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RESEARCH AND TECHNOLOGY REPORT

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Increasing Productivity on a Stitcher Using Automation

By Brandon Iskey, Greg Radencic and Dr. Mark Bohan

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Introduction

Computer Integrated Manufacturing (CIM) is becoming increasingly important and forms a central pillar within print production workflows. Each process throughout the production workflow is having automated systems introduced that are either software or machine driven. This may include features such as automated imposition or servo motors to help machine setup. These are creating very effective individual systems with high production rates. The underlying feature with new product development is improvement of throughput as a result of the systems. The connectivity between these different systems is critical to ensure effective implementation and ensure that we do not have so called *"islands of automation."* We do not want silos in the workflow to restrict communication between devices. CIM and JDF (Job Definition Format)-enabled equipment enable the communication between devices in the workflow, making one distinct production workflow.

Modern bindery equipment is becoming increasingly automated with the objective of creating a more efficient and streamlined workflow. The automation has the aim of minimizing the cycle times between different production jobs and, where possible, reducing the level of operators required for each of the production steps. Much of the work has been on the mechanics of automation with the focus in recent years in automating, in a common and open manner, the transfer of information within a print workflow through the use of the JDF specification.

CIM and JDF-enabled workflows are increasingly common in production environments, and there is a significant discussion on the savings that can be achieved by implementing these solutions. The majority of this discussion will analyze the transition to a new workflow and equipment, where there are savings to be made in both the JDF functionality and also from the automation on the equipment. The purpose of this paper is to quantify the impact of these factors in the bindery, specifically on the cutter and the stitcher.

The Research and Technology Report (RTR) describes an experimental investigation to quantify the time savings that can be made when automation is used as opposed to a fully manual system on a stitcher in the bindery. By eliminating repetitive steps in the process, automation has the potential to increase productivity, increase accuracy, and allow for a quicker turnaround on jobs. The automation used for Printing Industries of America's project ranged from device automation (servo motors) as well as JDF connectivity for the imported job.

The modern stitcher has undergone significant change over the past decade in terms of automation. These traditionally were labor-intensive machines where the operator carried out the majority of the adjustments manually. In recent years servo motors have been introduced to automate many of the functions, such as changing the size of the pockets. These machines have increased in complexity, and a computer interface has been added to drive all the servo motors. Many of these can now be automatically set and thereby reduce the setup times required. For the purposes of the RTR, the setup times from a manual stitcher have been compared to a modern automated stitcher using either the programmable interface or the JDF cutting information.

Evaluation Method

The experimental procedure was designed to follow several different jobs through the different workflows that would be present, dependent on the amount of automation available on either the cutter or folder. Real jobs were produced for the project, and these varied in complexity to simulate different working environments.

In the analysis of the stitcher times, the sequence of jobs from design was followed. For the purposes of this paper, the times from the cutting section of the work are reported, although there were time savings in the prepress department. The jobs were created in design with the job planning section being carried out in Creo Upfront and LithoTechnics Metrix. These are planning applications and the JDF data with respect to the cutting patterns were generated at this point as well as the data to set up the stitcher. These templates were exported to an imposition package for the contents to be placed in the job. The plates were then produced and the three different jobs were printed. They were passed to the bindery where they either passed through the cutter or stitcher.

The analysis of stitching times was achieved by setting up the stitcher to produce different jobs and assessing the time for changes between each production job. The sequence of jobs included both full and half-size products and a baseline was initially created on the machine to ensure that a true comparison of setup times could be achieved. The programmable workflow for the stitcher is shown in Table 1.

Step 1: Start
Step 2: Turn off/on pockets
Step 3: Start Program-Lower Knives
Step 4: Take Out Old Job
Step 5: Create new Job
Step 6: Select/Set Pockets
Step 7: Final Trim Size
Step 8: Calculate
Step 9: Load Job
Step 10: Stop all Movement
Step 11: Check Book Thickness
Step 12: Set Obliques
Step 13: Set Sheet Detectors
Step 14: Move Staple
Step 15: Check Pockets

Table 1: Steps required setting up stitcher

There was significant automation (servo motors) on the stitcher, though there were steps that have to be carried out with the actions of the operator. The machine setup shows the setup for the programmable workflow, steps 5 to 7 (highlighted) would be removed in a JDF-enabled workflow.

Four different jobs were created for the evaluation of the stitcher. These varied in complexity to represent different jobs that would typically be produced in a production environment. These vary in the number of pockets and size and are summarized below:

- Four pockets, full size. This was used as the baseline to ensure that the stitcher was set up consistently prior to the start of the investigation.
- Three pockets, half size.
- Three pockets, full size.
- Two pockets, half size.

Results and discussion

The setup of the jobs on a manual stitcher was carried out at a commercial operation and varied between 42 and 45 minutes, dependent on the number of pockets that needed to be altered. This is used as the baseline for a fully manual system.

