



2017

D-0005 BOM (Broadcasting Outer Module) Pilot's Guide

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BOM (Broadcasting Outer Module) Pilot's Guide

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AMENDMENT RECORD

This procedure is reviewed to ensure its continuing relevance to the systems and process that it describes. A record of contextual additions or mission is given below:

Revision No.	Date	Responsible Person	Description of Change
1	11/7/2017		Initial release
2	12/7/2017	Catherine Larotta	Updated instructions on initial calibration and use of BOM system.
3	04/01/2017	Ananda Leon	Added BOM Power ON/OFF functions, modified AOA calibration procedures

Warranty

Levil Aviation warrants this product to the original purchaser to be free from defects in material and workmanship for a period of one year from the date of the original purchase. The following are not covered: software, damage resulting from accident, neglect, misuse, fire, or flood, improper voltage supply or failure to follow operational guidelines supplied with this product. Extended warranty is available for purchase on our website.

Please register your product online at: <http://aviation.levil.com>

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CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

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1. Introduction

Every pilot should have a safety net when they go flying because no matter how much we hope for the best, it is always good to be prepared for the worst. The BOM provides an affordable solution that gives pilots the peace of mind they need to be able to safely overcome any instrument malfunction or related emergency.

The BOM (Broadcasting Outer Module) is the first and only aerodynamic pod that mounts under the wing of the aircraft. All components are incorporated into the BOM, making it a fully independent, completely wireless, all in one avionics device. The BOM is a platform for innovation, setting the stage for the future of aviation.

The BOM is a fully independent, completely wireless, self-powered, all in one avionics device. Avionics include WAAS GPS, ADSB-in, AOA, Air Data (Altitude, Airspeed), AHRS (Attitude, Directional Gyro, Turn Coordination, rate of turn, VSI) and outside air temperature. Once it is installed, the BOM connect via Wi-Fi to a tablet inside the cockpit and data can be displayed on multiple Apps thanks to its open protocol.

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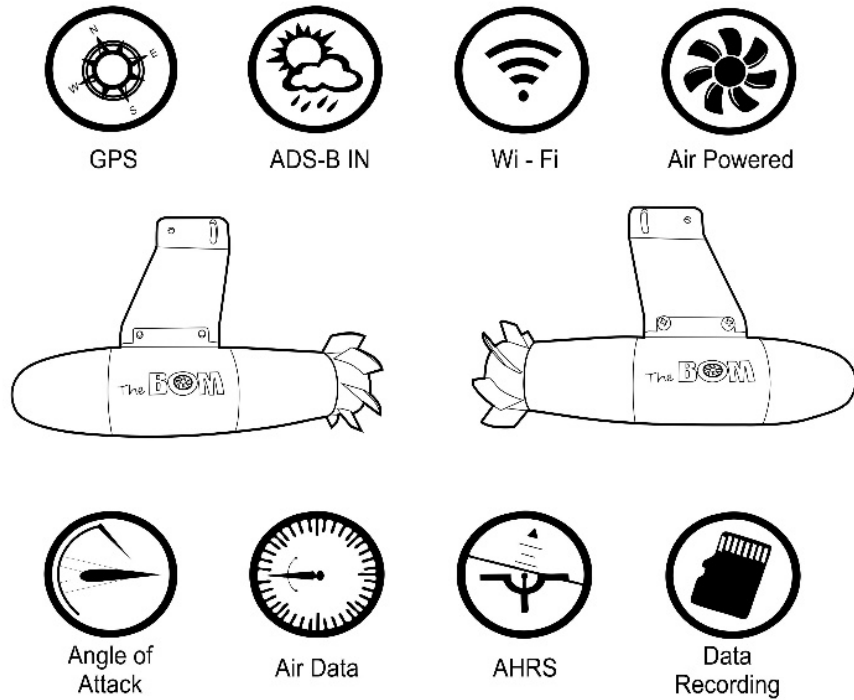


Figure 1. BOM features

What makes the BOM special?

