

RFID at the University of Central Lancashire

A case study by **Stephen Mossop**

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Background

UCLan's migration to the broad sunlit uplands of RFID has been a long and interesting one. We first began our exploration in the late 1990s, during the design stages of a new Library for our Penrith campus. Everything about this building was designedly adventurous, from the moss-covered roof (which gathers, filters and recycles rainwater for flushing the toilets) to the light tubes (which distribute natural daylight throughout the building) and the way the panoramic glazed study areas bend round and overlook the venerable oak tree in the courtyard – the tree was there first, and it just didn't seem right to move it. Using adventurous new technologies just seemed a natural progression, and our Director, keen to take advantage of the potential business benefits of using RFID in a library setting, was successful in negotiating for the inclusion of the capital costs of migration into the overall building budget – with the added bonus of becoming probably the first RFID-enabled Academic Library in the UK.

Library RFID was still very much in its earliest stages of development at this time, and we were working with relatively untried and unproven concepts and equipment. The intention was to use Penrith as a pilot study, with a view to rolling out RFID to our other libraries over time. Given that both the Library building and the collection it housed were relatively modest in size, the setting up costs (though fairly high at that time – tags were £1 each!) were containable, and the adverse effects of any systems failures could be mitigated. We opted, in the end, for a hybrid system, utilising RFID for Issue and Discharge (on a self-service basis), and EM as the primary means of security. A Staff workstation on the Issue/Enquiries desk allowed staff to handle queries and programme tags for new stock, and we purchased a Stock Management tool to assist with item location and to help keep the shelves in order. The monographs collection consisted of approx. 20,000 items. Tagging was handled in-house, by a team of three Library staff, and was completed after about three weeks of dedicated work.

The technology wasn't, it has to be said, used to its full potential. As noted above, much of the equipment was still in its infancy and really didn't work quite as well as might have been hoped – although the self-service equipment proved popular with users, staff found it difficult to switch their workstation between Issue and Discharge, which rather put them off using it; the stock management tool (which was heavy, and looked a bit like something out of Ghostbusters), was awkward to programme and use, and never really left the starting blocks; and the retention of EM security meant that the ability to self-issue videos rather lost its shine when users couldn't take them out of the building without staff assistance. All in all, although we had at least partially proved the concept, in that we now knew for sure that RFID worked well in a library setting, we really hadn't taken advantage of it as fully as we might have – in particular, we hadn't seized the opportunity to make the fundamental changes to procedures or working practices which is where the real cost benefit and value-added elements of the new technology could pay some of its biggest dividends. Effectively, we had simply replaced barcode readers with RFID readers, and in the process had made our customers' lives a little easier. Our traditional self-service equipment would issue one book at a time, and couldn't be used at all to issue video or audio tapes (because the electromagnets used to desensitise the item's security would wipe the tapes). Customers were required to open the front cover of a book so that the barcode could be read, and it certainly took practice for them to place the book in just the right position to be read and desensitised successfully. The spine of the book needed to be held firmly against the back of the machine to allow the EM security (tattle tape) tag to be desensitised properly, and those who got it wrong had to suffer the embarrassment of alarms, locked exit gates until staff could sort out the problem for them. RFID changed this quite dramatically – many items (up to 8) could be issued at one time, and

videos etc could also be issued, since the security element in the RFID tag was switched on or off electronically, rather than by magnets. The benefits to the customer were obvious and popular – transactions, individually or in bulk, were much faster and easier using RFID rather than barcode reading EM equipment, and the range of stock that could be self-issued had been very usefully extended.

We had, in addition, learned some valuable lessons from the experiment. 'Self-service' as a general concept had certainly proved popular with our customers, and we now knew that RFID as a technology could work well in a library setting. However, we, and the industry, now knew that if RFID as a tool was to make anything like the impact in libraries as it had in the logistics industry, for example, it was going to have to work much harder to justify the expense and effort. The equipment was going to have to evolve in terms of reliability, flexibility and range; the cost of tags would have to reduce to a more acceptable level, and – most importantly – the ways in which it could be used would have to be fundamentally reconsidered. 'Novel' might be nice, 'clever' might make you feel warm and fuzzy – but 'smarter' was the only way RFID was going to earn its living.

