SUMMARY

Companies across the world have realized the traditional way of measuring performance alone will not meet the needs of the stakeholders and incorporating sustainability is critical in the long term success. Customers have started requiring supply chains to prove and provide data on sustainability measures and the goals set for reducing operational impact on the environment.

In this paper, we will introduce the need for goal setting, performance monitoring, and reporting to make a business case for sustainability initiatives. This paper will also address several best practices and offer suggestions on implementation of a sustainability program for foundries considering similar initiatives.

INTRODUCTION

This paper demonstrates insights and opinions based on projects implemented at Harrison Steel Castings Company with assistance from Duke Energy and Department of Energy (DOE). Over the past decade there has been a significant increase in the number of firms setting and implementing sustainability programs and disclosing their initiatives publicly. Sustainability programs are not easy and the challenges include having management commitment, increased transparency, monitoring and measuring results in a systematic and efficient manner, maintaining continuous improvement programs to keep the momentum, incorporating sustainability from the initial decision making process for any business initiatives, and developing a team to have ownership for each footprint of the program.

SUSTAINABILITY

Regardless of how large or small the operation is, businesses today are inextricably associated with the communities and environment they operate in and every decision leaves a significant impact on the surroundings. The most widely recognized definition of sustainability is: “Meeting the needs of the present generation without compromising the ability of future generations to meet their needs”. (Brundtland, 1987). A sustainable business model maintains balance between their own needs and those of the environment they operate in with long term goals.

At Harrison Steel Castings, we have a 10 year vision for sustainability with achievable goals to reduce our operational impact by reducing energy intensity, reducing water withdrawal, improving compressed air performance, and reducing landfilling. These goals could not be achieved without the formation of a team to drive these initiatives and accountability at each step to compare with the goals.
SUSTAINABILITY TEAM DEVELOPMENT

The most important part before development of a team is the commitment from senior management. Sustainability programs are driven from top down and will be successful with support and vision from management based on long term business initiatives. At Harrison Steel Castings, we provided examples of other company’s experiences with sustainability initiatives and presented data in a recognizable form to senior management to obtain buy in for the program. For clarity, when presenting to management data was presented visually as graphs and tables. The data was used to fuel discussion on how these programs, especially Energy Star, can help reduce curtailments and brownouts. The next step in developing the team focused on identifying a manager for the program to make sure initiatives are measured, monitored and reported to the stakeholders. Identification of a team manager, who is strong, dynamic and goal oriented, is critical in the success of a sustainability program to provide visibility and communicate the progress of initiatives. Team members with sincere interest and expertise in different areas were identified and divided into two groups: technical committee and steering committee. The technical committee included individuals with strong background in various engineering fields, and the steering committee was created to communicate and spur interest with employees out on the plant floor. The sustainability program structure at Harrison Steel Castings is as shown below.
**PROGRESS TOWARDS OUR VISION**

Several factors affect the success of the program, the critical aspect being maintaining visibility of the program. The visibility can be demonstrated by communicating with customers and employees on why the program exists, what is expected of them and reiterating the commitment of senior management to the program. These can be communicated by memos, company newsletter, emails and web blasts. Continuous improvement is also a key factor in maintaining the program. The team members regularly attend supplier provided training and develop additional skills in various disciplines to cover the broad range of systems in the foundry.

Reinforcing management commitment by recognizing team and individual efforts played a crucial role in developing new ideas through our ISO 9001 continuous improvement boards. Projects with rapid payback and minimal negative consequences substantially accelerated the approval process of various ideas into implementation phase.

**ENERGY INTENSITY MEASUREMENT**

In 2009, Harrison Steel Castings Company became a partner in the Department of Energy’s Better Plants Program and enrolled in EPA’s Save Energy Now Program in 2010, pledging to reduce energy intensity by 25% over a 10 year period. This program introduced a variety of tools to the energy team, including the Energy Performance Indicator (EnPI). This tool uses a regression analysis to help establish a normalized baseline of energy consumption and track annual progress of energy improvement. The data input into the tool includes our monthly energy consumption data (gas & electric), heating degree days (HDD), cooling degree days (CDD), and production output in tons. The output of the tool is a calculated modeled consumption based on the independent variables selected for the regression. The tool calculates the total energy savings, cumulative improvement, and annual improvement. As of August, 2014, Harrison Steel Castings Company has reduced their annual energy intensity by 13.04% from the 2009 baseline.

**RATE STRUCTURE AND DEMAND CONTROL**

Electrical bills can be reduced greatly by knowing the utility rate structure, reducing peak loads, and improving the power factor. The average electricity bill contains the following items: customer charge, energy charge, demand charge, power factor correction charge, and additional riders. The customer charge is a fixed charge that covers the utilities expenses for billing, metering, etc. The energy charge is the charge for the kWh consumed during the billing period. The demand charge is a charge that is a function of the peak kW consumed over a specified period of time. The power factor correction charge is a charge that allows the utility to recover some of the fuel costs associated with generating reactive energy (kVAR). Finally, riders are
temporary charges which usually include fuel costs, generating capacity construction, pollution and emission controls, energy efficiency programs, etc.