- Automatically Powered on/off with the vibration of the engine
- Self-powered and self-charging
- Fully independent inertial measurement system & source of altitude, position, and flight telemetry
- Wireless platform offering iOS/Android compatibility
- Multiple App compatibility. For a full list of compatible apps visit our website <http://aviation.levil.com/compatible-apps.html>

2. Operating Limitations

- a) The BOM is not a required system and may not be used as a substitution for the certificated aircraft system.
- b) No operational credit may be taken for installation of the BOM system.



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- c) The AoA included within the BOM is non-required and is to be used only as supplemental information to the pilot. The AoA system may not be used as a substitution for the certified aircraft stall warning system.
- d) No operational credit may be taken for such items as reduced approach speed and shorter landing distances.
- e) The BOM may be flown at a Maximum speed of 210 kt.
- f) Although the BOM transmits AHRS Data is not to be used as a substitution for the certified AHRS instrumentation of the airplane. The AHRS supplied by the BOM is to be used only as supplemental information to the pilot.
- g) Levil Aviation does not provide or endorse any carry-on device that displays the information sent by the BOM.
- h) Ferrous Materials near the BOM may affect the compass reading.
- i) When transporting or temporarily storing in an airplane or vehicle, temperature range should be no less than 20 ° F (-12 ° C) and not more than 150 ° F (65 ° C)
- j) Storing our device at temperatures higher than 170 ° F for extended periods of time (more than 2 hrs.) may cause damage to battery and possible fire.
- k) DO NOT disassemble, remodel, drop or modify the BOM as this will invalidate the warranty of the unit as well as the FAA NORSEE certification.
- l) Do not use the BOM as an anti-collision system. Not all traffic is displayed using ADS-B in. Most aircraft are not currently ADS-B Out equipped and therefore not detectable by the BOM.
- m) Levil Aviation does not provide a display for this unit. Any display the pilot chooses to integrate Should comply with FAA certification requirements or qualify as a carry-on device. Under no circumstances should any display be placed in any way that it will obstruct the pilot's views of the aircraft flight instruments or the external view which may be detrimental to the ability of the pilot to fight the aircraft.

3. Specifications

3.1 AHRS

- 360-degree pitch and bank operations
- GPS Independent Attitude
- 300°/sec max turn rates
- 8 G's max rating
- Output: Roll, pitch, magnetic heading, slip indicator, rate of turn, G meter, indicated air speed (max 210kts), vertical speed (ft/min), Pressure altitude.

3.2 Internal Battery

- Self-charging battery.
- Operating Time after flight (if fully charged) <= 4 hrs.



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3.3 Wi-Fi

- Android and iOS compatible
- Support up to 5 devices connected simultaneously (UDP broadcast)
- Supports multiple protocols:
 - GDL90 (default)
 - Foreflight Sim
 - NMEA

3.4 GPS

- Support WAAS
- Cold start < 60 sec. Typ. (open sky)
- 1 Hz output (5 Hz optional)

3.5 ADS-B in (978/1090 MHz)

- Receives regional and continental NEXRAD reports broadcasted by ADS-B towers within range: (Regional every 2.5 min. /Continental every 15 min.)
- Receives "GROUND TO AIR" traffic. (re-broadcast of traffic by ADS-B towers nearby)
- Receives "AIR TO AIR" traffic reports from other aircraft operating 978/1090 MHz transmitters: (978 MHz UAT ADS-B out and Mode-ES transponders with extended squitter)

3.6 Angle of Attack (AOA)

- Differential pressure sensor
- indicated airspeed

NOTE: AoA requires calibration. Refer to section 6 for AoA calibration instructions.

