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**Final Report on Phases I – IV of Textile / Clothing Technology Corporation’s Lean  
Manufacturing Workshop**

**La Paz, Bolivia  
October 2004 through January 2005**

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# Lean Pilot Team Implementation

## Final Report

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# Deliverable #8 - Final Report

## BACKGROUND

Ametex personnel visited [TC]<sup>2</sup> offices in Cary, NC in December 2003. During the meeting, which included Will Duncan, Arturo Rodriguez and Tim Curran from [TC]<sup>2</sup>, Ametex provided a general company background and discussed their current needs. Another goal of this initial meeting was to provide Ametex with a better understanding of [TC]<sup>2</sup>'s services and offerings. After further discussion it was decided that Arturo Rodriguez should visit Ametex's facilities in La Paz to conduct a two-day assessment of their operations. The findings from this assessment were presented to the Ametex board during April 2004. After this presentation and subsequent meetings, it was decided that [TC]<sup>2</sup> should assist Ametex with improvements in the manufacturing of their products. Specifically, the objective was to improve customer service and competitiveness by implementing lean manufacturing teams and developing greater production flexibility.

## PROJECT OVERVIEW

The project was divided into 4 phases, of which Phase III was going to be funded primarily by BCCN. Phase III - Pilot Team Implementation and Support was further separated, by [TC]<sup>2</sup>, into the following seven tasks:

### [TC]<sup>2</sup> Tasks

- Lean Manufacturing Overview for Potential Team Members
- Team Selection
- Operator Cross-Training
- Compensation Training and Development
- Lean Manufacturing Workshop for Pilot Team
- Line Start-Up
- Follow-up Support

*The timeline for completing these tasks is included in Deliverable #8 – Appendix A.*

A brief description of each of these tasks is included below.

### **Lean Manufacturing Overview for Potential Team Members**

The Lean Manufacturing Overviews can be seen as the starting point for exposing lean principles to potential volunteers for the pilot team. In the case of Ametex's, the company decided that the team members were to be selected from the pool of Sample room operators. Thus, we conducted a two hour overview of lean manufacturing for this group of about 25 people.

This overview was delivered on October 5, 2004. The program was designed to expose the direct labor employees and support personnel to the concepts of Lean Manufacturing. Issues covered include:

- The importance of change, both in the world and as it applies to work
- Comparisons of various manufacturing systems (Penville exercise)
- The changing role of management and direct labor in a cellular environment

### **Team Selection**

Team Selection was completed using Ametex's preferred option of first selecting an initial operator, who in turn selected the 2<sup>nd</sup> and so on. The initial team member is selected by Ametex project champion and then interviewed and exposed to the lean concepts, including the implications of being a team member. This initial person then selected the next team mate with acquired information and some guidance provided by management. Each successive team member was selected for their zones by the previous members. *Making sure that the operator efficiency range is no more than 12%*. Each team member was interviewed by the project team and accepted to make sure that there is no deviation from the general plan.

The final nine team members were reviewed to insure that they met the selection criteria. One example of this is included below:

**Attitude** – Review each volunteer's personnel record for any past disciplinary actions. Interview past supervisors to attain their assessment of the volunteer's performance. Determine if there discrepancies from the goal and if so find out the reasons for participation through a 10-minute interview. For the most part when the actual team members select additional team mates they are usually familiar with the personalities of the individuals they wish to work with.

### **Operator Cross-Training**

The Operator Cross-Training was defined by [TC]<sup>2</sup> (*see Deliverable #8 – Appendix B*) and carried out by the Engineering staff of Ametex's during October and November of 2004. The cross-training schedule was originally planned for 6 weeks. However, Ametex's requested that this be extended to 7 weeks as these operators were needed to satisfy production demands. [TC]<sup>2</sup> monitored the progress of this training through weekly reports and communications, as well as, having set up their respective training curves. Minimum expectations were for the team members to reach a 60% efficiency level in the designated operations needed to fulfill the team-based job requirements.

### **Compensation Training and Development**

The Compensation Training and Development was carried out by Gloria Carter and Arturo Rodriguez during the month of October 2004. The essence of a successful lean manufacturing compensation plan is that the operators' transition from individual to group incentive. This was accomplished for Ametex's by setting up a Compensation committee that was instructed by [TC]<sup>2</sup> on the principles behind successful compensation systems and asked to develop the short and long term goals for this company plan. With this direction, we proceeded to get all the ideas into a workable solution which was presented do the Director of Ametex's, who in turn authorized the proposal.

### **Lean Manufacturing Workshop for Pilot Team**

The workshop for the pilot team acts as a kickoff for the line start-up. It provides information and motivation to the team and prepares the team members for their new responsibilities within the organization. This workshop was delivered by Richard Atwell and Arturo Rodriguez on December 1-2, 2004. This two-day program is designed to help support personnel and operators understand the requirements for successful Lean Manufacturing and the new roles of both the management team and direct labor employees.

