



SOLAR STIK®

Autonomous Interrogators in Afghanistan

Portable Solar Generators for the RF-ITV System



Figure 1 - RFID Interrogator System with Solar Stik Power Solution

The Summary

Radio Frequency In-Transit Visibility (RF-ITV) systems produce, collect, and integrate ITV information into usable data about asset location. This data is available to users on a web-based tracking portal accessed by 35 Department of Defense (DoD) systems. The RF-ITV network is composed of worldwide mobile and stationary read and write stations, satellite transponder-equipped vehicles, and Internet servers. This infrastructure directly employs Radio Frequency Identification (RFID) to assist in tracking assets both in peacetime and during combat logistics operations.

RFID systems collect information from various assets using electromagnetic fields. These fields allow data transfer from RFID tagged items to RFID Interrogators. The RFID Policy Memorandum mandates all DoD agencies utilize RFID in the transportation of DoD materials to enable real-time asset visibility.

The use of RFID within RF-ITV system architecture is essential in tracking DoD logistical movements worldwide and was critical to the retrograde mission in Afghanistan. The network in Afghanistan, particularly the RFID interrogators, required clean, reliable, and constant power to successfully relay asset location from the asset's point of origin to the final destination.

“This solution is a critical component to the successful completion of our mission.”

-101st SB

The Challenge

RFID Interrogators were strategically placed in Afghanistan along convoy routes and at collection ports generally in remote and obscure locations. These places often had unreliable power that hindered RFID functionality. Furthermore, additional RFID systems were required to increase real-time asset visibility but could not be installed due to lack of continuous electricity.

The areas where the Interrogator Systems were located or planned to be located were often in non-U.S. controlled space. This added to the security and logistical constraints associated with conventional generators and highlighted the need for an autonomous system that did not require constant refueling or maintenance.



Figure 2 - Solar Stik System powering RFID Interrogator in an Afghani truck yard

The visibility of retrograde cargo and DoD asset movements within and through Afghanistan had been severely degraded by the lack of installed RFID Interrogators and inoperative Interrogators that failed due to loss of power. Many Interrogator Systems were being supported by solar power systems that were not ruggedized for austere environments, those not designed for military application, or those improperly sized for the power requirements of the RFID system. A more reliable solution was urgently needed to effectively collect and transfer ITV information critical to mission accomplishment.

The Solution

The Operational Energy (OE) Advisors with the U.S. Army's Rapid Equipping Force (REF) were charged with finding an autonomous power solution for the RFID Interrogator System. Figure 3 depicts the Solar Stik solution the OE Advisors selected and installed to power RFID Interrogators at various locations in Afghanistan. The Solar Stik power systems consisted of ruggedized components that passed MIL-STD-810G testing by the Army, and each of the portable solar generator configurations included power generation, power management, and energy storage.

The system was designed for long-term deployments into remote, unattended locations. Its components generated solar power, processed unregulated DC solar power, distributed power to the RFID Interrogator system, and stored excess energy. The system generated up to 2.5 kWh of solar energy per day and provided 4 kWh of energy storage. Additionally, some of the RFID systems had a desktop or laptop computer connected to the Interrogator System. The modularity of Solar Stik's portable solar generator enabled seamless integration of a 24 VDC to 120 VAC inverter necessary for powering the computer.

