Technology at Armstrong and RR Donnelly

INTRODUCTION

The primary purpose of our visit to both Armstrong and RR Donnelly was to investigate how technology plays a role in the production of consumer oriented products. Specifically, our particular mission was to answer the following questions:

1. What is the role of new technology in a gravure printing plant? Reduce cost? Shorten cycle time? Increase throughput?
2. What is an example of the new technology adoption in the RRD operation?
3. What is an example of the new technology adoption in the Armstrong Operation?
4. What are other examples of new technologies that you reviewed in the literature?

Anton took control of Armstrong, while Thomas took the helm on RR Donnelly. Both of us worked on these sections using notes that we both obtained at each of the facilities. Our paper utilizes a combination of the notes we obtained from both companies, the employees who guided us through, and research we conducted on the Internet.

ARMSTRONG

Our first stop in Lancaster, PA was Armstrong Incorporated. Armstrong Incorporated is a leaded manufacturer of flooring, ceiling, and cabinetry products for household consumer or commercial businesses. What is unique about Armstrong is they produce specialty products that are much more affordable than the real thing. Customers look at Armstrong for providing flooring that looks like hardwood floors, or detailed cabinets that look built by a master craftsman. The plant
we visited in Lancaster is the second biggest in the United States. Both manufacturing facilities and corporate offices are located here and we had the opportunity to visit both.

ISO 9001

One of our research topics related to our topic of technology is the ISO 9000 specifications. ISO stands for the International Organization for Standardization and is the largest developer for global standardization in product manufacturing. ISO is very well known in the manufacturing industry; ISO 9000 outlines specifications in the area of quality management. These specifications enhance customer satisfaction and promote continuous improvement. To obtain and maintain ISO 9001 certification, audits by the organization must be performed regularly. More so, it is fair to say that customers of Armstrong serve as auditors as they ultimately decide how well Armstrong’s workflow is quality managed.

MANUFACTURING

Buddy Ganse, a printing industry veteran and an employee of Armstrong for six years, led us through the manufacturing facility at Armstrong. Generally, we were amazed to see the amount of automation that is involved in the manufacturing process. As we moved through the manufacturing facility we were able to see less of a need for human intervention.

PRE-PRODUCTION

For efficiency, Armstrong utilizes computer assisted tools before a job goes to press. One specific technology we noticed is computerized ink mixing. Formulas for ink mixes are calculated precisely by means of computer software. For proofing, Armstrong utilizes the X-Rite Color Master Software Suite. Using a spectrophotometer, users can obtain measurements on a proof and obtain calculations for how close that particular proof created by Armstrong is related to the customer approved L*A*B* values. A graphical representation of the measured proof in
addition to a data output column is given on the software, which is all measured against a set library of approved colors. The QA Master software, which is a part of the X-Rite Suite and common in the US, forecasts ink usage and serves as a powerful estimation tool.

Armstrong also relies heavily on robotic for materials handling throughout the facility. This is very significant to the company because of tremendously heavy weight that exists for finished rolls and gravure cylinders. Buddy Ganse mentioned that cylinders at Armstrong could cost upwards of $10,000, while the material used for printing is approximately $1.50 per square yard. These are significant costs for both, and it is imperative that Armstrong handles these materials very carefully to avoid costly damages. Overhead cranes on a crane rail system carefully transport materials when needed, significantly reducing the likelihood of human error.

**INSPECTION AND PACKING**

Customers expect to purchase a product from Armstrong with no defects. Minimizing defects can be difficult, especially for a company like Armstrong which is dealing with large, numerous rolls of material. In the area of inspection and packing, Armstrong utilizes a pattern recognition system. This system knows the pattern that has been printed and senses errors. This completely automated, computer controlled system has sensors that line up in certain zones to find defects. In addition to defect recognition, an optimizer knows the minimum requirements of a job and knows when to splice from roll to roll. This system is commonplace in specialty product market and ideally picks up on things the human eye may not be able to see.

