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**MEASURING THE EFFECTIVENESS OF AAMTD**

**DLA900-87-D-0017, DO 0008**

**Final Report**

by

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The purpose of this research has been to quantitatively assess the effectiveness of the apparel demonstration project at Clemson Apparel Research. In order to obtain the necessary data required, a survey was developed that is provided to visitors of Clemson Apparel Research. Through use of the survey, we have been able to capture a wealth of information from all sectors of the apparel industry, as well as from military personnel, government contractors, general public, textile manufacturers, educators, and students. In addition, historical data was captured through various means, including communications with apparel manufacturers and equipment vendors for whom we had done texting of fabrics and equipment.

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## INTRODUCTION

The purpose of this research has been to quantitatively assess the effectiveness of the apparel demonstration project at Clemson University (Clemson Apparel Research). In order to obtain some of the necessary data required for this research, a survey was developed that is provided to visitors of Clemson Apparel Research (CAR). Through the use of the survey, we have been able to capture a wealth of information from all sectors of the apparel industry, as well as from military personnel, government contractors, general public, textile manufacturers, educators, and students. In addition to the survey, historical data was captured through various means, including communications with apparel manufacturers and equipment vendors for whom we had done testing of fabrics and equipment.

A number of other methods were used to acquire information concerning vendors who benefited by having their product(s) demonstrated at CAR. Specifics will be provided later in this report.

## SURVEY INFORMATION

### *Visitors*

The staff at CAR, since its inception, have urged everyone who visits CAR to fill out a visitors card. To date, approximately 8,500 visitors have done so. As a result, we have been able to provide information to Defense Logistics Agency (DLA) concerning the people who have toured our facility. For example, based on our worksheets, 25 percent of our visitors are apparel manufacturers (17 percent of those are government contractors); 10 percent are textile manufacturers; 8 percent are vendors; 23 percent are general public; 10 percent are educators; 20 percent are students; 3 percent are military; and 1 percent are media-related.

It has been encouraging to see the number of people in the general public who are interested in CAR. We feel that by demonstrating modern technology in the apparel industry, it will help to overcome the "sweatshop" reputation that has been attributed to the apparel industry.

### *After Visiting CAR, Has Your View Of The Apparel Industry Changed?*

Approximately 500 people responded to the survey question, "After visiting CAR, has your view of the apparel industry changed?". Thirty-three percent were much more positive in their view of the apparel industry; fifty-one percent were more positive; sixteen percent felt about the same; zero percent were less positive.

### *Please Rate Various Aspects of CAR*

In order to determine which aspects of CAR were the most beneficial and the aspects that may need improvement, a question was added to the survey to ask visitors' opinions on various areas of CAR. Seven aspects were selected for the survey including equipment, research, workshops/seminars, staff knowledge, Apparel Manufacturing Capital Investment Advisory (AMCIA), Apparel Manufacturing Information Service (AMIS), and management. The results, shown in Table 1, were very enlightening:

<u>Category</u>	<u>Excellent</u>	<u>Very Good</u>	<u>Good</u>	<u>Poor</u>
Equipment	71%	25%	4%	0%
Management	43%	44%	13%	0%
Research	55%	35%	10%	0%
Workshop/Seminar	41%	43%	16%	0%
Staff Knowledge	75%	21%	4%	0%
AMIS	45%	38%	16%	0%
AMCIA	35%	39%	26%	0%

Table 1

Improvements have been made to AMIS and AMCIA which make them more "user friendly" and later surveys have been much more positive.

### *Economic Impact of CAR*

One important aspect of our survey has been to capture data relative to the economic impact of CAR. Visitors are asked to evaluate the benefit of CAR to

various segments of the U. S. economy. Approximately 500 visitors have responded to this question. Listed in Table 2 are the results to date:

<u>Segment</u>	<u>CAR Beneficial</u>	<u>CAR Not Beneficial</u>
Apparel Industry	100%	0%
Textile Industry	97%	3%
South Carolina Economy	98%	2%
U. S. Economy	98%	2%
U. S. Military	96%	4%
Equipment Vendors (Sales)	98%	2%

Table 2

*Purchases Because of Visit(s) to CAR*

One of the ways data were gathered concerning purchases as a result of the CAR demonstration area has been through the survey medium. The information received from the survey, however, is an intent to purchase, rather than after-the-fact information gathered from other sources. Therefore, it is unclear how many of the intended purchases have actually been completed at this time.