In January 2013, Harrison Steel upgraded to a new demand control system. The system receives kWh consumption pulses from our utility substation. These pulses are then converted into actual kWh consumption values and stored in the controller. At our facility, the demand window is 30 minutes, so the maximum kW we use within a 30 minute period sets our demand for the billing cycle. The demand set-point is adjusted via touchscreen at the beginning of the billing cycle to align with current production levels. The demand control system forecasts the expected demand, and sheds loads as needed to stay below the demand set-point. This functionality allows us to determine exactly how much demand charge will be on our utility bill.

![Demand Control System](image)

**FACILITY LIGHTING**

Harrison Steel has completed a number of lighting projects across the plant to save energy and improve existing lighting levels. In many locations, lighting has been upgraded from inefficient 465 watt metal-halide fixtures to 324 watt energy efficient fluorescents with integrated motion sensors. In foundries, heat and dust are common problems, and can reduce lighting output immensely. It is important to ensure that the lighting option chosen is able to withstand these environmental concerns. The fluorescents that have been installed across the plant have a
temperature rating of 140 degrees Fahrenheit and include a dust shield that can be easily removed for cleaning. They also have an integrated motion sensor which allows them to automatically turn off when the area is unoccupied after a set amount of time.

Some of the opportunity areas for installing motion sensors include break rooms, storage areas, and individual offices. One of our lighting upgrade projects involved installing fluorescent lights with motion sensors in a large storage area. This area is occupied less than 8 hours a week, yet the lights were left on 24/7 since they were controlled from a breaker panel. The table below shows the annual energy savings achieved by completing the upgrade.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Wattage/Each</th>
<th># Fixtures</th>
<th>Total kW</th>
<th>Annual Hours</th>
<th>Total kWh (Annual)</th>
<th>Total Cost (Annual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Metal Halide</td>
<td>465</td>
<td>30</td>
<td>13.95</td>
<td>8,736</td>
<td>121867.2</td>
<td>$11,455.52</td>
</tr>
<tr>
<td>Upgraded 6-Bulb T-5 w/motion</td>
<td>324</td>
<td>30</td>
<td>9.72</td>
<td>416</td>
<td>4043.52</td>
<td>$380.09</td>
</tr>
<tr>
<td><strong>TOTAL ANNUAL SAVINGS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>$11,075.43</strong></td>
<td></td>
</tr>
</tbody>
</table>

MAINTENANCE DEPARTMENT WEEKEND ENERGY AUDITS

An issue that was noticed by Harrison Steel energy team members was that during non-production hours, the energy intensity of the facility remained unusually high. After performing an initial audit during the non-production hours, the energy usage pattern was apparent. Equipment, lights, man fans, overhead exhaust fans, dust collectors, and air compressors were being left on after shifts were complete. An initiative that was started in early 2013 as a result of these findings was the weekend energy audit. A checklist for each specific area of the plant was created detailing which items to turn off, ensuring that no disruptions would be caused when production resumed. Maintenance supervisors pick up the checklists and perform the walkthrough every single weekend, noting additional energy saving opportunities (such as air leaks) during their audits. The energy manager reviews the weekend profile on Monday morning and provides feedback to the supervisors on how much energy their efforts saved. This value is shown to them in both kWh saved as well as monetary savings. In 2013, these energy audits accounted for $19,603.52 in annual savings.

COMPRESSED AIR SYSTEMS

Compressed air is one of the most expensive utilities in foundry industry and team members identified several areas of waste. Compressed air mixers were replaced with electric driven motors and satellite tanks were introduced to reduce peak demand on air compressors. The Harrison Steel Castings Company operate seven(7) dual reciprocating compressors to support its needs and was able to reduce peak demand by 8% by implementing these projects. The sustainability team is currently pursuing options to retrofit air lines with pressure boosters to reduce pressure demand on compressors and provide adequate pressure at points of use.
CONTROL SYSTEMS BASED ON DEMAND

Several systems in foundry industry are not sized for the demand and results in waste of energy and additional maintenance cost. A study at Harrison Steel Castings Company revealed the need to control dust collection systems, wells, and chemical mixers. Many dust collectors were oversized and dampers were used to control the airflow. The team recommended investment on variable frequency drives (VFD) to control the power input and open up the dampers to 100%. The project resulted in power savings of up to 20%. The need for process water is met by three (3) onsite wells which were uncontrolled resulting in waste of water and electric power. All the three wells currently run on VFD’s based on demand. The demand for water is controlled by line pressure and the wells run between 40Hz and 54Hz resulting in monetary savings and lower withdrawal of groundwater.

