**Purchase Specification**

**for a Solar Powered**

**Connected Warning Beacon Flasher (CWBF)**

1. **Overview**

**A Connected Warning Beacon Flasher System (CWBF) shall be used to increase roadway compliance and safety in applications such as, but not limited to, stop signs, speed limit signs and curve ahead beacons. Each CWBF shall be modular and available with a self-contained or cabinet-based solar Power Module. Self-contained systems shall have the solar panel integrated into its Power Module enclosure, while cabinet-based Power Modules shall have a solar panel mounted separately. Solar panels shall be available with top of pole or side of pole configurations. The self-contained or cabinet solar Power Module houses the charge controller, flash controller, Bluetooth communications, GPS/cellular communications, DC relay, knockdown sensor and battery(s).** **The CWBF shall conform to all provisions of the MUTCD, or MUTCDC, where applicable. The CWBF shall be pre-wired to the maximum extent possible.**

1. **Mechanical and Electrical**

**The CWBF shall be modular without a centralized controller. Adding other Flasher Modules or accessories shall not necessitate a change in system configuration.** A solar simulation shall be provided to verify the additional load(s) can be supported by the CWBF for reliable year-round operation.

CWBF shall be equipped as standard with an integrated knockdown sensor, **purpose-built by the CWBF manufacturer**. The sensor shall detect a knockdown or impact if the Power Module is more than 30 degrees off-axis in any direction.

**CWBF shall be equipped as standard with an integrated 5 A DC power supply/relay**, **purpose-built by the CWBF manufacturer**, **with fault protection against short circuits. This function is intended for accessories to be triggered while the CWBF beacons are actively flashing.**

**CWBF shall have an externally mounted Bluetooth antenna for local communications and an externally mounted GPS antenna for remote communications.**

**CWBF wiring shall be available off-the-shelf and non-proprietary.**

**CWBF shall be capable of being wired via a “centralized” or “distributed” approach:**

* **Centralized – all component wiring from Flasher Modules (LED beacons or LED signs) shall be terminated to the Power Module circuit board.**
* **Distributed – one Flasher Module shall be terminated to the Power Module circuit board. Additional Flasher Modules may be terminated to any Flasher Module available.**

**CWBF Power Module circuit board shall be conformally coated.**

**Self-contained and cabinet Power Modules shall be rated to a minimum of NEMA 3R.**

Fasteners shall be stainless steel.

**Mounting**

Mounting adapter hardware for the CWBF Power Module shall be available for the following configurations, for top of pole or side of pole:

* 2**"** – 2.5**"** perforated square post mount
* 2.38**"** – 2.88**"** diameter round pole mount
* 3.5**"** – 4.5**"** diameter round pole mount
* Wooden pole or post

Top of pole configurations shall allow direct mounting to top of signal housing when using self-contained Power Modules.

Side of pole configurations shall be available for pole sizes larger than 4.5**". Flat surface mounting shall be available for cabinet-based systems.**

Standard mounting options shall not require specialized tools for installation.

**Solar Charge Controller**

**The solar charge controller shall use maximum power point tracking (MPPT).**

**Charge controller shall be purpose-built by the CWBF manufacturer and feature 3-stage charging with temperature-compensation to prevent battery overcharging in hot weather. Charge controller shall not be an external module or device.**

**Charge controller shall be reverse polarity protected on the battery and solar inputs.**

**Charge controller shall be field replaceable.**

1. **Power Modules**

**CWBF Power Modules shall** be available **in one of four size and configuration options:**

* **Small self-contained solar Power Module**
* **Large self-contained solar Power Module**
* **Small solar cabinet Power Module**
* **Large solar cabinet Power Module**

**Small Self-Contained Solar Power Module**

The small self-contained solar Power Module shall be constructed from 16-gauge aluminum with an integrated solar panel. No external control cabinet or battery cabinet shall be required.

**Module** shall not exceed 12.6**"** in height from bottom of adapter fitting to top of solar panel. The depth of the module shall not exceed 5.3**"**.

Access to the interior of the module shall be provided by a lid that is hinged on the right edge and is fitted with a foam gasket. The lid shall have an integrated padlockable latch for use with lock shackles up to ¼". Optional industry standard #2 padlock available.

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

Module shall be affixed to the top of pole or side of pole.

Overall module weight [without battery(s)] shall not exceed 5 lb (2.3 kg).

Module shall be available in unfinished aluminum or with black powder coat. Optional yellow, green or custom powder coat colors available.

