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AMTEX Second Quarter FY95 Report

The AMTEX Partnership™

March 1995

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PNL-10519-2

The AMTEX Partnership

Second Quarter Report
Fiscal Year 1995

March 1995

Issued by
The AMTEX Program Office

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AMTEX Laboratory Program

and

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AMTEX Industry Program

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EXECUTIVE SUMMARY

The AMTEX Partnership™ is a collaborative research and development program among the U.S. Integrated Textile Industry, the Department of Energy (DOE), the national laboratories, other federal agencies and laboratories, and universities. The goal of AMTEX is to strengthen the competitiveness of this vital industry, thereby preserving and creating U.S. jobs.

Operations and Program Management

The operations and program management of the AMTEX Partnership is provided by the Program Office. This report is produced by the Program Office on a quarterly basis and provides information on the progress, operations, and project management of the partnership.

Program Office Operations and Management

Operating Committee

The first AMTEX *Progress Report* was held in conjunction with an Operating Committee meeting in Washington, DC on March 2, 1995. The *Progress Report* showcased extensive displays and demonstrations of AMTEX-developed technologies. AMTEX Chair, Jerry Work, and Vice Chair, Thomas Malone, reported to Department of Energy Secretary Hazel O'Leary on how AMTEX has fulfilled its public accountabilities and founding principles that were set forth two years ago at the AMTEX initiation ceremony. Secretary O'Leary expressed her commendation for the AMTEX accomplishments and pledged her continued support of the partnership. At a short business meeting of the Operating Committee, a new project was approved. It concerns the development of sensors and on-line process control systems for flexible manufacturing of synthetic fibers. A reception for members of Congress was held in the evening.

Projects

Computer-Aided Fabric Evaluation (CAFE)

The On-Loom Greige Inspection task has made good progress toward the deployment of all sensor, vision, and detection subsystems for the upcoming On-Loom Greige Inspection Alpha Test. The sensor systems and detection algorithms have shown great promise in laboratory testing.

The Machine Diagnostics system was demonstrated in an Alpha Test on an air-jet loom at Oak Ridge National Laboratory (ORNL). Methods for detecting machine faults in looms such a missing picks (fill yarns), double picks was shown. This capability provides a measure of color pattern accuracy, total picks per time period, and a calculated linear pick density. These parameters are important in optimizing the economic output and value of the loom. This system was installed and tested a month ahead of schedule.

Detection algorithms were improved in terms of feature extraction and real-time, on-loom analytical capabilities. Algorithms were tested on warp defects and in machine diagnostic evaluation.

The Central Inspection Computer was deployed and tested a month ahead of schedule. It was an integral part of the successful Machine Diagnostic Alpha Test. The Central Inspection Computer is based on an open, robust architecture and provides flexibility to accommodate additional needs of the CAFE industry partners.

The Color Printed Pattern task completed a second data gathering run at an industry printing range where useful image and vibration data were obtained. Development of the 2-dimensional algorithm continued in the area of detecting missing and defective colors in the print field. Development also continued in the algorithms that compare computer-aided design files with the actual captured images. Work also continued on the development of an improved colorimeter and associated color correction techniques.

Cotton Biotechnology

A significant discovery and advancement was made this quarter in understanding the process of cotton fiber production. Through a series of experiments, researchers were able to determine that genetic decision (or differentiation) of cells to become fibers occurs in two stages. Researchers were also able to determine the number of days before flowering when the genetic commitment is made. In the long run, the information will guide researchers in developing strains of cotton that naturally produce higher yields of longer, more uniform cotton fiber.

Other progress in the quarter included the demonstration that *simple sequence repeat* markers are useful in distinguishing genetic differences between cotton varieties. An initial version of the genome database was also established.

Demand Activated Manufacturing Architecture (DAMA)

DAMA has enjoyed significant progress and exciting accomplishments in all areas during this past quarter. Highlights from each of the five task areas are:

Enterprise Modeling & Simulation - Product line investigation and modeling on bed sheets and a men's nylon warm-up jacket has completed a number of site visits. A methodology for viewing the outcome of these industry visits has been developed, using multimedia tools, and is now in use.

Connectivity & Infrastructure - Several types of data security were successfully demonstrated, and File Transfer Protocol was implemented across the project with a file server at Lawrence Livermore National Laboratory (LLNL). A successful demonstration of video-teleconferencing

was achieved with broadcast of the first training course, *Joining the Internet Safely Using UNIX and Firewalls.*

Cooperative Business Management - The CBM Infrastructure Prototype #1 was successfully demonstrated during an industry evaluation session in January. A second, more refined prototype was recommended by the DAMA partners, and is currently being developed.

The Forecasting and Inventory Management activity held two definition and requirements meetings with industry. As a result, a collaborative effort has begun to develop the requirements for an integrated forecasting and inventory management prototype.

Architecture & Integration - The DAMA 1995-1996 Project Plan, Task Plans, 1994 Annual Report, and DAMA 1995-1996 Project Overview documents were completed and distributed. Monthly status and detailed cost reporting was initiated.

Education & Outreach - A field trial version of *"Strategic Issues: Creating Strategies for the Integrated Textile Complex,"* was held in March. It is a Learning Laboratory seminar on improving management skills in problem diagnosis, decision-making, and strategic planning, using elements from systems thinking and decision analysis.

Embedded Electronic Fingerprinting (EEF)

The EEF project is developing radio frequency (RF)-addressable miniature electronic devices as permanent identification markers and information stations for textiles and apparel. Initial efforts were devoted to identifying the needs of the industrial users and the state-of-the-art technologies in the rapidly changing RFID area.

The major goal is to develop the technical capabilities and protocol to enable remote communicate with, and delineate the signals of, up to 50 different tagged items contained in a box.

Rapid Cutting

The Rapid Cutting team is making good progress on all three objectives: high-speed laser cutting systems, advanced knife blades, and advanced mechanical drivers. To develop high-speed cutting systems for single ply fabric cutting, the national laboratories are investigating various forms of laser or photonic cutting. Proof-of-concept investigations using different laser sources, are well underway. Tests have shown improved cut quality and increased efficiency over present commercial systems.

Three laboratories have applied advanced materials to knife blades. A testing plan is being developed for these blade designs that will include laboratory testing, a limited run to evaluate reproducibility, and sequence of tests in factories of the industry research partners. On the third objective, pre-prototypes of magnetic drivers for automated

and hand-led reciprocating cutting heads have been fabricated and are being evaluated.

An overall project review was held in February with the laboratories and several of the research partners.

Sensors for Agile Manufacturing (SFAM)

The objective of this project is to develop sensors and feedback control methods that will improve the quality and productivity in the sewing processes associated with garment assembly. The first two tasks in this project are concentrating on the development of sensors for fabric edge detection and felled seam sensing. A third task on advanced sewing machine concepts is in the early phases of providing a better definition of industry needs.

Sensor development continues to progress at a rapid pace. The fabric edge detector at Sandia National Laboratory (SNL) has been bench tested. The industry and laboratory team are working to place this sensor in a production environment. The final report for the optical felled seam sensor was completed by Pacific Northwest Laboratory (PNL) this quarter.

In January, the joint laboratory/industry team met at SNL for a project review. From this review, it was decided that technologies being pursued by Argonne National Laboratory (ANL) for felled seam sensing were not feasible and that work was terminated.

Textile Resource Conservation (TReC)

Good progress continues to be made in the major TReC focus areas: recovering and reusing colorant chemicals and fibrous solid wastes, reducing the amount of water, chemicals and energy used in applying chemicals to fabrics, and in cleaning complex machinery parts and fabrics, using environmentally-safe methods. The industry task teams met this quarter to review progress. Feedback and direction from these teams has been used to focus the work for the remainder of the fiscal year on the items of highest priority and benefit to the industry. Consistent with that guidance, work in the coming quarter will include the continued refinement of these processes and development of plans for in-plant technology demonstrations later in the year.

The task on environmentally sound processes has led to an investigation of the concept of life cycle analysis and environmental decision tools. These tools would enable the industry to model and evaluate the environmental impacts of manufacturing processes and material choices before they are implemented. A workshop with the industry, laboratories, and universities was held to explore this concept. Continuation of this task into FY96 is being planned.

Formative steps were taken this quarter to develop a new task on the re-engineering of the slashing process. The industry sponsored an

informational workshop for the laboratory researchers to learn about the objectives of the task and the technical issues in the slashing process. The laboratory teams then prepared proposals for review and selection by an industry panel.

Financial Summary (DOE $ in thousands)

($K)	(A) Total FY95 Budget*	(B) Quarter Cost	(C) FY95 Cost to Date	(D) Remaining Balance (A - C)	(E) % Spent of Budget (C / A)
Program Office	1,036	284	582	454	56%
DAMA	13,843	2,463	4,369	9,474	32%
CAFE	5,843	1,388	2,550	3,293	44%
TReC	4,292	961	1,562	2,730	36%
EEF	777	133	250	527	32%
Cutting	2,041	320	589	1,452	29%
Sensors	900	218	318	582	35%
Cotton Biotech	1,724	256	326	1,398	19%
OPCon	528	21	21	507	4%
TA Leaders	46	10	17	29	37%
Uncommitted	266	0	0	266	0%
Total	$31,296	$6,054	$10,584	$20,712	34%

* Total FY95 Budget includes carryover from FY94. (See Project Summary Reports in Appendix A for details.)

OPERATIONS AND PROGRAM MANAGEMENT

Program Office Operations and Management

The Program Office provides management oversight of the daily operations and project activities of the AMTEX Partnership and is composed of an industry and a laboratory component. The following activities were conducted this quarter.

Project Initiation

Last quarter, the DOE laboratories prepared and submitted proposals of R&D concepts for the On-line Process Control for Flexible Fiber Manufacturing or OPCon Project. The proposals were evaluated during the quarter and laboratory task leaders selected by an industry review panel. The areas chosen for investigation and the laboratory task leaders are:

Characterization of Crimp and other factors influencing spinning of stable fibers; Chuck Batishko, PNL

Finish Oil and Moisture Characterization, E.A. Wachter, ORNL

Measurement of Polymer Rheology, Elliot Douglas, Los Alamos National Laboratory (LANL)

Polymer Morphology, Boris Grek, Princeton Plasma Physics Laboratory (PPPL)

The AMTEX project managers are Jack Scruggs from the industry and Marc Simpson from ORNL.

Press and Media Relations

A major activity was preparation, coordination, and staffing the March 2 Operating Committee meeting in Washington; composing Congressional invitation lists, writing and distributing news releases and press kits; and organizing coverage by reporters before, at, and after the event. Results: 15 reporters covered the event on-site; several others covered it by phone or radio interview. Coverage was prominent in many publications, ranging from the Christian Science Monitor, to a prominent feature in Textile World, to America's Textile International, to Apparel Industry magazine to Marketplace Radio, and more.

Many reporters' calls were fielded this quarter, notable among them ones from The Philadelphia Inquirer, for whom interviews were arranged. Other questions on AMTEX involved DOE budget impacts on the program, the validity of this partnership, the potential impacts on jobs and the economy, and the technology.

The Electronic-Embedded Fingerprint project was highlighted in a tipsheet for reporters, which led to several placements in publications, including Design News, and literally scores of calls have resulted.

Operating Committee Activities and Actions for the Quarter

AMTEX *Progress Report* Exposition

The AMTEX Operating Committee sponsored the first AMTEX *Progress Report* exposition in conjunction with its regular business meeting on March 2, 1995 in Washington, DC Demonstrations and displays from the eight AMTEX projects showcased the many technical accomplishments that have been made during the first year of project operation. The summary posters of the project shown at the *Progress Report* are included in Appendix B.

