# International Solar Signal Inc.

**The world's most advanced solar powered traffic signals**

**International Solar Signal** was founded by the world's leading experts in design and engineering of solar powered traffic beacons. Each member of the executive team has at least ten years of experience representing more than ten thousand installations across North America, Europe and Asia. In 2010 we made the decision to develop a new standard for state-of-the-art solar powered traffic signal. After three years of advanced engineering, we have designed a system that surpasses all others in theft resistance, functionality and reliability.

**Reinventing the Wheel:** Previous attempts to create solar powered traffic signals have followed the same path; connect huge solar panels to existing mains (AC) powered units. But traffic signals have changed very little over the past five decades. AC power has been available in such abundance that engineers did not even consider power waste in their designs. International Solar Signal decided to break the preconceived mold and reinvent the wheel. With our years of experience, we knew that eliminating power waste must be the overriding consideration in developing any solar system. We have reconsidered and redesigned every part of the system to arrive at the most efficient traffic signals possible. We can guarantee that no other signal in the world offers the same power efficiency.

**Control Circuitry:** A typical traffic signal control module uses up to 200 Watts of power, with another 200 W for the conflict monitor and 200 W for the vehicle detection system. These amounts only run the computers, not the lights.

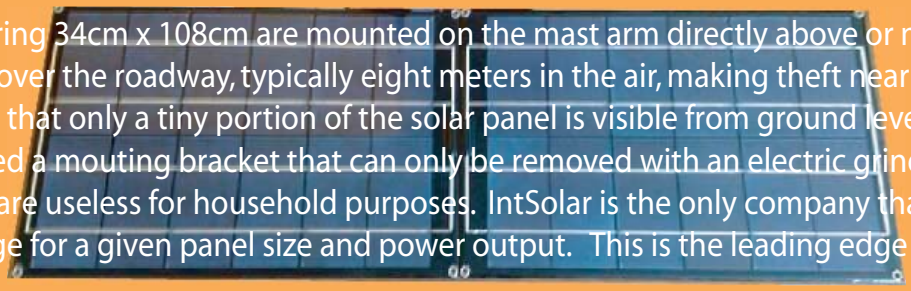
International Solar Signal has designed a control board that measures 11cm x 9cm and uses less than 1 Watt for its own operation. All of the power generated by the solar panels is directed to the traffic signal lamps, making the signals much brighter and the intersection much safer. This is the only logical approach when designing a modern system. It reduces power waste to zero and reduces the size of the solar panels and battery packs dramatically. IntSolar has also separated the charging and control circuitries on the same board thus providing vital protection to the micro-controller ICs. Solar charging is done via Pulse Width Modulation; as battery charge increases, the PWM algorithm reduces the current to avoid heating and gassing of the battery, while maximizing energy return during the charging period.

**Radio Control:** The greatest difficulty in any installation is not with the signals, but the cost and traffic disruption of trenching and repaving for underground wires. IntSolar removes this cost entirely by using a 2.4GHz RF mesh network with time-slot synchronization, to maintain constant and reliable communication between a master controller and each signal. There is no need for any trenching, digging or underground roadwork at all.

**Centralization and power loss:** Historically, systems have used a single, huge solar panel. The problem is that low voltage solar/DC power does not travel well over distance. Using the formula Power Loss = $I^2R$, it can be seen that 9.7% of power is lost for every 10 metres of 14 Gauge wire. Up to 30% of available power is lost simply by running a wire across the street. International Solar Signal resolves this by mounting individual solar panels and battery packs on top of the pole next to each traffic signal. Power drop is kept to the absolute minimum.

**Energy efficiency:** IntSolar is the only company using a 4 Volt power system. This offers important advantages, such as minimizing power loss from step-down voltage regulators and utilizing the most energy efficient DC-DC converters. A lower number of required cells virtually eliminates the chance of a complete battery failure and the lower voltage results in reduced radiated emissions, helping to meet federal communications regulations. We estimate that the cumulative advancements made by International Solar Signal and our development partners results in a system that is 50% more energy efficient than any other in the world.

**Solar Panels**, measuring 34cm x 108cm are mounted on the mast arm directly above or next to each signal head. The mast arm hangs over the roadway, typically eight meters in the air, making theft nearly imposible. The mast arm itself is 25cm wide so that only a tiny portion of the solar panel is visible from ground level, further reducing risk. IntSolar has developed a mouting bracket that can only be removed with an electric grinder - even by us. Finally, at 5 Volts, the panels are useless for household purposes. IntSolar is the only company that uses 5 Volts to provide the greatest amperage for a given panel size and power output. This is the leading edge of solar technology.