**Solar Panel**

Module shall include one 18 V solar panel rated at 15 W. Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Module shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented toward the equator with no additional mounting hardware.

**Batteries**

**Module shall include up to two 7 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free batteries. Each battery shall be equipped with a 15 A mini blade fuse.**

Batteries, in conjunction with recommended CWBF performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Batteries shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Individual batteries shall be supported by foam inserts and separated by a rubber bumper.

**Large Self-Contained Solar Power Module**

The **large self-contained solar Power Module** shall be constructed from 14-gauge aluminum with an integrated solar panel. No external control cabinet or battery cabinet shall be required.

**Module shall** not exceed 18.3**"** in height from bottom of adapter fitting to top of solar panel. The depth of the module shall not exceed 5.8**"**.

Access to the interior of the module shall be provided by a lid that is secured with four bolts and is fitted with a foam gasket. The lid shall have an integrated padlockable latch for use with lock shackles up to ¼". Optional industry standard #2 padlock available.

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

Module shall be affixed to the top of pole or side of pole.

The overall module weight [without battery(s)] shall not exceed 11 lb (5 kg) for 30 W solar panel or 14 lb (6.4 kg) for the 50 W solar panel.

Module shall be available in unfinished aluminum or with black powder coat. Optional yellow or green powder coat or custom colors available.

**Solar Panel**

Module shall include one 18 V solar panel rated at 30 W. Optional 50 W solar panel available. Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Module shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented toward the equator with no additional mounting hardware.

**Batteries**

**Module shall include up to two 18 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free batteries. Each battery shall be equipped with a 15 A mini blade fuse.**

Batteries, in conjunction with recommended CWBF performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Batteries shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Individual batteries shall be supported and separated by standoffs.

**Small Solar Cabinet Power Module**

The small solar cabinet Power Module shall be constructed from 11-gauge aluminum. The battery shall be mounted inside the cabinet with no external control cabinet or battery cabinet required.

Cabinet shall be vented to provide cooling of the electronic system. The vents shall be screened to prevent ingress by insects and other debris.

Cabinet shall have tamper-proof hinged door with an integrated padlockable latch for use with lock shackles up to ¼". Optional industry standard #2 padlock available.

Cabinet shall have integrated mounting brackets to accept industry standard banding. Cabinet may optionally be fastened directly to a square post or other flat surface using through-bolts.

Cabinet shall have exposed spring-loaded push button terminal blocks for final electrical connections.

Cabinet shall include a 1.25**" trade size threaded pipe nipple to facilitate running wiring internal to a pole.**

Cabinet shall include nine drill indentations to facilitate various conduit fitting locations for running wiring external of a pole or post.

The overall cabinet weight (without battery) shall not exceed 10 lb (4.5 kg). Dimensions of the cabinet shall be 16.7**"** H x 11.3**"** W x 7.0**"** D (42.4 cm H x 28.7 cm W x 17.8 cm D).

Cabinet shall be available in unfinished aluminum or with black powder coat. Optional yellow, green or custom powder coat colors available.

**Solar Panel**

Module shall include one external 18 V solar panel rated at 50 W, 80 W or 170 W with mounting hardware and bypass diode(s). Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Solar panel with top of pole mounting shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented towards the equator with no additional mounting hardware. Solar panel with side of pole mounting shall have adjustable tilt angle – including 45 degrees, and shall have the ability to be oriented towards the equator with no additional hardware.

**Battery**

**Module shall include one 18 Ah, 35 Ah or 55 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free battery. Battery shall be equipped with a 15 A mini blade fuse.**

Battery, in conjunction with recommended CWBF performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Battery shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Battery shall be supported from the sides by rubber bumpers.

**Large Solar Cabinet Power Module**

The large solar cabinet Power Module shall be constructed from 10-gauge aluminum. The battery shall be mounted inside the cabinet with no external control cabinet or battery cabinet required.

Cabinet shall be vented to provide cooling of the battery and electronic system. The vents shall be screened to prevent ingress by insects and other debris.

Cabinet shall have an integrated industry standard #2 lock and tamper-proof hinged door. Optional padlockable latch for use with lock shackles up to ¼".

Cabinet shall have integrated mounting brackets to accept industry standard banding or optional U-bolts. Cabinet may optionally be fastened directly to a square post or other flat surface using through-bolts.

Cabinet shall include a 1.25**" trade size threaded pipe nipple to facilitate running wiring internal to a pole.**

Cabinet shall include three drill indentations to facilitate various conduit fitting locations for running wiring external of a pole or post.