### **Line Start-up**

The start-up support for the pilot line was provided by Richard Atwell and Arturo Rodriguez during December 2004. The main purpose of [TC]<sup>2</sup>'s support during the start-up of any new manufacturing system is to teach the new movement and sewing methods to the operator. Ametex's Pilot Lean Manufacturing Team was designed by [TC]<sup>2</sup> as a Stand-up-Hand-off, single piece production system. Very specific movement rules and product flow are inherent in this type of manufacturing system. In general, the movement of operators is sequential within the trained operations for each operator. The movement of the operators is described as follows:

**Forward Movement** - An operator completes all of the assigned work for a workstation and then moves forward to the next sequential station. An operator will continue to move forward (up the line) until one of the following events occur:

- They are "bumped" back and the piece is taken from them
- They reach a station that is already occupied and are blocked
- They reach a station on which they are not trained.

**Backward Movement** – When the last operator on the line completes a product, they initiate the "bump" process. The operator begins to walk the line backwards until they reach the second to last operator. If they have the proper training, they will take the piece being produced by that operator and continue the processing from that point. If they do not have the training they will wait for the operator to move the work into their trained "zone". Once the piece has been handed-off to the last operator, the second to last operator would move back to the next operator and take their piece and continue processing. This "bump" would continue until the second operator on the line takes the piece from the first operator and the first operator introduces a new piece into the line.

Once the operators understand the movement required in the new system, a focus can be placed on increasing production efficiency and addressing quality assurance. Typically, 4-5 days is enough time to gain an understanding of the system.

### **Follow-up Support**

The follow-up support was provided by Arturo Rodriguez during January 2005. During this visit, several issues were addressed. The first being the new production style that was introduced to the line during mid-December. Although the original style on which the training and engineering was completed was the Men's Polo custom fit shirt, Ametex

management decided to switch to the Ladies Polo skinny fit. Thus the training curve for the Pilot team was extended and the first day of the training curve was moved to December 16, 2004. In regards to “work methods”, while both are essentially Polo shirts, the “skinny” pattern demands much more dexterity from the sewing operator, specifically in the collar, sleeves and closing sides operations.

At the time of the follow-up, the pilot team had been working on this model for about two weeks and have started to develop “stand-up” work habits such as knowing where to locate tools that they need in certain operations, where to stop in the seam so as to “hand-off” to their next team member and not jeopardize the quality of the stitches, etc. Also, they have overcome their fear of talking to each other and now can effectively communicate amongst each other when a problem is identified or to eliminate a potential problem before it impacts production and/or quality. There is still a need for the engineering department to analyze each operation, finding ways of improvement. This should be done during the later part of January and/or early February.

Other issues that were addressed during the visit included:

- Current capacity and efficiency on the line
- Quality and production projections vs. actual
- Engineering and management support
- Current performance against quality standards
- Equipment performance and technical support

A detailed description of the findings in these areas is included in Deliverable #8 - Appendix C.

	10/9/2004	10/16/2004	10/23/2004	10/30/2004	11/6/2004	11/13/2004	11/20/2004	11/27/2004	12/4/2004	12/11/2004	12/18/2004	12/25/2004	1/1/2005	1/8/2005
	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
<b>Lean Mfg Teams</b>														
Compensation Training & Development				■	■									
Ametex Gathering Compensation Data				■	■									
Finalize Compensation Plan					■	■								
Process Overview for Potential Team Members (max 100)	■													
Team Selection	■	■												
Cross Training Selected Team Members		■	■	■	■	■	■	■	■					
Equipment Procurement and Setup	■	■	■	■	■	■	■	■						
Verify Cross Training and Equipment Setup				■										
2-Day Lean Mfg. Seminar for Pilot Team(s)									■	■				
Lean Team Implementation									■	■	■			
Follow-up Support														■

- - denotes project work day
- - denotes travel time
- - denotes time for operator cross training and equipment setup

# Operator Learning Curves & Cross-

Operator Name	Required Training
SATURNINO PLATA HUANCA	Attach collar @ ends to placket, topstitch shoulders
DIONICIO CHOQUEHUANCA CONDORI	Set collar with neck tape, topstitch collar tape insert Boliva/content label
JHONNY TINTA PARI	Topstitch collar tape insert Boliva/content label
LUIS GONZALO ROQUE ROQUE	Topstitch left placket
ROBERTO GUTIERREZ APAZA	Set rib cuff to sleeve
GERMAN MAMANI MAMANI	Set polo label w/ size label
MERY AZPIAZU LOZA	Set polo label w/ size label, pre sew vent flat
FRANZ MAMANI BARRA	Close sideseam and sleeve
JAVIER CARI MAMANI	None

# Training Schedule:

Recommended Training	Cross- Training Required (weeks)	Week Ending Date					
		10/16	10/23	10/30	11/6	11/13	11/20
Topstitch shoulders	2					X	X
None	6	X	X	X	X	X	X
Trim bottom of placket & sew across placket ends	4			X	X	X	X
Topstitch right placket	6	X	X	X	X	X	X
Topstitch left placket, set sleeves flat	4			X	X	X	X
Make placket box, pre sew vent flat	5		X	X	X	X	X
Topstitch vent	6	X	X	X	X	X	X
None	3				X	X	X
None	3				X	X	X

X - denotes week of cross-training

## **Deliverable #8 - Final Report - Appendix C**

### **Current capacity and efficiency on the line**

Considering the new production style (skinny fit), new capacity was calculated and the line's efficiency tracked. Line Capacity is now based upon 13.5 standard allowed minutes (SAM's). Based on having nine operators, the pilot team should be able to produce 380 shirts per each 9.5 hour shift. The line capacity on the original style was 420 shirts based on a 12.2 SAM's.