AMTEX Chair, Jerry Work, and Vice-Chair, Thomas Malone, reported to Department of Energy Secretary Hazel O'Leary and the public on how AMTEX has fulfilled the public accountabilities and key principles that were set forth two years when Secretary O'Leary and others launched the AMTEX Partnership.

Work noted the *AMTEX Key Principles* have served as a foundation and cohesive force during the sometimes-difficult formative stages of the partnership. Adherence to the principles has ensured that AMTEX has been a good steward of the public trust in responsibly bringing together government, industry, DOE laboratories, and universities into the AMTEX Partnership.

Malone stated that AMTEX is well on its way to fulfilling the vision that was the driving force behind AMTEX two years ago. He pointed out that AMTEX is consistent with the government's policy on public-private partnerships and is a model of the tremendous accomplishments that can result from such collaborations.

Secretary O'Leary said that she was very pleased and impressed with the accomplishments of AMTEX is so short a time. She reiterated that AMTEX is the right thing to do because it is good for the industry and good for the government as well. She expressed her continued strong support of AMTEX, both as a beneficial program for the integrated textile industry and as a model for industry-government technology partnerships.

Operating Committee Business Meeting

At a brief meeting of the Operating Committee on March 2, 1995, a new project was approved. The project, called *On-line Process Control for Flexible Fiber Manufacturing*, deals with the development of sensors

and process control methods for flexible manufacturing of synthetic fibers. Jack Scruggs, industry project director from the Textile Research Institute (TRI), and Marc Simpson, laboratory project manager from ORNL, described the objectives and tasks of the project. Work will begin as rapidly as the CRADA documents can be prepared and signed.

Dick Quisenberry, AMTEX Executive Director, gave a summary of other activities that have occurred in AMTEX during the last quarter. He also gave a summary of the various budget scenarios that had been considered by the Industry Technical Advisory Committee (ITAC).

PROJECT ACCOMPLISHMENTS

During the last quarter, accomplishments within the AMTEX Partnership have been numerous. A review of those accomplishments for each AMTEX project is contained in the following paragraphs.

Computer-Aided Fabric Evaluation (CAFE)

The CAFE project is developing inspection systems that will provide U.S. textile manufacturers with a major leap forward in the assurance of high quality, consistent textiles.

Project Managers: Glenn Allgood, ORNL/615-574-5673
Dan McCreight, ITT/804-296-5511

Performance Related to Milestones

On-Loom Greige Inspection

1. Initiation of On-Loom Greige Alpha Test - Mar 29, 1995. The test was one month in advance of target date (May 1, 1995). Test commenced with Machine Diagnostic.
2. Delivery of Central Inspection Computer for Alpha Test. This computer is the main element of the CAFE architecture designed as a open, modular system.
3. Final testing of Argonne's non-vision sensors on the development loom.
4. Final testing of ORNL's vision system on the development loom.
5. Final testing of Sandia's non-vision system on the development loom.
6. Alpha Test Schedule and Plan.

CPE

1. Delivery of Economic Model to ITT.
2. Greige Defect Analysis database interfaced with the Economic Model.
3. Update of CPPG FD/RD completed.
4. Participation of team in the RGB Field Tests.

CPPG

1. Continued testing of the RGB field system at selected sites.
2. Continued and enhanced algorithmic development for color printed pattern inspection system. This process includes testing of algorithms against RGB field data.
3. Issuance of "Survey on Current Practice of Visual and Instrumental Color Evaluation."
4. Preliminary analysis and design of a tri-stimulus colorimeter.

5. Investigation into the possible exploitation of histogram characteristics for color segmentation.

Knit Inspection System

1. Draft Project Plan completed.
2. Draft Functional Description and Requirements Document for Knit Inspection System completed.
3. Coating of 120 needles for testing. Have been sent to Industry Partners for production runs.
4. Application of Greige Inspection Algorithms to knit defect detection.
5. Development of the Knit Defect Database with scanned images.

Activities and Technical Accomplishments for the Quarter

Oak Ridge, Lawrence Berkeley, and Sandia Laboratories

During this reporting period, the On-Loom Greige Inspection Team has progressed towards the deployment of all systems during the On-Loom Inspection System Alpha Test. In particular, Argonne has completed the design and preliminary testing of the non-vision subsystems being developed for the On-Loom system. The hardware has included a scanning system, mounting devices, modifications to sensor configurations, and reduction of system footprint. Included in this effort has been an investigation and study of sensitivity and response measure enhancements. In addition to the hardware design, Argonne has continued in the development of algorithms for signal and image enhancement and feature vector calculation. This system has undergone preliminary testing. ORNL has continued its efforts in the development of the On-Loom vision-based inspection system and the Machine Diagnostic system. Particular to the vision subsystem, ORNL has continued in the development and evaluation of detection algorithms. Parametric adjustments have been made to accommodate both backlit and frontlit images. The team continues to work toward the development of a vision-based linear pick density measurement for both the warp and fill directions. In the area of hardware development, the team has deployed the floor mounted version of the vision inspection system at the Y-12 loom site. As a result of the preliminary test, modifications have been made to the system to ensure constant contact of the encoder wheel.

For Machine Diagnostics, the ORNL/Y-12 Team has teamed with SNL in the development of a scheme for measuring single or double pick insertions. This capability provides measures of color pattern correctness (or errors), total picks per period of time, and calculated linear pick density. ORNL continues to develop the energy calculations (Beta functions) that are used to detect anomalies in machine performance. This system was deployed on March 29 as the first On-Loom System for Alpha Testing–a month ahead of schedule. The team continues in the development of a sensor that can provide a direct measure of linear pick density and velocity during the operation of the loom. It is envisioned that this same sensor will also provide some

measure of fabric defects, such as missing pick, light/heavy start marks, and mixed fill. This sensor suite may offer a low-cost, low-level fabric inspection capability, along with the Machine Diagnostic system. The team plans to visit several Industry sites to obtain power data that may provide additional information into the health of the loom.

SNL continues to make progress on their non-vision fabric inspection system. Specifically, they have made major modifications to the hardware suite that has enhanced the system's capability to not only identify anomalies in the structure of the fabric, but also possibly provide an application as a selvage detector. After these modifications were made to the electronics, Sandia mounted the hardware on the loom for preliminary tests. Work has continued in the development of detection algorithms. This work has included connectivity and feature-extraction, initial testing of detection algorithms on warp defects, and the evaluation of algorithms for the Machine Diagnostic system.

Particular to Machine Diagnostics, SNL has worked with ORNL to develop the real-time analytic capabilities for the system. Of particular importance is the testing of a real-time algorithm for processing the Picanol fill detector. The algorithm was successfully tested on loom data. Sandia has also worked on developing the real-time implementation of all algorithms used in the Machine Diagnostic system.

CPE – Oak Ridge and Lawrence Berkeley Laboratories

The main emphasis for the CPE Team has been the development and deployment of the Central Inspection Computer. This system was an integral part of the Machine Diagnostic Alpha Test. In preparation for this early deployment, the CPE task team has (1) defined computer hardware requirements, network software and protocols, and data storage requirements, (2) defined data structures to enable successful multi-lab system integration, (3) communicated critical system integration issues to all labs, and (4) developed a full-functioned, well-integrated software platform capable of reliably storing vast amounts of sensor and test data in an integrated system. The team has also developed a database and report capability that is consistent with Industry use today and which includes graphics for After-Action Reports, and in the case of fabric inspection, real-time reporting. This system is based on an open, robust architecture and provides flexibility to accommodate additional needs of the CAFE Industry partners. The system was delivered a month ahead of schedule.

CPPG – Lawrence Livermore, Oak Ridge, and Sandia Laboratories

The CPPG Team (ORNL/SNL) completed a second field test of the RGB field test system. The setup for this configuration was on a Stork Print Range. Due to the nature of the site, the inspection frame mounting was modified. The team collected approximately 650 MBytes of useful image data, as well as vibration data, on the installation.

Algorithm development (SNL) continued in the area of a new 2-D algorithm for detection of stick-ins, missing and scabby color for the color print project. In addition to this, SNL continued to develop an algorithm that associates CAD file data with actual captured images and generates an exemplar based on the information gathered from the RGB camera. LLNL wrote code to adapt the RGB field test data to an internal format. Both labs further developed and tested color printed pattern defect detection algorithms. This effort proceeded in conjunction with the processing of image sets acquired from the RGB field tests.

A survey was developed jointly between ORNL and two CAFE Industry Partners to determine the current color evaluation practices of the industry members. The survey title is "Survey on Current Practice of Visual and Instrumental Color Evaluation." This survey has been distributed to the CPPG team for evaluation.

ORNL continued in the design of an imaging tri-stimulus colorimeter. The effort was directed towards defining the best configuration for the imaging software needed to implement the optical filtering. ORNL also continued to develop the algorithm for investigating new nonlinear or iterative techniques to correct the tri-stimulus values from an imperfect colorimeter.

Knitting – Argonne, Lawrence Livermore, Oak Ridge, Y-12, and Sandia Laboratories

An electronic database of digitized defects has been initiated. The database resides at ORNL and currently includes fabric samples from two industry partners. The images were digitized by LLNL and SNL. More samples will be added at later dates.

Progress has been made at LLNL, ORNL/Y-12, and SNL in designing and testing detection algorithms for the knitting project. The results are promising. ANL has prepared mounts for coating 100 knitting needles. After the coating procedure is complete, the needles will be evaluated by a long-term field study at an industry site.

Issues, Major Problems, and Resolutions

As reported in the First Quarter FY95 Report, the DIPIX image capture board was finally delivered in February 22 to the Vision Task Team. This delay has put their development effort four months behind schedule. Even with this late delivery, it is expected the team will be prepared for the upcoming Alpha Test.

Explanation of Variances

None to report this quarter.

Plans for Next Quarter

For the Greige Inspection Team, the major emphasis for the next quarter will be the Alpha Test of the On-Loom Greige Inspection System. This test is on-going at this time and is being conducted at the Y-12 loom site at ORNL. The test is slated for completion in the late-June/early-July time frame. The output from this test will be a complete test report and economic assessment forwarded to the Department of Energy, AMTEX Program Office, and the CAFE Industry Team.

The CPE Team will focus their efforts on finalizing the Central Inspection Computer–the unifying element in the CAFE's open, modular architecture. This system will be used in the On-Line Greige Alpha test and will provide the reports that will be used in the assessments. In this effort, the CPE Team completed the software and data structures for database reporting and graphics, together with establishment of the communication protocol for the test.

The CPPG Team will complete the RGB field tests. From this data, the team will begin testing the multiple algorithm concepts needed for the development of the Color Printed Pattern Inspection System. The team will continue to research issues associated with color clustering and color-based segmentation.

For all the laboratories, extensive efforts will be expanded over the next quarter to complete the JWS/SOW for the CAFE CRADA extension.

Invention Disclosures

None.

Publications/Presentations

Publications generated during this quarter pertain specifically to System Design Documents, Defect Analysis, Machine Descriptors, and Cost Benefits, as they apply to each of the major subsystems being developed for CAFE. For a complete list, contact Dr. Glenn Allgood, CAFE Laboratory Project Manager,

Presentations:

January 17-19 CAFE Quarterly Review Meeting.

The CAFE Laboratory team held a review for the CAFE Industry Partners at Cone Mills, Greensboro, NC. At this meeting, complete updates were given for all the current tasks (On-Line Greige, CPPG, CPE, and Knitting (proposed)).

March 2 Operating Meeting, Washington, DC

The CAFE team presented a poster session to the Operating Committee and the invited guests. All aspects of the project were covered. In attendance with the laboratory scientists and engineers were Industry Partners representing certain textile segments.