RECYCLING INITIATIVES

Going green by reducing landfilling has been an initiative at Harrison Steel Castings Company over the past decade. Sand reclamation, card board recycling, paper recycling, shot blast dust recycling and metallic recovery have reduced landfill waste. The mechanical sand reclamation units processes approximately 500 tons/day and thermal units process approximately 100 tons a day, reducing landfilling and also providing financial benefits due to uncertainty in the sand market. The metallic recovery helps the company to keep approximately 1500 tons a year off the landfill and also generates revenue to sustain the program.

CONCLUSION

A robust system to review performance management is required to continuously improve sustainability initiatives to meet the demands of the stakeholders. Based on the experience with our initiatives we suggest:

Set tangible and time bound goals

Develop a strong self-motivated team and associate sustainability goals to all business initiatives

Develop a robust measurement and monitoring system to document and report to management the progress towards goals, be it financial, reputational or any other business benefits.

Actively involve all stakeholders through proper communication to maintain visibility of the program.

Demonstrate continuing commitment from management by recognizing individual efforts.
ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend gratitude to Robert Harrison, Vice-President; Derek Hughes, Director of Engineering; David Wittenmyer, Maintenance Manager for their support and assistance to help complete this paper.
REFERENCES


SPOKANE INDUSTRIES’ EXPERIENCE CONVERTING FROM FILM-BASED TO COMPUTED-RADIOGRAPHY INSPECTION

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Spokane, WA

Submitted for presentations at SFSA Technical and Operating Conference 2014
# Table of Contents

I. Abstract ...............................................................................................................................3

II. Background and History ...................................................................................................3

III. Computed Radiography (CR) Implementation and Training .......................................4
   i. Selection of a CR System .............................................................................................4
   ii. Hardware Setup and Environment..............................................................................5
   iii. Data Storage................................................................................................................8
   iv. ASNT CR Personnel Training and Certification ...........................................................8

IV. Film to CR Comparison ...................................................................................................9
   i. Physical Comparison .....................................................................................................9
   ii. Consumable CR costs vs Film Costs .............................................................................9
   iii. CR Speed vs Film System ...........................................................................................18
   iv. CR Image Quality and Digital Enhancement ...............................................................18

V. Customer Acceptance ......................................................................................................20

VI. Summary ...........................................................................................................................20

VII. Acknowledgements and References...............................................................................21
I. Abstract
Commercial radiography inspection has been undergoing a technology conversion from film-based systems to digital systems over the last couple of decades. Spokane Industries adopted a computed radiography system to supplement our established film system in December of 2011. This paper is to share our experience with the implementation, use, and acceptance of this new system. This paper is not meant to imply that the CR system we chose is the best system available for all situations, but it is the system we are experienced with.

II. Background and History
Spokane Industries is currently located in an industrial park in Spokane Valley, WA. Founded in 1952 as a sand casting foundry the company has evolved into three, distinct divisions: a stainless steel fabrications division, an investment castings division, and the sand casting division. We primarily cast steel and high-chrome iron, both requiring soundness verification either for specific customer requirements and/or our internal needs. Radiographic inspection has been an in-company capability for Spokane Industries since the early 1980’s using both Iridium 192 and Cobalt 60 gamma sources and a Kodak Industrex Processor, Model M35A (Fig. 1).

Figure 1 Kodak M35A Film Processor - film dispenser output tray
III. Computed Radiography (CR) Implementation and Training

i. Selection of a Computed Radiography system

In 2011 we began to have maintenance downtime issues with our Kodak processor that was affecting the workflow through our RT department. In addition, increased customer demand was highlighting a need for improved overall speed. Additionally, our RT staff at the time was one ASNT Level II employee who also had responsibility for all setups, processing, and interpretation of results. Because of this we had a strong desire to decrease his non-inspection time so he could focus more on interpretation. With these needs in mind we began a review of the current state of digital systems for commercial radiography hopeful that one of these systems could offer significant improvements to our inspection speed with the benefit of increased ease, while interfacing easily with our gamma sources and procedures.

At the forefront initially in our investigation were Digital Radiography Systems (DR) that uses a digital flat panel detector in place of standard film. These systems have the advantage of not requiring a separate scan processor unit – the detector panel interfaces directly with the computer. This feature was attractive but we decided the risk of damaging these panels was too high in our foundry environment (Fig. 2). DR imaging plates can be in excess of $50,000 each and are rigid and can be cracked. DR plates also cannot be bent around curved parts nor cut down to smaller sizes if needed.