Ametex engineer Jonny Yampara has kept track of the line's efficiency since day #1 (December 16, 2004) and the team has been producing at approximately 60-65% against a training curve goal of 80% during the 1<sup>st</sup> week of January 2005. This six week training curve is set so that 100% is planned for the 28<sup>th</sup> off Jan. 2005. (See attached efficiency chart).

The efficiency results are lower than the expected curve due to a drop in 1<sup>st</sup> quality and higher off standard time. Both of which will be explained below.

### **Quality and Production projections versus Actual**

As an integral part of this Lean Manufacturing project, a training curve was set up so that the pilot team would have a "ramp-up" period (see attached). Originally the curve for the custom fit model was determined to be spread over 7 weeks. However, when Ametex decided to switch over to the skinny fit model the curve was adjusted to 6 weeks. It is expected that as the team members adjust to their new roles and responsibilities in the team environment, their production results will also improve. At the time of this follow-up visit, expected production results per a 9.5 hour shift was 319 units. The actual results were hovering around 230 units.

This fall in production can be explained in several ways. First, the training curve that should have been followed was the 7 week version rather than the 6 week curve because the style being produced was more difficult to sew. Another reason for decreased productivity was the increase in off standard time (up to 10%). The primary causes for this increase were poor quality thread and sewing machine downtime. While the problem of faulty sewing thread is widespread throughout the Ametex sewing plants (Matex and Mex) it is NOT tracked because the high levels of work-in-process (WIP) decrease the impact. In the pilot team however, the line must stop to address these issues because there is minimal WIP. The Fortalez team members are now very conscious of this issue. Mechanical failures in the modular line have the same impact, shutting down the line. The head mechanic (Elmer) has accepted the fact that the selected machines were just not "up to par" and that PM practices have to be stepped up. (See attached chart).

Quality levels for the pilot team are equivalent or better than the traditional lines. The Fortalez team quality results (measured at end of sewing and before going into washing) are at an average of 83% 1<sup>st</sup> quality, thus having 17% rejects. This compares very favorably to the 33.4% reject level in Matex and 18.14% at Mex. However, caution must be used in comparing these results since in the traditional lines there are no trustworthy figures before washing. It is evident that the Lean manufacturing project has unearthed several QA dilemmas that must be addressed.

For example, before wash sewing specs have to be defined so that both sewing operators and inspectors/auditors follow the same quality guidelines.

The main quality defects encountered by the pilot team are skipped stitches, uneven stitching and variable stitching width. All of these problems are being investigated and corrective actions are being taken, both at an individual level as well as at the team level.

### **Engineering and Management Support**

Engineering is a relative new department in Ametex and the manager Carlos Arboleda has only been in place for one year. Even so, they have risen to the challenge and undertaken the mission of supporting the pilot team. Several of their engineers have undergone the two-day introductory workshop and also the one-day engineering training. However, a project champion had not been identified. We now have an agreement that two of the engineers, Efren Gonzalez and Jonny Yampara, are going to fill this critical role and be responsible for engineering support for the rollout into future modular teams. They will also lead an in-depth study of work methods and the use of work aids to realize the full benefit lean manufacturing.

Management support has been very positive from the top level. The company president and vice-president believe in this project and put their full support behind it. In this initial stage, the pilot team has been under the direction of the Engineering manager. The Production Director and the Sewing Plant Manager have had very little involvement because of their lack of time. To facilitate their active involvement, it was agreed that the next two modules are to be set up with the Production Director as the person directly responsible for its success.

One staff manager that has taken a genuine interest in this project has been the QA Manager. He clearly sees the benefits of applying Lean Manufacturing principles and makes time check on the progress of the team every day.

### **Equipment performance and technical support**

Attached you will find a chart showing that 25% of all off standard time is due to mechanical failures of the sewing machines. This represents 180 minutes in 14 days of work or an average of 12.8 minutes per 9.5 hour shift. While this average might seem a minor problem, this downtime stops all the line and thus it is the down time of 9 operators, not just an individual. The Fortaleza team quickly realized this and is demanding that this problem be solved.

Most of the machine failures can be traced to a poor initial set-up, especially in regards to the replacement of worn out (or almost worn out) parts. The mentality in Ametex is not one of Preventive Maintenance. Team members and sewing technicians are working hand in hand on this problem. The sewing operators have started training on minor machine repairs, set-ups, etc. under the guidance of the technician. The mechanic, Elmer, has been under the pressure of keeping the line running and has grasped the concept of using the team breaks, lunch hour, etc. for his minor adjustments.