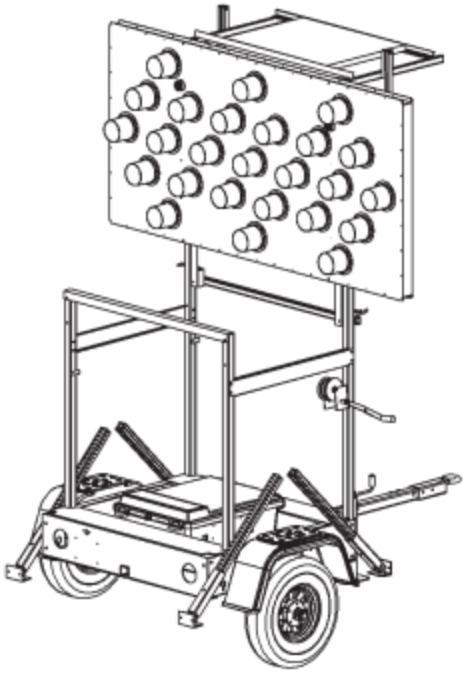
Silent Sentinel
Solar Powered Advanced Warning

Arrow Panels

Procurement Specifications



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This document presents a detailed specification for Advanced Warning (flashing) Arrow Panels. This specification typically requires additions and/or modifications to meet a user's specific requirements.

This specification is subject to periodic revisions as required without notice.

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1. General

1.1 Product Description

The **SILENT SENTINEL** is a solar powered advance warning (flashing) arrow panel (FAP). The **SILENT SENTINEL** consists of an arrow display panel, a supporting structure for the display panel, a photovoltaic array, a battery power supply and an electronic control console, all mounted on a heavy-duty trailer frame.

1.2 Design Objectives

1.2.1 Maximize reliability by using generally accepted design techniques for outdoor-use electrical and electronic equipment.

1.2.2 Minimize operating cost by using a renewable energy source, requiring minimal maintenance.

1.2.3 Maximize safety and effectiveness by using a high contrast arrow display panel with long-life expectancy, high-reliability LED lamp technology.

1.2.4 Meet or exceed the standards for Arrow Boards as listed in the U.S. Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD).

1.3 Performance Objectives

1.3.1 Visibility greater than 1 mile.

1.3.2 Legibility at 1 mile.

1.3.3 Minimal glare from sunlight and headlights.

1.3.4 Continuous, uninterrupted operation on solar power.

1.3.5 One (1) month minimum, three (3) month typical maintenance interval.

1.4 Quality Assurance Objectives

1.4.1 All manufacturing shall be carried out in a facility with a completely implemented and properly maintained ISO 9001:2015 certified quality management system.

1.4.2 All units shall be tested to ensure that they are neither susceptible to nor produce any electromagnetic interference.

2. Physical

2.1 Dimensions

2.1.1 Length

Transport/Towing position	– 111 in. (282 cm)
Stowage/Operating position	– 122 in. (310 cm)

2.1.2 Width

Overall	– 96 in. (244 cm)
Across fenders	– 76 in. (193 cm)

2.1.3 Height

Transport/Towing position	– 92 in. (234 cm)
Stowage/Operating position	– 137 in. (348 cm)

2.1.4 Ground Clearance – 13.5 in. (34 cm)

2.1.5 Weight – 1,200 lbs. (544 kg)

2.2 Environmental

2.2.1 Temperature, operating and storage - -40 to +185 °F (-40 to +85 °C)

2.2.2 Relative Humidity - 20% to 98%, non-condensing

2.2.3 Wind

2.2.3.1 Transport position, maximum towing speed - 70 MPH (112 KPH)

2.2.3.2 Operating position, max. height, outriggers in place – 65 MPH (105 KPH) sustained (Standard), 60 MPH (97 KPH) sustained (ECO)

2.2.3.3 Operating position, max. height, outriggers in place with additional ballast - 80 MPH (128 KPH) sustained

2.2.4 Electrical Interference - Unaffected by RFI (Radio Frequency Interference) and EMI (Electromagnetic Interference).

3. Trailer Chassis and Sign Support

3.1 Trailer Chassis

3.1.1 Frame Construction

3.1.1.1 Trailer frame shall be constructed of welded 7 Gauge (3/16-inch) CNC formed steel plate and structural steel tubing with 3 x 3 x 3/16 inch structural steel tubing receiver for the tongue, reinforced and welded to the front crossmember.