Cabinet shall have industry standard barrier type terminal blocks exposed for final connections.

The overall cabinet weight (without battery) shall not exceed 19 lb (8.6 kg). Dimensions of the cabinet shall be 21.9**"** H x 16.1**"** W x 8.3**"** D (55.6 cm H x 40.9 cm W x 21.1 cm D).

Cabinet shall be available in unfinished aluminum or with black powder coat. Optional yellow, green or custom powder coat colors available.

Optional cabinet door switch available for SMS and/or email notifications of ingress and egress of the system. If module cabinet door is not fully closed and locked a digital alarm shall remain present on the system, which can be viewed locally on-site (see Section 6) and remotely (see Section 7).

**Solar Panel**

Module shall include one external 18 V solar panel rated at 50 W, 80 W or 170 W with mounting hardware and bypass diode(s). Nominal voltage of the solar panel shall be 12 V. Electrical connections on the back of the solar panel shall be contained within an IP65 enclosure that prevents accidental contact with either of the power leads.

Solar panel with top of pole mounting shall be supplied with a fixed tilt angle of 45 degrees and shall have the ability to be oriented towards the equator with no additional mounting hardware. Solar panel with side of pole mounting shall have adjustable tilt angle – including 45 degrees, and shall have the ability to be oriented towards the equator with no additional hardware.

**Battery**

**Module shall include one 35 Ah, 55 Ah or 100 Ah 12 V nominal sealed valve-regulated AGM lead-acid maintenance free battery. Battery shall be equipped with a 15 A cartridge fuse. Supplemental battery fusing shall include a 15 A mini blade fuse at the Power Module circuit board.**

Battery, in conjunction with recommended CWBF performance, shall be designed for a demonstrable service life of 5 years.

The operating temperature range of the battery shall be -40° to 140°F (-40° to 60°C).

Battery shall have quick connections to facilitate installation and be readily available from multiple suppliers and non-proprietary.

Battery shall be supported from the sides by rubber bumpers.

1. **Flasher Modules**

**The CWBF shall come standard with one or more LED beacons. Optional LED sign(s) shall be available in conjunction with LED beacon(s) or standalone.**

**LED Beacon**

**The LED beacons shall conform to the Standard of the Manual of Uniform Traffic Control Devices (MUTCD) 2009 with May 2012 Revisions 1 and 2 or TAC guidelines within the MUTCDC.**

**LED beacon shall only require an input of 12 VDC nominal for operation and shall contain its own active electronics including an LED driver and flasher. LED beacon shall operate out-of-the-box with applicable flash pattern, daytime intensity and nighttime intensity settings. Configuration switch shall be available to adjust between unison and alternating flash patterns.**

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

**The CWBF shall be capable of driving beacons at ITE-compliant intensities if solar conditions and programming configuration permit.**

**LED beacons shall be available in red and yellow in 12" (305 mm) and 8" (203 mm) diameters.**

**LED beacon optics shall be premium, UV-resistant polycarbonate.**

**Signal Housing**

**The signal housing shall meet the equipment standard of the Institute of Transportation Engineers (ITE) Vehicle Traffic Control Signal Heads (VTCSH) Chapter 2.**

**The signal head’s bracket assembly shall be constructed such that the signal head can be removed easily in the field.**

**The signal housing must be able to rotate** **independently from the Power Module or bracket for lens alignment.**

**The signal housing shall be** **constructed from either UV-resistant polycarbonate or aluminum. The signal housing shall be available in yellow and black with optional green.**

**Signal housing shall be rated to a minimum of NEMA 3R.**

Signal heads shall be capable of being mounted to a post or pole using a separate bracket assembly to facilitate mounting multiple beacons in either vertical, horizontal, or back-to-back (bi-directional) arrangements. **Self-contained Power Modules shall also be capable of direct attachment to the top of a signal head.**

**LED Sign**

**The CWBF shall be available with optional LED sign(s).**

**LED sign shall only require an input of 12 VDC nominal for operation and shall contain its own active electronics** **including an LED driver and flasher. LED sign shall operate out-of-the-box with applicable flash pattern, daytime intensity and nighttime intensity settings.**

**The purpose-built junction box shall be integrated into the sign mount and shall completely conceal electrical connections to discourage vandalism. The junction box shall be constructed of glass-fiber reinforced plastic for additional impact resistance and shall provide a high degree of weather resistance.**

Module shall have exposed spring-loaded push button terminal blocks for final electrical connections.