The same production jobs were taken through a programmable CIM-enabled stitcher, with each of the steps outlined in Table 1 being recorded. The times taken with the automated programming and data transfer approaches are shown in Figure 1 for setting up the three half-size pockets, while Figure 2 shows the setup time of three large-size pockets. The initial steps show the same time as the steps are identical, regardless of the approach being utilized. During the programming stages, steps 5 to 7, there are time savings using the JDF / PPF stitcher data. During these steps the timelines deviate. There are similar requirements for the remainder of the setup and the timelines are approximately parallel. The total time required for either of the setups is significantly less than that required for the manual setup of a stitcher. The benefits to having JDF / PPF data are the stitching parameters are already programmed into the file. Instead of having to rule out the paper and set it manually, this is already done for the operator within the JDF / PPF file. This can be achieved in the program used to create the JDF / PPF file. It bases the rulings off of the media size, media dimensions, thickness, and other attributes.

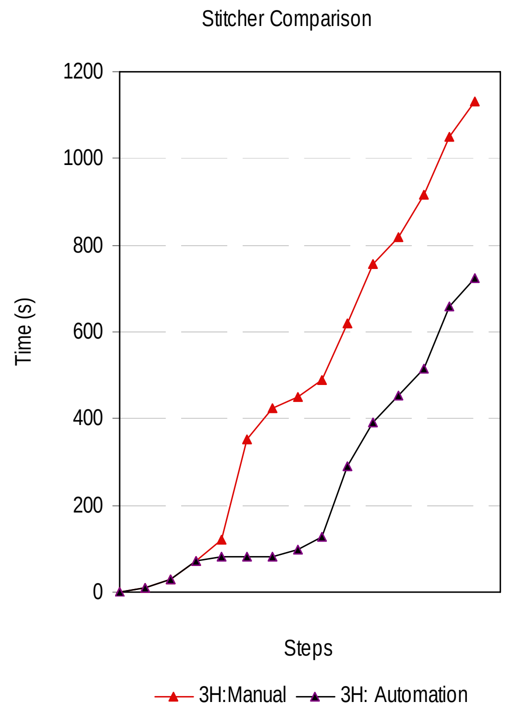

Figure 1: Comparison of stitcher times for three half pockets

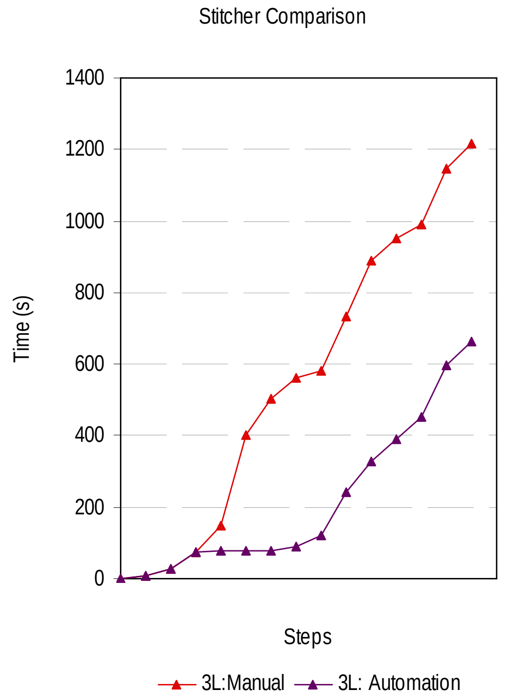

Figure 2: Comparison of stitcher times for three full pockets

The data for all three setups and configurations is shown in Figure 3 and Figure 4. These show similar trends to those observed with the three half-size and three full-size pockets. The reduction in time is generated primarily during the programming stages. The times are greatly reduced when compared to the manual setup of the stitcher, with the times reducing from an average of 43 minutes to 18 minutes using the programming on the stitcher. This time saving is a direct result of automation on the stitcher and is not related to the transfer of JDF / PPF data. The times can be reduced further using the JDF / PPF data, with an average setup time of 11 minutes. It is not possible to fully utilize the JDF / PPF data without the automation. From a practical perspective, the use of automation and the transfer of JDF / PPF data allows the production facility to easily transfer between jobs and facilitates the interruption of a long job with a rush order because all of the settings needed are in the JDF / PPF file itself and not programmed manually by the operator.