While our Penrith library continued to operate RFID, we opted to develop and extend our range of Barcode/EM self-service equipment at our main Library in Preston. Customers were beginning to demand longer and longer periods of access to the Library building and its facilities, and much of our effort was devoted to finding ways to satisfy this growing demand without incurring additional costs in terms of staffing. We felt very strongly that just opening the building for more hours would be insufficient, and that our customers should continue to have the fullest possible access to resources that we could arrange, whether or not staff were available – so, in terms of borrowing and returning library stock, while we continued to offer a staffed issue desk service on a 9 to 5 basis, and a similar but more limited service on evenings and weekends during term, our growing range of self-service equipment enabled us to extend our opening hours eventually to 24 hours.

By the middle of 2007 our suite of equipment included 6 3M self-issue machines, a 2CQR Returns Unit and 5-bin sorter (all using barcodes for item recognition, and EM for security), and (since our rules dictate that no borrowings can take place whilst fines remain unpaid), a Lorensbergs Fines Payment Kiosk. Whilst this didn't cover absolutely everything (videos, closed collections, etc), it did enable customers to have full 24/7 access to the majority of resources, including borrowing and return facilities.

In terms of RFID, we watched and waited – keeping in close contact with the industry, and influencing, wherever we could, the development of an increasingly useful set of tools.

Current Developments

There's never a 'best time' to adopt any new technology – today's facilities are always better, cheaper and faster than yesterdays, but whatever you buy today is almost guaranteed to have been superseded by something even more ideal by the time tomorrow comes. In the end, you just have to proceed when the time seems right for you – when what is available will adequately fulfil your requirements for the short to medium term. By the end of 2006 we judged that the range, accuracy and reliability of RFID-enabled equipment had matured sufficiently to offer a viable and cost-effective alternative to our existing EM tools, and in consequence we were now comfortable in proceeding with our plans for migration. The timing was also influenced by our judgement that not only were equipment costs becoming more realistic (the cost of tags, for example, had dropped from £1 to about 25p), but that the additional facilities offered by technology would be of great assistance in the implementation of several important organisational strategies – to the extent that further procrastination might well have a negative effect on our ability to fulfil our ambitions in several key areas.

As with many other institutions, we were under pressure to offer increasingly high performance levels in terms of efficiency, effectiveness, relevance and value for money. We addressed this first by reviewing our internal strategies to ensure that they aligned with and fully supported the University's academic aims and objectives, and then we set about a root

and branch restructuring exercise to ensure that we were in the best possible shape to deliver the best possible service to our customers – the backbone of which was a far greater emphasis than ever before upon the ‘soft’ elements of the service, strongly supported by enhanced collections of both traditional and electronic stock. Effectiveness and relevance was addressed by increased investment, in terms of staff time and skills, in delivering high levels of support and training in the areas of information literacy, information discovery, research skills, etc, and, in terms of materials, by increased investment in reading and research materials of all types. Value for money assessments, of course, are achieved by estimating Value and balancing this with Money – value, in our case, was calculated using an equation involving Effectiveness, Efficiency and Relevance, and justifying this against the Money invested in the service. The calculations were aided dramatically by the external imposition of a 10% cut in our staffing budget – which forced us to adopt even more dramatic solutions in terms of efficiency, since we were then faced with supporting our new, revitalised, re-emphasised service with fewer bodies on the ground. One obvious solution to this dilemma was to increase even further our reliance upon self-service equipment, and to increase our use of technology to support other staff-intensive areas such as the location of lost or reserved items, etc. Under these circumstances, the facilities offered by RFID, over and above those offered by Barcode/EM equipment, became an irresistibly attractive proposition. We desperately needed to take advantage of the enhanced stock management tools, both to locate items and to undertake stock-checks; and we certainly needed to be able to issue every possible type of loanable item via self-service – including video and audio tapes, which had been a major source of irritation previously, and certain of the ‘closed’ collections. So far, we had been unable to close the Issue Desk because of the need to issue items which could be handled through self-service. We now needed to release staff for other duties.

In designing our migration strategy, we decided at a very early stage that we needed to build in as much flexibility as possible. Although of course our first consideration was to replicate and enhance the network of self-service issue and return facilities we had carefully constructed using Barcode/EM, our ambitions went far wider than that. We had ideas for a whole range of RFID-enabled services, and wanted to be able to make use of the most appropriate equipment for our purposes - to which end we might well want either to pick key products from, or develop them with, a variety of different suppliers and manufacturers. The implications of this, of course, is that whatever piece of equipment we chose would have to be able to interact seamlessly with our tags. That sounds like quite a simple problem to get over – wrong! Although tags are probably the most fundamental of all RFID equipment, and in essence are almost identical no matter which factory they’re made in, they change dramatically once programmed. It seemed, when we looked into it, that pretty well every equipment manufacturer uses a different programming standard – very effectively making it almost impossible for non-proprietary equipment to read their tags.