*Interest in Becoming a Military Contractor*

DLA personnel suggested to the researcher that it would be beneficial to obtain information on non-military contractors who might be interested in obtaining government contracts. Therefore, the question was added to the survey. Since it was added much later, to date we have received only 166 responses. Of those responses, 22 would like to become military contractors, 112 would not, and 32 were undecided. A list of the companies who were favorable to the idea will be compiled and forwarded to DLA soon.

## HISTORICAL INFORMATION

### *New Products/Innovations*

A number of new products including software, attachments, and equipment have been invented by researchers at CAR. Many of these new items are being utilized in the apparel industry. In a number of cases, productivity and quality have significantly improved in the plants after the innovations were implemented. For example, the sewing foot and guiding mechanism invented by one of our engineers, Mr. Elroy Pierce, is being used by a number of shirt manufacturing companies on the French Fell operation. This innovation has made the operation more efficient, in addition to decreasing the likelihood that the operator will develop repetitive motion disorders.

Another example of new products developed at CAR is the VAST (Voice Actuated Sewing Technology) which allows an operator to give voice commands to the sewing machine rather than pressing a foot pedal to control the machine. It is being marketed by EFKA of America who recently made it available to the apparel industry; therefore, we do not have any results to date concerning productivity and quality improvements.

A disabled Vietnam veteran at CAK is currently using VAST to sew collars and other items. VAST will be beneficial to the apparel industry by providing a means of utilizing disabled workers. This is especially significant since the Americans with Disabilities Act has been implemented.

Another innovation developed at CAR is the Apparel Manufacturing Information Service (AMIS) which is a computerized bulletin board. It allows anyone with a computer (PC or Macintosh) and a modem to dial in on a toll-free number and receive the latest information concerning apparel and textiles. For example, the new products bulletin board provides information concerning new equipment, software, etc. available to the industry. Another bulletin board provides information on research projects around the world that are related to apparel. AMIS can also be used to communicate with other people in the apparel industry. The American Apparel Manufacturers Association (AAMA) has voted to make AMIS the primary means of communication to its members.

Tony Aspland, another of our engineers at CAR, has developed several new adhesives as a result of his work on the Chemical Protective Suit and the Quick Doff Hood. He has gotten excellent results from most of these adhesives on materials such as butyl rubber that are difficult to bond together.

The Apparel Manufacturing Capital Investment Advisor (AMCIA) was also developed at CAR. This software program allows an apparel manufacturer who is considering a particular piece of equipment to determine how beneficial that equipment would be to his operation using net present value, payback period, and return on investment. The program is available in MicroSoft Excel or Lotus 1-2-3 for PC's and Macintosh.

Another software program we have provided to the industry is Clemson Apparel Productivity Share (CAPS). It is an alternative to the piecework system for compensating workers. It was designed for flexible work group / team management / modular manufacturing units.

There are a number of other innovations and new products that were developed at CAR. These include:

- A communications link between the pattern & marker making system and the automated cutter
- A prototype turning machine
- A prototype air flotation device
- A pivot turner to turn military style collars.

#### *Various Tests Run at CAR*

A number of apparel manufacturers have asked CAR to do testing on various problems they have encountered in their production. Many of the tests performed at CAR were related to fabric puckering. In each case CAR staff was able to suggest solutions that decreased or eliminated completely the pucker in the fabrics. Other tests completed include a major project with Greenwood Mills and Levi Strauss to test tensions vs. shrinkage of denim fabric to the finished product. We were able to solve the problems they had with the denim fabric and suggestions were made by our staff on further improvements.

A number of tests for Milliken have been done at CAR including use of the automated cutter to cut seat cover fabrics. It was very successful. In addition, we have provided them with solutions to various problems including stitching; fabric wrinkling; needle pulls and cuts on various kinds of material; the seam strength on some of their fabrics; cutting and sewing a knit rayon; and fabric handling through assembly.

A project was also successfully completed with Precision Fabrics. It involved two steps. First, CAR designed a better protective garment to be used in nuclear plants. In addition, CAR tested various experimental fabrics for this garment. Precision was very pleased with the results.

In addition, tests were run on various linings, the use of ultrasonics to permanently crease work pants, and various collar problems. All of these tests were successful and results were provided to the manufacturers.