Next in our review were Computed Radiography (CR) systems. Although similar to DR systems, CR systems use phosphor imaging plates as the replacement for film, but these plates require a separate step of using a scanner to process the image. For us, the main advantage of the CR imaging plates are that they are less than $1000 for the larger size we most typically use (14x17in).
Contact was made with Carestream to discuss their CR system: the HPX-1. We had a limited knowledge of the Carestream system from previous sales contacts and NDT advertisements. Within a short time they were able to schedule an on-sight demonstration for us. The sales representative brought the CR system out to us and, after some discussion had it set up and running in minutes. That day, he had the system dialed in with the proper imaging plate and lead screens and producing digital images that were comparable to the visual quality and detail of the film we were running.

After some continued research of competing CR systems and on-going discussions with Carestream we purchased the HPX-1 in December of 2011.

ii. Hardware setup and Environment

The CR system hardware consists of the imaging plate scanner connected to a computer with the CR imaging software and monitor. Our setup is in a typical office environment with the entire setup on one office desk in an area of subdued lighting (Fig 3). The CR imaging plates are light sensitive and it is recommended to minimize overhead lighting. During use, the CR imaging plates are in the film sleeves, but to load them in the scanner they must be removed from the sleeves and during this time are exposed. The lighting does not damage the CR imaging plates, but have the potential to “erase” the data on them.

System startup time for both the scanner and computer is similar to a standard office computer – ready to go about a minute, compared to 30 minutes for the film processor. The scanner does use fans for internal cooling that require periodic cleaning of its air-filters. The filters are easy to remove and clean or replace. In our environment this is required about once a month. It is important to note that this is about the only
maintenance required for the CR system. Chemicals and water are not needed – this is also a significant cost savings. Weekly upkeep of the film unit (cleaning, flushing), has been eliminated.

The scanner has a front tray similar to a standard office copier where the CR imaging plates are placed under a cover and fed into the scanner. The scanner uses a red laser to stimulate the phosphors which then release a blue light that the scanner detects and transmits the data to the computer to be converted to the digital image. Once scanned, the imaging plate is erased by a bright white light from halogen bulbs inside the scan unit and the plate is ejected back out ready for reuse. Total scan time with digital image displayed is approximately 90 seconds.

The computer monitor offered for purchase with the CR system can be either a monochrome or full-color. The monochrome monitor has a slightly higher resolution (2560X2048 pixels) versus the color monitor (2048X1536). For comparison, a typical desktop wide-screen monitor is 1920x1080 pixels. We chose the color monitor to help with the annotations that we use for the images, to highlight indications (Fig 4), for example.

![Figure 4 Example of Color Annotation](image)

The monitor itself has a verification check – the SMPTE RP-133 test pattern (Fig 5, a small subsection of the visual test).
A system verification test is also used – the CR Phantom test per ASTM E2445, or recently adopted alternate test pattern system as shown in Fig 6.
iii. **Data Storage**

The CR images are high resolution and require large storage systems for archiving. A typical CR image is 5-7 mb of data per image. Terabyte hard drives and archival grade DVD storage is needed. The CR system also controls the storage of the raw, unaltered images and images that have been modified in any way, such as annotations or image enhancements.

iv. **ASNT CR Personnel Training and Certification**

Implementation of the CR system in our radiography department required additional classroom training (40 hours) and certification per SNT-TC-1A for our technician. We used the training provided by Carestream at their location in New York, with final approval by our contracted NDT Level III.

In addition to personnel certification we also needed to update our internal RT procedures to incorporate the CR system and processes. Our procedures were updated with appendixes to cover the CR system primarily per ASTM E1742 and E2446. Our NDT Level III performed this work for us and provided the updated training needed.
IV. Film to CR Comparison

i. Physical Comparison

The CR imaging plates are very similar to film in the day-to-day physical use. They are about .010 thick and flexible, similar to a semi-flexible plastic or rubber sheet. They can be used in hard cassettes or standard film sleeves with lead screens (Fig. 7). We found that for the proper image quality required we needed to use the standard film sleeves with lead screens. Currently, the cassettes do not have the lead screen capability, although we know that newer generation cassettes may incorporate this. This would then minimize the handling of the CR imaging plates and lengthen their lifespan.

![Figure 7 CR Imaging Plate in Standard Film Sleeve](image)

ii. Consumable CR costs vs Film costs.

Since implementation of the CR system at the end of 2011 we have virtually eliminated the use of standard film. Year-to-year work load has varied significantly as well, so comparing the costs of film usage in one year to the costs of phosphor plates another year would not give a clear comparison. A better comparison would be an “exposure” cost comparison. For the year 2013 we purchased and used nine 14x17 CR imaging plates. On average we used each plate for approximately 500 exposures. The imaging plates don’t wear out except due to wear and tear from handling. But, by using the 500 exposures per CR plate usage rate we can calculate our costs:
9 CR plates x $910 per plate = $8190.00 total plate cost for 2013

500 exposures per plate x 9 plates = 4500 total exposures.