**The LED wiring shall be covered by aluminum channels. There shall be no gaps or exposed wiring between the channels and LED modules or from the sign to the pole. All harnessing must be concealed and vandal resistant.**

**LED sign shall be available as:**

* **W3-1 (Stop Ahead, in 36**" **or 48**" **sizes)**
* **R1-1 (Stop, in 30**"**, 36**" **or 48**" **sizes)**
* **R5-1a (Wrong Way, in 42**" **x 30**"**)**

**The sign sheeting shall be 3M High Diamond Grade DG3 retroreflective with 3M anti-graffiti and overlay film or High Intensity Prismatic sheeting. Sheeting color and color combinations will vary by applications but will include yellow and red options.**

The LED sign shall consist of eight yellow or red high-power LEDs in waterproof, polycarbonate impact-resistant housings, rated to a minimum of NEMA 3R, that can be driven at a high intensity. Each individual LED housing shall be tested for shock and vibration as part of the manufacturing process.

The LED optics shall be integrated total internal reflection (TIR) for optimal light efficiency and shall be premium, UV-resistant polycarbonate. The optics shall be purpose-built by the **CWBF manufacturer** for optimal intensity.

In the event a single LED fails, all other LEDs shall continue to operate.

The LED bezel shall be black (W3-1) or red (R1-1 and R5-1a) and placed within the border of the sign for enhanced LED contrast and increased visibility.

LED signs shall be able to be mounted in a single or back-to-back (bi-directional) configuration.

Mounting options shall include both banding and bolting to all specified pole types.

**Optional Z-bar mounting kits shall be available for high wind zone regions.**

1. **Operation and Configuration**

**Operation**

**The CWBF, once powered up, will immediately begin flashing in a 24-7 mode. CWBF shall be operational upon** **power-up without any on-site configuration required.** **Operating mode shall be adjustable for triggered operation when using optional vehicle detection radar.**

**CWBF shall have low voltage disconnect (LVD) protection to aid in preventing fully discharging the battery(s). When in LVD the beacon(s) shall not flash.**

**Configuration**

**The CWBF shall contain a button to activate a multi-colored status LED for on-site troubleshooting. Status LED shall be capable of displaying:**

* **No fault detected**
* **System is charging via solar panel**
* **Fault detected**
* **System is in low voltage disconnect (LVD)**

**CWBF shall use integrated Global Positioning System (GPS) for determining location and time. GPS shall be used to determine day or night status. The CWBF shall determine dusk and dawn times based on location and time of year.** **Day or night status shall be used for the beacon to apply daytime or nighttime intensity values.**

**CWBF beacon(s) shall flash using an MUTCD-compliant flash pattern at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall not be less than one-half and not more than two-thirds of the total cycle (for beacon equipped CWBFs).**

**CWBF shall provide configurable daytime and nighttime intensity settings ranging from 10% to 100% of factory defaults.**

**Radio System**

**The CWBF shall be equipped as standard with a 2.4 GHz radio with externally mounted antenna.**

**CWBF shall synchronize with other CWBFs linked with the same network parameters by wireless communication within 1000' (304 m).**

**CWBF shall have 16 unique channels that can be configured on-site to avoid local wireless congestion.**

**CWBF shall have “unlimited” unique network parameter combinations to create a link between more than one system.**

**The antenna shall be field replaceable without requiring system disassembly or entering the Power Module.**

**Optional remotely mounted antenna shall be available to improve communications with advanced beacon systems and shall have the ability to be installed without system disassembly or entering the Power Module.**

**Options**

**CWBF shall be available with optional** external weather-proof box, including harnessing, for manual activation. Box shall include a toggle switch for continuous activation or beacon(s) off.

**CWBF shall be available with optional external radar for vehicle detection. The beacon(s) shall begin flashing, for a programmed duration, whenever a vehicle is detected.** **Upon detection of a vehicle, the Power Module shall broadcast an activation to all other nearby CWBFs sharing the same network parameters.**

**Vehicle Detector Radar**

 Detector shall be Doppler radar. Detector shall meet specifications for an FCC part 15 Low Power Device - 24.150 GHz (K-band) and shall not require an operating license.

Detector shall have a reporting accuracy of ±1 mph and shall be set to detect approaching vehicles only.

Detector shall be capable of detecting vehicles from 1 mph to 206 mph.

Detector shall have a detection range of up to 2000 ft., output power of 20 dBm, and a beam angle of 9 x 18 degrees.