**PRODUCTION**

One of the things we noticed was the press was quite old. Although very large in size, Armstrong utilizes a press that is over twenty years old. However, technologic tools exist on this seemingly ancient press and it greatly help with production at Armstrong. The Armstrong Register System
has a CCD array at each unit which helps for mark to mark registration. Although press crews are on hand to supervise the production, the control of the press is computer controlled and monitored at a control station. This control station also specializes in data collection for problem recognition and troubleshooting.

**CORPORATE HEADQUARTERS**

Rod Sosa was our guide for the Corporate Headquarters at Armstrong. This was a completely different world in comparison to the manufacturing facility. Specifically, it was quite clear that the main focus was on aesthetics. Armstrong utilizes the Corporate Headquarters to showcase many of their products for customer tours; in addition, employees are working on innovating and improving their product line.

**DIGITAL PROOFING**

To better mimic the materials associated with the real thing like wood, high detail scanning equipment is necessary. The Cruse Digital Scanner at Armstrong scans images at 300 DPI and allows for objects as thick as four inches. This scanner is what we would consider unique to the industry; Armstrong holds one of the two scanners in the entire country. At a cost of about $90,000, another unique benefit to the scanner is the ability to do large pieces. Armstrong’s previous equipment only allowed for objects about twenty inches in length; the new Cruse Scanner can scan objects much larger. This shows how Armstrong is innovating in the industry to better serve its customers.

**WORKFLOW**

Armstrong currently utilizes a combination of InkSite and AVA for workflow optimization. Here, they have a data-based library that allows for digital storage and manipulation of Armstrong’s production files. All of these files can be edited in real-time at any workstation in
the headquarters. This is vastly different from their old production methods, which required the use of a mini, hand press. However, this particular discussion at the Armstrong Headquarters led us into our next research topic: JDF.

**JDF**

JDF stands for Job Definition Format and was developed through a partnership between Adobe and the International Cooperation for the Integration Processes in Prepress, Press, and Postpress (CIP4). Both of these organizations have backed JDF for a number of years and have helped to make JDF become more popular in the print industry. The main idea behind JDF is workflow simplification. JDF is based on an extensible markup language, which means it has the flexibility to allow changes throughout the workflow. A JDF file can contain file specifications, job requirements, and even commands to automate JDF enabled devices. More so, this plays into the whole notion of fingerprinting where individuals who are working with a JDF file can see who the last person to make changes was. JDF files could also increase customer satisfaction because it outlines the job requirements that could come right from the customer via a JDF driven template.

With many benefits to JDF, there are barriers to adoption that must be considered as well. One barrier is the cost of implementation. Adopting a JDF workflow would mean investing in JDF-enabled software or equipment. Another barrier is the employee training that would be involved. Anyone who is involved with a job throughout the workflow would need an understanding of how JDF works. The next barrier would be Armstrong’s acceptance and the learning curve involved with JDF. It can be said that whenever something new is implemented within an organization, the level of satisfaction in the beginning is low while the company adjusts and troubleshoots. Finally, there could be a low motivation to change if Armstrong feels their
workflow is already optimized. Armstrong employees spoke highly of their current workflow, and many employees may not see the need to change.

**MASTERWORKS TECHNOLOGY**

To bring this area of the research paper full-circle, we felt it was necessary to discuss a unique technology specific to Armstrong. The MasterWorks Technology is a specification for quality that sets forth minimum requirements for a job including: 135 line resolution, and 16-bit color. MasterWorks is their proprietary name for how they develop their realistic products that make an acceptable substitute to the real thing.

Figure 1 shows a comparison between two of Armstrong’s laminates in comparison to the real thing; this was created, by Armstrong, to show consumers that there is no real need to invest extra time and money in real hardwood floors. The highly detailed laminates that are created using gravure make it very hard to determine visual differences between the real wood and the imitations created by Armstrong.