**2 Volt Batteries** are connected to produce 150 Ah at 4V. Other companies use 12V, vented batteries that face rapid evaporation in tropical heat and are prone to theft. Our partner, Enersys, has built the most robust, sealed gel-cell batteries. Our experience includes 2,000 batteries that have been operating perfectly for eight years in Las Vegas, where temperatures routinely top 40ºC. 2V batteries are useless for household purposes and they are installed in a sealed metal box, typically eight meters in the air, making them virtually impervious to theft.


**Signal Lamps:** We have worked closely with FAMA - Chevy Light Co. of Shenzhen, China to develop the brightest and most energy efficient traffic signals possible. Improvements include the narrowing of each LED's focus; a clear inner and outer lens allowing for the greatest light access and removal of extraneous power converters. IntSolar's engineers have developed a 1khz duty cycle program for each lamp to provide the greatest visual luminosity with the least power consumption. FAMA is ISO 2001 registered to ensure the highest possible quality and reliability.

**Radar Vehicle Detection:** The second generation signals will include full radar vehicle detection. IntSolar plans to hire a local team of hardware and software engineers to develop the world's first solar powered radar vehicle detection system. We are working to reduce power requirements of existing systems by 95% by putting the radar beam to sleep for 30 second intervals, while storing junction standard data in flash memory.

**Traffic Flow** patterns across a city can be optimized using precise time data from GPS satellites. Available programs such as Trafficware Synchro will be used to model, analyze and perfect flow patterns along major corridors. Time-of-of-day and day-of-week controls will allow for different signal patterns to optimize for rush hour inbound and outbound traffic, slack periods and overnight flashing Red/Yellow lights. This type of traffic flow optimization is used in the most modern traffic signal systems in major cities.

**Local Manufacturing & Engineering:** International Solar Signal is working to establish local manufacturing facilities in nations with sufficient installation volume. To date, we have formed a subsidiary in Abuja, Nigeria so that product assembly work will be completed locally. To the greatest extent possible, local engineers will be hired to complete future advancements of the traffic signals. IntSolar's Canadian electronic engineers will train local nationals to perform this highly technical work. This project is ongoing, with many engineering advancements being made over the coming decade. We anticipate that local professionals will perform the majority of the development work.

**Installation and Maintenance:** The biggest failure of previous systems has been a lack of after-sale support. Companies have sold systems and walked away. We are prepared to end this unfortunate practice with complete installation and ongoing service. International Solar Signal will form a partnership with local companies to provide installation and ongoing maintenance under monthly contract. IntSolar will offer all of the training and continual mentoring necessary to ensure success. Maintenance will include scheduled testing and cleaning along with emergency repairs with a guaranteed 4-hour response time, available 365 days a year. The crew will respond to notification from the police, municipal staff or the public if any unit is not functioning as required.

# System Overview

International Solar Signal Inc.

International Solar Signal has created the world's most advanced solar powered traffic signal. Each unit is completely self contained, but operates on command from the Master Control Module.

Narrow solar panels are mounted directly on the mast arm, making them nearly invisible from the ground and less prone to theft. The 5V panels are useless for other purposes.

Each traffic signal has its own solar panel, battery box and control board. There is no need for any trenching, digging or underground road work.

Batteries and circuitry are mounted high on the pole in secure cabinets. The 2V batteries are useless to thieves.

The system can be coordinated with new or existing traffic cameras.

Pedestrian activated crosswalk signals notify the master controller when a ped call has been made.

City-wide traffic patterns can be optimized to improve flow and reduce carbon emissions using GPS precision timing and specialized software programs.

Traffic industry standard lane numbering patterns form the basis of the network address system. Signals with the same address operate as one unit. Signals with different addresses operate separately.

In future versions, Radar Vehicle Detection will notify the master controller when a vehicle is present.

Technicians use the IntSolar Service Laptop for all aspects of system operation, including installation files, maintenance diagnostics and scheduling of the signal phase sequence.

Control instructions are sent continuously to each signal . Acknowledgement must be received from all signals before any phase change is allowed.


At each intersection, a Master Coordinator Module is programmed with the signal phase sequence. A spread spectrum RF network connects the Master to each signal. If the network is broken for more than 5 seconds, all signals revert to a flashing red failsafe.

In future versions, a city-wide mesh network of all Coordinator Modules will connect every signal in the region to a central location and transmit instant diagnostic messages. This will enable IntSolar to meet a guaranteed 4-hour response time to any signal problems.

The use of 5V solar panels, 2V batteries and the elimination of voltage drop makes IntSolar's traffic signal the most energy efficient in the world. This results in more power directed to the signal lamps for greater safety.


**International Solar Signal Inc.**

Andrew Evans, President
Victoria, Canada
+1.250.516.0244
ABEvans@IntSolar.com

**www.IntSolar.com**