3.1.1.2 Trailer shall be equipped with a 2 1/2 x 2 1/2 x 3/16 inch structural steel tubing receiver capable of accepting a standard Class 2 (II) drawbar and hitch pin to accommodate tandem towing. The rear hitch receiver shall be reinforced and welded to a 7 Gauge (3/16-inch) CNC formed steel plate rear cross member. Tandem trailer towing using rear hitch receiver is intended for off road use only and is subject to local laws and regulations!

3.1.1.3 The trailer tongue shall consist of 2 1/2 x 2 1/2 x 3/16 inch structural steel tubing. The tongue shall bolt into the tongue receiver to facilitate easy removal of the tongue for repair, transportation, or security purposes. The trailer tongue shall be equipped with a 2,000-pound minimum capacity swivel-type top-wind screw jack with a formed steel footpad.

3.1.1.4 Trailer frame shall be equipped with tie down points to facilitate securing unit to utility trailer or truck deck for transport.

3.1.2 Suspension

3.1.2.1 Trailer shall be equipped with an independent suspension, torsion-type axle with a 2,000 pound overall capacity. Axle load capacity shall be set at 1,400 pounds.

3.1.2.2 Axle wheel spindles shall be equipped with grease fittings to accommodate wheel bearing lubrication.

3.1.3 Coupler

3.1.3.1 Trailer tongue shall be capable of accepting a 2-inch ball coupler, a 2 1/2-inch pintle ring, an optional removable combination coupler (2-inch ball coupler & 2 1/2-inch pintle ring), or an optional adjustable height coupler (2-inch ball coupler and/or 3-inch pintle ring).

3.1.3.2 Trailer shall be equipped with 1/4-inch safety chains with snap-type hooks for secure attachment to tow vehicle hitch.

3.1.3.3 All coupler and safety chain configurations shall comply with SAE J684 standards for Class II (2) trailers.

3.1.3.4 Hitch Heights

- Pintle couplers are measured from the ground to the bottom of the pintle ring.

- Ball couplers are measured from the ground to the top of the ball socket.

Tongue Angle	2 ½" Pintle	2" Ball	3 Position Pintle	3 Position Ball	6 Position Pintle	6 Position Ball
-1°	18"	18 ¾"	17"-21"	18 ¾"-22 ¾"	17"-27"	18 ¾"-22 ¾"
-4°	13 ¾"	14"	12 ¾-"16 ¾"	14"-18"	12¾"-22¾"	14"-24"

3.1.3.5 Tongue length shall be approximately 56 inches (measured from the centerline of 2-inch ball)

3.1.4 Surface Preparation and Finishing

3.1.4.1 Trailer chassis and superstructure shall be completely cleaned and deburred prior to finishing. All metal surfaces shall be prepared for finishing using an iron phosphate wash-down process.

3.1.4.2 A polyamide epoxy primer shall be applied to a dry film thickness of 1.5 mils.

3.1.4.3 A high gloss federal safety orange aliphatic acrylic urethane finish shall be applied to a dry film thickness of 1.25 mils.

3.1.5 Lighting

3.1.5.1 Trailer shall be equipped with sealed flush-mounted combination stop, tail and turn lights.

3.1.5.2 Trailer shall be equipped with a lighted license plate holder.

3.1.5.3 Trailer wiring harness shall be completely sealed and water resistant.

3.1.6 Fenders

3.1.6.1 Trailer shall be equipped with unbreakable, molded, solid color, UV-stabilized HDPE (High Density Polyethylene) fenders, completely closed on the inside.

3.1.6.2 Fenders shall be secured to trailer frame with zinc-plated steel thread forming screws and fender washers to facilitate easy repair or replacement.

3.1.7 Leveling Jacks

3.1.7.1 Trailer shall be equipped with four (4) telescoping jacks consisting of 2" x 2" x 12 Gauge perforated galvanized steel tubing equipped with a 3" x 3" x 3/16" x 6 inch wide steel foot plate.

3.1.7.2 Jack stands shall be inserted into 2 ¼" x 2 ¼" x 12 Gauge galvanized steel tubing, welded to the trailer frame at a 45 degree angle.

3.1.7.3 Jack stands shall be locked into position by 3/8-inch zinc-plated steel tab lock pins secured to trailer frame by nylon-coated stainless steel lanyards.