**RR DONNELLEY**

RR Donnelley is a public corporation, and commercial printing industry, found by Richard Robert Donnelley, who is the brother of Reuben H. Donnelley. It is one of the seven most attractive Gravure Industry Plants worldwide today. Their pre-media technologies can handle all production needs. RR Donnelley also has the capacity and resources to deliver what the
customers want with state-of-the-art equipment. To do so, the plant has a complete-cylinder automation that includes the technologies that contain cutting edges that are located worldwide. Costs of cylinders vary on sizes up to a 125” wide by 58” cylinder, which is the largest, would be around $7500. Cylinders can be reused and recycled, resulting to around $300 each time or less. Most parts of the facility are “hands-off,” meaning they do not intervene with most of the technology due to robotics that are on the job, however operators must check for stripping and inspections every day and time when jobs take place or during clean ups for the next process. Products that Donnelley produce is: books, catalogs, financial documents, magazines, direct mail labels, electric SEC filings, and most publications in gravure. During our trip we viewed several catalogs such as Toys R’ Target, Best Buy, Circuit City catalogs, and Us that are used for the presses.

**CYLINDER MAKING**

RR Donnelley has state-of-the-art automated cylinder making technologies. Such automated cylinder making machines like the Cell Guard 3 and Sprint-Easy heads can run at a maximum speed of engraving set at 7500 cells per second to measure the volume of the cells. The press contains a CLC (closed loop color) to focus on color balance and consistency. Prior to transferring the cylinder onto the press, calculations must be made to determine the length, width vs. the displaced surface area where the cylinder would be put onto. There is also “Xtreme Engraving,” which can test stronger type resolution and can engrave the cells by producing several engraving lines. Resolution can be higher than screen definition with the engraver. Although we have learned the capabilities of what “Xtreme Engraving” can do, it is not ready for publications.
**WEB PRESS**

Another piece technology we saw is the Cerutti single web press, which contains a 5 and 8 unit machine. The size for webs can go up from 28”-125”. The average roll weight the web can go up to us 1,200lbs up to 13,000lbs in a 32”-50” diameter. It can run from 1,800 feet per minute up to 3,000 feet per minute depending on the size. Process-reels roll paper is fed through the press. Tension is measured by the “dancing” roller, which controls the speed. The cylinders run in both of ink and wipes out the non-image areas. Inks follow through an YMCK process. The web press is just one of the used presses in RR Donnelley.

**ENGRAVING**

One of the most popular presses used in the facility is the K6 Engraver. This is a fully automated and innovative machine that is used for loading and docking of the cylinders. The K6 contains a lateral head replacement where the cylinder is put into the engraver and the hood closes to prevent the chemicals from spilling out from the cylinder. An average cylinder takes about an hour to engrave for colors. Once the colors are engraved, the final process is chrome-plating which places a 6 micron hard protective finish of a chrome on the engraved cylinder and protects the softer copper from extended production runs. Once the cylinder is fully engraved it is then transferred by a suspended monorail and placed either for storage or additional work. The K6 engraver is a very popular machine used at RR Donnelley.

**MATERIALS HANDLING**

How do cylinders get sent to different locations of the facility? They would be too heavy and wide for the operators to either carry it or transport it by vehicle. The development of suspended monorails can do just the trick. The monorails can deliver the cylinders to the “Buffer” ovens to prevent any stains from being splattered onto the cylinder. It is a great way to use this method.
When cylinders are not in use, the suspended monorails can just store them on the shelves. The average time to bring them by vehicles would take around 30 minutes based on the weight of the cylinder and the location in the facility. With the monorail, the cylinders can get there within 5-10 minutes. The monorails are just one of the several inventions of robotics. Injuries have been reduced due to the improvement of robotics, resulting to reducing the use of workers and labor cost. Robotics are better off doing the work instead of by hand which makes RR Donnelley become almost exempt from serious hazards.