Detector shall operate on voltages from 5 VDC to 24 VDC and shall typically consume 0.010 A at 12 VDC.

Detector shall a be self-contained unit, housed in impact-resistant, outdoor-rated plastic, with a single multi-conductor cable connecting it to the Power Module and system controller.

* Detector dimensions: 4.1" x 3.7" x 1.1"
* Weight: 0.6 lbs.

Detector shall be furnished with a mounting bracket that will enable aiming of the radar beam in the direction of approaching vehicles independent of the Power Module or mounting pole orientation. Detector can be adjusted left-to-right and up-and-down to suit the roadway.

The system shall be configurable such that the detector can be mounted remotely from the system controller and Power Module via a wired connection.

Detector shall be IP68 with an operating temperature range of -40° to 185°F (-40° to 85°C).

Detector shall be field-configurable with the following attributes:

* Speed units (mph, kph, fps, mps)
* Minimum detectable speed
* Maximum detectable speed
* Detection sensitivity
* Detection direction
* Range boost
* Slow speed target filtering

A suitable interface cable shall be provided for the purpose of on-site configuration and connection between the system controller and a local computer.

Radar shall have the ability to be programmed by a standard laptop or PC with a Windows 7/10/11 operating system and shall support 32- and 64-bit operation.

**6.0 Local Connectivity**

**The** **CWBF shall have integrated Bluetooth Low Energy (BLE) local communications for on-site configuration and diagnostics via a purpose-built mobile app by the CWBF manufacturer.** The mobile app shall be available free of charge on the Apple App Store or Google Play Store for compatible devices.

Mobile app, in conjunction with CWBF, shall contain “bank-level” security. The mobile app shall “pair” with the CWBF using a “digital key” via one of two methods:

* Pairing button **shall** be pressed inside the Power Module, or
* System has a valid existing remote connectivity plan (see Section 7). Digital key is sent automatically, for authorized account users, to the app with a cellular connection

If the pairing button is used the mobile app shall retain the digital key for 14 days. After 14 days has elapsed the user automatically reacquires the digital key through the login procedure in the mobile app.

Mobile app shall not require a system password, passcode or any default method of security for system access.

Mobile **app shall display all CWBFs within Bluetooth range that can establish a connection.**

Mobile app shall have the functionality to identify the presently connected system by temporarily activating the beacon with a unique quick flash. If the beacon is actively flashing, the beacon shall temporarily stop and initiate the unique quick flash for system identification before resuming normal operations.

**Mobile app** shall have the functionality to **perform a system reboot without needing physical access to the system.**

Mobile **app shall report any faults in human readable form. If more than one fault is detected, each fault shall be listed separately. Fault messages shall clear automatically if the fault condition has been resolved.**

Mobile **app shall be capable of over-the-air software updates.**

Mobile **app shall be capable of over-the-air firmware updates to Power Modules and Flasher Modules.**

Mobile **app shall be capable of modifying the following parameters:**

* **System name for on-site and remote identification**
* **Operation mode**
* **Daytime intensity**
* **Nighttime intensity**
* **Network linking**
* **Network channel (11 – 26)**
* **Door switch alarm (enabled or disabled)**
* **Rotate digital key (for security purposes)**

Mobile **app shall be capable of displaying the following read-only parameters:**

* **System status**
* **System voltage**
* **Solar panel voltage**
* **Charge current**
* **CPU temperature**
* **System date and time**
* **Power Module part number**
* **Power Module serial number**
* **Power Module first activation date (date Power Module first powered up)**
* **Power Module firmware version**
* **Latitude and longitude of system**
* **Flasher Module part number**
* **Flasher Module serial number**
* **Flasher Module first activation date (date Flasher Module first powered up)**
* **Linked systems**

Mobile **app shall be capable of providing in app fault alerts:**

* **Power Module communication error**
* **Power Module cabinet door switch open**
* **Overcurrent/short circuit detected**
* **Flasher Module open/short circuit detected**
* **No battery detected**
* **Battery voltage very low**
* **Low voltage disconnect (LVD)**
* **Cellular communication error**
* **Status wire communication error**
* **Flasher Module removed from system**
* **System knockdown**
* **Integrated relay overcurrent/short circuit detected**
* **Accelerometer communication error**
* **No charging for >24 hours**
* **High temperature alarm**
* **Synchronize wire short**
* **Memory full error**
* **Internal memory corrupt**
* **External memory corrupt**
* **Flasher memory corrupt**

Mobile **app shall have access to digital user guides and live chat support (during normal business hours).**

1. **Remote Connectivity**

**Overview**

The CWBF shall be equipped as standard with integrated remote connectivity. Subscription **shall** include 3 years of enhanced-level features.

