

Case Study: International Paper

Steve Van Fleet, Director, Smart Packaging, International Paper

We've had a completely RFID-enabled warehouse running now for 14 months in Texarkana. We're presently deploying five additional warehouses inside IP and three with our customers. So today I will go through some of the impacts and triggers that affected our business case.

Texarkana is right on the border of Texas and Arkansas. The warehouse was built in 1972 at a cost of 1.2 billion dollars. It employs over 900 people. It's about 1,800 acres under one roof. We produce about 4,000 tons of bleach board, which goes into packaging things such as Microsoft DVDs. We are presently consuming about 1.2 million chips a year. ([Download presentation.](#))



Steve Van Fleet

In terms of trying to frame the problem, this is a typical sort of a warehouse. The warehouse is about three quarters of a million square feet. These are very big rolls and we lose them. You might not believe that, but we have a tendency to lose them, and it creates a sort of a unique challenge. A couple of things happen if you can't find them. You have orders, so we have to make another roll. You eventually find them [so now you have excess inventory]. The current technology is bar codes. [The bar code identifies which 40 by 40 foot bay the roll should go in]. The operators use symbol technology bar-code readers, and we have problems with operators who put the wrong rolls on the wrong rail carts for the wrong customers.

Our current technology before we implemented RFID was onboard bar code with Intermec screens our DC back door WMS system. An operator would drop a roll off and scan the bar code up on the ceiling for the bay, and that basically associated the roll with the bay. But often, for lots of reasons, it didn't happen, including operators who wouldn't do it all the time. A big challenge occurs if you are loading a particular rail cart and the roll you need is three or four rolls back into the bay don't move those front rolls and all the best intensions of putting them back they don't for own purposes are missing so we typically write off between 1 million and 8 million dollars a year per warehouse.

It's a sizeable issue and not just specific to International Papers or problems with these types of rolls. Such sort of framed up problem in terms of going into this project to put RFID we have some non-financial methods. First, we had to find three customers to agree to share on this value proposition, and we met that criterion. Right now what we are doing with three of our converting partners to see her in the moment that you put the tag on the cart and the rolls as there were papers built so stays with it. We have three converting partners where we put RFID readers on the back stands, and as the roll comes into that reader field it does a couple of things. It orders a new roll and it bills them for that last roll so we met that criterion. We've been able to consistently locate 100 percent of the rolls produced over the last year. The ability to read a tag 75-inch diameter paper 150 inches wide this was a very difficult challenge. Again the tag is on the core and the paper's built around it. There is a lot of water in the roll, about 100 gallons of water in a large roll, and this is probably the maximum limit I've been able to drive RF energy through. But we've been able to do that successfully. We had a requirement to read a roll and locate a roll and our warehouse was in plus or minus 2 feet. We actually ended up reading plus or minus 4.8 inches. We not only track our rolls, but we track our operators in our forklift trucks.

We make about 2,000 rolls a day. To tie this back into our legacy system, we associate the RF tag with the bar-code tag is very important that we had a 100 percent association. We actually stop the roll before it goes into the warehouse and spin it on the conveyor. If we don't get the bar code, we don't get RFID; we stop the conveyor line we ask for revolution this way. All rolls going into the warehouse where the real value proposition lies. We know there is a 100 percent association. We've a target of 100 percent operator utilization running about 97.8 percent. Up until few months ago, we left the bar-code system in the system I showed you as a backup. There is always a percentage of your workforce that refuses the change, and three months ago we pulled the bar codes off the system. So there is absolutely no backup on the system now. Still we are running at 100 percent on our RFID.

We had a requirement to identify and report. I will in five seconds we ended up doing 2.3 seconds. Basically what happens is the operator is seeking a moment the clamps grab the roll we've to

identify that unique ID beside what customer it is and give the convenient instructions as to what rail cart to put it in. We do that in 2.3 seconds, so it does not slow the system down. We had a requirement to use the existing RFID infrastructure. Again, we had the Teklogix terminals stocking our backdoor or legacy system. The problem is that it was running on 950 MHz. It was a proprietary backbone, and we started up 22 forklift trucks with 950 MHz; that was another bad day. Basically, we shut down the communications on the network, so we are now having to put in 802.11 back bone, which overall was a good thing.

