PURCHASE SPECIFICATIONS FOR A SOLAR LIGHT

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| Model | SP-401S |
| Type | Solar Runway Threshold End Light  |
| Optics Type | Bidirectional |
| Optics Configuration | Green / Red |

**General Overview**

Each light shall consist of or be capable of:

* LED optics,
* Non-corrosive polycarbonate casing,
* Built-in microcomputer with integrated plug-in radio-transceiver (replaceable),
* Externally mounted (replaceable) and tilted solar panel for optimal energy collection,
* Dual-function power ports allowing to energize the light:
	+ via solar panel and,
	+ electrical grid,
* Two independent built-in batteries (connected in parallel),
* External (replaceable) antenna for wireless control & monitoring,
* Wireless network should be a mesh (not point-to-multipoint) protocol and operate in a non-licensed frequency band such as 868 MHz (optionally 915 MHz or 2,4 GHz),
* Each Light should be equipped with an emergency On/Off button.

The entire light shall be delivered complete and ready to install. It shall not require assembly except for the solar panel and mounting accessories.

**1.0 Physical and Mechanical Parameters**

* The light shall have a solar panel mounted externally and connected to the light via a power port,
* All batteries and electronics shall be contained within the light,
* The maximum height of the solar light (excl. antenna) shall not be more than 360 mm,
* The maximum weight of the solar light shall not be more than 15 kilograms,
* Solar-powered airfield light (fully assembled) shall be tested against jet blast and wind load of a minimum speed of 240 kph. A compliance report of actual wind tunnel testing (not computer simulations) shall be provided,
* The body of the light shall be polycarbonate,
* The light’s dome shall be borosilicate glass,
* The light should be equipped with a waterproof pressure stabilizing valve,
* Body of the light shall have an Ingress Protection rating of min. IP68. Compliance shall be confirmed by a test report issued by a third-party laboratory or institute,
* Light shall have an Impact Rating of not less than IK10. Compliance shall be confirmed by a test report issued by a third-party laboratory or institute,
* The light’s dome shall be replaceable on site in case of damage,
* The optical LED head shall be replaceable. The manufacturer shall offer complete optics replacement kits, including required tools to perform the replacement,
* The batteries shall be of standard type available from the local battery stores (worldwide battery standard),
* All types of lights (including runway, taxiway and obstruction) shall be equipped with the same type and capacity of battery.

**1.1 Mounting of the lighting unit**

* The light shall be capable of being mounted on all types of surfaces, including grass and concrete,
* The mounting shall include a frangible coupling,
* Mounting components should be manufactured of high-quality material with high metal corrosion resistance (ie. stainless steel).

**1.2 Light Capabilities**

* The light shall be capable of at least 99 x different brilliancy levels,
* The light shall be capable of operation during the day if required,
* The light shall be equipped with a manual on/off button to allow for light activation when it is operated without wireless control,
* The lights shall be equipped with an LED indicator showing: [1] battery level and also [2] whether the solar panel or the charging station is charging the battery.

By switching the manual on/off button on any light installed on the airfield, the rest of the lights located within radio range shall be remotely activated in less than 1 second.

**2.0 Operational Parameters**

**2.1 Optical Performance**

LEDs must have a lifespan of at least 100.000 hours.

The light shall provide optical performance meeting or exceeding the following specifications:

* an average **Green light** intensity of **no less than 400 candela (cd)** at the highest level,
* an average **Red light** intensity of **no less than 280 candela (cd)** at the highest level.

All values are tested and certified by a third-party laboratory.

Light intensity and color shall undergo third-party testing and certification by Intertek or Bureau Veritas or STAC or TUV Rheinland, or CAA.

Optionally, optics can be additionally equipped with Infra-Red LEDs to enable covert operations using NVG goggles.

**2.2 Solar Panel**

* The lighting unit shall use a solar panel installed separately from the light unit body,
* The entire solar panel shall face one geographical direction for optimal energy collection,
* Solar panel shall be mounted at a circa 33 degrees tilt,
* The entire solar panel shall have a minimum nominal power output of 25 watts,
* Solar panel mounting shall allow for replacing the entire solar panel in case of breakage,
* The mounting system shall allow the solar panel to be directed towards the optimal sun exposure for maximum energy collection.

**2.3 Energy storage**

* All models of the light shall be equipped with nominal 12-volt battery systems,
* The lights shall be equipped with two batteries; each battery shall have a minimum power capacity of 108 Wh. Total capacity of batteries shall not be less than 216 Wh,
* Failure of one of two batteries shall not prevent the light from operating – hence the light shall be able to operate only on one battery,
* The batteries shall be of one of the following types: Valve-Regulated Lead-Acid (VRLA), Lead-Acid Cyclon, Lithium-Ion (Li-ion), or Lithium Iron Phosphate (LiFePO4),
* The batteries shall be replaceable. Replacement shall require no special tools and shall take no longer than 15 minutes per light,
* Manufacturers offering lights energized by self-designed battery packs shall offer a standard, globally available battery,
* Light unit shall be equipped with a built-in battery status indicator,
* The battery operating temperature range published by the manufacturer shall be at least from -20 to +50 °C,
* The light’s operation in autonomous mode shall be designed to ensure both sufficient battery lifespan and continuous performance at minimum intensity levels, as outlined below:

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| **Battery type** | **­­Battery lifespan, cycles** | **Operation time at minimum intensity level, hours** |
| Lead Acid | 1,200 | 360 |
| Li-ion | 3,000  | 680 |
| LiFePO4 | 3,000  | 480 |
| Lead Acid Cyclon | 300 | 200 |

**2.4 Power**

The light shall be capable of drawing power from its internal battery.

The battery shall be capable of being charged by four alternative methods:

* via solar panel,
* via electrical cable (24VDC),
* via back-up charging station,
* via drop-in charging port.

When connected to an external electric grid (24VDC) and in case of battery failure, the lighting unit shall still be able to continue operation.

 **2.5 Electronics**

The light’s control system shall have:

* Temperature-compensated Maximum Power Tracking battery charging,
* Low-voltage cut-off to prevent over-discharge of the battery system,
* Temperature sensor,
* Battery capacity temperature compensation logic (to show temperature-calibrated battery capacity).

The light and controller shall be capable of receiving firmware upgrades.

**3.0 Wireless Specifications**

* Light shall be wirelessly controlled,
* Wireless communication should use the mesh protocol (manufacturers using the point-to-multipoint radio protocol shall offer the mesh protocol).

**3.1 Wireless Signal**

* The light’s antenna shall be detachable/replaceable,
* The light should be equipped with an external antenna to maximize radio range,
* There shall be no limit to the number of lights the controller can communicate with, provided they are within the required radio range,
* The wireless system shall communicate using non-licensed 868 MHz (optionally 915 MHz or 2,4 GHz) radio frequency with a power output of no more than 20 mW,
* The frequency band shall not require special approval and shall not be designated for other types of communication (e.g., GSM carriers: 900 / 1800 MHz),
* The system shall be capable of normal operation in the presence of RF activity typical for an airport environment.

**4.0 Quality Assurance**

Excluding the batteries, the system, including solar panels, LEDs, optics, electronics, mechanicals and associated components, shall carry a minimum two-year warranty. The batteries shall be guaranteed for 1 year.

The light shall be manufactured by an ISO 9001:2008 certified manufacturing facility.

**5.0 Turn-Key Operation**

The light shall be ready for installation upon delivery. Assembly consists only of threading the antenna onto the light, activating the light through a single button-press on the light, and attaching it to the mounting accessories and solar panel.