$8190.00 total cost / 4500 exposures = $1.82 per exposure using the CR plates.

Our cost for standard film during this time was $5.16 per sheet. Assuming a straight-line exposure of film per exposure of the phosphor plates:

4500 total exposures with standard film = $23,220.00 with the $5.16 per exposure cost.

But, the above one-to-one comparison of a CR imaging plate exposure to standard radiographic film is not the normal situation in our operation. Most of the castings we radiograph have varying densities / thicknesses that need the proper exposure to capture the total thickness ranges (Fig 8 through Fig 14, some images shown with blacked-out customer identification for this paper). For example, the casting shown in the images has wall thicknesses that range from ½” to 6”. To capture the proper exposure for each thickness in film would require three sheets (D3 for thin, D5 for the middle thickness ranges, and D8 for the thickest areas). The CR imaging plate has a wider exposure band than film, allowing all of these thicknesses to be captured at once. During 2013 approximately 2/3 of the exposures required 3 pcs of film. Adding this information into the cost calculation above would result in this calculation:

4500 total exposures with 2/3 requiring 3 sheets of film = 10,500 sheets of radiographic film.

10,500 film sheets x $5.16 each= $54,180.00
Figure 8 CR Image of typical part showing heaviest density ranges
Figure 9 CR image of typical part showing medium density ranges
Figure 11 CR image with digital filters applied to combine/enhance all density ranges into a single image
Figure 12 Standard Film (D8) image of typical part showing heaviest density ranges
Figure 14 Standard film (D3) of typical part showing lightest density ranges
iii. **CR Speed vs Film System**

Because we can capture more density ranges with the CR images as shown above, and with applying some digital edge enhancement we are able to reduce the overall time needed to complete the inspection process. Our film processor requires 8 minutes of processing time for the first sheet of film in a batch. Each additional sheet in that batch requires about 2-3 minutes more. Our typical exposure batch of three sheets of film would require at least 12 minutes processing time, versus the 90 seconds for the CR system. In addition to this time savings, we have found that most exposures with CR can be achieved with about a 20% reduction in exposure time, especially impacting the longer shots required for the thicker cross sections. An exposure for film that required one hour can be done in about slightly over 45 minutes using the CR imaging plates.

The reduction in non-inspection time has allowed our inspector to focus on the primary need – interpretation of the images and determination of acceptance/rejection.

iv. **CR Image Quality and Digital Enhancement**

From the images above (Fig 8 -14) you can have a general appreciation for the similar image quality of the digital images versus film. Of course, what is presented in this paper are scaled down reproductions of the higher-resolution digital images and photographs of actual radiographic film. Comparing the images side-by-side in real life does reveal some differences. Standard film does tend to look “smoother” while the digital looks more “digital” or pixelated. Upon close scrutiny most people can tell the difference between a digital photograph and a film photograph – and the differences are similar in the CR system as well. Looks can be deceiving so we focused on the image quality indicators that we used for our film shots, primarily the need to clearly see the 2T hole of the appropriate pentrameter (Fig 15).

![Figure 15 Step wedges with Penetrameters](image_url)
In side by side comparisons we typically could detect the 2T holes clearer with the CR images versus standard film. In addition, with some digital edge enhancement used as shown in Fig 11 and Fig 15 we could more clearly see the 2T holes across a wider density range in the same image. Our typical penetrameters used daily for our casting thicknesses are .017 to .060 with no difficulty determining the 2T hole. Upon close examination we have been able to detect the 2T (.024 dia) hole on the .012 penetrameter. For us this was a good indication of the system’s functional resolution. We have not experimented with image quality for thicknesses over 6” cast steel as our gamma system is not practical above that.

The CR system also allow the use of the other enhancements to the images that we have found useful—easy application of annotations (as previously shown in Fig 4) and magnification as shown in Fig 16:
V. Customer Acceptance

Our implementation of the CR system has been well accepted by our customers. Initial notice was given to our major customers via email contact notifying them of our new system. We presented the system information and that we would be comparing the digital images to standard, ASTM reference films. A couple of concerns and or issues were raised:

1. Will it be faster and will we see a price reduction on castings that require production RT?
2. Have you verified that the digital system can detect the same indications as the film on our castings (calibrated to the same level)?
3. Will we receive film?

Once we answered these questions to their satisfaction we began use of the CR system for all of our inspections. Since then the feedback has continued to be positive, especially with the RT reports that now contain digital images directly in the reports. Typically, our customers did not ask for film to view, but we can now provide the images directly in our certifications. Additionally, during onsite reviews and audits our customers have been impressed with the speed and clarity of the CR system and how it allows a more complete inspection package to be compiled and shared.