3.1.7.4 Jack stands and tongue jack shall be configured such that unit can be set up on jack stands, level, in operating position, with the trailer wheels raised completely off the ground, permitting removal of wheels and tires for additional security.

3.1.7.5 Jack stands shall be configured such that, when in the operating position, they create a footprint of at least 93 inches (236 cm), front to rear, and 61 inches (155 cm), side to side, to provide adequate stability of unit in high winds.

3.1.8 Tires and Wheels

3.1.8.1 Tires shall be ST175/80 R13 Load Range C.

3.1.8.2 Wheels shall be 13-inch x 4 1/2-inch, 5-lug pattern (4 1/2-inch bolt circle), white steel wheel.

3.1.8.3 Wheels and tires shall be sized according to load requirements of trailer and axle.

3.2 Arrow Panel Support

3.2.1 Trailer superstructure shall provide complete support of the arrow panel in the transport (down) position. Cantilevered support of arrow panel is not acceptable!

3.2.2 Trailer superstructure shall be completely assembled with removable fasteners to accommodate quick, easy maintenance and repair.

3.2.3 All fasteners shall be rust resistant and equipped with either all metal (stover) or nylon lock stop-nuts to prevent loosening of fasteners during normal transportation and operation.

3.2.4 Arrow Panel Lifting Mechanism

3.2.4.1 Arrow panel lifting mechanism shall consist of a minimum 1,000-pound capacity, automatic brake type winch with 1/4-inch wire rope capable of holding the arrow panel in any position from full upright to the travel (down) position.

3.2.4.2 Winch shall be zinc-plated to minimize rust and corrosion.

3.2.4.3 Winch shall be designed such that the handle can be removed, for added security, without interfering with the operation of the automatic brake.

3.2.4.4 Arrow panel shall be secured in the operating (up) position by two (2) stainless steel, spring-loaded, locking pins. Locking of the arrow panel in the down position shall not be required; however, available as a field installable option.

3.2.5 Trailer superstructure shall provide for support and operation of solar array, with solar array positioned to accommodate charging in both the operating and transport positions.

3.2.6 Solar array shall fold flat and flush onto back of arrow panel when arrow panel is in the transport (down) position to minimize wind resistance without the need for an air deflector or spoiler.

3.2.7 Trailer superstructure shall be equipped with a steel angle upper rear crossmember and formed steel upper side members to reinforce the arrow panel and solar array support frame.

3.2.8 Trailer superstructure shall be equipped with an integral sighting device, welded in place, to accommodate proper alignment of the arrow panel with oncoming traffic, during setup.

4. Arrow Panel

4.1 Dimensions

4.1.1 Width Overall – 96 in. (244 cm)

4.1.2 Height Overall – 48 in. (122 cm)

4.1.3 Depth Overall – 3 in. (7.6 cm)

4.2 Construction

4.2.1 Arrow panel frame, including internal braces, shall consist of 3 x 1 x 1/8 inch extruded aluminum alloy channel, MIG welded at corners and at internal braces.

4.2.2 Front and rear surfaces shall consist of .063 inch aluminum alloy sheet with a baked matte black enamel finish.

4.2.3 Front and rear panels shall be attached to welded aluminum frame with 8-32 x 3/8-inch, black-finish, stainless steel, torx-head, thread-rolling screws located on 6-inch centers. In order to facilitate simple repair, rivets or any other form of non-removable fastener shall not be permitted.

4.2.4 Arrow panel shall be equipped with 2 1/2-inch diameter by 1-inch thick rubber bumpers to support panel when in the transport (down) position.

4.2.5 Arrow panel shall be equipped with a light sensing device to monitor ambient light and provide information to the control module to regulate the intensity of the arrow panel lamps.

4.3 Lamps

4.3.1 Arrow panel shall be equipped with 15 or 25 lamps, approximately 5 inches in diameter.

4.3.2 Arrow panel lamps shall consist of an array of at least 20 LEDs mounted in a weather resistant high impact polycarbonate housing.

4.3.3 The arrow panel lamp housing shall be sealed to protect the internal components from corrosion caused by harsh environmental conditions.

4.3.4 The outer surface of the lamp shall be convex (diverging) to minimize reflection of incident light and to maximize the contrast of the arrow panel display.

4.3.5 The lamps shall provide an Approximate Initial Maximum Beam Candlepower of 1000 candela typical, 750 candela minimum, over an operating voltage range of 10.7 to 16.0 V_{DC}.