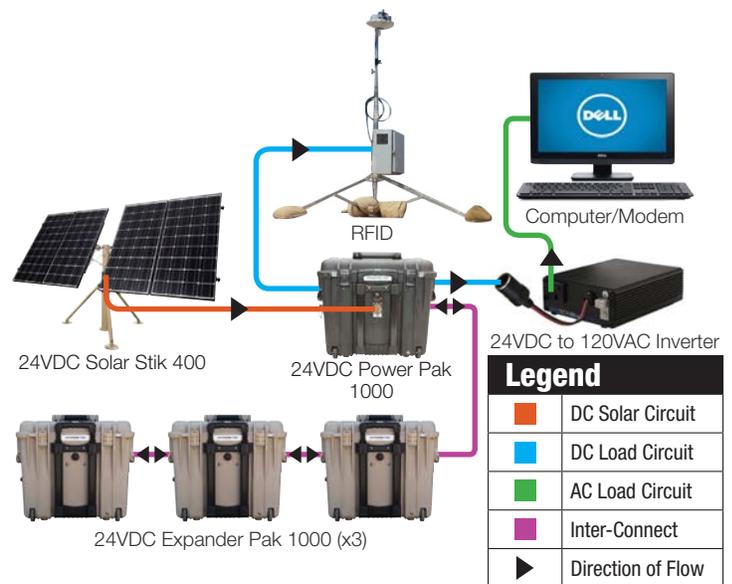


Figure 3 - Solar Stik RFID Power Solution

- **24VDC Solar Stik 400** – Generates up to 400 W of power or 2.5 kWh of daily solar energy generation (assuming 6 hours of solar irradiance)
- **24VDC Power Pak 1000** – Processes unregulated DC power from the Stik 400 and contains 1 kWh of energy storage
- **24VDC Expander Pak 1000s** – Provides 1 kWh of energy storage (3 kWh total)
- **24 VDC to 120 VAC Inverter** – Converts 24 VDC from the battery bank to 120 VAC for powering a computer when required

The Result

The RFID Interrogator System had a continuous power requirement of approximately 40 W. Figure 5 demonstrates how the solar power system configured and employed by the REF enabled autonomous operation of the RFID Interrogator Systems.

As shown in Figure 5, the Solar Stik 400 was able to generate enough power to keep the batteries charged during the day leaving plenty of stored energy to support the RFID Interrogator overnight. During ideal conditions, the battery state of charge (SOC) never dropped below 80%, ensuring the RFID Interrogators had ample power. The solar power systems provided by Solar Stik were also sized to ensure there was sufficient energy storage available to survive several days of little to no sunlight. The RFID Interrogator Systems powered by Solar Stik's portable solar generators operated without grid connectivity and eliminated the logistical challenges associated with using fossil fuel generators.



Figure 4 - Solar Stik Solution powering Interrogator System with a computer



Figure 6 - Interrogator powered by Solar Stik solar generator



Figure 7 - Solar Stik System powering RFID Interrogator at a convoy rest stop

Idealized Daily Cycle

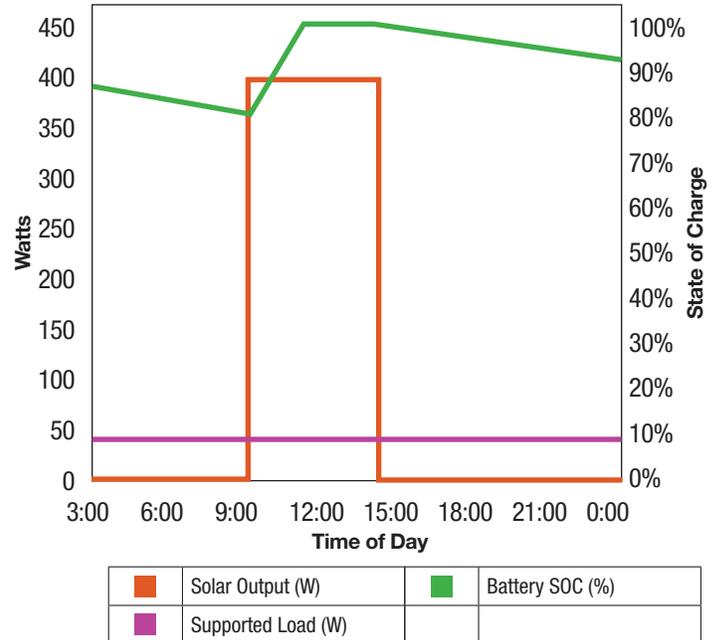


Figure 5 - Idealized daily cycle of RFID Solar Stik System

Solar Stik's power solution demonstrated the typical 40 W load of an RFID Interrogator in RF-ITV systems could be satisfied by a fully autonomous solar power system. Harnessing alternative energy alleviated the need for grid or generator connectivity, and power requirements were met purely off solar power generation and energy storage. This Solar Stik power system gave RFID Interrogators the ability to collect and transmit data without human involvement in virtually any location.

Without the solar power solution employed by the REF, the visibility of retrograde cargo and DoD movements within and through Afghanistan would not have been possible. The OE Advisors received feedback from the leadership and soldiers of the 101st Sustainment Brigade stating Solar Stik's portable solar generators were critical to the successful completion of their mission.



SOLAR STIK®



Why Solar Stik

Solar Stik is the premier manufacturer of portable hybrid power systems for military applications in the 1 to 15 kW power spectrum. It pioneered the design and manufacturing of scalable, modular system architectures used to alleviate the logistical burdens of providing power in remote, off-grid locations.

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