two buttons should be designed in a manner that makes them easily identifiedd as different operations.

1.3.2.1 Power Button Functionality

Short Press (<0.25 second)

- The short press operation on the power key will turn the unit on. If the unit is already on, then this is a no-op

Long press (1 second)

- The long press operation on the power key will turn the unit off if the unit was on. If the unit is already off, then this operation will also turn the unit on.

Very Long Press (10 seconds)

- The very long press operation on the power key is a hardware-controlled press which will completely reset the unit in case of total software failure. This will not be documented in the manual but will be available for TAC to use to help users recover when the unit cannot be reset through software control.

1.3.2.2 Beacon Button Functionality

Short Press (<0.25 second)

- The short press operation on the beacon button has a number of similar functions.

  If in Best mode, the short press operation will force the beacon receiver into Fixed mode and will lock the frequency to the frequency currently being tracked. Performing further short press operations will move to the next frequency in the list of enabled frequencies. The next frequency to choose is determined by the number of enabled frequencies configured in BoB. See section 3.2.1.2 for more information.

Long press (1 second)

- The long press operation in the Beacon button will switch the operating mode of the beacon receiver from Fixed to Best mode and selects the current best frequency. If the receiver is already operating in Best mode, then this should function as per a short button press.

Very long press (10 seconds)

- The very long press operation in the Beacon button will toggle wireless transmission on or off. This can also be done via PC-BoB. On startup, the wireless state will revert back to that configured by PC-BoB, or On (default) if there is no configuration.

1.3.3 Displaying and Changing the BoB Configuration

The current BoB configuration can be displayed or configured (uploaded or downloaded) via the PC-BoB software running on a Windows 95, 98, or NT computer.

1.3.4 Transmission of Data from a Datalogger

When operating in wireless mode it is not possible to transmit data from a datalogger to BoB. When operating in cabled mode, the only information BoB will accept from a datalogger (such as a GPS position and time.

1.3.4.1 Dual Button Operation

Dual button press (5 seconds)

- The Dual button press operation resets the configuration of BoB. Performing this operation is a cold boot of the BoB receiver. It clears any configuration sent from PC-BoB, as well as the current almanac.

1.3.5 Best Mode station tracking

This section has been incorporated into section 3.2.1.1.

1.3.6 Firmware upgrade

Winflash be used as the mechanism to put the firmware onto BoB. Further definition may be as to exactly what options, but the initial options will be;

- Wireless enabled
- Wireless disabled
- Encoded beacon stations support

1.3.7 Keypad/Display

No display or keypad. All other UI is via the serial port or wireless link. Commands to BoB must be sent via the serial port, but status can be received on either the link or serial port.

Commands and Status are defined in the Software Document.

1.4 BoB Sub Systems

1.4.1.1 Beacon channels

There are to be two channels (Primary and Secondary).

	Best Mode	**Fixed Mode**
Primary Channel	Pass RTCM through to Datalogger	Pass RTCM through to Datalogger
Secondary Channel	Searches for the second Best frequency	Searches for next frequency on the filter list (if 42 or more frequencies available from user's list) or track the next frequency (if less than 42 frequencies available)

1.4.1.2 Signal Acquisition

Cold Start Time <45 seconds

Warm Start Time <5 seconds

1.4.1.3 Power

An internal 2-cell Li-Ion battery will power the unit. The intention is to build the battery into the unit and it will not be removable by the user. An external power source connection is, and the unit must operate from 9 to 24 VDC. When connected to an external power source, this will not only power the BoB unit, but also charge the BoB internal battery. An internal battery charger is required to charge the Li-Ion battery. There are many special requirements of the battery system:

1.4.1.4 I/O

In addition to power and ground, the following I/O exists

Name	Type	I/O	Other
Rx	RS-232	Input	Data into BoB
Tx	RS-232	Output	Data out of BoB

1.4.1.5 Beacon Antenna

A internal antenna has been selected.

It is not a requirement to connect to an external antenna.

1.4.2 Mechanical

The following information is detailed herein and does not necessarily appear in the mechanical specification. The specification will detail the how and why of obtaining the following product level specifications.

Mounting

- BoB will be supplied with a pouch that will allow BoB to be easily removed from the pouch. This pouch must be easily attachable and detachable from a belt.
- Cannot catch or snag in difficult environments, causing detachment.
- User need not detach unit when getting in and out of a vehicle.
- Must be comfortable and fit snugly on a hip.
- Must take into account variances in body sizes.

1.4.2.1 Connectors

- External Power Latching
- Data Port DE-9 male , DTE Device

1.4.2.2 Environmental

- Operating range -10 to +50 degrees C.
- Storage tbd
- Shock tbd
- Vibration TBD
- Water Heavy, wind driven rain and dunk proof for 2 seconds.
- Weight No more than 700grams (1.5lb)

1.4.3 Configuration Manager Software

The configuration of BoB will be done through a Windows based configuration program called PC-BoB. Basic configuration of BoB can also be achieved on the unit itself. A complete description of the configuration manager software can be found in “PC-BoB Specification”. Configuration parameters and how they are communicated to BoB are described in the BoB Software Specification.

1.4.4 Data Backup Scheme

At power-off, BoB will save all current parameters and re-instate them at power-on. A software crash means that this will not happen, and parameters will be reset to those last saved. For more details refer to section 3.8.3 of the Software Specification.

2. Additional Information

This section is for informational purposes only and serves as a place to retain product information and development ideas not yet targeted for other sub system documents.

2.1 Warranty Information

BoB ships with a 1 year warranty. Additional support agreements will allow the user to extend this warranty in 1 year increments.

2.2 Coast Guard MSK Signals

Frequency range	283.5 to 325 kHz
Bandwidth	2 kHz
Modulation	MSK
Polarisation	Vertical
Signal Strength	5 uV/m (The coverage area is defined in this way)
Bit rate	50, 100, 200 bps
Common RTCM msgs (US)	1 and 9

2.3 RTCM Message Support

All RTCM messages will be passed onto the destination device. It is then the responsibility of the target device to then filter out the unnecessary messages. Type 16 messages will NOT be used to carry any BoB status information. Type 59 can be used for this (refer to “BoB/PC-BoB. Interface Specification”).

2.4 Integrity Monitoring

In both Best and Fixed MSK operating modes, BoB will continuously monitor the integrity of the RTCM data received from the differential radiobeacon. If BoB detects more than 10% of parity errors in the data stream, the MSK receiver will automatically switch to a different radiobeacon (if in Best mode) where available and specified. In Fixed mode, these messages will not be used, but the receiver will stay locked to that station.