Cotton Biotechnology

This visionary project in cotton biotechnology promises to provide revolutionary advancement in the qualities and performance of cotton fiber. By increasing the rate of progress in gene description tenfold, this project will enable scientists to improve the strength, length, and uniformity of cotton. These improvements will add an array of new product features for consumers and a competitive edge for U.S. companies in the world market.

Project Managers: Ben Burr, BNL, / 516-282-3396
Gay Jividen, Cotton, Inc., / 919-881-9874

Performance Related Milestones

No milestones for this period.

Activities and Technical Accomplishments this Quarter

A fundamental discovery was made this quarter which significantly advances the scientific understanding of cotton fiber growth. Cotton fibers are produced because a subset of the cells of the seed coat have active genes that cause them to elongate into fiber cells. A series of controlled experiments were performed wherein cotton buds were subjected to gamma radiation at different times before bud flowering occurred. The gamma radiation causes enough damage to the cells that they will continue to differentiate but will no longer divide, i.e., unless the cell has committed to become an elongated fiber cell prior to the irradiation, the differentiation will not take place at all. The tests showed clearly that seed coat cells first commit to become a fiber cell and then, a few days later, commit to becoming an elongated fiber rather than a short (and useless) fiber.

This information is valuable for two reasons. First, by knowing the exact time at which a cell is undergoing commitment to becoming first a fiber and then an elongated fiber, genetic engineers can time the release of plant hormones to most effectively increase the number of cells that become useful fibers. Second, knowing the timing of these genetic changes provides guidance to researchers regarding where to look in the cotton genome for the specific genes that control the fiber growth process. When the specific genes are known, researchers can begin work on developing

strains of cotton that produce higher yields of cotton with the long, uniform fibers the textile industry values.

Another accomplishment for the quarter was the demonstration that simple sequence repeat (SSR) markers are effective in finding genetic differences between the cotton varieties. Cotton is a uniform species and conventional molecular markers are inefficient for finding genetic differences. The SSR markers will speed cotton breeding, particularly the introduction of new genes into elite varieties.

The third major accomplishment was the establishment of the cotton genome information processing system and database. Scientists at LBL have devised a means of storing and retrieving information about clones and sequences. The processed information can then be used by scientists to understand and relate the gene information to the traits of the cotton plants.

Issues, Problems, and Actions to Resolve Them

Our projections for this project were much larger than can be accomplished within the limits of the present budget. To adapt to the $2 million/year figure, the team has taken three actions:

1) Abandon the physical mapping task. This task would have mapped genes identified in the sequencing task. This information is important for cotton breeding, and may be revisited at some later date.

2) Reduce the number of SSR molecular markers developed. Plant breeding requires only a tenth the number of markers as would a physical map.

3) Use the same team to accomplish both the molecular markers and the gene sequencing. The molecular markers work should be nearly finished by the end of FY95.

Explanation of Variances

No variances to report.

Plans for the Next Quarter

An industrial partners meeting will be held at BNL in early May. During this period, the team expects to issue a contract for oligonucleotide primers in conjunction with the Molecular Markers task. The first markers should be mapped during this period. Meanwhile, sequencing of genomic clones enriched for SSRs will continue.

Donn Davy (LBL) will visit BNL in late April to review progress with the database, instruct in its use, and to observe the flow of information, so the database can be updated to handle sequence information.

Personnel in the Fiber Differentiation task will refine their estimates of commitment times and begin work on *in vitro* ovular differentiation.

Invention Disclosures

None.

Publications

None.

Demand Activated Manufacturing Architecture (DAMA)

The objective of the DAMA project is to define, develop, integrate, and deliver an electronic marketplace system/structure that can be used by all elements of the U.S. textile industry. DAMA will enable companies to reduce process requests for apparel on demand, and establish new strategic alliances to create business opportunities. These steps will enhance industry productivity and competitiveness in the world marketplace.

Project Director: Jim Lovejoy, $[TC]^2$/919-380-2184
Technical Project Manager: Leon Chapman, SNL / 505-845-8668

Performance Related to Milestones

Enterprise Modeling & Simulation (EM&S)

Milestone: *Complete product line investigations and associated industry models for Bed Sheets, Men's Warm-Up Jacket, and Ladies Fashion Item*

The bed sheets and men's nylon warm-up jacket product line investigations are currently moving forward, with a number of site visits completed. Work has begun on the process step model validation process for these product lines as well. A methodology for viewing the outcome of site visits with industry has been developed using multi-media tools, and is now in use. The first Ladies Fashion Item investigation will start during the next quarter.

Milestone: *Complete Textile Industry Simulation Model Ver. 1*

Several prototype simulations have been developed and analysis and validation has started. Work has also begun on a simulation builder tool.

Connectivity & Infrastructure (C&I)

Milestone: *Complete assessment and demonstration of secure electronic connectivity & messaging technology*

A demonstration of how an Electronic Data Interchange (EDI) message can be encapsulated in an e-mail message was completed in March. The ASCII-encoded EDI transaction was wrapped in an e-mail message, along with a description of a process that could be utilized to achieve EDI via Internet mail.

LLNL and Burlington tested Pretty Good Privacy (PGP) by sending files between the two sites. Burlington has used PGP by sending encoded e-mail between company employees.

Milestone: *Implement AMTEX Collaborative Information Systems, including file formatted file transfer and video conferencing among DAMA members*

Formatted File Transfer Protocol (FTP) was implemented for DAMA with a file server residing at LLNL. At the March 15 Steering Committee meeting, industry partners voted to raise the level of connectivity to FTP capability across the project now, and World Wide Web capability by August, 1995.

A successful demonstration of video-teleconferencing was achieved on March 10 with broadcast of the first C&I training course, *Joining the Internet Safely Using UNIX and Firewalls* from LLNL. This 4-hour course was attended by more than 40 people (including ~35 from the ITC) at four sites -- two industry sites (Milliken and JC Penney), one commercial site (Kinko's), and one laboratory (LLNL).

Cooperative Business Management Tools (CBM)

Milestone: *Demonstrate and pilot a national sourcing database*

An expanded scope and schedule for the National Sourcing Database (NSDB) activities have been developed. The scope of the effort is expanding with the ultimate goal of commercialization.

Milestone: *Complete prototypes for forecasting, inventory, and CBM infrastructure*

The CBM Infrastructure Prototype #1 evaluation session was held January 24-27 at $[TC]^2$. Four separate sessions were attended by 47 people from 17 companies. Valuable programmatic and technical feedback from industry about the infrastructure, data sharing, and future directions for CBM work were obtained. A second, more refined prototype (Prototype #2) was recommended by the DAMA partners, and is currently being developed.

The Forecasting and Inventory Management activity held two meetings: 1) February 8-9 in Charlotte, NC and 2) March 22-23 in Spartanburg, SC. An important message received from industry was

that forecasting and inventory management strategies are tightly interwoven. The subtask leaders began a collaborative effort to develop the requirements for an integrated forecasting and inventory management prototype.

Architecture & Integration (A&I)

Milestone: *Complete updates to:*
- *FY96 project plan*
- *opportunity assessment*
- *demonstration plan*

The FY96/97 Project Plan preparation started March 20 with a meeting of the DAMA Advisory Committee in Spartanburg, SC. This meeting was held to review DAMA goals and objectives, and discuss strategic level items for the project to consider while preparing Task and Project plans.

This Advisory Committee meeting provided initial input relative to opportunity assessments for DAMA. Individual members are conducting opportunity assessments with Industry partners as they relate to each task. The results of these assessments will be integrated into the 1996/97 Task and Project plans. A specific opportunity assessment document is not planned at this time.

Demonstrations for DAMA participation have been tentatively identified for this year. In addition to the successful demonstrations held at the AMTEX Progress Report Meeting (March 2) and at Quick Response '95, DAMA will participate in RISCon and, at a reduced level, at the Bobbin Show later this year.

Education & Outreach (E&O)

Milestone: *Developed learning laboratory curriculum*

A micro-teaching seminar was conducted at $[TC]^2$ to provide training for learning laboratory instructors in teaching and facilitation skills for adult learners, class management techniques, and handling difficult classroom situations.

A field trial version of "Strategic Issues: Creating Strategies for the Integrated Textile Complex," was held March 29-31. This seminar can concentrate on improving management skills in problem diagnosis, decision-making, and strategic planning using elements from systems thinking and decision analysis.

Reviewers from academia, DOE laboratories, and industry have been selected to review the learning laboratory curriculum.

Milestone: *Prepare DAMA briefing materials*

A specialized DAMA press kit was created and distributed at the Quick Response '95 conference. This kit is being expanded for use by DAMA partners.

Activities

The following accomplishments are in addition to those reported in Section II, and are provided by DAMA Task area.

Enterprise Modeling & Simulation

- As a first step in Strategic Business Structures, an initial literature search of ITC *best practices* related to logistics was completed. Approximately 250 hits were generated. It is anticipated that once the abstracts and selected full papers are screened, approximately 20 ITC best practices related to logistics will merit documentation. Other topics that appear to be well-covered include EDI, Partnering and Strategic Planning, QR, and Business Re-Engineering/New Technologies. A draft format for documenting best practices was generated and illustrated.

- The simulation prototype of warehousing and distribution was extended to study the effect of forecast error on lost sales and holding costs. A simplified version of a material requirements planning (MRP) system was added to the simulation prototype. Work has started on modeling the generic types of processes needed to model material flow.

Connectivity & Infrastructure

- Several potential technology demonstrations were proposed and initiated with industry task participants. The purpose of these demonstrations is to evaluate key information infrastructure technologies that may be applied to future Cooperative Business Management prototypes or to directly address industry requirements. The primary focus of these demonstrations was testing methods of secure transmission of data over the Internet and exploring ways of using Electronic Data Interchange (EDI) more effectively.

- Several National Information Infrastructure (NII) training courses were selected for maximum interest and benefit to DAMA industry partners.
  - T01: Executive Overview of Internet
  - T03: Internet Tools Overview
  - W02: Internet Tools Workshop
  - T04: Introduction to Internet Security
  - T05: Joining the Internet Safely Using UNIX and Firewalls

  Preliminary DAMA project World Wide Web (WWW) pages were developed and are available for review on the DAMA WWW

server at LLNL. The home page is currently password protected and accessible only to DAMA participants, pending DAMA review and LLNL publication release, hopefully in April.

- Several technology demonstrations with Industry participation were conducted. The purpose of these demonstrations is to evaluate key information infrastructure technologies that may be applied to future CBM prototypes or to directly address industry requirements. Work on the following demonstrations took place in March.

  ⇒ User Authentication with Kerberos -- Spartan Mills
  ⇒ Secure Data Transport Using PGP -- Burlington Industries
  ⇒ Privacy Enhanced Mail -- Spartan Mills
  ⇒ Internal Use of WWW -- Burlington, Cone, Fieldcrest Cannon
  ⇒ Sending X12 Advance Shipping Notices (ASN) Over the Internet -- Fieldcrest Cannon + trading partner

Cooperative Business Management

- Two consumer focus groups were conducted in January. The groups focused on the purchase of apparel and the shopping experience, as this is the primary contact most consumers have with the textile complex. Both groups gave helpful feedback on their views and attitudes toward the future that will provide input to our improved formulation of a vision.

- Ken Washington, SNL, was named the new CBM task leader.

- Jeff Klinefelter of Target has been named as the new Industry Co-Chair for CBM.

  A WWW-based user interface was prototyped to the Auburn database. This prototype was demonstrated on-line, over the Internet, at Quick Response (QR) '95 and several companies.

Education & Outreach

- A field trial version of "Strategic Issues: Creating strategies for the Integrated Textile Complex," was held March 29-31. This Learning Laboratory seminar emphasized improving management skills in problem diagnosis, decision-making, and strategic planning using elements from systems thinking and decision analysis.