‘Standards’ for RFID in Libraries have been under debate for some time, and while no clear definition has as yet emerged it seems likely that a derivative of the existing ‘Danish’ standard might well prevail. The first challenge we faced, then, was to identify a tag supplier whose product most resembled what seemed to be the emerging ISO standard. This took some time, and a great deal of research and investigation as part of our tendering process. In the end, however, we selected the supplier whose product we felt most closely matched the specification, and who seemed most open to sharing the details of their specification with others. We took delivery of half a million tags, together with the necessary conversion equipment, during the autumn of 2007. Whilst the majority of these were book tags, we had also included a reasonable number of tags to suit CDs and DVDs, videos and audio tapes. The CDs and DVDs presented particular problems in their own right, in that they had long been recognised as ‘problematic’, and very difficult to cope with in terms of RFID. If we were to achieve the almost 100% self-service target we had set ourselves, we knew that solving this issue would be key to our success. We had never been able to allow self-service for videos and other magnetic media, so the automatic ability to do so by using RFID would be a massive step forward for us – however, magnetic media items are diminishing very quickly in importance, superseded in large part by CDs and DVDs. It would have been a supreme irony if we could not now facilitate their self-issue and return due to a novel conflict of technologies, but through experimentation and development with several manufacturing

partners, we are confident that we have been able to reduce any negative impact to a bear minimum. Another important point to consider, in terms of standards, was what would happen if we found ourselves stranded between the Danish standard (or at least our supplier's version of it) and the final version dictated by the emerging ISO standard? To build in as much insurance against this (quite likely) possibility as we could, we exhorted guarantees from our equipment suppliers. 2CQR, for example, who supplied our Returns equipment, have assured us that they will supply software which will not only recognise both standards but will convert our tags to whatever standard finally emerges. 3M, who now supply our Issue and Security equipment, have assured us that their equipment will be programmed to read both standards. Nobody can read the future, we can only do our best to build in sufficient contingency arrangements to insure against adverse change.

Obviously installing and programming half-a million RFID tags is not an exercise to be rushed into. We had considered the merits of using Library staff to perform this function, but for a range of reasons (some political, and some logistical), we elected in the end to contract-out this element of the project. Following a tendering process, we selected a small but well respected specialist tagging company, a decision based as much on their reputation as upon their competitive price. The Tagging Team (Mike and Martin Parsons) began their operation on 4th February, and brought it to a successful conclusion on 30th June – remarkably, a full month ahead of schedule. Quality control was a major concern for us. Although we had worked hard to ensure that our 'front of house' colleagues were comfortable that RFID would offer major improvements for our customers, they needed to be certain that RFID would at least match, if not outstrip the current facilities in terms of accuracy. Our EM and barcode-reading machines were, after all, tried and trusted tools – with RFID we had an opportunity not only to make it easier and faster for our customers to borrow and return items, but to widen the range of self-service-friendly items to include magnetic media, etc., which we had previously been unable to allow on the grounds of possible damage from the equipment. Although we could test and reassure ourselves that shelf-ready new stock from our suppliers was properly tagged and programmed, it seemed inevitable (given the number of items) that some mistakes would occur during the retrospective tagging project. The last thing we needed was to find that any improvement in range and scope had been offset by untagged or improperly tagged items – we had found from previous experience that our staff needed to be able to trust the equipment, and to have confidence in its accuracy and reliability before they could 'sell' it effectively to their customers. Without that their trust in the equipment would evaporate, and any lack of enthusiasm would very quickly be transmitted to our customers. A robust quality control regime was initiated, designed jointly by ourselves and the tagging team, and colleagues from all sections of the Library were invited to take part. In the event, very few failures were identified, and were quickly rectified. The effect of involving our staff closely in this process, though, was a very beneficial raising of confidence levels and the development of a strong and lasting sense of ownership of the project.