VI. Summary

The CR system has been one of the most beneficial inspection systems we have implemented. ROI was achieved in about 2 years. We have improved our inspection speed and enhanced the detail and data presented in our reports to customers. Information sharing within our company has improved as well, with casting soundness issues being shared directly on the shop floor, improving repairs. As with any new system, a learning curve is involved, as well as additional costs associated with secondary issues such as updating procedures and ongoing warranty plans. These issues have been minor compared to the overall benefit that the system has brought to our RT department.
VII. Acknowledgments and References

The author wishes to thank Jay Zimmerman, Steve Mango, and Paul Biver of Carestream for their assistance with our implementation and use of the Carestream Computed Radiography System and for providing some technical details for this paper. A special thanks also to both Rod Grozdanich and Roger Cornell for their assistance and direct hands-on experience and knowledge.

Carestream’s Digital and Computed Radiography for Non-Destructive Testing handbook was used throughout this document as a technical source.
“Implementing an ERP... and actually making it work”

Corporación POK’s experience with SYNCHRO, ERP Software

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Steel Founder’s Society of America - 68th Technical & Operating Conference
Chicago, IL, USA. December 11 – 13, 2014
Company Overview

Corporación POK is a job shop foundry and machine shop located in Guadalajara, Mexico founded in 1894. It started out as a small manufacturing and repair shop for ware parts for a sugar-mill. 120 years later, the company has close to 350 employees; exports nearly 95% of its products world-wide and serves a large variety of markets.

POK is made up of four major areas: the sand casting foundry (with a floor molding-line and a no-bake line), the investment casting foundry, the conventional machine shop and the CNC machine shop. Other important areas within POK are the engineering department, the pattern shop, the heat-treat department, NDT & Inspection department and the quality-assurance department.

POK produces up to 300 tons per month of castings ranging in weight from a few ounces to 12,000 pounds, clean-weight. The alloys cast are low-alloy steel, carbon steel, stainless steel, ductile iron, gray iron, bronze and other specialty alloys such as Monel and Inconel. POK has recently installed 2 new furnaces incrementing its melting equipment to 8 induction furnaces, ranging in capacity from 300 pounds to 7,000 pounds.

Most of the castings are produced and finish-machined in-house either by the Conventional machine shop or the CNC machine shop.

Background

In mid-2011, POK transitioned from lot (or heat) traceability to individual serial number traceability in order to comply with the needs of some of our customers. The decision was made that instead of migrating only some of the products to serial number traceability, we would completely convert all part numbers to this type of tracking. We knew it was hands-down the best traceability you can achieve and in the long-run, would facilitate things by standardizing criteria and deliver more precise information for quality-problem solving.

In early-2012, POK was in an urgent need for a system capable of tracking serial numbers throughout the entire manufacturing process and rendering automatic material certificates; since doing it through spreadsheets was consuming too much time and was vulnerable to human mistakes.

While in the process of creating a tailor-made traceability system; POK discovered Synchro, a British ERP software created for the foundry industry which was able to execute all the things that were planned for the tailor-made system and much more. When approaching the Synchro team, we had specific questions and they had all the correct answers…the decision of buying Synchro at that point was an easy call.
After POK bought the new ERP software in mid-2012, I knew that it would be a life-changing event for the company; there would be a time when we would refer to “Before or After Synchro”.

The Implementation Plan

We’ve all heard of how implementing an ERP system is a huge task for any size company and also heard of the consequences of an improper implementation. That is why an accurate implementation plan is essential. Of course, the main component of a plan is “time”, however we knew from research that the time frames set were likely to be broken; understanding this before starting the implementation is important for the project leader (and to whomever that person is reporting to) in order not feel frustrated and to continue working towards the set goals.

We designed the implementation plan after the first visit from Synchro which was a week-long. The objective of that visit was “to get to know Synchro” and to understand the full capabilities of the software.

Assessment

First, we had to assess where we stood. Like in many other companies, POK already had a system. We were doing planning through excel and had Protheus (a Brazilian ERP) for accounting and HR. We also had the first phase of the in-house traceability system in place. We needed to evaluate if we were going to keep any of those older systems.

After understanding all the modules within Synchro, we defined implementation stages with clear goals and deliverables. We chose to keep Protheus since Synchro did not have capability of managing the payroll nor the technical needs for the Mexican tax system. Synchro would be a production ERP system and we would leave aside (for now) the financial administration handled by Protheus.

Stages of Implementation

Building the Foundations

1. Creating Synchro Libraries: We agreed that it wasn’t a good idea to “automatically import” data from our other databases into Synchro since we knew lots of that data was not up to date. Only very few people with high knowledge of the company were involved at this
point. We decided to be “jealous” of who could input data since we were building the foundations for what would become the backbone of POK.

At this stage we created the product library, process library, customer library, sales book, company calendar, alloy library, supplier library, and scrap codes, among others. We chose to only input data that was applicable for existing open-orders. We continue to expand these libraries with each new purchase order.

