Smart Tags in Storage Systems

Doug Rogan, International Conservation Services

Introduction

Storage systems for artworks, museum objects, archives, books, and other collectibles are many and varied. Finding items within a collection can be straightforward if these items are filed in their correct place and if the items lend themselves to a structured filing system. This is rarely the case for museum and art gallery collections where like items are either stored together by subject, material or size; all of which can be somewhat subjective.

Over the years many manual systems have been employed (and usually still are) which order items by their accession number, by a classification system (eg Chenhall or Linnaeus), by material types, and many others. Some employ no system as such, relying instead on the location simply being recorded in the organisation's Collection Management System (CMS). Invariably most storage systems are a combination of the above.

As we are all well aware, collections in storage rarely remain static. Collection items are moved for loans, exhibitions, conservation, reorganising storage, research, and more and more commonly for redevelopment and building works. Whenever an item is moved its' new location needs to be recorded. Some evidence suggests that using the manual systems outlined above, even with all the care in the world, error rates can be as high as 10%, not to mention the considerable staff time involved. Too often, for under-resourced museums and galleries, location recording of collection items is seen as a low priority – the list of movements is written down on a pad only to be filed in someone's desk drawer to 'get to later'.

Taking a leaf out of the commercial warehouse book, some museum/gallery storage areas have employed barcode systems to streamline and automate procedures around location recording.

However, many warehouse and retail chains are now moving away from bar-coding and instead employing Radio Frequency Identification (RFId) or 'Smart tag' systems. Some industry analysts say that barcodes in the retail sector could be completely replaced by RFId's within 10 years or less.

What is a 'Smart tag' system?

A 'Smart tag' or RFId system comprises two components – an RFID Tag (see Figure 1), and a RFID Reader (see Figure 2). The tag consists of a small chip, attached to an aerial. The reader is generally a powered device of some sort with a larger aerial, which sends out a radio wave that "reads" the radio wave sent out by the tag. In general, the bigger the antenna, the greater the radio power, ie the further away the tag can be read.

Radio **F**requency **Id**entification or 'Smart Tags'

- The identification of objects by means of electronic devices that communicate through radio waves
- The identifier is the "transponder" or "tag"
- Transponders are read by "readers", "interrogators" or "transceivers"

Figure 1. An example of RFId tags – 4 different types of tags with pen inserted for scale. Source: Doug Rogan, International Conservation Services

Figure 2. An example of an RFId Reader (black, on left) and aerial (white, on right). Each is about 25 cm x 20 cm. Source: Clayton Jones, Unisys.

What are the benefits for Collection Storage?

The main benefits of an RFId system over a barcode or manual system are:
1. The ability to read tags through boxes/crates without opening them
2. The ability to read many tags at once
3. Line-of-sight not required

These features provide numerous benefits for Collection Management tasks, namely:
1. Reduction in handling – don't have to 'rifle' through collections looking for accession numbers or barcodes to scan.
2. Stock-takes/Inventory – these can be done much faster, and it is possible to easily do 100% stock-takes on large collections (assuming collections are tagged and data-based). It is even possible that inventories could be entirely automated eg carrying out a stock-take every night in a storeroom using an automated gantry system – providing you with a list of exceptions the next day.

3. The ability to walk down storage aisles scanning for 'lost' or mis-filed items

Other possible benefits include:
1. Loans tracking – being able to scan the tags through a packing crate, or being able to read environmental conditions within the crate (through linking with a datalogger)
2. Enhancing the visitor experience by using the tag as a link to further information (eg on the web).
3. Enhanced security through the virtual elimination of the risk of losing an item.
4. Use of active or semi-passive system for items on display – location tracking, motion sensors, etc built-in. Current users of this function include the National Gallery, London and the Immigration Museum, Melbourne.

Museum Scenario

As an example of how RFId can assist with storage tasks outlined below is a scenario that is very common to most museums and galleries:

Scenario
A museum staff member is having to retrieve a number of objects for consideration for display. In total 50 items are pulled out of the storage area, from a total of 25 boxes, and placed in an assessment area. Each of these items has their current location recorded in the museum's CMS. Over the course of the next week half of these items are selected for the display, and the remainder are to be returned to storage. Of those selected for display 20 items will need conservation treatment before being installed, and are sent off to the conservation lab, while the other 5 are considered ready for display, and are sent off to the display department to be installed.

Manual System
Using a manual recording system, ideally the location of each item at each of the steps mentioned above would be written down and then transcribed into the CMS as soon as possible thereafter.