4. Power system overview

- **Battery Mode:** The internal battery will power systems temporarily when vibration sensors pick up movement from the engine. Battery mode is time-limited; all systems will shutdown after 10 minutes, unless:
 1. GPS has a position fix
 2. AND Groundspeed is 10Kts or higher (i.e taxiing)
 3. After system shutdown, if the engine is ON, the vibration will immediately wake up the BOM, resetting the timer to 10 more minutes. The user will experience a pause in data transmission over the wifi channel for about 6 seconds, while the BOM restarts.



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4. The “remove before flight” cover is in place. The magnet embedded in the cover prevent the battery from powering the BOM. Remove the cover to allow Battery power mode.
 - **Turbine Power Mode:** When speed is greater than 60Kts, the turbine will power all systems and recharge the internal battery.

5. User Interface

The BOM is designed to be compatible with various Apps on both iOS and Android platforms by offering an open Broadcast of data using UDP communication. Third party developers can use the information broadcasted and display it on their App, but there are no restrictions on how or what data they can display. Refer to a table of compatible Apps on Levil Aviation’s website to determine the capability of each App available.

5.1 Connecting to your favorite app

The BOM offers the most compatibility with Apps on both iOS and Android platforms.

- Remove the protection cover from the BOM and simulate an engine ON scenario by tapping the BOM rapidly for at least 6 seconds to activate the vibration sensor and wake up the systems.
- Go to your tablet’s “Wi-Fi Settings”.
- Connect to a network called BOM-xxxx, when xxxx is the unique serial number for the device.
- Once your connection is established, a checkmark will appear next to the network name.
- Open your favorite App, the connection will be automatically.

5.2 AHRS Utility App

Levil Aviation developed a free app that makes the use of the BOM easy and reliable for pilots. The AHRS Utility App is an application capable to display the BOM data graphically and numerically.

This is a proprietary App developed by Levil Aviation that runs on iOS devices only (iPad /iPhone). This utility App is designed as a tool to help the pilot troubleshoot and calibrate the required systems, and as an aid for instrumentation display. Pilots can download the AHRS Utility directly to their iOS devices from the App Store. Installers are recommended to use this App when installing the BOM to set the tilt and calibrate the AoA. For a complete AHRS Utility User guide visit aviation.levil.com.



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NOTE:

- Other apps may require subscriptions, and some offer more features than others.
- Some Apps may not support all the features of the BOM.
- You may choose to use one Navigation App or a combination of apps on multiple devices depending on your flying needs.
- For a complete list of compatible Apps go to www.aviation.levil.com/compatible-apps

6. Magnetic Heading

There are two ways to obtain heading information from the BOM, depending on the navigation App of choice, you may choose between the following:

- True Track: Heading information based on GPS track.
- Magnetic Heading: Heading information determined by a combination of 3-axis magnetometer and gyros that form part of the internal AHRS inside the BOM.

6.1 When using Magnetic Heading, it is important to be aware of the following:

- Magnetic fields caused by other things, such as Magnetic Compasses, may affect the AHRS heading.
- Verify your magnetic heading after following alignment and installation procedures: using the AHRS Utility App → options → Heading → Use magnetic
- In case of magnetic deviation, the internal AHRS will slowly learn your aircraft configuration during flight to compensate. This learning process requires the aircraft to turn both clockwise and counter clockwise for at least 40 seconds.
- After turning, or at the end of your flight, verify the magnetic heading again using the AHRS Utility App. If the AHRS was able to successfully compensate for errors, you may store this data inside the BOM and it will use this new configuration on the next power cycle: Using the AHRS Utility → Device Config → Enable Configuration → Save Mag Data
- ERASE Magnetic data using AHRS Utility before moving the BOM to a different aircraft or environment.

7. AOA Calibration

The following procedures will provide guidance on how to calibrate the AOA on the BOM. AOA is not calibrated from factory because the behavior is dependent on aircraft aerodynamics,



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BOM placement etc. Before going through this process, make sure the BOM has been installed and approved by your A&P, secured on the airplane and aligned with the chord of the airfoil. Because this process requires the pilot in command to do certain maneuvers and operate the iPad simultaneously, it is recommended to have a copilot that can operate the tablet while the pilot maneuvers the aircraft.