2. Appointing a Synchro Master: This was harder than we thought, and still do not consider ourselves successful yet. It is common for the people who are involved in the early stages of the implementation of the ERP to be key personnel for the company and since they are important assets; it is logical that they have their hand’s full. It has been tricky for POK to maintain a Project Leader who can dedicate most of his/her time to the ERP project.

3. Testing the software: Before inputting real data, the system was tested for any issues or “bugs”. Several were found and reported to Synchro’s staff who responded quickly and efficiently. Many times, on-site visits served for proper documentation of the bugs and an update was released shortly after they left.

Getting Ready to Go-Live Take I

4. Stock Take: After building the foundations and testing the system, it was time for real data to be input. Now, there would be many Synchro users. During August 2012 a huge effort was done throughout the company. We presented Synchro to the supervisors and their elite staff and had them form “Synchro Teams” who would be responsible of performing a physical inventory and input of data to the system. Training sessions were carried out and the plant stopped activities for the inventory from a Friday morning and resumed on Monday morning.

After the stock take was complete, we found a huge set-back that had not been foreseen by anyone. Many of our castings when they reach the machining stage, can be turned into a variety of part numbers and although Synchro had the ability of tracking serial numbers, they had never had a customer tracking 100% of their production through UIDs (unique IDs) and furthermore the possibility of converting from one part (casting part number) to several others (machined part numbers). We wanted to make sure that the system represented what was truly going on “in reality” so that we could trust and use the data it would deliver in the near-future. A series of customization programming had to be done at a core level of the software, this set us back quite a few months.
We also learned that the concepts of how to allocate parts to production orders had not been fully understood by everyone so our WIP was not reliable. The main issue was that the most-advanced serial numbers in the process had not been put against the most urgent orders; also, we found there had been several part numbers which we did not have open-orders for which we couldn’t allocate since their information had not been input.

After serious consideration, we decided that it was easier to clear-down all the stock take information and start again; rather having to fix the un-reliable info.

**Getting Ready to Go-Live Take II**

1. *Creating a campaign*: Getting people involved and actually believing that the new ERP system will eventually minimize administration labor vs. having to input a lot of data that hadn’t been relevant before; was probably the most difficult part. Even though POK has a relatively young (but experienced) staff, which helped battle against computer illiteracy, it is always hard to break habits.

   We learned that the basic concepts of how the system worked and the goals it would help us reach had not been successfully transmitted to the workers. We decided to launch “Synchro Week” where we would dedicate a week’s worth alongside chosen “Synchro Process Owners” in order to empower the people who were going to be using Synchro on a daily basis. Twenty young, enthusiastic, and knowledgeable of their particular process people were selected.

   Now, with everyone understanding the advantages of a correct WIP count and order allocation, we were ready for another stock take. In Feb 2013 a physical inventory took place and teams were commissioned to input data and as a confirmation, a route sheet was printed from Synchro and attached to every single part in process; that way we made sure nothing got left out.

**Day to day use**

With the Synchro Process Owners trained and eager to use the system, we controlled what we defined as most important processes and instituted obligatory bookings. This meant that if a serial number had not been recorded as “passed that stage”, the part could not be booked to the next stage. We picked pouring, heat-treat, NDT inspections, casting finish-goods stage, machining reception and finish-machined stage.
We have found that it has been normal for users to seek for help on things they should know how to solve on their own. One challenge has been for the project leader to have time to continue the implementation of the system instead of troubleshooting and internal customer service. Proper training but specially user manuals (personalized to our own company) have helped minimize this.

Keeping the system up to date is a team effort and must be supervised. It is easy to leave inputting as an activity for the end of the day, causing the data to be skewed. This is why we have launched a pilot trial of shop floor data collection (SFDC) where the operators themselves input data in real-time. We didn’t begin with the SFDC from the get-go because we wanted to make sure we understood what information was the one that we really wanted and needed; having Synchro Process Owners allowed us to identify such data.

**SFDC Pilot Run**

We chose a manufacturing cell that processes parts very quickly as the area where we would collect floor data. We have been successful but have come across many obstacles, and still have a long way to travel.

Four computer screens were located in the manufacturing cell. Quality Plans were created for the products being processed and results were being input by the operators. If a part did not pass the inspection it would instantly be booked into a “re-work route” helping us obtain a re-work and scrap percentage instantly. Also, all the certificates; including NDT reports, dimensional verification reports, material test reports, hardness reports and shipping documents, that need to be sent to the customer are generated straightaway, printed and placed with the parts.

**Information Output**

We didn’t actually see results of the implementation, until we could finally generate reports. Synchro works alongside Crystal Reports (a SAP owned report designing software). With both software programs you can literally generate any report and visualize any type of information the way you’d like. Knowing how to use crystal reports, has been an important factor for the success of the implementation; since giving people data they can use and analyze has been key for the acceptance of inputting data into the software in the first place.