In terms of financial performance, we had a capital request of \$1.98 million to do our warehouse. We have about \$800,000.00 targeted benefits for a 17 percent hurdle rate, which is not a bad hurdle rate, and the paper industry could be better. Most of this came from write-offs, again the rolls that we can't find. We have a customer service center in Memphis that takes all the incoming orders from our customers, and they are supposed to allocate that to an order. But history has proven to them if the rolls are not really there. So, they are on the safe side and actually produce a second roll. As you can see, this becomes a snowball, and at the end up lots of rolls out there. Real storage with the mirage a lot of shipping areas, this was a very low number that was actually quite higher than that. We put consistently the wrong roll and the wrong roll in the wrong rail cart to the wrong customer. Tremendous labor savings, reducing our client's fleet and a big area was eliminating our A1 quality rolls of the roll deck. We have a broke system if rolls are not high quality they get blocked and (inaudible) and recycled through the system for fiber. What happens with operators is if they didn't know where to put a roll, they will just put it on the rope deck. There were no checks or balances, so they ended up throwing good fiber after bad so this is how we went to do it how we ended up was little better than that.

We ended up a close to 30 percent ROI, and our benefits audited out from the first year 1.4 million dollars. The incremental improvements came from quite a few different areas. One was we spent less capital, and we said the work was (inaudible) go over. But more importantly, there was some tremendous insight so there were a lot of things that we didn't know going in.

In terms of how the system works, it is basically three systems. We have put RFID tags in the floor throughout our warehouse periodically in the driving aisles; these are then battered into the floors. We have tags in our paper rolls, and we have a locator system built onto our forklift trucks. Basically, it's inertial navigation unit. Collectively what it does is when operators come up to grab a roll and kind of one was to roll that read the unique ID and then as they (inaudible) as they move throughout the warehouse we are able to track them with a plus or minus 4.5 inches.

A couple of things these are I think the tacklers with respect to business value that we found that really impacts your ROI. One is the legacy integration. There has been a tremendous amount of emphasis put on the low cost tag, but you really have to look at this from the prospective of your roll-in costs. We had some proposals from the traditional thought leaders that wanted to come in as consultants. That would basically double the capital cost of the project. We have all legacy systems; they all are COBOL based systems. I am not sure the people that wrote them are even living anymore, but the problem was is to interact with them to be able to take advantage of high granularity RFID data. You can't take the traditional integration. So what we did was we fundamentally use the very thin client layer interface, and on the legacy side of the application is still thinks that the bar code and still thinks a 40 x 40 foot bay on the application side. We are talking about a 64-bit EPC tag at the time and plus or minus 4.8 inches. So by only integrating a minimal amount of information, we significantly reduce the cost of the project and hence the higher value of the project.

By associating the roll the ID that was always in the system to the unique ID we have opened up quite a few opportunities that hereto (inaudible) really available on the paper industry. One was the ability to do preferential loading. For example, as soon as I grab a roll I can see exactly all my quality data. I can know exactly what roll position is on the machine, I can tell you the basis way in the quality perimeters that are so fundamental. If you have a customer that is looking for a certain level of granularity or quality, this type of unique ID allows you to do that. Here is an example of the type of information we have done, and again, this was done with almost zero. It's like I see integration by simply associating the unique ID with the existing identifier that we have in the system right now. We were able to pull forward all the quality data, so for now we have one printer partner that is actually using readers on the back stand and is looking at the quality of the rolls coming in and make an assessment as to how to set up the printers.