In the scenario above there are the following locations recorded at each of the following steps:
1. 50 items pulled out of storage – temporary location = Assessment area
2. 20 items selected for display requiring conservation– temporary location = Conservation
3. 5 items selected for display not requiring conservation – temporary location = Display storage

4. 25 items not selected for display = returned to permanent storage
5. 25 items put on display – temporary location = On Display
6. 25 items taken off display (when exhibition closes) = returned to permanent storage.

In total there are therefore 150 location recordings required for this entire process. In practice the recording of these locations in the CMS is often carried out the next day, or even later, and often the items may have moved again before the location is updated. On top of this, manual entry is prone to human error – in the recording of the accession numbers, recording the locations, entering the accession numbers onto the CMS, and entering the locations onto the CMS. Even a relatively low error rate of 1% may lead to 1 or 2 collection items being mis-placed or lost.

Using a fully RFId-enabled system all of steps 1-6 are automatically updated in the CMS in real-time with no room for error. In the scenario above we have assumed that items were removed from their boxes when they were removed from storage, thereby leaving the remaining contents of the box in place. In practice however it is common for an entire box to be removed and the selected items pulled out as required. The remaining items in the box rarely, if ever, would have their locations updated using a manual system, yet for sound collection management reasons it is essential that *all* items that have been moved have their locations updated.

Issues and Limitations

A major issue in the use of Smart tags in museum/gallery collections is the attachment of the tag to the item. There is no single easy answer for this as the attachment method employed depends considerably on the make up of the collection. It can also come down to a philosophical decision. The Vatican Library, for example, has been tagging its entire collection, especially its rare books. Because they were often losing or misplacing many items they decided that it was better to tag the book and know where it was, and accept the potential irreversibility of the attachment (an archival self-adhesive), rather than not knowing where the book was at all.

Melbourne Museum (Forbes Hawkins pers. comm..), using barcodes, has gone down another route entirely, which is to not attach a label directly to anything in the collection at all. Labels are instead attached to swing tags, boxes, packaging, etc, and rigorous procedures are in place to ensure that these labels are not lost and are always associated with the correct object.

How the storage is constructed can have considerable bearing on the functionality of an RFId system. What are the shelves made of – metal or wood? Metal shelves reflect Radio Waves, whereas wood shelves let these

waves through. It is possible to use these differing properties to create different solutions that still provide the functionality required.

The type, size and materials used for collection boxes can be an issue. For example standard Solander boxes can generally be read through easily, but the normal metal bracket on the front of the box used to house a box label can cause some interference.

A fairly integral part of implementing an RFId system is having full connectivity to the CMS system. Ideally this is accomplished through the use of wireless networking, which can be expensive and difficult to implement in storage areas that often contain concrete walls and beams, as well as metal shelving. It is also important that your CMS can handle the information. At its most basic level though, an RFId system is really only sending a unique number to the CMS. What the CMS does with that information is up to you (and the CMS vendor/developer).

Smart solutions using a range of RFId tags can help get around these issues. For example a semi-passive tag can be located on the front of a Solander box that records the contents of the box. Each time the contents are changed, the updated inventory list is re-written to the tag.

Costs

RFId tag prices are falling all the time but at the time of writing a standard 96-bit passive tag (see Fig. 1) sells for around 20-25 cents. This is expected to fall to ca 10 cents in the next 1-2 years. RFId readers can range in price from several hundred dollars to several thousand, but these too are getting cheaper.

By far the largest cost component of any RFId system is usually the integration with the organisation's CMS. There will need to be some careful planning and thinking required around how best to link the information generated through the use of an RFId system, along with some development costs. As time goes on and more CMS providers take this technology on board we should expect to see many of these costs decrease.

Other costs may include the need to upgrade IT hardware (cabling, wireless, computers, etc), and training for users.

Conclusion

With increasing scrutiny from auditors as to how public monies are spent on looking after our valuable heritage collections, it is becoming more are

more important that we be as close as possible to 100% certain that collection items are where they are supposed to be at any given time. Institutional knowledge tied up in staff heads of where collections are stored is no longer acceptable in today's accountable world. We have to find smart ways of doing things better and more efficiently in the Museum and Gallery sector if we are to survive and be relevant into the future. RFId systems offer just such an opportunity.

Doug Rogan is the Senior Collections Manager for International Conservation Services. He can be contacted at d.rogan@icssydney.com