Our first major success was the automation of all certificates of conformance and material test results. Our spectrometer and carbon and sulfur analyzer were linked to Synchro’s data base and the report was
created in Crystal. This reduced amount of the man hours needed to put the information together by 70% but most importantly did away with human error.

Today, we have many reports being generated through our ERP. Supervisors receive by email daily, weekly or monthly automatically generated reports of relevant information about their area. Some of the reports are: parts poured, on-time delivery score, pending open orders, parts in finish-goods, parts currently at out-sourcing, new orders received, projected sales per customer, and scrap rate, among others.

![INVESTMENT PER CONCEPT](image)

POK’s Investment

(Figure 1)

We’ve had Synchro for 30 months now, so the average cost per month has been $4,125usd. Although licenses only account for $1,150usd per month, On-site training accounts for the highest percentage of investment. We’ve had a total of thirteen on-site training sessions from Synchro (four in 2012, five in 2013, and four in 2014 - Forecasted visits for 2015 are four and we would like to continue with a quarterly visit on a normal basis.)

Calculating ROI can be tricky, lots of the benefits of an ERP system will be intangible returns. Of course we are able to monitor scrap rates, thus pin-point specific problems to address and solve, we have also reduced the level of inventory, started reducing material costs
Implementing an ERP System… and actually making it work

Conclusion

We believe that the implementation of the ERP will and should never end. POK will continue to evolve, and with it so should our ERP system. That is why, we will continue with quarterly on-site visits from Synchro.

Synchro’s team has truly been an important contributor to the success of the implementation. The on-site training visits have proven to be very useful and even though the implementation continues year-round, when Synchro’s staff is at POK we always see a revitalized push towards results.

We have faced many obstacles on our way, the main one being the language barrier. Even though Synchro’s system is translated to Spanish; unfortunately during on-site training direct communication has been difficult between POK’s team and Synchro’s implementation team. Luckily, computer illiteracy has not been a main obstacle at POK due to the young generation of workers. One of the things I would change if I could re-start the implementation would be to involve the supervisors a bit more. With the amount of work that the supervisors already have, we were worried that the information wouldn’t reach the people below; therefore, we concentrated on training the workers directly and lost-sight of middle management which are the motors and leaders of the areas. We are now working on training the supervisors and have handed them useful reports. We have seen that with their enthusiasm, Synchro has received a boost of input of information.

We are currently finishing creating quality plans for all of our products just like we did in the manufacturing pilot run cell. We are also analyzing bottle necks and with the help of Synchro we have been able to create and keep track of efficiency in our production lines. We are also re-designing our pattern warehouse and making sure that the important information and location of each pattern is input (and physically maintained) since we found that there is a lot of lost time in “pattern seeking”. We will also be able to keep track of pattern usage and plan pattern quality inspection and repair. Costing is also a module that we are currently implementing. Since we now have enough data to actually analyze, we are rediscovering our manufacturing costs.

In the near future we would like to spread the SFDC pilot run to all areas, probably beginning with the CNC shop. We will also begin

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quoting and estimating through Synchro. Furthermore we will link Synchro to our CMM machine so that dimensional results won't have to be manually inputted. Lastly, we will link our accounting system Protheus to Synchro; this way any information input in either system will be automatically updated.

**Things to keep in mind when implementing an ERP software**

- Upper-management must be fully convinced that the project is very important and although time is of the essence, time is not the only crucial feature when implementing an ERP; determining and actually achieving your objectives is key.
- Have an enthusiastic proactive project leader
- Be jealous at first, involve very few key people; once the foundation is set... create a fuzz and make the implementation a BIG DEAL.
- Give ownership to key players and hold them accountable.
- Don’t just “dump” information into your new database, be sure to debug.
- Have proper consulting, they know their system better than you; BUT remember that you know your company better than they do. When possible, it is always better to make the system adapt to your procedures, rather than changing the way you do things to adapt to the ERP.
- Set check-points. The project is bound to change as there is no one correct way of implementing an ERP, it is a project with life of its own which will be unique to your company. Be sure to update your objectives.
- Watch out for language barriers and computer illiteracy, and of course... old habits die hard.
- The only way of really getting people “on-board” and excited is for the system to actually benefit them. Be sure to explain the ultimate goals but make sure to show them results on the way… Reports! Reports! Reports!
- Continue to improve your ERP, remember it should always emulate what you are actually doing in “real-life”. Be prepared to always have a team dedicated to the on-going implementation.

We believe that this “After Synchro” time of our history has made things easier than ever; information is flowing and upper management is being able to make more informed decisions about the future of the company. The implementation of an ERP has proven to be very challenging but above all, extremely useful and necessary.