You could have more and more reads and hits on the reader, there is an opportunity for incremental value. This was part of our value proposition. This is creating the business value is obviously an evolutionary process. We've been in this now since early 2001. We started with a 125 KHz. It had some problems it had some opportunities. We actually use 2.45 GHz beacons on the ceiling as part of the locator system. Each of these have their inherent problems, but if you take it, if you look at this from the prospective of the business value, you need to have that drive it and all these sort of fell through to the fall force, so in the end of analysis, we ended up with a tag on the cart and industrial harden reader and common processor. The point here is that we had lots of failures. We went down a lot of dark rabbit holes. We failed with a very strong team that was fond of methodology to basically work with failure. But in the end, as long as you kept the ball sort of, looking at business value, it turned out quite well for us.

Another serious issue affecting business values is robustness. In a typical driving aisle in a paper mill, we have conveyors that go over these bumps in the road (inaudible). I don't know if you have seen large forklift trucks, but there is little suspension on them. In fact, the accelerometer test was shown that we saw shocks up to 20 Gs. So we ended up having to build a reader that supports 30 Gs of acceleration to atmospheres the water, because we use high-pressure cleaners to do this nothing 220 degrees non condensing. We spend a half million dollars industrial harden and matrix readers just to get the type of work time that we need here.

This is an example of our clamp trucks. You can see the kind of vicious pieces of equipment you have got the conveyor and (inaudible) sitting on the clamp pads here, you are forced to put the reader outside on the conveyors, because these things turns 360 degrees, you can't put RF through slip rings so this created some difficult design problems for us. We put the antennas right on the pads to make them work, and they are very close to the paper. One of the issues that we had with some other technology was difficult to control the angle of a (inaudible) of our forklift operators. With this design, it doesn't matter which angle they come at the product with.

The industrial hard and Matrics reader sits right down on the clamps itself in a very hostile environment. We can set with a half million dollars investment, we had those readers run now for 12 and a half months with zero failure rates. They sit out there, and they work everyday. If you look at some of these clamps trucks, they have large indents and solid steels to block (inaudible) removable objects in this particular electronics continue to operate. For example, this is the commercial available reader that I think this made to lunch time one day last battle with the Big Hydraulic Clamp. But most of the readers you buy today are still R&D quality. Part of the business value proposition is giving equipment that is going to last 24/7. I mean connectors parts and side rattling water heat humidity obviously not all your applications are going to be as intense to these, but you know this is not our (inaudible).

If you are trying to support a business value proposition, you have to think of both things like this. Business value road less travel. You know when I look back on this, probably two years ago, this was our R&D setup. I can see now why management didn't have much faith in us delivering anything. But clearly, if you think about what we were doing, we had a big open space with rolls and peddles that didn't work. And it just wouldn't work, because we know it's been there. We just didn't know where to find it, so we had to push the limit and we had to try to understand how we could track our operators so that we knew precisely where they were on the floor; if they can touch that roll, I can track them with plus or minus 4 inches. Soon as he releases that roll, I know precisely where it is and illuminates a lot of the issues.

This is what we ended up with after two or three years of dark rabbit holes, but this common process sits on the machine, automatic forklifts, it takes in the readers it takes in the inertial nave unit that communicates back to the host. We solved the lot of problems, and there are other ways to do this, and there are probably better ways to do this. But the point is, this was driven by business value.

This is really where a lot of incremental value came from. This is a typical run of an operator picking up and dropping rolls to the warehouse. For example, if he drops the roll in the wrong rail cart, a screen immediately comes up and says this is the wrong rail cart, please move it over to the right rail cart. Again having a high granularity of closing distance allows as to make those type of decisions and write business rules. But what we found, which is kind of disconcerting, is that out of the eight hour shift, 4.2 hours a day the forklift truck is neither moving; and of that 4.2 hours, 60 percent of the time is nothing in the clamp. So if you do the math, we are giving about

2 hours a day of work out of an employee, and you can't blame the employees, because they are basically doing what we have been doing for a 100 years in the paper industry. In the morning, they were given a list to fill this rail cart, and they drive all over house half acre to fill that rail cart, and they come back from that corner when they are empty.