- Galey & Lord signed up as a new research partner on DAMA.

- David Kemper, Glen Raven Mills, has been promoted within his corporation and resigned as Task Leader for Education and Outreach.

Architecture & Integration

- The DAMA 1995-1996 Project Plan (DAMA-G-1-95), Task Plans (DAMA-I-2-95), 1994 Annual Report (DAMA-G-8-95), and a DAMA 1995-1996 Project Overview document (DAMA-G-9-95) were

completed and distributed.

- Two Advisory Committee, two Core Management Team, and the Quarterly Steering Committee meetings were held and documented during March.

Issues, Major Problems, and Resolutions

- Placement of a new manager for the Education and Outreach task has proven difficult. Jim Lovejoy is in the process of hiring support at $[TC]^2$ that will be responsible for managing this task. In the interim, Marty Piltch, LANL, has agreed to assist in coordination of the preparation of the FY96/97 task plan.

- FY95 funding for INEL participation is being supported through SNL. Implementing the subcontract with INEL has resulted in a delay in INEL participation of one month. Back on board March 13, this delay has resulted in a 1-month slip on the deliverable schedule for TEXNET Prototype #2.

Explanation of Variances

The significant variances in quarterly budget vs. costs are attributed to several circumstances:

- The Enterprise Modeling & Simulation task has had a significant increase in requirements this fiscal year. Bringing on new staff across three laboratories has taken additional time and resulted in a slower startup than initial estimates.

- DAMA reduced from nine to seven laboratories involved for FY95, resulting in a major realignment of task responsibilities in several areas. New staff are being added, but the process has been slow.

FY95 funding to INEL required a transfer of funding from SNL. This subcontracting situation has caused a 1-month delay in INEL funding receipt.

Plans For Next Quarter

Enterprise Modeling & Simulation

- Product line investigations and modeling will continue with the bed sheet and men's jacket lines. The ladies fashion item investigation will begin.

- Work will continue on the high-level modeling with emphasis placed on identifying the modules for each business theme that are independent of the methods used to implement them, understanding the strategies and tactics relevant to each module and identifying relationships and structures among the strategies, tactics and

decisions.

Connectivity & Infrastructure

- The Internet E-mail reliability technology demonstration will be conducted with Glen Raven Mills.
- LLNL publication release will be sought for public DAMA WWW pages to be served from ACIS' WWW server.

Cooperative Business Management

- Design specifications for Forecasting and Inventory Prototype #1 will be completed.
- Requirements specifications for Infrastructure Prototype #2 will be completed.
- The annual opportunity assessment/review will occur in early May.
- The forecasting and inventory management design review meeting will occur.
- The CBM World Wide Web page will be completed and published on the Internet.
- The National Sourcing Database will be demonstrated with six databases on line.

Education & Outreach

- A Task Leader will be appointed.
- Telephone interviews with task leaders in support of a 5-9 minute DAMA video will begin in April.
- Completion of the DAMA press kit for use by project partners will occur.

Architecture & Integration

- The FY96/97 Task and Project plan drafts will be completed and submitted to the AMTEX Program office.
- The DAMA Management Plan will be updated and distributed.

Invention Disclosures

No invention disclosures were processed during this period.

Publications / Presentations

Publications

DAMA was featured in the March 1995 edition of "UPC Talk", published by Quick Response Services, Inc. This special conference edition provided a two-page foldout of the Process Steps for Men's Cotton Slacks graphic developed by the Enterprise Modeling & Simulation task, and a summary overview of all DAMA tasks.

Jim Lovejoy, $[TC]^2$, and Leon Chapman, SNL, presented a paper entitled *"Demand Activated Manufacturing Architecture: A Progress Report"* at the QR '95 conference in Atlanta, GA on March 15, 1995 to about 150 retail goods and apparel manufacturers.

Presentations

Jim Lovejoy, $[TC]^2$, presented an overview of the DAMA project at the Material Handling Industry ProMat 95; Chicago, IL Feb. 13-15, 1995.

DAMA demonstrations were provided at the AMTEX Progress Report meeting held in Washington, DC on March 1-2, and at the QR '95 conference March 13-15 in Atlanta, GA. DAMA provided four interactive demonstrations and a presentation of the Cotton Slacks Process Step Model.

Electronic Embedded Fingerprints (EEF)

The Electronic Embedded Fingerprint project is developing miniature electronic devices as permanent identification and information markers for textiles and apparel.

Project Managers: Mike Riley, LLNL/510-422-3045
Jim Caldwell, $[TC]^2$/919-380-2156

Performance Related to Milestones

The major milestone remaining for this fiscal year is developing the capability to read and sort among 50 tagged items contained in a box. This procedure will require sophisticated capabilities in order to sort out the various transmissions and avoid clashing–all within the allotted 1-second read time. To that end, the team has built a prototype component version of EEF. Three of these units have been mounted on a board and are wired to a computer to allow us to evaluate our anti-signal clash ideas. At this point, the team has successfully communicated with these three tags on a nearly simultaneous basis. All three of them were identified in spite of having serial numbers that purposely were designed to partially clash (they had one common digit) in order to challenge the system. Once the scheme has been validated, a new version capable of RF communications will be constructed.

Activities and Technical Accomplishments for the Quarter

Meetings

On February 1, Jim Caldwell, $[TC]^2$ Ron Gilbert, PNL, Mike Doty, LLNL, and Mike Riley, LLNL toured the Levi Strauss facility in Wichita Falls, TX, hosted by Amy Walker and Roger Vasser. This plant, which is Levi's advanced development site, has been volunteered by the Levi people as an alpha test site for EEF tags.

On March 2, EEF participated in the Operating Committee meeting/demonstration in Washington, DC for Secretary of Energy Hazel O'Leary, members of Congress, and the press. An updated version of the Bobbin display was demonstrated, including a carousel with tagged garments which revolved past a reader equipped to transmit the garment-specific data to a computer display. Significant interest was expressed by meeting attendees; both Levi Strauss and J.C. Penny requested the entire display be shown at their plant managers' annual meeting in Dallas in mid-April. DOE representatives suggested that EEF tags be evaluated in the field for waste container tracking and inventory applications. $[TC]^2$ is very interested in having a similar display, as well as mock-up EEF tags available at $[TC]^2$ for demonstration to their industry partners.

Internal Technical Review

In February, an internal technical review was conducted at LLNL in order to assess the state of the project. The division leader and his deputy, two group leaders, and other interested parties attended the presentation, which was well-received.

Technical Accomplishments During the Past Quarter

Code to read and write to the EEPROM on the processor is complete, and the code necessary to recognize the decrement commands to the tag is functional, but not yet completed.

In the RF arena, the team worked on three areas: 1) measuring field strengths for a prototype tag powering system using a powering antenna array; 2) testing a prototype tag powering circuitry for tag receiver modules; and, 3) identifying a likely two-way communication architecture.

Communications were established with the FCC to determine allocated frequencies and acceptable power levels for the EEF system.

Looking ahead to the manufacture of the EEF, the team also continued to search world-wide for industrial capabilities that will be vital to our goal of producing a small, inexpensive, monolithic (single chip) EEF. An attempt is in progress to obtain information on the circuitry used in low power system designs in order to make reasonable

comparisons and evaluate the power transmission and conversion requirements of the LLNL prototype EEF.

The issues of nonvolatile memory and vendors for the final chip design are being investigated. Several alternatives are being explored.

Issues, Major Problems, and Resolutions

Minimizing the required power consumption is an important issue, which is being addressed in the task work.

Explanation of Variances

The RF Expo has been scheduled for late June at $[TC]^2$.

Plans for Next Quarter

Goals for the April-June time frame include:

- Finish the command detector code
- Develop a command set for the PC to reader communications
- Wire a 10-tag unit prototype board to test for identification function
- Improve the recovery from conflict code
- Continue tag powering link measurements
- Continue tag powering circuit development and measurements
- Obtain, test, and develop prototype two-way communication system
- Begin work on the anti-counterfeiting method and code
- Begin construction of the conveyor system and user interface for the Bobbin Show demonstration.

Invention Disclosures

None during this reporting period

Publications/Presentations

AMTEX Operating Committee meeting booth presentation in Washington, DC on March 2.

Rapid Cutting

The Rapid Cutting project is developing a new generation of cutting systems and technological advancements in current systems that will improve cutting quality and efficiency. Such systems will enable true demand activated manufacturing of apparel. The Rapid Cutting project consists of six national laboratories, each with laser and optical technologies appropriate for the mechanical cutting of textiles using new materials and photonics.

All teams were actively involved with their tasks during this quarter.

Project Managers: Craig Fong, LBL/510-486-5298
Jim Caldwell, [TC]²/919-380-2156

Performance Related to Milestones

Phase One of this project ran from approximately August 1, 1994 to January 31, 1995; seven months. Phase Two is planned from February 1, 1995 to September 30, 1995; eight months. This phasing will align the project with the DOE fiscal year. A major project review, earmarking the end of Phase One, was held at LANL on February 4, 1995. Because of different CRADA start dates, technical progress and spending levels are different for each laboratory. A recovery plan which should bring all tasks and all laboratories back into synchronization will be fully implemented by August 1, 1995.

Activities and Technical Accomplishments for the Quarter

Phase One consists of proof-of-principle experiments to meet the longer term objectives of 200 inches/second single ply, single garment cutting at a manufacturer's cost of $70K and a market price of $150K. Recent CO_2 laser-based systems at this performance level are priced in excess of $800K and provide acceptable edge quality mostly for high polyester content textiles. At the LANL milestone review, with preliminary results presented, an overall project plan was approved. Task descriptions and a brief assessment of status follows:

Task 1 - Improved Blades

Provide new post manufacturing and new materials for cutting edges and blade bodies. Progress: over 28 blade configurations of both from new materials and coatings were processed by ANL, LBL, and ORNL. The laboratories are considering three test plans to evaluate these blades by conducting accelerated wear and mechanical properties tests. From this evaluation, a culled lot will be produced in statistically significant numbers for final evaluation by our industry partners. Also, a new material based on amorphous (glass like) metals, has never before been considered for blades. Introduced by LANL, this task is now

underway. Status: at the milestone review, the need to produce blades in quantities of statistical significance was tabled. A more rigorous test plan will be implemented by the laboratory teams before industry tests them in a full production environment. The first set of blades is expected to be delivered to industry by July, 1995 (about three months behind schedule).

Tasks 2 - Advanced Cutting Heads

Provide improvements to existing automated commercial cutters. Progress: bench scale electromagnetic drivers and power supplies have been tested. From that, alpha typical drivers appropriate for multiple ply cutting. Status: On track.

Task 3.0 - Laser Cutting

This task consists of the three following subtasks:

Task 3.1 - CO_2, YAG:Nd Lasers

Provide improvements to commercial laser sources and optical transport systems. Progress: trial cuts on textiles have been conducted using YAG:Nd research lasers. Results were reported at the progress review. For Phase Two, ANL will determine the feasibility of high average power fiber optic transport for CO_2 wavelengths. Status: On track.

Task 3.2 - UV Cutting

Develop next generation systems and test new laser sources in the UV range for textile cutting. Progress: trial cuts on textiles have been performed. A basic model based on photonic ablation has been developed. These results were presented at the LANL progress review. A preliminary study to examine commercialization of these source lasers is underway. Status: On track.

Task 3.3 - Solid State Laser Cutting

Test several next generation laser sources from solid state devices for textile cutting. Develop a model based on specific wavelengths. Progress using copper vapor lasers as a surrogate (to model a diode pumped solid state laser wavelength) have commenced. A fundamental model has been developed. Status: Three months behind both budget and schedule benchmarks. A recovery plan based on an accelerated effort rate has been implemented. Between Phases One and Two, LLNL will be on track by August 8, 1995 (proposed laser cutting design review).