Connectivity solution **shall** be purpose-built by the CWBF manufacturer, not require any external/third-party control box or device and shall include a SIM card. Remote connectivity shall be cloud-hosted software with web-based user access. Other software or IT infrastructure shall not be required for installation or maintenance.

**Remote connectivity shall use the LTE-M wireless broadband network. SIM card shall be network provider agnostic and support major wireless carriers in the United States and Canada. LTE-M modem shall automatically connect to the best available network for the installation location. If cellular service is interrupted or unavailable, LTE-M modem shall automatically connect to the next available network provider.**

User interface shall be web-based and viewable using any modern browser on a PC, laptop or mobile device with a cellular or Wi-Fi connection. **Remote connectivity shall be mobile friendly and operate without requiring a static IP address.**

**Each CWBF shall have an externally-mounted, combination GPS/cellular antenna for geolocation and date/time.**

**Remote connectivity shall be capable of over-the-air software updates without requiring user interaction.**

**The CWBF shall be capable of receiving over the air updates for both Power and Flasher Modules.**

**Basic level subscription, with limited feature set, shall be included for 3 years at no cost. Additional enhanced-level subscription plans shall be available.**

**Features, Operation and Configuration**

**Enhanced-level subscription shall include the following additional features:**

* **System performance charting for previous 180 days**
* **System knockdown alerts via SMS and/or email**
* **Enhanced system security with ability to lock out local on-site pairing with mobile app**
* **Remote programming, including the ability to strategically adjust the operational mode on individual or all systems within the account from one screen. This is primarily used for temporarily turning the flashers modules on or off at any given time without having to access each individual system.**

The user interface dashboard shall provide an overview of all systems without having to leave the page. Dashboard shall provide the following information:

* System name
* System application identifier
* System serial number
* System status
* Subscription type
* Operation mode
* Local pairing lockout status

Dashboard **shall** have a filter to show:

* All systems
* Systems with alerts only
* Systems with critical alerts only
* Systems with expired subscriptions only

Dashboard shall separate a list of uniquely linked systems and others that are not linked.

Dashboard **shall** include a scrollable, zoomable map display, with the CWBF shown as a representative icon on the map. The map display **shall** have the option of satellite view or standard street view. The map shall include the ability to see the CWBF icons using Google Maps, with the ability to view the location with Google Street View. Icons **shall** change color based on system status with green indicating system is operational, yellow indicating an abnormal condition, and red indicating a critical fault. Map shall automatically adjust to show a geofenced area with a view of all systems.

**CWBF shall report in every fifteen minutes with the following information:**

* **Most recent battery voltage**
* **Most recent solar voltage**
* **Most recent charge current**
* **Most recent CPU temperature**
* **Most recent cellular signal strength**
* **Most recent cellular signal to noise ratio**
* **Charting with 180 previous days of data for the items above**

**User shall have the ability to request updated system data at any time on a self-serve basis. Dashboard shall reflect the time since last report.**

**User shall have the ability to refresh system GPS location or manually override via a map view.**

User shall have the ability to manually log system notes for record keeping purposes.

User shall have the ability to change the following system parameters on a self-serve basis:

* **System name for on-site and remote identification**
* **Operation mode**
* **Daytime intensity**
* **Nighttime intensity**
* **Local pairing lockout**

When a fault occurs, real-time alerts shall be published via SMS and/or email. The alert shall be immediately sent to all users who have opted into one or both delivery methods.

**System, Subscription and User Management**

**System Management**

**System Management shall be restricted to administrators only and provide the following functions:**

* **View a list of all systems by system name/serial number showing status,** local pairing lockout status and last checked in date. System and serial number shall be searchable.
* **Transfer system ownership to another account’s administrator.**
* **Reset system “digital key”, which shall remove local on-site mobile app access to anyone who is not an authorized account user.**
* **Enable a lockout for local pairing, which disables the on-site pairing button for local access. Mobile app users** **will need to be an authorized user in order to receive the “digital key” to connect to the system.**
* **Disable a lockout for local pairing, which enables the on-site pairing button for local access. Mobile app users require access to pairing button to receive the “digital key” to connect to the system.**
* **Download a log of all system alerts and events from the past 180 days.**