Now because of our RF technology, I know when there is nothing at the clamp and also know that you are in that corner. So what we have done is we have gone to a picking pool versus a piece of paper, and if are sitting on that corner and you drop a roll off and I know you are there what were given in the instructions to pick a roll up now may not be for the same rail cart may be for a truck may be another rail cart what we've done is that we rationalized the ability to run a warehouse but not 22 operators but 6 operators. This is a union environment, so we have to walk slowly on this one. I think this is a good example of insights. I guess you could have an efficiency expert look and see what just watch trucks not moving, but it took this type of granularity to (inaudible) understand fundamentally is a different way of running a warehouse. To that point, as we move out into other mills, one of the events of the 802.11 wireless is we have help desks so on built into these things so that we can check the performance of these readers we can watch movements.

There is a lot of data being generated by RF. Any others desiring IT, on the part of our IT groups throw it all the way and I won't let it be thrown away for a while, because a lot of these insights were in that data. Eventually we won't keep track of all this data, but because business value is somewhat fleeting in RFID, you have to look through this data and understand what the value is so.

The ability to keep things running, we have a remote support service in Memphis, we look at these trucks moving around the country or watch the movements and again because RFID values highly marginal we go to keep these things run on a 100 percent of the time. We are taking the same technology with our customers now and actually applying it to forklifts and tracking wheel on an (inaudible) distribution arm we are tracking some of the trucks in the yards and so on. It's a pretty robust technology from that perspective.

And finally, the last point that's key to understanding business case value is employee engagement, so we chose Texas County for a couple of reasons, one being that it's probably one of our most efficient mills and it has been very receptive to new technologies.

And what we found was this is example of the Web page we created performed matrix from our operator right down to our drivers in fact can't see it here but we have actually created something very attentive fantasy football with you in fact quarter back scoring for our operators basically, a 100 percent utilization every day is a touch down no manual moves is first down. If they make an emergency move and put it what we tell him not that's a fumble and essentially what we have done is we have created a sort of a competitive environment for our operators it's training under very good opportunity from this particular screen here forget about the colors. You can see very quickly the operation of the warehouse in terms of what trucks will be unfilled or there are any issues with emergency moves truck availability and what we trying to do is again because the marginal nature of RFID value it's very important that you get these things in terms of matrix.

In terms of challenges at (inaudible) both inside and outside in a national paper, one of the problems we are dealing with right now is internal competition for a scarce capital. Obviously energy is a big issue; the paper industry is a huge user of energy. Energy projects have a 50 percent ROI, so even though 30 percent is incredible, 50 percent is even better. We are competing just like any other project for incremental funding.

Our learnings are continuing, and our maintenance model is evolving. For example, over time, the coaxial cable between the antennas and the readers is destructing a little bit. What we found, and maybe we should have known this because we have some very good engineers working for us, is certain length of cable that will support a standing wave, because we cut having antenna failures. We kept sending the antennas back to Matrix, and they nothing was wrong. Eventually we found we had a standing wave issue that came about only after a certain amount of way, so you know we are looking at ways of evolving our maintenance models so it's much more robust. These operators have the forklift trucks despite SOP use these clamps as can openers to close the door and open doors on rail carts, sometimes there is damage in the antenna, so you have to keep making these things a little more robust.

In terms of external deployment, we done a pretty good job of educating our own management executive, but as we take this to our customer, our efforts just starting to get into the executive offices. There is a lot of hype out there, and a lot of people are selling top and business cases and sort of power point technology. We have come out through the school of (inaudible) marks through last two years we learned what does not work and what does work, and education is going to be very important I think ground everybody until where the real values are going to come from. Now pragmatic business case is mandatory. There is a lot of hot top and business case that were sitting out there they have need to them. We believe that in the early infancy of this marketplace, the business cases have to be built from the floor up. You have to try to solve the problems of your own particular application and work through it, and when you do that, the business cases look radically different from those that have been published recently. Over, slap and ship mentality I mean I just hope those words go away. I don't think anybody in their right mind is going to put cost into the system forever, but does know value associated with this so this be used to be get behind this don't be afraid to fail.