4.3.6 The lamps shall produce a field spread (angularity) of 30 degrees horizontal by 6 degrees vertical.

4.3.7 The color of the light produced by the lamps shall be amber (approximate wavelength of 592 nanometers).

4.3.8 The lamps shall have a minimum life expectancy of 100,000 hours (200,000 hours typical).

4.3.9 The lamps shall be equipped with quick disconnect terminals to accommodate quick, easy replacement of lamps.

4.3.10 Arrow panel lamps shall be secured to the arrow panel by a black, molded, impact-resistant shroud, approximately five (5) inches in diameter and approximately four (4) inches high. Lamp shroud shall mount to panel with stainless steel screws through keyholes such that the shroud and lamp can be removed from the panel without the need to remove the screws from the panel.

4.3.11 Arrow panel lamps shall be keyed to the shroud and the shroud shall be keyed to the front panel so the lamps are secured to the front panel with proper lamp beam orientation.

4.3.12 The rear of the arrow panel shall be equipped with three (3) ultra-bright LEDs, in watertight housings, to indicate the arrow panel pattern currently being displayed. This provides a visual indication to individuals in the work zone that the arrow panel is functioning properly.

4.4 Connectors and Wiring

4.4.1 Arrow panel shall be equipped with a watertight connector, AMP CPC Series 2 Receptacle P/N 205843-1 with Peripheral Seal P/N 2267473-3, or equivalent, to permit arrow panel to be removed easily for repair. Arrow panel control cable connector shall be suitable for outdoor use and completely sealed against moisture. Arrow panel control cable connector shall be equipped with gold flashed pins to provide maximum electrical contact reliability.

4.4.2 All internal wiring pass throughs shall be fitted with plastic grommets to prevent wire damage and/or failure.

4.4.3 All internal wiring shall be secured to inside of front panel to prevent wire damage and/or failure.

5. Main Control Module

5.1 Physical

5.1.1 Control module shall consist of a totally solid state fully integrated device which provides for wired or wireless control of the arrow sign panel, lamp pattern generation, battery status monitoring and indication, solar electric charge control, low battery voltage disconnect, high battery voltage disconnect, reverse battery polarity, surge protection and optional remote control and tracking via an integrated cellular/GPS transceiver module.

5.1.2 Control module shall be either enclosed in a weather resistant, lockable, molded HDPE (High Density Polyethylene) enclosure secured to the trailer chassis (Standard Model) or enclosed in a weather resistant enclosure mounted on the right upper side crossmember with a lockable steel cover (ECO Model).

5.1.3 Control module front panel shall be sealed to accommodate operation in all types of weather.

5.1.4 Control module shall be constructed of all industrial temperature range components to insure reliable operation under all outdoor environmental conditions.

5.1.5 Control module power and control cables shall be equipped with locking type connectors to provide secure reliable operation while permitting quick, easy removal of the control module for maintenance and repair.

5.2 General Operation

5.2.1 Local Control Operation

5.2.1.1 Control module shall be equipped with an array of membrane push buttons to enable an operator to select the desired arrow panel pattern with the push of a single button.

5.2.1.2 Control module shall be equipped with multicolored LED indicators for local monitoring of battery voltage (charge) level, solar charger activity, and lamp intensity control settings.

5.2.2 Remote Control Operation

(NOTE: Cellular/GPS connection is an optional upgrade)

5.2.2.1 Control module shall provide for remote control of the arrow panel, including geographic location monitoring, without the need for additional hardware, software, external computers or hand-held control devices.

5.2.2.2 Control module shall provide all necessary hardware and software to operate the arrow panel locally (via array of membrane pushbuttons) and remotely (via integrated cellular transceiver and antenna) control including geographic location monitoring (via integrated GPS module and antenna). Full remote control (including GPS mapping) via internet accessible server based remote control software shall be included free of charge from date of purchase (i.e., cellular service shall be included free from date of original purchase for life of the unit).

5.2.2.3 Control module operating processor, firmware and software shall be remotely upgradeable over an IP addressable network connection via the integrated cellular transceiver. Upgrades shall be provided by manufacturer free of charge for life of machine and automatically applied via integrated cellular transceiver and included remote control service from date of original purchase.

5.2.2.4 Control module embedded CPU shall incorporate an ARM based microprocessor design to ensure future hardware and software compatibility through upgrades provided by manufacturer free for life of the machine. Operating system shall be Linux based and include multiple watchdog timers to ensure automatic system restarts if any critical function stops working properly or communication with remote control servers is interrupted.