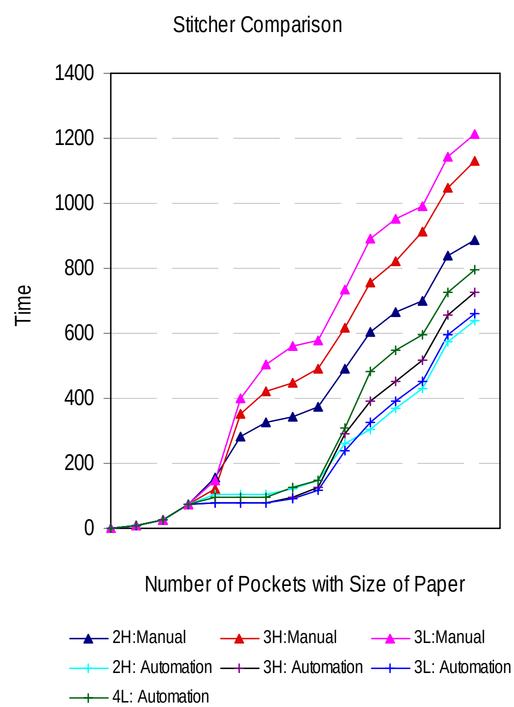

Figure 3: Comparison of stitcher times for all jobs

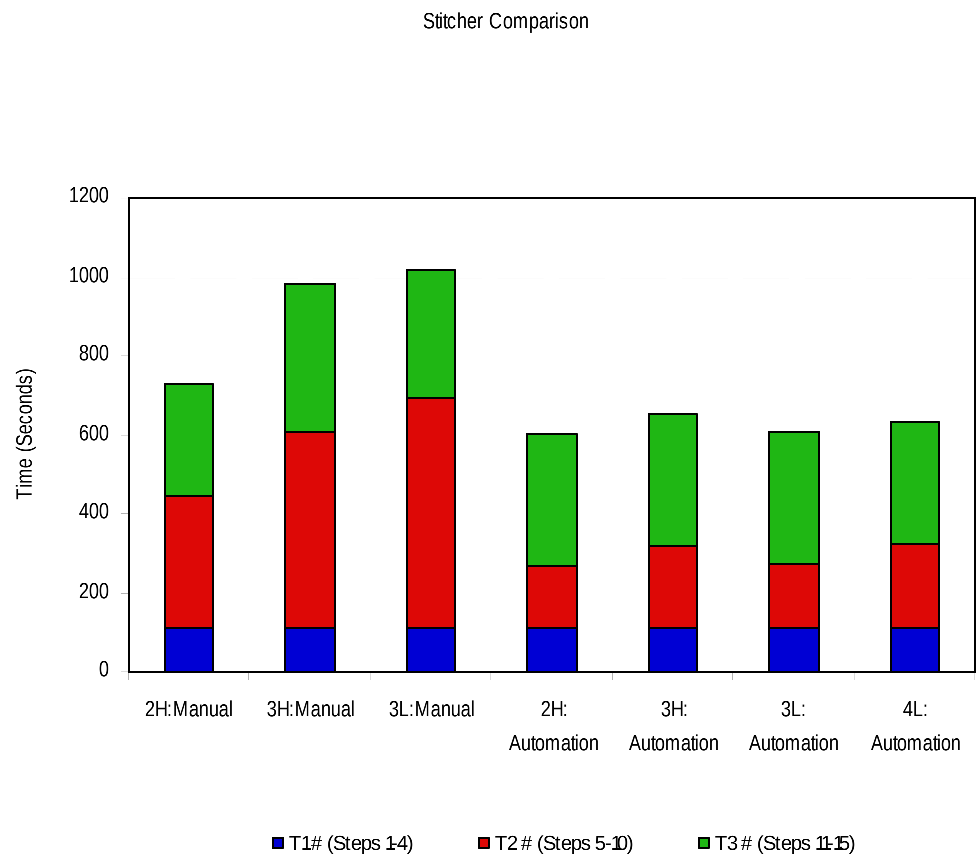

Figure 4: Comparison of stitcher times for all jobs as broken into the times for the steps

Conclusions

A series of print production jobs have been successfully used to quantify the impact of automation and CIM workflows on the stitcher in the bindery. The greatest benefit with CIM workflows is the increase in equipment utilization. By cutting down the setup and run times, the stitcher can run more jobs. CIM workflows also cut down operator mistakes and increase consistency because all operators use the same program and templates within the CIM environment.

The results from the stitcher showed a significant impact of automation with an average time reduction from 43 minutes to 18 minutes as a direct result of using a stitcher with the automation to increase the setup times. This could be further increased by the implementation of a CIM-enabled workflow to an average setup time of 11 minutes.

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In this *Printing Industries of America Increasing Productivity on a Stitcher Using Automation* study, a series of print production jobs have been successfully used to quantify the impact of automation and CIM workflows using a stitcher. The greatest benefit with CIM workflows is the increase in equipment utilization. By reducing down the setup and run times, the stitcher can run more jobs. CIM workflows also cut down operator mistakes and increase consistency because all operators use the same program and templates within the CIM environment.

The results from the stitcher showed a significant impact of automation with an average time reduction from forty three minutes to eighteen minutes as a direct result of using a stitcher with the automation to increase the set up times. This could be further increased by the implementation of a CIM enabled workflow to an average set up time of eleven minutes.

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