A number of factors influenced our decision-making as we began the next phase of the project, the selection and installation of RFID equipment. We had just embarked on a series of major projects to modernise the Library building, the first phase of which included the total transformation of the Ground Floor to create a sector-leading Student Learning Zone. Our existing range of self-service equipment (consisting of six 3M self-issue machines, a 2CQR Returns Unit and 5-bin sorter, and a Lorensbergs Fines Payment kiosk) had proved extremely useful and very popular with our customers, but we had always needed to retain a staff-assisted facility to handle those transactions (mainly magnetic media items) which could not be facilitated through our EM equipment. Our ongoing RFID migration programme, however, had enabled us to remove the last barriers to full self-service. Our traditional Issue Desk could now be removed completely, and staff resources redeployed to more actively customer-supportive roles. We would henceforth rely entirely upon self-service for all 'circulation' transactions.

As illustrated above, our Library modernisation programme involved not only some major alterations to our physical infrastructure, but some really fundamental changes to the way we work as a Library – with the focus very strongly upon delivering top class customer service and support, reinforcing and building upon already high performance levels in this area.

Clearly, then, the equipment we selected would have to interact perfectly with our chosen tags, and would have to offer very high levels of reliability and flexibility – as well as delivering value for money. We exhaustively tested machines from three suppliers, and after a great deal of deliberation we selected 3M Self-Check units – on three counts: they are easy to use (the interface is simple and largely self-explanatory); they incorporate a change-recycling fines-payment facility (reducing the need for staff intervention), and our tests proved them to work extremely well with our stock. As part of the tendering process we arranged for colleagues to independently test the equipment offered by all three of the tendering suppliers (3M, 2CQR and Intellident). All three supplier's equipment behaved well, and read our tags correctly. Individual books were read equally as well by each, and so were piles of several books at a time (although the design of both Intellident and 2CQR's equipment restricted the number of items which could be offered). However, we were impressed that 3M's Issue machine was the only one which read our multi-pack items correctly - first time, every time. In addition, although each supplier had offered equipment which would accept payment of fines, 3M had an edge being the only manufacturer to offer change-recycling facilities, which would, of course, substantially and importantly reduce the requirement for staff intervention on an ongoing basis.

We have installed seven issue machines – six to replace our current compliment of EM machines, and an additional one will be employed to open up our previously 'closed' collections (Reservations and Restricted Loans, and the new 'Core Texts' collection of heavily used course books). These will be housed in a new Core Collections room, and protected by its own RFID security system.

Our existing 2CQR Returns Unit, originally supplied to operate using Barcodes and EM, has been converted to RFID, and we have added a second Returns Unit to reduce the need for queuing. Behind the scenes, the sorting equipment has been extended to incorporate a further two bins – and has been modified to catch any items which might have been on loan for long periods, and thus have yet to be tagged. We first obtained the equipment after we hosted an RFID in Libraries conference in December 2004 – our Director persuaded the manufacturer that it would be far more cost-effective to sell it to us at a small discount than transport it back to Finland – and we have been more than impressed by its reliability and usefulness ever since. Indeed, it has become such a vital part of our Circulation equipment that our staff almost revolted when it was dismantled in readiness for the Ground Floor conversion. The Lorensbergs Fines Payment Kiosk has been retained for use by anyone who needs to use banknotes to pay their fines (the 3M machines will accept coins, but not notes), and, to cover all bases, a card-payment facility will be introduced shortly, either attached to the 3M machines or offered via the Web, thus reducing even further the need to queue or to seek staff assistance for this type of transaction.

Has it been worth the effort? It's early days yet, and in many ways only time will tell – though we are very confident that it will have been. Some impacts are easily measurable, such as the length of time that customers are involved in 'circulation' transactions, or how much staff time has been saved in the search for 'lost' or 'reserved' books, but some are more complex. We will be monitoring a range of factors, but anticipate that one of the most important gains facilitated by RFID-enhanced self-service will be the re-focussing of valuable staffing resources away from the traditional 'Issue Desk' activities to provide enhanced, individual support to our customers.

Where next?

So – we've done the basics, and by using RFID to enhance the traditional circulation tools, have created the opportunity for some really quite fundamental improvements to the way we operate. But what else can you do with RFID? It's helped us to re-allocate some valuable staff time which can be devoted to other efforts, most importantly to enhancing our assistive service to customers, but it's still not enough, and we want to reclaim even more staff time that we can devote to similar efforts. So – can RFID help us to work 'smarter'?

Given that RFID is, at its simplest, just an alternative means of identification and location, how far can we push the boundaries? Can we use it to improve our performance in any other ways? Maybe it can.