Task 4 - Material Handling

Level of effort management for these tasks. Progress: all work is underway. Status: On track.

In addition to the accomplishments previously discussed, the following notable events have taken place:

The Rapid Cutting project team participated in the AMTEX Operating Committee meeting at Washington, DC March 2, 1995 by presenting a poster session on RCUT. Several videos showing both industry manufacturing environments and laboratories laser cutting were shown. Blades and cut textile samples were also on hand. Industry was represented by Roger Vasser and Amy Walker from Levi Strauss and Jim Caldwell from $[TC]^2$. The laboratory team consisted of Mike Green, Tamara Johnson, Bob Sze, Virgil Sanders, and Craig Fong. Secretary O'Leary paid a visit and heard a presentation by this team.

Tours of Industry Partners–site visits are continually occurring. For this quarter, plant visits were made to Levi Strauss, Wichita Falls, Haggar, and Williamson-Dickie in Weslaco and Harlingen, TX. The RCUT team was joined by other laboratory team participants from the AMTEX SFAM and DAMA projects.

Issues, Major Problems, and Resolutions

Differences in individual CRADA start dates for each laboratory team continue to be a problem. This problem causes each laboratory to be at different progress points at major reviews. Although a recovery plan is underway to bring all teams up to equal progress points, the industry research, education, and technology transfer (RETT) institution has expressed concern when comparing work between the laboratories.

Explanation of Variances

Discussed above.

Plans for Next Quarter

Task 1 - Approve the test plan for blades. Process and manufacture a statistically significant group of blades for industry test. Make final arrangements for industry beta test site.

Task 2 - Continue the fabrication of alpha typical magnetic and alternate drivers and power supplies. Commence evaluation testing.

Task 3.1 - Examine new generation optical transport devices for present commercial lasers.

Task 3.2 - Continue with the test cutting for two key laser wavelengths.

Task 3.3 - Continue with the test cutting for other laser wavelengths based on solid state level wavelengths.

Task 4 - Commence the preliminary design and bench scale fabrication of key material handling components.

Task 5 - Continue the level of effort and process all Joint Work Statements for the laboratory team for the period January 16, 1995 to September 31, 1995.

A major progress review has been scheduled for June, 1995. A laser cutting design review is scheduled for August, 1995.

Invention Disclosures

In January, SNL formally applied for a disclosure on material handling. LBL has submitted an invention disclosure for magnetic drivers.

Publications/Presentations

Interviews on the RCUT project were conducted with Apparel Industry Magazine through Craig Fong and Newsweek Magazine through the LANL public affairs office. Publication dates have not been determined. No publications were made during this reporting period.

Sensors for Agile Manufacturing (SFAM)

The Sensors for Agile Manufacturing project team is developing sensors that will allow the automation of sewing processes to improve product quality and process productivity in the apparel manufacturing sector of the U.S. textile industry.

Project Managers: Kevin Widener, PNL/509-375-2487
Jim Caldwell, [TC]^2/919-380-2156

Performance Related to Milestones

The final report for the optical felled seaming task was completed.

Activities and Technical Accomplishments for the Quarter

A joint laboratory/industry project team meeting was held at SNL on January 25. The individual principal investigators presented their research findings. Tim Peters, PNL, presented the results of investigations using various optical sensors for felled seam sensing. Although not appropriate for felled seam sensing, industrial members

identified other potential uses for this technology that may be investigated.

Basil Picologlou, ANL, presented the status of sensor research at ANL. It was felt by all industrial members in attendance that these technologies were not feasible to pursue at this time.

Work was completed on a tabletop demonstration and data acquisition unit that incorporates the SNL developed edge detection sensor and a moving loop of fabric. The fabric loop moves over a bed that holds the sensor, and real-time edge position data from the fabric loop is displayed on a computer screen. This unit effectively demonstrates the ability of the sensor to track fabric edges accurately, and data taken using this unit shows the sensor can be used with different fabric types at different speeds. This system was functional for the March Operating Committee meeting in Washington, DC. It will also be used to demonstrate and test the sensor for industrial partners and will be useful at conferences and technical shows.

Work was also completed on a demonstration of the SNL-developed felled-seam folder sensor. This mechanically flexible sensor is designed to be integrated into a felled seam folder and return the exact position of the fabric edge inside the folder. This data is used to control fabric position within the folder, maintaining seam quality. This demonstration was shown at the joint laboratory/industry meeting in Albuquerque, NM in January, and proved the ability of the sensor to accurately track the position of a fabric edge within a felled seam folder. An invention disclosure regarding this technology was submitted to the SNL patent office in January, and a patent application is currently being processed by SNL.

In March, the three members of the SFAM team visited three sewing plants in Texas, including the highly automated Levi Strauss Plant in Wichita Falls, TX. This trip was extremely valuable to our team for the exposure to real plant processes and the chance to talk to operators and mechanics about real machinery and automation. Close-up examination of sewing machinery allowed the team to formulate a plan for installing the prototype sensors on sewing machines for factory demonstrations later this year. The team has been discussing conceptual designs for these prototype units and is ready to begin work on this next phase of the project.

Issues, Major Problems, and Resolutions

None.

Explanation of Variances

None.

Plans for Next Quarter

SFAM staff have made arrangements with $[TC]^2$ and Levi Strauss to obtain two machines for prototype sensor installation. $[TC]^2$ will ship a felled seaming machine with fabric feeders that is ready for integration with the felled seam sensor. Levi Strauss will ship, if available, a side seaming machine for prototype installation of the edge detection sensor. During the next quarter, work at SNL will concentrate on installing sensors on these two machines in preparation for in-factory tests later this year.

Invention Disclosure

An invention disclosure for the SNL-developed felled-seam folder sensor was submitted to the SNL patent office in January, and a patent application is currently being processed by SNL.

Publications/Presentations

The final report for the optical felled seam sensor was completed this quarter.

A demonstration of the Sandia-developed felled-seam folder sensor was shown at the joint laboratory/industry meeting in Albuquerque, NM in January, and proved the ability of the sensor to accurately track the position of a fabric edge within various apparel manufacturing processes, including the felled seaming operation. The project team set up a demonstration booth at the Operating Committee meeting on March 2 in Washington, DC demonstrating the fabric edge detector.

Textile Resource Conservation (TReC)

The objective of the TReC project is to define, develop, integrate, and deliver processes, devices, and techniques to be used by all elements of the U.S. textile and soft goods product chain to enhance environmental quality and minimize the production of wastes.

Project Managers: Paul Farber, ANL/708-252-6522
Don Alexander, ITT/803-595-0035

Performance Related to Milestones

Performance related to milestones has been satisfactory during the present quarter. A membrane de-fouling test unit has been completed and initial tests are being performed. Optimization experiments on salt recovery are at the point to plan for an in-plant field test, and preliminary procedures for metals speciation have almost been completed. A review by the Industry Research Partners has been accomplished on a low waste chemical application technique and a

follow-up review is planned for May of 1995. The Call for Proposals for a Slashing Initiative was sent on schedule and proposals were received from several national laboratories. Results from the industry review of the proposals are expected in at the beginning of the next quarter.

Quarterly Activities and Technical Accomplishments

The Textile Resource Conservation (TReC) Project completed the remainder of industry task team meetings during the month of January. These meetings were industry/laboratory task team meetings for: (1) Recovery of Colorants; (2) Solid Wastes Fibrous Recovery; (3) Metals Speciation; and (4) Air Emissions Monitoring. Meetings were designed to get feedback from the industry partners, based on reports on work-to-date by the laboratory investigators. Results reported by the investigators include attainment of an 18% brine solution product from the dyebath salt recovery tasks and 90-95% removal of dye from dye bath wastes. Positive results have been achieved in the separation and recovery of cotton and polyester from cotton/poly blends and samples of the recovered polyester have been evaluated by industry partners. Some further investigation is proceeding in this area to determine the reasons for a difference in intrinsic viscosity between virgin polyester and the recovered product. Procedures are in preliminary stage for the speciation of metals in dye bath wastes and further samples are being obtained from the industrial partners. The INEL VOC sensor has been demonstrated in a plant test at one of the partners' facilities and the results favorably compared to those obtained by a FTIR at the same site.

Work is progressing with the multiple unit chemical application system at ORNL, as well as the development of improved (low water) washing techniques at the LLNL. Finally, tests on advanced cleaning techniques on spinnerette heads are proceeding at ANL and on industry supplied metal coupons at INEL. Cleaned parts and coupons will be sent to the industry partners for evaluation.

Activity in this quarter also included the Operating Committee meeting in Washington, DC. The TReC Project had a display that high-lighted the activities and accomplishments of the project to all of the AMTEX Partners, to the members of Congress, staff, and administration who attended the meeting.

Issues, Major Problems, and Resolutions

Issues that have arisen this quarter primarily center around the delays experienced by many of the laboratories in the updating and renewing of their CRADAs. It is hoped that the One-Project-One-CRADA concept being worked on by the DOE will alleviate many of these delays which have resulted in disruption of research activities.

Explanation of Variances

Variances in milestones and deliverables from the project plan are minor and have been due to some slight modification in direction of some laboratory efforts. These changes were based on recommendations and continued contact between the textile industry teams and the principal investigators to better align national laboratory research efforts with textile industry needs.

Plans for Next Quarter

During the next quarter (April-June, 1995), laboratory researchers will continue to refine concepts in the directions suggested by the partners based on the industry/laboratory task team meetings in this and the previous quarter. The individual national laboratories will hopefully have their CRADAs renewed and the FY95 funding released to them. An all-TReC Project meeting will be held in June or July, at which time the investigators will report on their accomplishments to date, especially the plans for in-plant testing. Also during this next quarter, the preliminary program plan will be developed, based on a budget given to the project managers by the AMTEX Program Office. The selection of the multi-laboratory team to proceed with the Slashing Initiative also will be made.

Invention Disclosures

No invention disclosures have been reported to the TReC Project Office during this quarter.

Publications/Presentations

The project team set up a booth at the Operating Committee meeting on March 2, 1995 in Washington, DC demonstrating project progress.

FINANCIAL SUMMARY

Appendix A contains program financial summary information.

