Utilization of RFID Technology to Improve Inspection Documentation and Reporting for Transmission Structures & Components

A White Paper illustrating the benefits of using RFID technology to capture individual structural components identification to improve both accuracy and processing times of the inspection process

In the continental USA there are thousands of transmission line segments requiring periodic inspection of all structural components. These structural components consist primarily of poles and arms that are aging and require inspection, maintenance, and replacement. The inspection of these poles and arms are vital to the industry goal of longevity, increased grid reliability and resiliency. Owners of these transmission lines contract inspection companies to survey the line and all structural components in preparation for maintenance activities.

This paper outlines how **JPL RFiD,** utilizing RFID technology, provided **AECOM** a cost effective solution that greatly improved data accuracy and collection time in the field during the inspection process. Data captured in electronic form was then used in the timely creation of inspection reports. **AECOM** then provides this report to **ETT** who own the transmission lines. This paper explains how significant improvements in field data accuracy and collection time is achieve. Also how the electronic transmission of this data facilitates the creation of accurate and more timely inspection spreadsheets by inspection companies. It further demonstrates how the use of RFID enhances safety for inspection technicians and installation crews.

Background

JPL RFiD's partner, Honeywell-Intermec, invited us to meet with AECOM and ETT to discuss the use of RFID to improve the inspection process. The general inspection process normally utilizes a subcontracted inspection company. The inspection company provides field personnel to conduct the physical inspection and fill out inspection forms. Once the inspections are completed these forms are sent to the office for manual data entry and the creation of inspection report spreadsheets. These spreadsheets are then submitted to ETT.

The inspection process starts with inspectors visually locating the serial numbers of individual poles and arms. This requires the use of bucket trucks and/or climbing of structures. Once located, the inspector manually records the serial number of the component and its physical location (location of arms) on the structure (pole) itself. All subsequent inspection details and notes are also recorded onto individual forms that are individually component specific. At the conclusion of the inspection, these completed forms are sent to the AECOM office for manual data entry and the creation of inspection report spreadsheets. These spreadsheets are then sent to AECOM and in turn submitted to ETT as the owner of the transmission line.

This hand recorded field data and the subsequent manual data entry is prone to errors and delays. The time required to complete the inspections, data entry, and creation of inspection spreadsheets is 7-10 days of which 4-6 days is manual data entry.

The major issues were identified as::

1. Component identification is extremely time consuming

2. Weather significantly effects handwriting on paper forms

3. Manual recording errors are frequently made in the field
    - Transposition and omission of numbers are most common

4. Field errors from illegible writing, numerical errors, and missing forms result in delays of spreadsheet creation

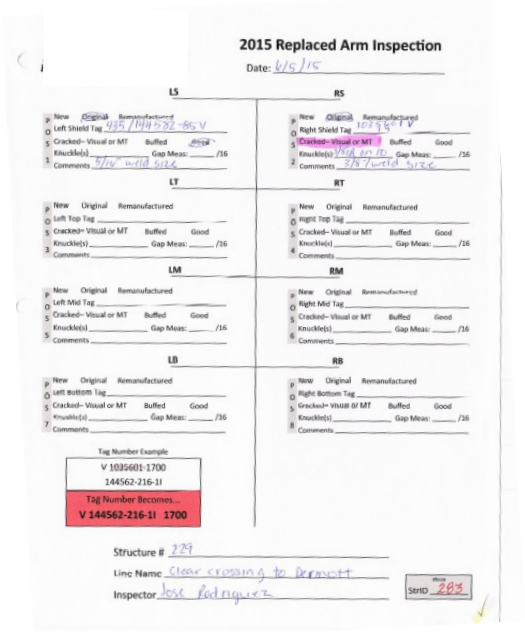
Explanation of Identified Issues

1. Component Identification

Prior to the use of RFID the inspection process required a contracted inspection company to deploy personnel on and around the structures to read serial numbers on the pole and other components such as arms. Getting into position for good visual recognition required the use of bucket trucks and/or climbing the structure which is hazardous and time consuming.

2. Handwritten forms in the field

Once located, the serial numbers are manually recorded on inspection forms. The inspector is required to correctly write down serial numbers and notes on paper forms working outside in the weather. The inspector has to manage all the paper forms until they are returned to the office for data entry. Papers are often lost or weather damaged making them difficult to locate or read by the manual data entry person.



Explanation of Identified Issues (cont.)

3. **Manual Recording Errors by Inspectors**

Inspectors working in the field are reading numbers and then writing them onto forms. Transposition and omission errors are problematic requiring time consuming investigation by the data entry personnel. Often this requires locating the inspector that did the work for clarification or a possible trip back out into the field. Form errors cost time and money to investigate and resolve.