5.2.3 Control module shall employ lamp power drivers that provide completely automatic short circuit and over temperature protection. If lamp wire leads are shorted together or to the chassis or if the wrong type of lamp is connected to the lamp wire leads no damage should occur to the lamp power drivers.

5.2.4 Control module shall be completely protected against reverse battery and solar array connections.

5.2.5 Integrated charge control circuit shall provide for dual slope, temperature compensated control to maximize transfer of energy into the battery while protecting batteries from overcharging, minimizing outgassing and minimizing loss of electrolyte.

5.2.6 Control module shall be equipped with a lamp intensity control circuit to automatically adjust arrow panel lamp intensity for changing ambient lighting conditions and to maintain consistent lamp intensity over a wide operating voltage range. A manual override shall be provided for the automatic intensity control circuit so that minimum or maximum lamp intensity can be manually selected. If the lamp intensity control function is inadvertently left in the High or Low setting, the lamp intensity control circuit shall return to the Auto setting upon the occurrence of the first day/night cycle sensed by the light sensing device in the arrow panel. This feature prevents the use of potentially hazardous lamp intensities (i.e. low intensity during daylight hours and high intensity at night) and unexpected excess energy consumption.

5.2.7 Control module shall provide for the following display patterns:

Right Arrow	- 10 lamps flashing in unison, forming an arrow.
Left Arrow	- 10 lamps flashing in unison, forming an arrow.
Double Arrow	- 5 lamps in each arrow head, 3 in center of shaft, flashing in unison.
Caution Bar	- 7 lamps in center horizontal bar, flashing in unison.
Four-Corner Caution	- 4 lamps in outer most corners, flashing in unison.

Sequential Right Arrow - 2 lamps in left side of center bar in first phase, plus 3 lamps in middle of center bar in second phase, plus 5 lamps in arrow head in third phase flashing in sequence.

Sequential Left Arrow - 2 lamps in right side of center bar in first phase, plus 3 lamps in middle of center bar in second phase, plus 5 lamps in arrow head in third phase flashing in sequence.

25 Lamp Panels only:

Right Sequential Chevron - 5 lamps on left side of the panel forming a right-hand arrow head in the first phase, plus 5 lamps in the center forming a second right-hand arrow head in the second phase, plus 5 lamps forming a third right-hand arrow head on the right side of the panel in the third and final phase.

Left Sequential Chevron - 5 lamps on the right side of the panel forming a left-hand arrow head in the first phase, plus 5 lamps in the center forming a second left-hand arrowhead in the second phase, plus 5 lamps forming a third left-hand arrow head on the left side of the panel in the third and final phase.

Sequential Double Arrow - 1 lamp in the center of the panel in the first phase, plus the two lamps adjacent to the center lamp forming a bar in the center of the panel in the second phase, plus 5 lamps in each arrow head (total 10 lamps) in the third phase.

Alternating Double Diamonds - 8 lamps in the center of the panel forming a diamond shape in the first phase, dark in the second phase, 16 lamps forming diamond shapes at each end of the panel in the third phase, and dark in the fourth phase.

5.2.8 Control module power consumption, not including lamps, shall be less than 0.5 Watts to optimize overall energy consumption. Power consumption of control modules with cellular and GPS connection option shall be less than 1.3 Watts, not including lamps.

5.2.9 Control module operating firmware shall be field upgradeable.

5.2.10 Control module shall be equipped with positive locking connectors to provide for reliable operation and easy removal for maintenance and repair. Battery bank and solar array power connector shall be rated for a 13-Amp per contact minimum current rating to ensure minimum voltage drop and maximum energy transfer. Arrow panel control connector shall be AMP D-subminiature 37-pin right angle female header AMP P/N 5747847-6, or equivalent, with gold flashed pins for optimum reliability.

6. Power System

6.1 General

6.1.1 Operating Voltage - 12 Volts DC nominal

6.1.2 Operating Energy Requirement - Single Flashing Arrow, < 6 Amp Hours per day nominal at Spring or Fall Equinox (12 hours of daylight, 12 hours of darkness)

6.1.3 Main Power Switch - Main power switch shall be unnecessary. When arrow panel pattern selection switch is in the OFF position, control module shall automatically shut down all unnecessary operations to reduce energy consumption to less than 0.13 Watts (1.3 Watts for control modules with cellular/GPS connected). Solar generator charge controller shall operate automatically, as required, during daylight hours and shut down completely at night.