**Subscription Management**

**Subscriptions shall be self-serve managed with the following functions:**

* **View a list of all systems with their current subscription level and expiry date**
* **View all available subscriptions that have yet to be applied to a system**
* **Apply an available subscription of the same level or higher to a system**
* **Transfer available subscriptions from one account to another**

**User shall have full access to the state of their system, which system subscriptions are expiring soon and inventory of available subscriptions.**

**User shall be able to procure additional subscriptions in advance of knowing specially to which systems the subscriptions may be applied to in the future.**

**Administrators shall receive an automated email notification for upcoming pending expiring subscriptions.**

**Upon expiration of connectivity subscription, the CWBF shall continue normal operation without interruption or change in performance. Local connectivity shall remain available for on-site configuration and diagnostics.**

**User Management**

**The initial account administrator shall be automatically assigned by the CWBF manufacturer. Additional users shall be invited by the administrator for account access. Administrators shall have the ability to invite additional users with the following roles:**

* **Administrator – highest level of account authority. Can manage all account aspects including adding/removing users and transferring system ownership**
* **Operator – can manage and edit all systems**
* **Field Technician – can access the system on-site with a “digital key” and without need to “pair” with the system, for use with mobile app (see Section 6). Field Technician role shall not have the ability to view systems remotely.**
* **Observer – read-only access**

**All user roles, aside from Field Technician, shall have the following functions:**

* **Self-serve password change**
* **Self-serve SMS and/or email alert preferences**

**User Management shall be restricted to administrators only and** **shall provide the following functions:**

* **View a list of all user’s names, emails, user’s roles and last login date**
* **Change user’s role**
* **Invite a user**
* **Delete a user**

**Providing an invitation to new user shall require only a valid email address and required user role.**

1. **Solar Simulations (If Applicable)**

Detailed solar simulations shall be provided as evidence that the system is capable of year-round performance at a specific location. Solar simulations shall be composed of three calculations: Energy Balance, Array-to-Load Ratio (ALR), and Autonomy. The manufacturer or bidder shall provide a detailed analysis of these three calculations in a “Solar Power Report” (SPR).

Monthly average sunlight (insolation), night length and temperature data for a specific location shall be from recognized public sources such as the NASA Atmospheric Sciences Data Center.

**Energy Balance**

During a normal 24-hour cycle of operation, a system shall take energy in from the sun and consume energy through the flashing of the beacon and general quiescent power draw. Energy Balance refers to the evaluation of these energy values to determine system sustainability with respect to variances in sunlight and system load.

Energy Balance compares Energy-In and Energy-Out. Calculations shall be performed for the “worst month” of the year where worst month is determined by the lowest value of Energy-In divided by Energy-Out.

**Energy-In**

Energy-In is the total amount of sunlight energy in watt-hours *available* to the system over a 24-hour period. Energy-In is available to operate the beacon, charge the battery(s), or both. Energy-In shall be determined as follows:

* Insolation X panel wattage X shading X charging efficiency X battery charge acceptance
	+ The energy from the solar panel shall be based on available solar radiation at the installation location for the panel’s inclination angle. The solar radiation (insolation) values used shall be for the worst-case month of the calendar year.
	+ Shading from nearby trees, buildings, or other structures unique to a particular location are to be factored-in and the calculations shall clearly show and justify the de-rating of the solar panel energy input. A photograph showing the sun’s path and obstructions it encounters shall be included.
	+ Battery(s) shall be returned to full or close to full charge by sunset at the end of each day.

**Energy-Out**

Energy-Out is the total amount of energy in watt-hours consumed by the system in a 24-hour period of normal operation.

Energy-Out is the sum of quiescent and operating loads, measured in watt-hours, in all circuitry over 24 hours, including:

* Controller quiescent draw (during and between flashes)
* Wireless quiescent draw calculated over 24 hours
* Operating load of beacon at rated intensity per activation. The number of beacons and their electrical load details (voltage, current and power when lit) shall be clearly indicated
* Energy adjustments due to LED drive circuit efficiency
* The simulations shall clearly detail the flash pattern being used and calculate the duty cycle of the pattern
* Calculations shall assume 24-hour continuous flashing unless otherwise noted

**ALR (Array-to-Load Ratio)**

System Array-to-Load (ALR) ratio shall be calculated as:

* Daily Available Energy-In divided by daily Energy-Out, as defined above

Solar simulations shall be calculated demonstrating a minimum Array-to-Load (ALR) ratio of 1.2:1 (1.2).