4. Field errors delay manual entry and spreadsheet creation

The process of manual recording in the field, the transport of written records back to the office, and the subsequent manual entry of this data at a later time is prone to a variety of issues. Errors, missing paperwork, and office investigations typically add 4-6 processing days extending the overall inspection and reporting process out to 7-10+ total days.

JPL RFiD Solution

The JPL RFiD solution virtually eliminates human generated errors throughout the inspection and repair process. Utilizing RFiD tags, readers and enabled tablets can resolve most issues currently experienced during the inspection and repair process.

From the time the user scans the tag, historical data begins to be collected. All scans and data uploads will be time stamped including specific user identification and information.

Electronic forms can now be completed on-site in the field. This eliminates any handwriting legibility issues and double entry back at the office. Once the documents are completed they can immediately be uploaded to the cloud via GSM or Wi-Fi.

After all inspection and repair is complete, the inspection company or end client can view and download all inspection data in the form of a spread sheet, PDF and photo images requiring no manual data entry.

Pre-Inspection Surveys and Mapping With RFID

Data accuracy in the field – Individual RFID tags are associated permanently with a component and that serial component serial number. The use of RFID tags on structural components such as poles and arms allows for immediate and error free capture of any data specific to that individual component. In addition, structural components such as arms are also associated with the primary structure on which they are attached. This is called a child/parent relationship.

RFID tags on pole and individual arms

RFID Pole Template to match Structure. Pole and 6 arms

Secondary RFID tags for arms. Enables ground survey of arms attached to structure.

Pre-Inspection Surveys and Mapping With RFID

An inspection technician can drive the entire right of way for a transmission line and read the pole base tags without leaving the vehicle and capture every asset and associated sub components serial numbers in a very short amount of time.

RFID handhelds are small and lightweight so they can be easily carried and used in remote locations where access may be limited to 4 wheeler or by foot.

The ability to survey and quickly locate individual components is highly valuable in the case of a component recall or maintenance alert from the manufacturer.

Beyond Inspections - Enhancing Asset Management

JPLRFID Technology can easily be integrated into existing asset management systems that are already used by the major transmission companies. The use of JPLRFID technology will improve their existing asset visibility as well as the asset management of these components. JPLRFID Technology offers proven savings in terms of man hours with fast and accurate identification of components in the field.

Enhanced Safety

Safety – The use of JPLRFID technology greatly increases the distance required to capture the serial number of components for inspection. The passive RFID tags can easily be read at distances of 30+ feet. A technician can read numerous tags from one position in a few seconds. This greatly reduces the amount of time a technician needs to be in a bucket truck or on the structure. The physical position of the technician is irrelevant as they aren't required to get close enough for visual identification of the serial numbers. They just need to get in range of the RFID reader. In addition to passive tags, JPLRFID also have battery assisted tags that read at distances up to 200 feet.

Field Equipment

JPLRFID offers a variety of Rugged RFID and data capture equipment. We offer Rugged tablets, Bluetooth RFID Readers as well as all in one handheld units.

Military Grade tablets offer extreme durability and resistance to weather and dirty conditions.

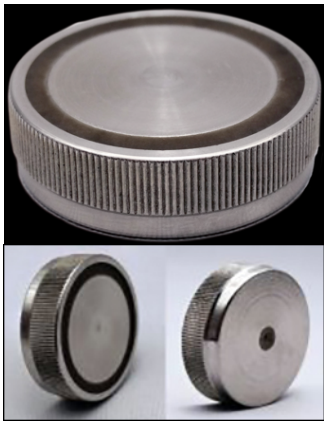
Bluetooth RFID Reader with tablet mount or wearable strap.

Rugged all-in-one RFID/ Barcode enabled Handheld computer.

RFID Tags

JPLRFID offer a variety of RFID and barcode tags for various substrates and conditions. We offer bar code tags that can survive the galvanizing process including acids and temperatures over 1000 F.

JPLRFID offers a wide range of tags and bar codes that can be applied in the field and will last decades with direct sun exposure.



Component Manufacturer installed tags are inserted into the substrate after the galvanizing process. These are permanent tags and held in place with friction.
40+ year life expectancy .

Bar Code Tags

JPLRIFID offers bar code tags designed to withstand the galvanizing process of acid baths and immersion at temps of 1, 000°F. The tag is attached to the component prior to the galvanizing process. Once galvanizing is complete, the tag is then removed from the wire and permanently attached to the pole or arm.