APPENDIX A

AMTEX FINANCIAL SUMMARY

PROGRAM SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	AMTEX PROGRAM	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	5. START DATE: OCTOBER 1994 6. COMPLETION DATE: SEPTEMBER 1995

7. PROJECT YEAR: FY 1995

8. COST STATUS

a. $ EXPRESSED IN: THOUSANDS

b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000; GB-01-06-010

c. FIN. NO.:

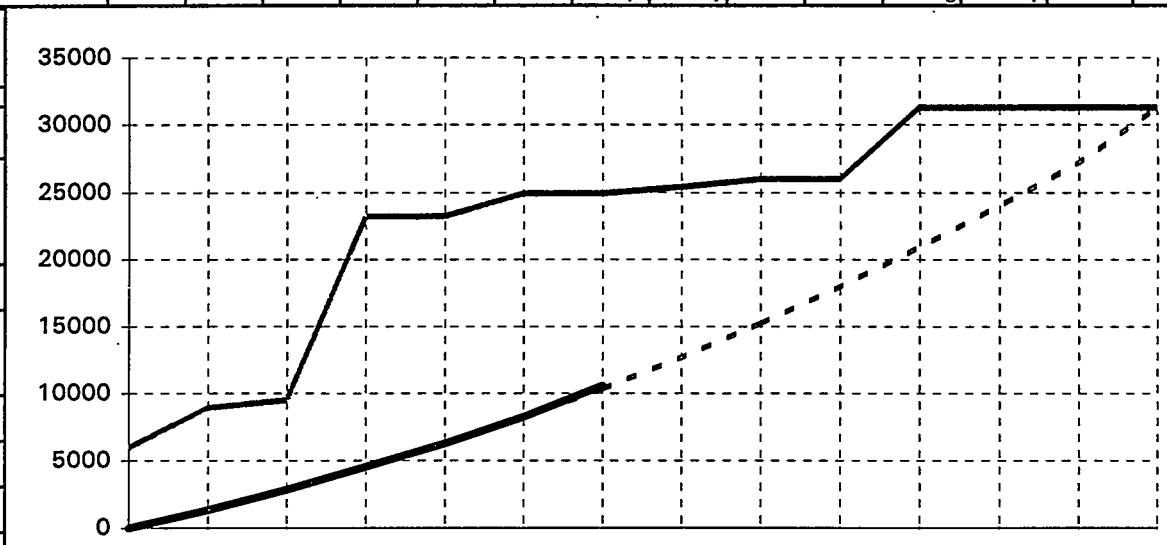
d. ACTUAL COSTS PRIOR YEARS: $13,863

e. ER BUDGET *: $19,058

f. DP BUDGET *: $12,238

g. ER FUNDS AUTH: $18,112

h. DP FUNDS AUTH: $6,844



LEGEND: PLANNED = = ACTUAL ——— PROJECTED - - - - - - - FUNDS AUTH ——— 90% SPENT ▷

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
	PLANNED	711	860	1006	1125	1234	1232	1470	1543	1693	1783	1918	1966	2517
	ACTUAL	724	867	987	1106	1162	1059							
i. ER	VARIANCE	-13	-7	19	19	72	173	1470	1543	1693	1783	1918	1966	2517
COSTS	CUM PLANNED	711	1571	2577	3702	4936	6168	7638	9181	10874	12657	14575	16541	19058
	CUM ACTUAL	724	1591	2578	3684	4846	5905							
	CUM VARIANCE	-13	-20	-1	18	90	263	7638	9181	10874	12657	14575	16541	19058
	PLANNED	585	620	680	700	730	860	890	1010	1040	1170	1185	1220	1548
	ACTUAL	604	645	703	631	830	1268							
j. DP	VARIANCE	-19	-25	-23	69	-100	-406	890	1010	1040	1170	1185	1220	1548
COSTS	CUM PLANNED	585	1205	1885	2585	3315	4175	5065	6075	7115	8285	9470	10690	12238
	CUM ACTUAL	604	1249	1952	2583	3413	4679							
	CUM VARIANCE	-19	-44	-67	2	-98	-504	5065	6075	7115	8285	9470	10690	12238
	PLANNED	1296	1480	1686	1825	1964	2092	2360	2553	2733	2953	3103	3186	4065
	ACTUAL	1328.3	1511.7	1690	1737	1992	2325							
k. TOTAL	VARIANCE	-32	-32	-4	88	-28	-233	2360	2553	2733	2953	3103	3186	4065
COSTS	CUM PLANNED	1296	2776	4462	6287	8251	10343	12703	15256	17989	20942	24045	27231	31296
	CUM ACTUAL	1328	2840	4530	6267	8259	10584							
	CUM VARIANCE	-32	-64	-68	20	-8	-241	12703	15256	17989	20942	24045	27231	31296

9. MILESTONES	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
(REFER TO INDIVIDUAL PROJECT REPORTS)													

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $4,008K, DP - $2,238K, TOTAL - $6,246K).

10. NAME OF PARTICIPANT'S PROGRAM MANAGER

DOUGLAS K LEMON

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	AMTEX PROGRAM OFFICE	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE
AMTEX PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	OCTOBER 1994 6. COMPLETION DATE SEPTEMBER 1995

7. PROJECT YEAR: FY 1995

8. COST STATUS

a. $ EXPRESSED IN: THOUSANDS

b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000

c. FIN. NO.:

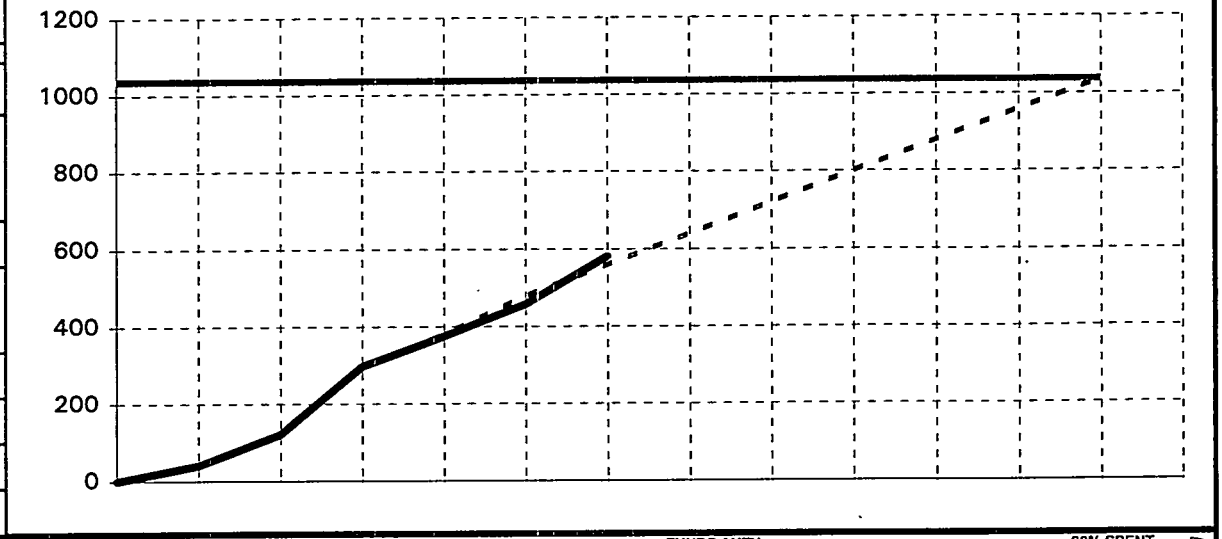
d. ACTUAL COSTS PRIOR YEARS: $1,659

e. ER BUDGET *: $1,036

f. DP BUDGET *: $0

g. ER FUNDS AUTH: $1,036

h. DP FUNDS AUTH: $0



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
i. ER COSTS	PLANNED	40	80	180	80	100	80	80	80	80	80	80	76
	ACTUAL	41	80	177	78	83	124						
	VARIANCE	-1	0	3	2	17	-44	80	80	80	80	80	76
	CUM PLANNED	40	120	300	380	480	560	640	720	800	880	960	1036
	CUM ACTUAL	41	121	298	375	458	582						
	CUM VARIANCE	-1	-1	2	5	22	-22	640	720	800	880	960	1036
j. DP COSTS	PLANNED	0	0	0	0	0	0	0	0	0	0	0	0
	ACTUAL	0	0	0	0	0	0	0	0	0	0	0	0
	VARIANCE	0	0	0	0	0	0	0	0	0	0	0	0
	CUM PLANNED	0	0	0	0	0	0	0	0	0	0	0	0
	CUM ACTUAL	0	0	0	0	0	0	0	0	0	0	0	0
	CUM VARIANCE	0	0	0	0	0	0	0	0	0	0	0	0
k. TOTAL COSTS	PLANNED	40	80	180	80	100	80	80	80	80	80	80	76
	ACTUAL	41	80	177	78	83	124						
	VARIANCE	-1	0	3	2	17	-44	80	80	80	80	80	76
	CUM PLANNED	40	120	300	380	480	560	640	720	800	880	960	1036
	CUM ACTUAL	41	121	298	375	458	582						
	CUM VARIANCE	-1	-1	2	5	22	-22	640	720	800	880	960	1036

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
AMTEX Quarterly Report				▲			△	△			△	
AMTEX Policies & Procedures Manual										△		
AMTEX FY 1996 Operating Plan											△	

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $36K, DP $0K, TOTAL - $36K).

LEGEND: SCHEDULED △ COMPLETED ▲ DEVIATION □ TIMELINE PROGRESS PROPOSED DEVIATION APPROVED DEVIATION

10. NAME OF PARTICIPANT'S PROJECT MANAGER

DOUGLAS K LEMON

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	DEMAND-ACTIVATED MANUFACTURING ARCHITECTURE (DAMA)	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	OCTOBER 1994 SEPTEMBER 1995

7. PROJECT YEAR: FY 1995

8. COST STATUS

a. $ EXPRESSED IN: THOUSANDS

b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000; GB-01-06-010

c. FIN. NO.:

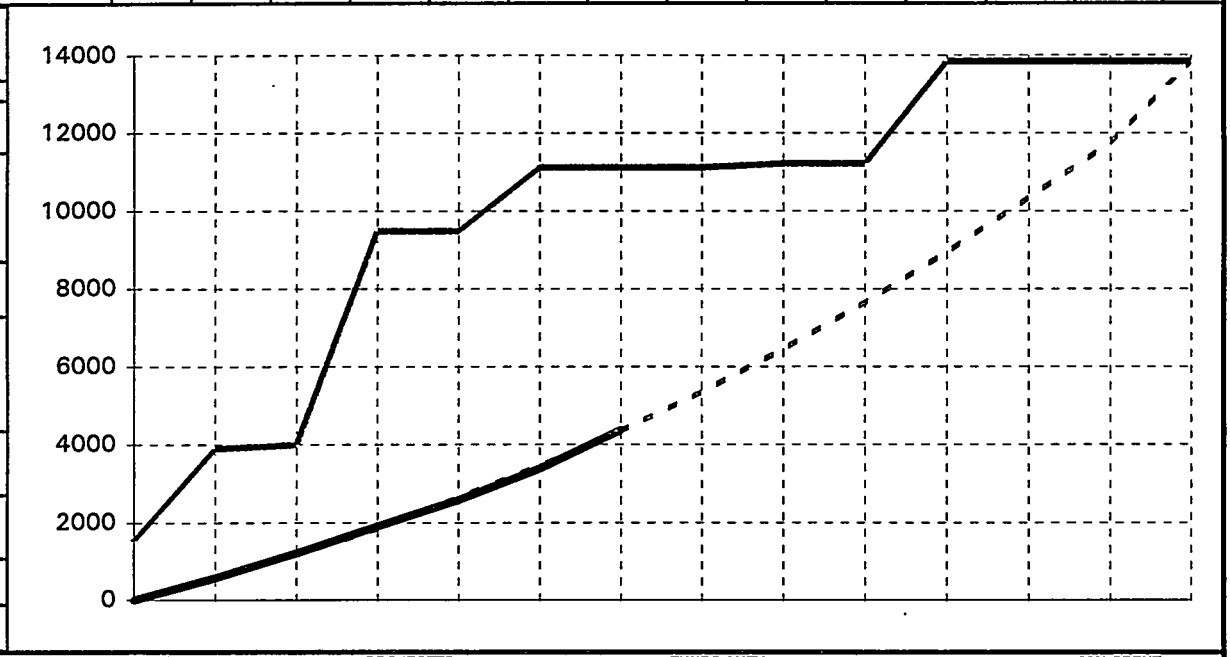
d. ACTUAL COSTS PRIOR YEARS: $7,527

e. ER BUDGET *: $7,834

f. DP BUDGET *: $6,009

g. ER FUNDS AUTH: $7,734

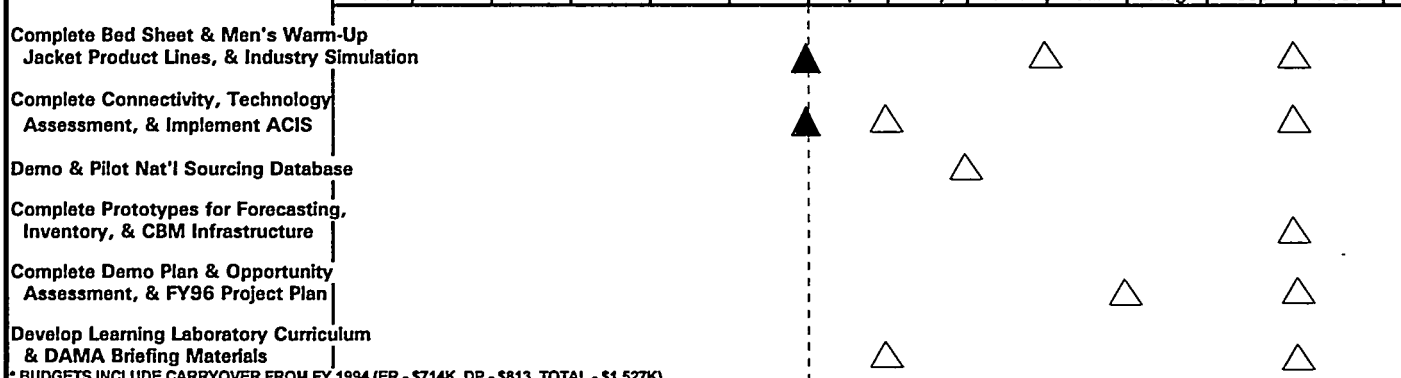
h. DP FUNDS AUTH: $3,384



LEGEND: PLANNED — ACTUAL — PROJECTED - - - - - - - FUNDS AUTH ▬▬ 90% SPENT ▷

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
i. ER COSTS	PLANNED	270	310	410	500	500	500	600	600	700	700	800	800	1144
	ACTUAL	268	311	403	357	393	351							
	VARIANCE	2	-1	7	143	107	149	600	600	700	700	800	800	1144
	CUM PLANNED	270	580	990	1490	1990	2490	3090	3690	4390	5090	5890	6690	7834
	CUM ACTUAL	268	579	982	1339	1732	2083							
	CUM VARIANCE	2	1	8	151	258	407	3090	3690	4390	5090	5890	6690	7834
j. DP COSTS	PLANNED	280	310	270	300	300	400	400	500	500	600	600	600	949
	ACTUAL	297	334	292	316	415	631							
	VARIANCE	-17	-24	-22	-16	-115	-231	400	500	500	600	600	600	949
	CUM PLANNED	280	590	860	1160	1460	1860	2260	2760	3260	3860	4460	5060	6009
	CUM ACTUAL	297	631	923	1239	1654	2285							
	CUM VARIANCE	-17	-41	-63	-79	-194	-425	2260	2760	3260	3860	4460	5060	6009
k. TOTAL COSTS	PLANNED	550	620	680	800	800	900	1000	1100	1200	1300	1400	1400	2093
	ACTUAL	565	645	695	673	808	982							
	VARIANCE	-15	-25	-15	127	-8	-82	1000	1100	1200	1300	1400	1400	2093
	CUM PLANNED	550	1170	1850	2650	3450	4350	5350	6450	7650	8950	10350	11750	13843
	CUM ACTUAL	565	1210	1905	2578	3386	4368							
	CUM VARIANCE	-15	-40	-55	72	64	-18	5350	6450	7650	8950	10350	11750	13843

9. MILESTONES



* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $714K, DP - $813, TOTAL - $1,527K).

LEGEND: SCHEDULED △ COMPLETED ▲ DEVIATION □ TIMELINE ——— PROGRESS ▬▬ PROPOSED DEVIATION - - - - - - APPROVED DEVIATION - - - - -

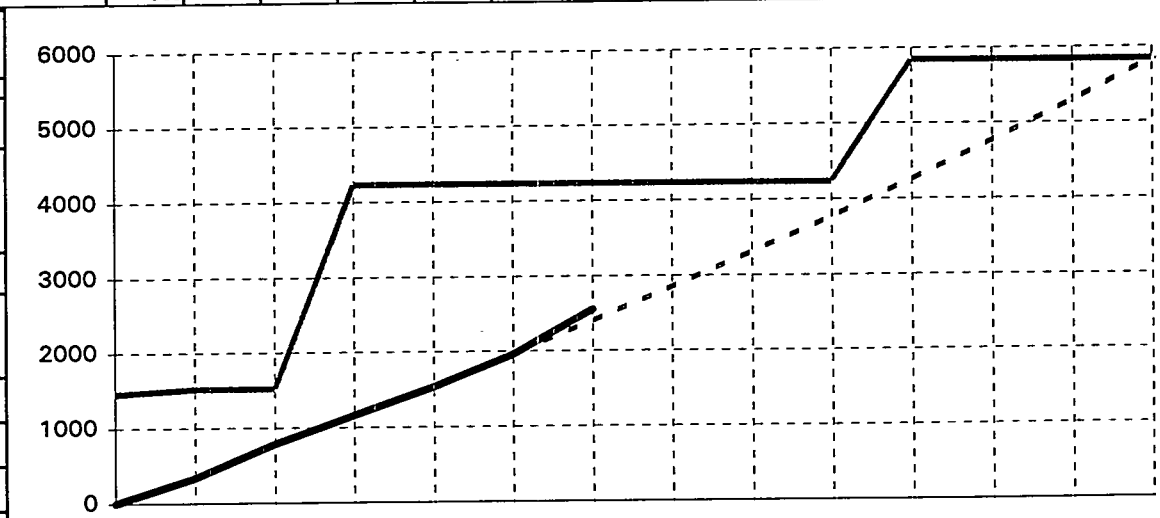
10. NAME OF PARTICIPANT'S PROJECT MANAGER: LEON CHAPMAN (SNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	COMPUTER-AIDED FABRIC EVALUATION (CAFE)	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	5. START DATE: OCTOBER 1994 6. COMPLETION DATE: SEPTEMBER 1995

7. PROJECT YEAR	8. COST STATUS	a. $ EXPRESSED IN	b. BUDGET & REPORTING NO./SUB. ACCT NO.	c. FIN. NO.	d. ACTUAL COSTS PRIOR YEARS	e. ER BUDGET *	f. DP BUDGET *	g. ER FUNDS AUTH	h. DP FUNDS AUTH
FY 1995		THOUSANDS	KU-01-00-000 GB-01-06-010		$1,906	$2,597	$3,246	$2,597	$1,636



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
i. ER COSTS	PLANNED	190	260	110	150	180	180	200	200	200	220	240	240	227
	ACTUAL	185	264	114	203	209	173							
	VARIANCE	5	-4	-4	-53	-29	7	200	200	200	220	240	240	227
	CUM PLANNED	190	450	560	710	890	1070	1270	1470	1670	1890	2130	2370	2597
	CUM ACTUAL	185	450	564	767	976	1149							
	CUM VARIANCE	5	1	-4	-57	-86	-79	1270	1470	1670	1890	2130	2370	2597
j. DP COSTS	PLANNED	150	180	270	240	240	250	250	260	260	270	270	280	326
	ACTUAL	151	184	265	168	214	421							
	VARIANCE	-1	-4	5	72	27	-171	250	260	260	270	270	280	326
	CUM PLANNED	150	330	600	840	1080	1330	1580	1840	2100	2370	2640	2920	3246
	CUM ACTUAL	151	335	600	768	981	1402							
	CUM VARIANCE	-1	-5	0	72	99	-72	1580	1840	2100	2370	2640	2920	3246
k. TOTAL COSTS	PLANNED	340	440	380	390	420	430	450	460	460	490	510	520	553
	ACTUAL	336	448	379	371	423	594							
	VARIANCE	4	-8	1	19	-3	-164	450	460	460	490	510	520	553
	CUM PLANNED	340	780	1160	1550	1970	2400	2850	3310	3770	4260	4770	5290	5843
	CUM ACTUAL	336	785	1164	1535	1957	2551							
	CUM VARIANCE	4	-5	-4	15	13	-151	2850	3310	3770	4260	4770	5290	5843

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
Printed Pattern Inspection System, Proof-of-Concept	▲												
Image Processing Workshop		▲											
Delivery of RBG Color System for Field Testing			▲										
On-Loom Greige Inspection System, Proof-of-Principle			▲										
Alpha Test of On-Loom Greige Inspection System							△						
Color Printed Pattern Goods Operational & Environmental Considerations Document							△						
Algorithm Real-time Implementation Concepts Document									△				
Site Selection of Beta Test Sites (Industry Site Selection)												△	

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $630K, DP - $826K, TOTAL - $1,456K).

LEGEND: SCHEDULED △ TIMELINE PROPOSED DEVIATION
COMPLETED ▲ DEVIATION □ PROGRESS APPROVED DEVIATION

10. NAME OF PARTICIPANT'S PROJECT MANAGER

GLENN ALLGOOD (ORNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	TEXTILE RESOURCE CONSERVATION (TReC)	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	OCTOBER 1994 SEPTEMBER 1995

7. PROJECT YEAR: FY 1995

8. COST STATUS

a. $ EXPRESSED IN: THOUSANDS

b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000; GB-01-06-010

c. FIN. NO.:

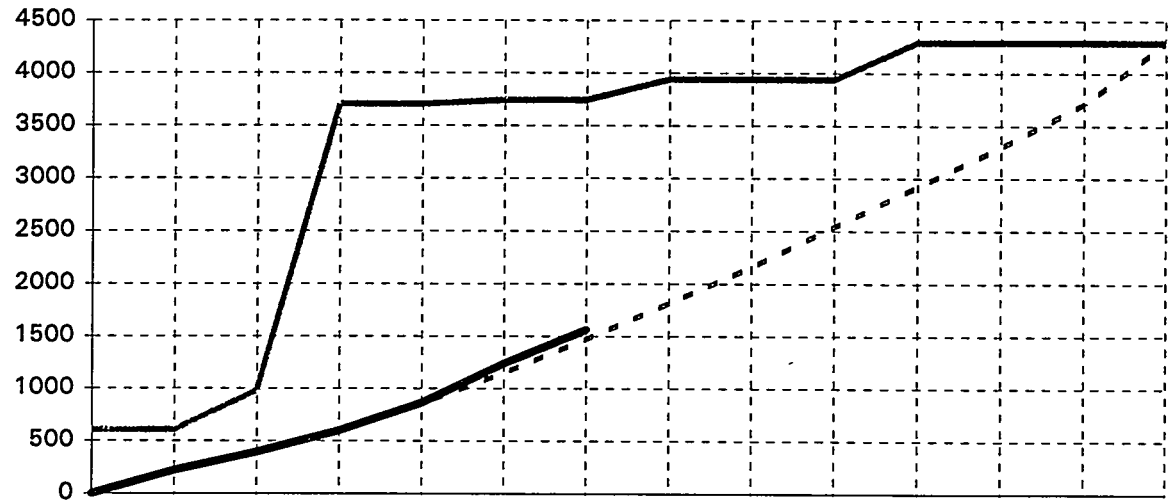
d. ACTUAL COSTS PRIOR YEARS: $1,782

e. ER BUDGET *: $3,352

f. DP BUDGET *: $940

g. ER FUNDS AUTH: $3,157

h. DP FUNDS AUTH: $585



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
I. ER COSTS	PLANNED	120	120	170	200	230	250	270	280	300	300	300	320	492
	ACTUAL	117	115	166	212	295	237							
	VARIANCE	3	5	4	-12	-65	13	270	280	300	300	300	320	492
	CUM PLANNED	120	240	410	610	840	1090	1360	1640	1940	2240	2540	2860	3352
	CUM ACTUAL	117	232	398	611	906	1143							
	CUM VARIANCE	3	8	12	-1	-66	-53	1360	1640	1940	2240	2540	2860	3352
J. DP COSTS	PLANNED	100	60	40	50	60	70	70	70	80	80	80	90	90
	ACTUAL	105	59	38	51	81	84							
	VARIANCE	-5	1	2	-1	-21	-14	70	70	80	80	80	90	90
	CUM PLANNED	100	160	200	250	310	380	450	520	600	680	760	850	940
	CUM ACTUAL	105	164	202	254	335	419							
	CUM VARIANCE	-5	-4	-2	-4	-25	-39	450	520	600	680	760	850	940
k. TOTAL COSTS	PLANNED	220	180	210	250	290	320	340	350	380	380	380	410	582
	ACTUAL	222	175	204	264	376	321							
	VARIANCE	-2	5	6	-14	-86	-1	340	350	380	380	380	410	582
	CUM PLANNED	220	400	610	860	1150	1470	1810	2160	2540	2920	3300	3710	4292
	CUM ACTUAL	222	396	601	864	1241	1562							
	CUM VARIANCE	-2	4	9	-4	-91	-92	1810	2160	2540	2920	3300	3710	4292

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
Joint Task Team Meetings - Industry & Lab	▲												
Draft Report on Industry-Wide Cost Estimates for Raw Material Not in Product								△					
Completion of Low Water Use Scouring Tests									△				
Development of SOP for Advanced Parts Cleaning										△			
Completion of Low Waste Chemical Application Technique Manual												△	
Commence In-Plant Demo Test of Dyebath Salt Recovery System												△	
Commence Advanced Fabric Spot Cleaning In-Plant Test												△	

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $527K, DP - $80K, TOTAL - $607K).