6.2 Battery Bank-Standard Model

6.2.1 Number of batteries – Two (2) standard, upgradeable to Four (4)

6.2.2 Battery type - 6-Volt DC, heavy duty, deep cycle – Specify Flooded Lead Acid, Gel-Cell or AGM

6.2.3 Energy capacity – 260 Amp-Hours (2 batteries) Sufficient energy capacity to operate the arrow panel, displaying a single flashing arrow for more than 30 days, without any energy input from the solar array. Upgradeable to 520 Amp-Hours (4 batteries).

6.2.4 Battery / Equipment Compartment

6.2.4.1 Battery / Equipment Compartments shall be constructed of molded HMWPE (High Molecular Weight Polyethylene), color impregnated with Federal Safety Orange with 0.5% UV stabilizer added to prevent fading.

6.2.4.2 Compartments shall be designed to completely contain spills from a failed or damaged battery case.

6.2.4.3 Compartments shall be capable of supporting an operator standing on top of the battery / equipment compartment to service unit.

6.2.4.4 Compartments shall be designed such that the lid automatically latches in the closed position and holds the batteries in place. Lid shall be equipped with a locking hasp capable of being locked in the closed position with a standard padlock.

6.2.4.5 Lid shall be secured to compartment by an integral hinge that permits the lid to be completely removed from the compartment for service.

6.2.4.6 Compartments shall be designed to provide adequate ventilation for the batteries during charging yet prevent the ingress of water during use or transport.

6.2.4.7 Compartments shall be capable of housing four (4) BCI Group GC-2 batteries.

6.3 Battery Bank-ECO Model

6.3.1 Number of batteries – Two (2) standard, upgradeable to Four (4) , Six (6), or Eight (8)
NOTE: Units with cellular/GPS connection option shall have, at a minimum, four (4) batteries

6.3.2 Battery type – 12-Volt, 21 Amp-hours, threaded inserts, sealed AGM

6.3.3 Energy capacity - 42 Amp-Hours nominal. Sufficient energy capacity to operate the arrow panel, displaying a single flashing arrow for more than 15 days, without energy input from the solar array for a 2-battery configuration without cellular and GPS connected control module. Upgradeable to 168 Amp-Hours (8 batteries)

6.3.4 Batteries shall be concealed and mounted under the front and rear crossmembers using a 1/8-inch steel formed bracket.

6.3.5 Battery polarity shall be indicated on the mounting bracket. Positive (+) and negative (-) markings are used to identify orientation of each battery.

6.3.6 Batteries shall be separated by a 1/8-inch high density polyethylene (HDPE) plate to prevent accidental shorting while connecting batteries.

6.4 Solar Array

6.4.1 Solar array shall remain horizontal in both the transport (down) and operating (up) positions. Solar array shall erect automatically when arrow panel is raised to operating position.

6.4.2 Photovoltaic module type - Single crystal (monocrystalline) silicon

6.4.3 Number of solar cells per module - 36

6.4.4 Solar array power output - 50 Watts, upgradeable to 110 Watts peak (min.)

NOTE: Solar energy system performance charts are available to assist in selection of appropriate solar array power output requirements

6.4.5 Entire unit shall tilt back and rest on jack stands for fast, easy cleaning and maintenance.

6.4.6 Solar array energy output shall be sufficient to operate the arrow sign, under normal operating conditions, with the solar array in a flat, horizontal position. It shall not be necessary to tilt or rotate the solar array to provide sufficient energy output from the solar array to operate the arrow panel continuously.

6.4.7 Photovoltaic module junction boxes shall be equipped with watertight strain reliefs at all cable entry points.

6.5 Wiring and Cabling

6.5.1 All external wire and cable shall be covered with a weatherproof jacket, rated for outdoor use, and secured to trailer frame or superstructure with UV resistant cable ties and anchors.

6.5.2 All wire and cable fittings shall be sealed at bulkheads or enclosure entry points.

6.5.3 All wiring shall be marine grade, multi-strand, tin or silver plated copper with PVC insulation rated for outdoor use.

6.5.4 All power system wire terminals shall be tin or silver-plated copper to minimize the effects of galvanic corrosion.