**PRESS OPERATIONS**

While working on a press, it is important to know how many workers should be operating the press. There can be up to 7 members depending on the complexity and physical requirements of the material handling process of the press. First, there is the Press Leader, whose job is to be responsible for everything on the press, safety, quality, crew assignments, instructions, troubleshooting minimizing paper waste, and press speed. Second, there is the Assistant Press Leader, whose job is to be responsible for upper folder setup and operation and relieves the Press Leader for lunches and breaks. Third, there is the Press Roll Tender, whose job is to prepare the next roll of paper for high-speed reel splicing, minimizes strip and core waste, and inspects the rolls for defects. Fourth, there is the Ink Tender, who is assigned to the press at the start of the job to facilitate the inking of the job to supply guidance and work with the color analyst for achieving color. Once the color is gone, and the customer office copies are completed, the ink tender is removed from the press and reassigned to another press. Fifth, there is the Equipment Operator, whose job is to work on the robots, logging and stacking equipment, semiskilled equipment. They also handle the troubleshooting equipment problems if needed. Sixth and the final leader is the Material Handler, who also works with the equipment operator, doing most of
the manual labor if necessary. A seventh crewmember can be added if the material handling on the front of the presses is particularly labor intensive. The crewmembers usually stick with 5 to 6 leaders for most presses.

**WORKFLOW**

When submitting a job, it is important on how the job should go from A to B (Appendix 1). To do that, RR Donnelley follows a process of how to deliver the job to the customer. The gravure plant takes in the files direct from the customers, or from PMT (pre-media technology) and the DSC (digital service center). If PDF files are received from customers, the PDF first needs to be ripped to CT (continuous tone) and LW (line work) on a commercial RIP (raster image process) at the gravure plant or at a PMT or DSC. The prep operator then converts the non-RRD continuous tone and line work to RRD CT and LW when it is input to NKI. Then the prep operator performs the page cropping and splitting if needed, rotation, color correction and mechanical proofing. Proof impositions would then be provided to the engraver where the cylinders are engraved. Once it is set, the process begins to print, finished, then delivered to the customer for clarification. If the process does not work properly, then they would have to repeat all over again to see where they went wrong.

**CONCLUSION**

Overall, the tour of RR Donnelley was successful for the students. They got to view the engraving cylinders, plus watch the process of how it is engraved. It was a learning experience for those that want to further their studies in the gravure industry and earn a career. A lot of questions were asked to demonstrate how the plant is still running today. Improvements have been made with the use of robotics to reduce the amount of injuries. In my view, I don’t see any
further recommendations for the plant to improve on. The common factor to rely on is safety. In conclusion, it was a thrill to explore how the Gravure Process is done in the world today.

**REFLECTION**

The field trip was a great way to apply what we learned in the classroom. More so, giving us the opportunity to work in a team allowed us to focus on each of our sections closely. The topic was of great interest to the both of us. More so, the tour guide leaders were knowledgeable and helpful during our visit. It would have been worthwhile to spend a little more time on the road and visit another company that is part of the gravure workflow; we feel that the hands on experience is ultimately what we will take away from the class.

**RESOURCES**

3 - Buddy Ganse, 717-396-2080. EJGanse@armstrong.com
4 - Rodrigo Sosa, Armstrong World Industries, INC
9 – Timothy Flynn. timothy.flynn@rrd.com
Receive job info from CAM and imposition info from Pressroom
Review job folder for prep work and plan job
Create helio imposition hard card and helio instructions
Receive pages via network or load from media.

PDF or PS?
RIP pages
Convert to RRD CT/LW
Non RRD CT/LW
files?

Process Pages as needed:
Crop, split, rotate, CVC, spread.

Soft, hard, or PDF proof?
Soft Proof for Prep check
Hard proof pages
Color or B&W
Enter imposition info and filenames into edf
Soft proof okay?
Hard proof okay?
PDF of PS
tiles?

Receive job info from CAM and
schedule info from planning
Receive job info from CAM and
for prep work and plan job
Create helio imposition hard card and helio instructions

Coordinate data with supplier
delivery
Release job and job folder to Helio

Check form proof
OK
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OK
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