Factors in RFID Tool Tracking

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Because tool tracking is a ubiquitous and perpetual problem for all industries, there is continual hope that RFID technology will be able to solve that problem. The good news is that RFID can solve about 85% of the tool tracking problem but it cannot, and will not be able, to solve the other 15% by itself. Yet everyone is hoping for a 'one-size-fits-all' solution and they will wait a very long time.

RFID technology offers a wonderful hope for easy, transparent data collection because the RFID tags automatically identify themselves to the reader without people having to manually enter data. The tag only has to be in the read field of an RFID antenna for data to be collected. The supporting computer systems can then automatically add other needed data like location, time/date stamp, etc. Barcode technology operates in a somewhat similar fashion, but each item has to be individually handled and the barcode visually presented to the reader, one item at a time, and sometimes items are missed or the barcode is damaged and won't read. RFID offers for more flexibility and ease of use to help humans avoid the casual mistakes that are made and to make the whole process significantly faster. RFID technology can read hundreds of tags/second without the human having to do anything special.

Tool tracking in any industry creates special challenges, primarily related to the size of the tools that need to be tracked. Large tools generally are not lost and/or are more easily found; it is the small tools that cannot be found and they are the difficult problem to solve.

The 85% of the tool tracking problem that RFID can solve is:
- ID and track all the tools that require calibration
- ID and track all larger tools
- ID and track various kits of tools
- Significantly reduce the time, errors, and labor involved in tool check in/check out

The other 15% of the problem that RFID alone will not solve involves small tools:
- Sockets
- Drill bits
- Screw driver bits
- Small hand tools

These are the small items that get left on the job site and are difficult to locate. In aviation, these items are considered FOD (Foreign Object Debris) that can cause catastrophic problem in an aircraft. RFID technology alone will not help with these issues for several reasons:

- The size of the RFID antenna in the tag is directly proportional to the read distance that tag. A very small tag (chiclet, size ½" long) can only be read from 2' feet away, where a 4" long tag may be able to be read from 15' away.
- When looking for lost tools, we would like to use a handheld scanner and be able to find tools in a 15' vicinity of where we are looking. That cannot happen with a very small tag on a tool. The basic physics of the current RFID technology make this impossible. And if one has to be within 2' of a lost tool to fond it with technology, you will visually see it before the scanner can read it.
- RFID tags only respond when enough signal power from the reader energizes the chip. If the RFID tag is surrounded by metal (which reflects the signal away), the tag will not receive enough power to respond. So RFID tags do not "always" respond, as is commonly believed – but only if they get enough incoming signal to respond.

Other solutions offered for tool tracking include sophisticated, computerized tool chests with cutouts for each tool and RFID readers above every drawer. Similar tool chests use cameras above every tool drawer to visually determine whether every tool is in place. These are very expensive solutions but only answer half the question: "Is the tool here?" But these solutions do not address the more difficult part of the question: "Where is the tool?". That is the real problem to be solved.

The solution is to use a combination of technology to solve most of the problem, and a change in business process to address the rest of the problem. RFID can make tool check in/out very fast and efficient, so if small tools are kitted into a larger box with an RFID tag, and then assigned to a mechanic, accountability for the missing tool can be established and data entry is automatic. If linked to a task card, a likely location for the lost tool can also be established. When the kit is checked back into the toolroom, a quick visual check can indicate whether all the pieces are present or not. For small driver bits and consumable items (e.g., drill bits) it will take a little more effort to determine exactly what is missing, but those items can then be replaced and the kit made whole for the next usage. The re-stocking of a kit can be accomplished with less expensive labor than what the mechanic is being paid.

There is no practical way to use either barcode or RFID technology to mark those small parts, but using people's visual skills to see what is missing out of a kit is quicker, less expensive, and more cost effective than trying to use a technology solution.

This solution still does not address the core problem of where is the missing tool? This is where a change of business process – changing the culture – is required. By kitting small tools and making it easier for the mechanic to realize he is missing a small tool, the expectations need to change so the mechanic will look for the tools before he closes the kit up at the job site – not when he returns the kit to the toolroom. RFID technology can address many problems, but it can only completely solve those problems in combination with necessary business process changes.