6.5.5 Main power wiring shall be 16 AWG minimum.

6.6 Charge Controller

6.6.1 Solar power system shall include a solid-state charge controller.

6.6.2 Charge controller shall monitor battery voltage and ambient temperature.

6.6.3 Charge controller shall regulate energy flow from the solar array into the battery bank to prevent over charging of the batteries and minimize the consumption of electrolyte.

7. Documentation

7.1 Operation and Maintenance Manual – available online at www.solartechnology.com

7.1.1 Installation and Operation

7.1.2 Maintenance

7.1.3 Service, Repair & Troubleshooting

7.1.4 Wiring Diagrams

7.1.5 Parts Lists & Assembly Drawings

7.1.6 Specifications

7.1.7 Appendix

7.2 Command Center – User's Manual – available online at www.solartechnology.com

7.2.1 Installation and Setup

7.2.2 Command Center Operation

7.2.3 Appendix

7.3 User Guide – Hard Copy – attached to unit with Nylon lanyard

7.3.1 Pre-transport checklist.

7.3.2 Job site setup checklist.

7.3.3 Basic programming instructions.

7.3.4 Basic system status evaluation.

7.3.5 Weatherproof card attached to unit with 5/32-inch diameter nylon lanyard.

7.4 Integration Support Documentation – Per request from customer support (1-800-475-5442)

7.4.1 Proprietary Protocol Documentation for Custom System Integrators

7.4.2 NTCIP Support Documentation for NTCIP System Integrators

7.4.3 Web-Server Protocol Documentation for Web Based Application System Integrators

8. Maintenance

8.1 Scheduled Maintenance

8.1.1 Solar Array - Clean with water and mild detergent as needed.

8.1.2 Battery Bank - Check electrolyte level once each month and add distilled water as needed. (NOTE: Not required with AGM or Gel-Cell Batteries.)

8.2 Preventive Maintenance

8.2.1 Battery Bank - Clean and tighten battery electrical terminals.

8.2.2 Inspect and lubricate axle hubs once per year.

9. Warranty

9.1 Standard Warranty

9.1.1 Limited Bumper to Bumper – Five (5) years – consult factory for terms & conditions

9.1.2 LED Lamps - Ten (10) years

9.1.3 Solar Panels - Ten (10) years

10. Options

10.1 Battery Charger

10.1.1 Charger type - Switching regulator, constant voltage with automatic switch to maintenance or trickle charge.

10.1.2 Input Voltage - 110 VAC 50/60 Hz

10.1.3 Available models with typical recharge times.

45-Amp: 13 hours (4 batteries)

10.1.4 Battery charger unit shall install in the field with minimum effort.

10.2 Couplers

10.2.1 Combination Coupler

10.2.1.1 Combination coupler shall provide for quick easy selection of a 2-inch ball coupler or a 2 1/2-inch pintle ring.

10.2.1.2 Combination coupler shall provide for the quick, easy removal of coupler and safety chains for additional security.

10.2.1.3 Combination coupler shall install on front of tongue, secured with 1/2-inch diameter hitch pins locked into place with locking-type (rue ring) pins for maximum safety and reliability.

10.2.1.4 Combination coupler shall comply with SAE J684 standards for Class II (2) trailers.

10.2.2 Adjustable Height Coupler

10.2.2.1 Adjustable height coupler shall accommodate hitch heights ranging from 18 to 28 inches.

10.2.2.2 Adjustable height coupler shall accept a 2-inch ball coupler or a 3-inch pintle ring.

10.2.2.3 Adjustable height coupler shall install on front of trailer tongue, secured with 1/2-inch diameter hitch pins locked into place with locking-type (rue ring) pins or with 1/2-inch diameter, grade 8 bolts and all metal (stover) lock nuts.

10.2.2.4 Adjustable height coupler shall comply with SAE J684 standards for Class II (2) trailer.

10.3 Cellular Transceiver & GPS Receiver Module

10.3.1 Integrated into Control Console – proprietary

10.4 Sign Panel Flux-Gate Digital Compass

10.4.1 Operating Voltage – 5-36 V_{dc}

10.4.2 Input Current – 5.7 mA @ 12 V_{dc} maximum

10.4.3 Operating Temperature Range – -40°C to +65°C (-40°F to +150°F)

10.4.4 Accuracy – ±0.5 degrees

10.4.5 Repeatability – ±0.2 degrees

10.4.6 Resolution – 0.1 degrees

10.4.7 Dip Angle – ±80 degrees

10.4.8 Tilt Angle – ±16 degrees

10.4.9 Response Time – 1 second