Angle of Attack is the angle between the vector of the airflow and the chord line of an airfoil. When the aircraft reaches a critical angle of attack, the pressure differential sustaining lift is interrupted and the wing stalls. The BOM does not output an Angle, but instead a range from 0 to 1, where 1 represents the stalling point with a 15% added layer of safety. The AOA will be disabled until the BOM gathers the calibration information. Before starting this process, the pilot must gather:

1. **iPad with AHRS Utility installed, using version 5.2 or higher**
2. **Calibration point:** defined as Aircraft's Stall Speed, multiplied by 1.15 (i.e if the aircraft stall speed on landing configuration is 45Kts, then *Calibration Point* is approx. $45 \times 1.15 = 52$ Kts)
3. **A reference Airspeed indicator** alternate from the BOM's

Calibration Procedures:

1. Before starting the calibration maneuver, connect iPad to BOM's wireless network.
2. Open AHRS Utility and confirm connection to the BOM, all systems must be up and running
3. On the AHRS Utility, go to Device Config -> Enable Configuration (if you haven't done so) -> Acknowledge the pop up warning (if you haven't done so) -> Select the BOM tab -> Click on "Check Two way communication".
4. If the message "Device Connected" appears, proceed to Step 5. Otherwise, WiFi communication did not initialize correctly. You must go to your iPad's WiFi settings and disable the WiFi momentarily, then Enable again. Repeat Steps 1 to 4.
5. Enter your *Calibration Point* on the textbox (speed in Kts) under "AOA Calibration" on the AHRS utility.
6. Using your reference Airspeed Indicator (not the BOM's), Start maneuvering the aircraft until your speed reaches the *Calibration Point*, then click "Calibrate AOA"
7. Wait for confirmation and acknowledge the pop-up window.
8. Immediately the AOA gauge will be enabled (bottom right corner) and you can test the performance of your angle of attack.



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8. Data Recording

The BOM will automatically begin recording once the unit is powered on and has acquired a GPS fix.

8.1 Save files

- File name will be saved as follows ___BOMxxxx-yyyymmddThhmmss
- The BOM will have three file formats in which to choose from to record (.gpx, .csv, .fdr)
- .csv will be the default format from the factory and can be changed before flying using the AHRS Utility App.

8.2 How to change recording format

- Open AHRS Utility App
- Tap on the Device config tab
- Find Recording File Format
- Tap on Select, and choose desired format
- Press Apply

8.3 How to change Callsign

- Open AHRS Utility App
- Tap on the Device config tab
- Scroll down to find Callsign
- Tap and type desired Callsign
- Press Apply

8.4 How to use Triggers

Triggers are for use while in .csv format. These can be used to mark a specific event during flight for future references, while reviewing the spreadsheet.

NOTE

- .gps – Google Earth, CloudAhoy, etc.
- .fdr – Xplane flight simulator.
- .csv Microsoft Excel (ASCII file)
- Data retrieval may be performed wirelessly using the AHRS Utility platform and is explained in detail in the AHRS Utility user guide available online.



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9. Helpful Tips

- If you encounter Wi-Fi connection problems, try resetting the device's Wi-Fi (disable/enable)
- If using Apple devices, you may use our free AHRS Utility App to see battery percent, GPS signal power, ADS-B Diagnostic etc.
- In most locations, it is not possible to received ADS-B information from ground towers unless you are airborne (typically above 2000 feet) with line of sight to the tower
- The Internal AHRS has a max rate of turn of 300°/sec. Most likely you will exceed this limit (or “tumble” it) when playing with the BOM in your hands. If this is the case, and the AHRS did not recover, you might “tumble” it again, and set it on a level surface. It will recover within 4 se.