As I said earlier, I am particularly proud of my team. We had some pretty dark days, you know three years is a long time to be allowed to be in (inaudible) so to speak inside a paper industry. We spent \$30 million from November 1999 through December of last year on several projects and developments, but it takes a special type of people, which I have in my team, to be able to fill and keep going and I think it has paid off for us. Focus on RFID. This is a silver point for me. There are a lot of people selling into us right now, but one who rap RFID around the particular thing is that the selling be it servers, be it consultant services that type of thing. I would suggest that one of the most important things you have to do is make sure the RFID works first. Focus on the RFID, make sure it works in your particular application before you start worrying about investments and middleware integration and all the other things that we try to put into the same package. And the last thing is keep it simple. One of the greatest findings that came out of Texarkana, and we should have understood this, was we have had drivers for years in the paper industry and over the years we have added on bar code, we have added on computer terminals. Well now with this RF, we have been able to strip all that off the truck. We were sitting with some operators, who have had an unusually high acceptance to this technology, and one operator said it allows me to just to drive again. That struck home. It's really pertinent, because if you keep it simple, you try to engage your operators and get back to what they are going to go, what on the payroll for, you will find it with a very good acceptance.

Question: One of your stated benefits was reducing the client truck fleet. How did you realize that?

Van Fleet: Well, obviously when we found that we rationalize that we could only ran it with six people versus 22 we maintain a fleet of about 25 forklift trucks. So clearly as you reduce your fleet, these are on the lease basis would be able significantly reduce the lease rate. In fact, one of the things that failed dimension was were actually working with our leasing companies so that inbound clamp trucks in the future will already be RFID enabled, which changes the dynamics of your capital versus leasing.

Question: Are any of your customers using the RF information or are you supplying it to them yet?

Van Fleet: We have three partners that are converting partners. First, we had to do an environmental analysis on the chip, because all of these paper rolls go to our converting partners and the carts get pulped or re-pulped. So everything was fine there. We have three converting partners that actually receive the rolls and we put readers we have actually paid for the readers to prove this so at time back standing they are converting equipment as the rolls comes on to the back stand and reading that tag and waken up a process I am phoning home and billing him for that roll and I am ordering another roll. So one could argue that this could be the first step so somewhat vendor made is inventory you know consignment inventories pretty big in the paper industry vendor to be based on our honored system not really honorable some and this is a way normally the papers consumed may be you could pay quicker type (inaudible).

Question: What was the functions that were part of your team and who was the owner?

Van Fleet: In November 1999, we wrote a capital request to fundamentally deploy an RF solution with some of those non-financial targets. We did not want to reinvent the wheel. We reached out

to several vendors who did a lot of the antenna design to redesign those type of things, so I would say that my team is more of an aggregator as opposed to somebody reinvest the wheel. Now we generated about 17 patterns out of the work we did specific to the warehouse and so on it's the result to it there was great deal of learnings. But our role right now is one of an aggregator versus sit down physically doing the work ourselves. In terms of owners, the mill manager who owned the Texarkana facility was the ultimate owner. I had responsibility for the capital expenditure, but ultimately the way it works International Paper as the mill manager you sign off on that capital request and it's a 15- or 20-month project. On the 21st month, the benefits that you claimed are in your budget, whether you get them or not. So obviously there is some high percentage of making sure when you sign off and this thing is going to work.

Question: Were the tags you put on those rolls active, semi-active, or passive?

Van Fleet: Passive tags. That was the challenge of getting through 72 inches of paper (inaudible) are Matrix 915 tags. We tried some 125 KHz and 5 (inaudible) but we had some issues with stability on those we went to 1356 on the outside just behind the label when we thought that we were on a road, killing the project but we couldn't make it happen the problem on the outside is we got to read distances and issues and right now we have to put four labels on a roll traditional bar-code labels, because the operator it was so large can't control the angle of the tags so as a result of this RFID tag on the inside we will back and off on labels if we eliminate 319 cent labels we start still balance out of the (inaudible) RFID. Thank you.