#### *Courses, Seminars and Training Programs*

Since January 1989, CAR has routinely held "Theme Days" where apparel manufacturers are provided a one-day extensive class on a particular piece of equipment or on manufacturing techniques. The cost to attend a Theme Day is very low (under \$100), but response from attendees at the end of each class has been very good. Some of the Theme Day topics to date are:

- CAD systems
- UPS Systems
- Automated Parts Manufacturing
- Real-time Data Collection
- AMCIA
- Computerized Engineering
- Sewing Thread
- Modular Manufacturing
- Skil-Sew

In addition to Theme Days, we also hold a number of seminars each year. Our first seminar, Fundamentals of Apparel Manufacturing, was held in February 1989. This particular seminar is usually held three times per year, and attendance has been excellent. Flexible Work Groups/Modular Manufacturing

has also been a successful seminar that is held twice per year in addition to an Advanced Modular seminar that is held once a year.

The newest seminar we are offering is called "Benchmarks of the All Stars". It is sponsored by CAR/SMTC and *Apparel Industry Magazine*. Representatives of the most successful manufacturing plants come together to teach this seminar. They provide information on the methods they have used to become "All Stars". In 1992 this seminar was provided in all four regions of the U. S. Each time it has been held it has gotten excellent reviews from the attendees.

In addition to the major seminars CAR provides each year, a number of others have been offered including "The Personnel Dilemma", "Production Scheduling for Quick Response", "Real-Time Data Collection", "The Theory of Constraints", and "Ergonomics". The major difference between Theme Days and seminars is that seminars normally last more than one day and the cost is a bit higher.

Training programs are generally scheduled when a company wants a number of its employees to come to CAR for training in a particular area. In the past, CAR has hosted a textile management training course; a computerized pattern making and grading course; pneumatic systems training; Jet Sew training; a GSC certification course; a training program for Natick Mantech Thrust Area Management; a production management course; and several Industrial Education training sessions.

#### *Summary of Equipment Sold as a Result of Seeing It at CAR*

Table 3 shows the summary of known items of equipment that have been sold as a result of the CAR demonstration. It is very difficult to get this kind of information from the equipment vendors. Most of the information shown in Table 3 actually came from the apparel manufacturers who purchased the equipment; therefore, there are probably many more items purchased of which we are unaware.

Equipment vendors said they could not track information such as 'what prompted a purchaser to buy a particular piece of equipment'. They must believe that CAR is important to their sales, however, because equipment vendors approach us regularly to consign or donate more equipment.

Equip. Purchased by Mfrs.	No. Purchased	Value	Total Value
Real-time System	1	32,000	32,000
CAD System	5	Various	320,350
UPS	11	Various	1,060,000
Run Collar	4	40,000	160,000
Set Pocket	5	Various	289,450
Run Cuff	2	25,000	50,000
Line/Hem Cuff	2	20,000	40,000
Block Sleeve Placket	4	40,000	160,000
Topstitch Cuff	1	50,000	50,000
Ergonomic Chairs	65	244	15,860
Lockstitch	1	8,500	8,500
Guides, plates, feet, etc.	201	Various	38,725
Bottom Hem	1	3,595	3,595
Top Limit. Top Ctr.	1	38,900	38,900
NC Cutter	3	250,000	750,000
HPV	6	60,000	360,000
Skil-Sew Kit	4	10,000	40,000
Shirt Folder	1	32,000	32,000
Collar Topstitch	1	62,000	62,000
Spreading Machine	3	40,000	120,000
			3,631,380

Table 3

### *Equipment and Materials Donations*

CAR is very fortunate to have vendors who are willing to donate equipment and materials to us. They understand that it is a win-win situation. CAR benefits by having equipment to demonstrate to the apparel industry. The vendors profit by increased sales of their products because apparel manufacturers are able to see the equipment operate first-hand at CAR. Apparel manufacturers benefit from the demonstration of the equipment at CAR. In addition, by using the capital investment advisor (AMCIA), CAR can help apparel manufacturers make an educated decision as to whether or not the equipment is cost-effective for their operation.

### *Government Contractors*

There are a number of government contractors who participate in various CAR activities. In addition, representatives of Workwear Corp., Dan River, Inc., Springs Industries, Dowling Textile Manufacturing Co., Oxford Industries,

National Industries for the Severely Handicapped, and UNICOR/FPI are on CAR's Steering Committee. Seventeen percent of the apparel manufacturers who visit CAR are government contractors. To date, approximately 354 government contractors have visited CAR.

### **FINAL OBSERVATIONS**

This project has been very beneficial in establishing the effectiveness of Clemson Apparel Research. Based on the results provided in this report, it is obvious that CAR has had quite an impact on the apparel industry since its inception in 1988. It is unfortunate that much of the information generated by this project will no longer be tracked for future use. The researcher believes that given the CAR staff currently in place, there are no limits to the ways we can continue to benefit the domestic apparel industry.