**Autonomy**

Autonomy is the number of days that the CWBF can continue to operate normally in the absence of any solar charging. Autonomy shall be calculated as follows:

* (Nominal battery capacity de-rated for temperature minus battery capacity unavailable due to Low Voltage Disconnect) divided by (daily total energy consumption at the specified operational duty cycle)

CWBF autonomy shall be determined based on regional requirements – at a minimum of 7 consecutive days.

1. **Custom Build**

**Fill out the table below to create a CWBF custom build:**

|  |  |  |
| --- | --- | --- |
| **Section 2 – Mechanical and Electrical** | Power Module Mounts | [ ]  2" – 2.5" perforated square post mount [ ]  3.5" – 4.5" diameter round pole mount[ ]  2.38" – 2.88" diameter round pole mount [ ]  Wooden Pole |
| **Section 2 – Mechanical and Electrical** | Power Module Orientation | [ ]  Top of pole[ ]  Side of pole |
| **Section 3 – Mechanical and Electrical** | Power Modules | [ ]  Small self-contained solar [ ]  Small solar cabinet [ ]  Large self-contained solar [ ]  Large solar cabinet  |
| **Section 3 – Mechanical and Electrical** | Power Module Colors | [ ]  Unfinished aluminum [ ]  Green powder coat[ ]  Black powder coat [ ]  Custom \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_[ ]  Yellow powder coat   |
| **Section 3 – Mechanical and Electrical** | Solar Panels(self-contained solar only) | [ ]  15 W (small only) [ ]  30 W (large)[ ]  50 W (large) |
| **Section 3 – Mechanical and Electrical** | Solar Panels (solar cabinet only) | [ ]  50 W[ ]  80 W[ ]  170 W |
| **Section 3 – Mechanical and Electrical** | Batteries (self-contained solar only) | [ ]  1x 7 Ah (small only) [ ]  1x 18 Ah (large only) [ ]  2x 7 Ah (small only) [ ]  2x 18 Ah (large only)  |
| **Section 3 – Mechanical and Electrical** | Batteries (small solar cabinet only) | [ ]  1x 18 Ah[ ]  1x 35 Ah[ ]  1x 55 Ah  |

|  |  |  |
| --- | --- | --- |
| **Section 3 – Mechanical and Electrical** | Batteries (large solar cabinet only) | [ ]  1x 35 Ah[ ]  1x 55 Ah[ ]  1x 100 Ah  |
| **Section 3 – Mechanical and Electrical** | Option (small/large self-contained solar only) | [ ]  Optional #2 padlock  |
| **Section 3 – Mechanical and Electrical** | Option (small solar cabinet only) | [ ]  Optional #2 padlock  |
| **Section 3 – Mechanical and Electrical** | Large Solar Cabinet Options | [ ]  Optional padlockable latch [ ]  Optional door switch   |
| **Section 4 – Flasher Modules** | Flasher Modules | [ ]  LED Beacon [ ]  Optional LED Sign |
| **Section 4 – Flasher Modules** | Flasher Module Colors | [ ]  Black powder coat [ ]  Yellow powder coat [ ]  Green powder coat   |
| **Section 4 – Flasher Modules** | LED Sign Option | [ ]  Optional U-bolts  |
| **Section 5 – Operation and Configuration** | Options | [ ]  Optional External Radar[ ]  Optional Manual Switch Box |
| **Section 7 – Remote Connectivity** | Enhanced Subscription Plans | [ ]  1 year [ ]  6 years  [ ]  2 years [ ]  7 years [ ]  3 years [ ]  8 years  [ ]  4 years [ ]  9 years [ ]  5 years [ ]  10 years   |

1. **Packaging**

Packaging shall consist of only recyclable corrugated cardboard and soft plastic bags.

1. **Qualifications**

The CWBF shall be FCC certified to comply with all 47 CFR FCC Part 15 Subpart B Emission requirements.

The CWBF shall be manufactured in the USA and shall be Buy American and Build America, Buy America (BABA) compliant.

The Manufacturer shall provide a 3-year Limited Warranty, with the exception of the battery(s) which shall be covered by a 1-year warranty.

The Manufacturer shall be ISO 9001 certified.

The CWBF shall be a standard configuration and ship within 10 business days from receipt of order.

The CWBF shall be manufactured by Carmanah Technologies.

Manufacturer: Carmanah Technologies Inc.

Model: R247-MX solar Connected Warning Beacon Flasher

Toll-Free: 1-877-722-8877

[www.carmanah.com](http://www.carmanah.com)