RFID identifies individual items, remotely, and very fast – depending on the thickness of the items offered, it will read, recognise and record anything up to 10 items of assorted types at a time. The benefit to customers, in this respect, is that they can issue several items in the same amount of time as they used to issue one using our Barcode/EM equipment. Our new stock now arrives from suppliers in a shelf-ready condition, which includes a programmed RFID tag – so why can't we use the technology as part of the Acquisitions process, and thus remove yet another manual intervention? We've set up a project panel to look into just this, and are working with 2CQR and Talis to develop a system which will use our Returns machine to receipt new stock, and our Bin Sorter to filter the new stock ready for shelving. Having a second Returns Unit will enable us to do this whilst still retaining a fully automated Returns service – and the value-added benefits for our customers will include additional staff time allocated to direct customer service, and the books will reach the shelves probably days earlier than they might have done using the traditional manual methods. Also, by integrating this with the facilities offered by EDI and an integrated Talis / Agresso system, we hope also to have closed the final manual gap in our financial procedures. For example, when a box of shelf-ready, pre-tagged stock arrives from our suppliers, we will be able to open the box and offer the books to one of the Returns Units. The Returns Unit will, via the item's pre-created record in Talis (our LMS), be able to recognise the item as 'new stock'. The Talis record will be update as 'received', and the item deposited into the appropriate bin, either for immediate shelving or set aside as a reserved item for the subject librarian. The supplier will already have delivered an electronic invoice for the item via EDI (Electronic Data Interchange), and as part of the receipting process within Talis, a 'proceed to payment' flag would allow the invoice to be queued for payment, and the catalogue record exposed as 'in stock'. Several manual steps will have been removed from the process, saving valuable staff time which can then be redeployed to more productive activities, and saving probably several days delay in making the item available to customers. We hope to have this facility sorted (excuse the pun) during the next academic year.

And then there's the age-old problem of stock management and item location. We'll be using Stock Management tools which will assist staff to locate lost, missing, reserved items, etc, and for occasional stock-taking exercises – but why can't RFID just tell us what's on the shelves, and exactly where an item is?

It can, of course – there are already 'Intelligent Shelving' systems available which will feed library-wide information back to a staff terminal, making remote stock-taking and item location very easy. The system developed for the Singapore Library Service works very effectively, and similar systems are in use in bookshops in Scandinavia. As far as I am aware, no suppliers are offering a product in the UK which would be attractive to most libraries – certainly not unless they are willing to replace their current shelving systems with new. We are currently working with 2CQR and TagVision in Denmark to develop a free-standing product which will work with our metal shelves, and very much hope to pilot a system in the foreseeable future. There will be one major difference to the standard model, though – ours will certainly report back to staff monitors, but will also feed back to our online catalogue. We're really looking forward to the time when our customers can stop telling us 'The catalogue says the book's in the library, but it's not where it should be and I can't find it'. There are a number of issues to overcome here, of course – one major problem is that RFID and metal (or electronics) don't mix easily; another is the read-range of the RFID readers, and the need to ensure that the readers are looking only at the area required. We and our partners are confident, however, that with determination and persistence we will overcome these hurdles so that, once this system is operational, our customers will know not only where the item should be, but where it actually is – RFID will have reported the item's exact current location to them as part of their catalogue search, whether it's been misshelved in the stacks, is in use on a desk, or indeed which trolley it's on waiting to be re-shelved. No more lost or mis-placed items – and we will certainly be able to tell which items have never been removed from the shelves, and so be able to identify stock for withdrawal

and replacement by more pertinent items. Gone will be the days when such decisions relied upon the thickness of dust!

Does it have to stop there? Probably not – there are lots of other ways in which RFID could be developed for use in Libraries....anyone interested in walk-through check-out maybe? Wouldn't it be great if customers never had to check out or check in library materials? If our equipment could recognise the customer, and automatically record the items they walked out with as issues – and then return the items back into stock when they walked through the entrance, we wouldn't have to worry about fines and such like – and nor would they. The technology's not there yet, but maybe in a couple of years' time?

The questions to ask of any suggestions for development, of course, are – Will it help us to improve our performance? Will it help us to release staff to other, more directly customer-supportive roles? Will it help us to deliver excellent services and value for money? Never mind if it's novel, never mind if it's clever – will it deliver smarter?

RFID might not be a cure-all for every ailment libraries may have - but we are certainly convinced that RFID will change the way we operate as a service, for the better, and in more ways, eventually, than we can even imagine at the moment. We are ready, and are certainly prepared, to take advantage of any advance it can help us make in terms of making it easier and better for our customers to use our resources – and which might help us to improve our efficiency and effectiveness as a customer-oriented service.

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