LEGEND: SCHEDULED △ TIMELINE ——— PROPOSED DEVIATION - - - - - -

COMPLETED ▲ DEVIATION · □ PROGRESS ▬▬▬ APPROVED DEVIATION ▬ ▬ ▬ ▬ ▬

10. NAME OF PARTICIPANT'S PROJECT MANAGER

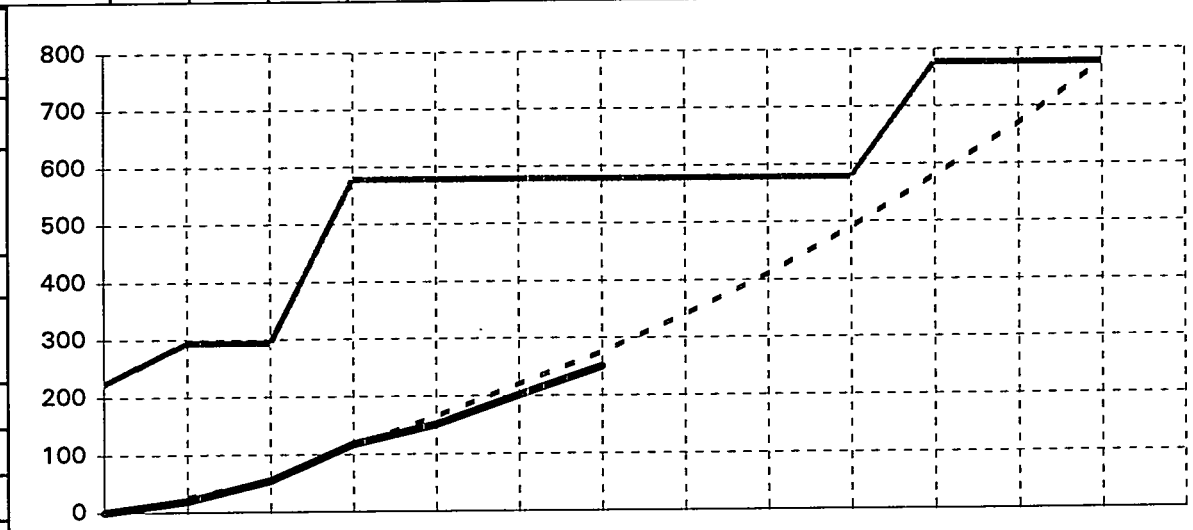
PAUL S FARBER (ANL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	ELECTRONIC EMBEDDED FINGERPRINT (EEF)	2ND QUARTER FY95

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	5. START DATE: OCTOBER 1994 6. COMPLETION DATE: SEPTEMBER 1995

7. PROJECT YEAR	8. COST STATUS	a. $ EXPRESSED IN	b. BUDGET & REPORTING NO./SUB. ACCT NO.	c. FIN. NO.	d. ACTUAL COSTS PRIOR YEARS	e. ER BUDGET *	f. DP BUDGET *	g. ER FUNDS AUTH	h. DP FUNDS AUTH
FY 1995		THOUSANDS	KU-01-00-000 GB-01-06-010		$107	$232	$545	$232	$346



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
i. ER COSTS	PLANNED	15	10	10	10	15	15	15	20	25	30	30	37
	ACTUAL	14	12	9	4	10	12						
	VARIANCE	2	-2	1	6	6	3	15	20	25	30	30	37
	CUM PLANNED	15	25	35	45	60	75	90	110	135	165	195	232
	CUM ACTUAL	14	26	35	39	48	60						
	CUM VARIANCE	2	-1	1	7	12	15	90	110	135	165	195	232
j. DP COSTS	PLANNED	10	20	50	40	40	40	50	50	55	60	60	70
	ACTUAL	6	23	54	30	40	37						
	VARIANCE	4	-3	-4	10	0	3	50	50	55	60	60	70
	CUM PLANNED	10	30	80	120	160	200	250	300	355	415	475	545
	CUM ACTUAL	6	29	83	113	153	190						
	CUM VARIANCE	4	1	-3	7	7	10	250	300	355	415	475	545
k. TOTAL COSTS	PLANNED	25	30	60	50	55	55	65	70	80	90	90	107
	ACTUAL	20	35	63	34	50	49						
	VARIANCE	5	-5	-3	16	5	6	65	70	80	90	90	107
	CUM PLANNED	25	55	115	165	220	275	340	410	490	580	670	777
	CUM ACTUAL	20	55	117	151	201	250						
	CUM VARIANCE	5	0	-2	14	19	25	340	410	490	580	670	777

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Assessment of RF Fingerprinting Technologies	▲											
Industrial Statement of Need/ Tag Criteria	▲											
Technology Assessment	◭											
RFID Expo						△	-----	□				
Multiple Tag Reading											△	
RFID Demo											△	

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $82K, DP - $141K, TOTAL - $223K).

LEGEND: SCHEDULED △ TIMELINE ——— PROPOSED DEVIATION - - - - -
COMPLETED ▲ DEVIATION □ PROGRESS ▬▬ APPROVED DEVIATION ▬ ▬ ▬ ▬ ▬

10. NAME OF PARTICIPANT'S PROJECT MANAGER
MIKE RILEY (LLNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	RAPID CUTTING	2ND QUARTER FY95

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	OCTOBER 1994 6. COMPLETION DATE SEPTEMBER 1995

7. PROJECT YEAR: FY 1995

8. COST STATUS

a. $ EXPRESSED IN: THOUSANDS

b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000; GB-01-06-010

c. FIN. NO.:

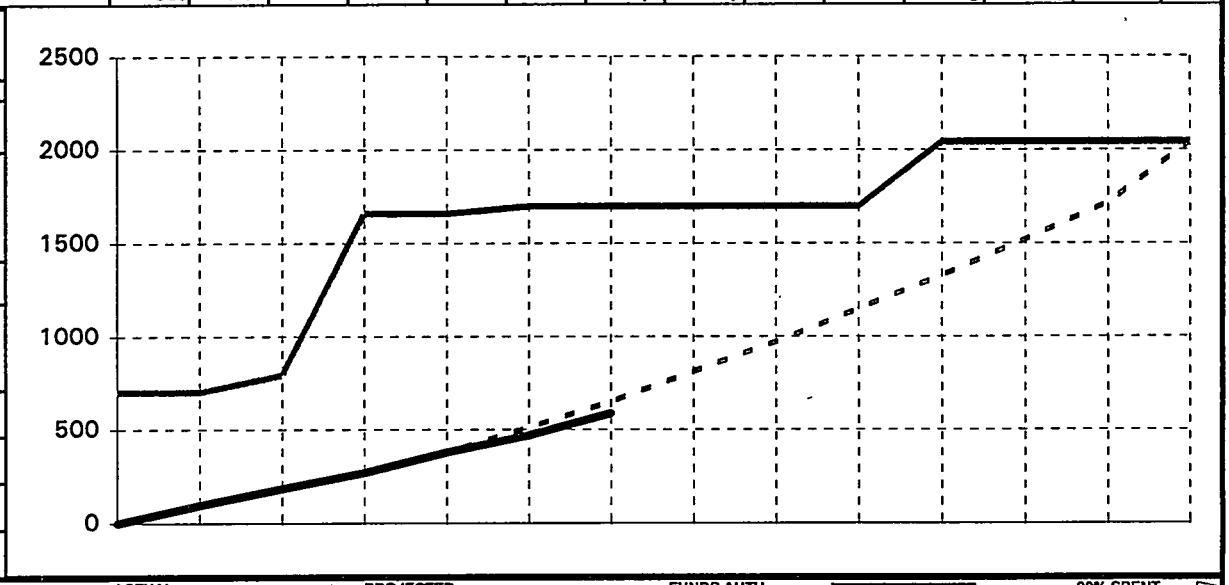
d. ACTUAL COSTS PRIOR YEARS: $209

e. ER BUDGET *: $1,132

f. DP BUDGET *: $909

g. ER FUNDS AUTH: $1,132

h. DP FUNDS AUTH: $569



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
i. ER COSTS	PLANNED	60	60	60	60	70	80	80	80	90	90	90	100	212
	ACTUAL	64	62	54	82	56	55							
	VARIANCE	-4	-2	6	-22	14	25	80	80	90	90	90	100	212
	CUM PLANNED	60	120	180	240	310	390	470	550	640	730	820	920	1132
	CUM ACTUAL	64	126	180	262	318	373							
	CUM VARIANCE	-4	-6	0	-22	-8	17	470	550	640	730	820	0	0
j. DP COSTS	PLANNED	30	30	30	50	60	60	80	80	90	90	100	100	109
	ACTUAL	31	27	30	30	33	65							
	VARIANCE	-1	3	0	20	27	-5	80	80	90	90	100	100	109
	CUM PLANNED	30	60	90	140	200	260	340	420	510	600	700	800	909
	CUM ACTUAL	31	57	87	117	150	215							
	CUM VARIANCE	-1	3	3	23	50	46	340	420	510	600	700	800	909
k. TOTAL COSTS	PLANNED	90	90	90	110	130	140	160	160	180	180	190	200	321
	ACTUAL	95	88	84	111	89	120							
	VARIANCE	-5	2	6	-1	41	20	160	160	180	180	190	200	321
	CUM PLANNED	90	180	270	380	510	650	810	970	1150	1330	1520	1720	2041
	CUM ACTUAL	95	183	268	379	468	588							
	CUM VARIANCE	-5	-3	3	1	42	62	810	970	1150	1330	1520	1720	2041

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
Project Technical Review (Lab & Industry)					▲								
AMTEX Program Technical Review						▲							
Project Technical Review at (TC)2												△	
Optimum Laser Source Identified												△	
Advanced Cutting Head Magnetic Driver Alpha Prototype Tests Complete												△	
Material Handling Alpha Prototype Complete												△	

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $507K, DP - $184K, TOTAL - $701K).

LEGEND: SCHEDULED △ TIMELINE ——— PROPOSED DEVIATION - - - - - -

COMPLETED ▲ DEVIATION □ PROGRESS ——— APPROVED DEVIATION — — — — —

10. NAME OF PARTICIPANT'S PROJECT MANAGER

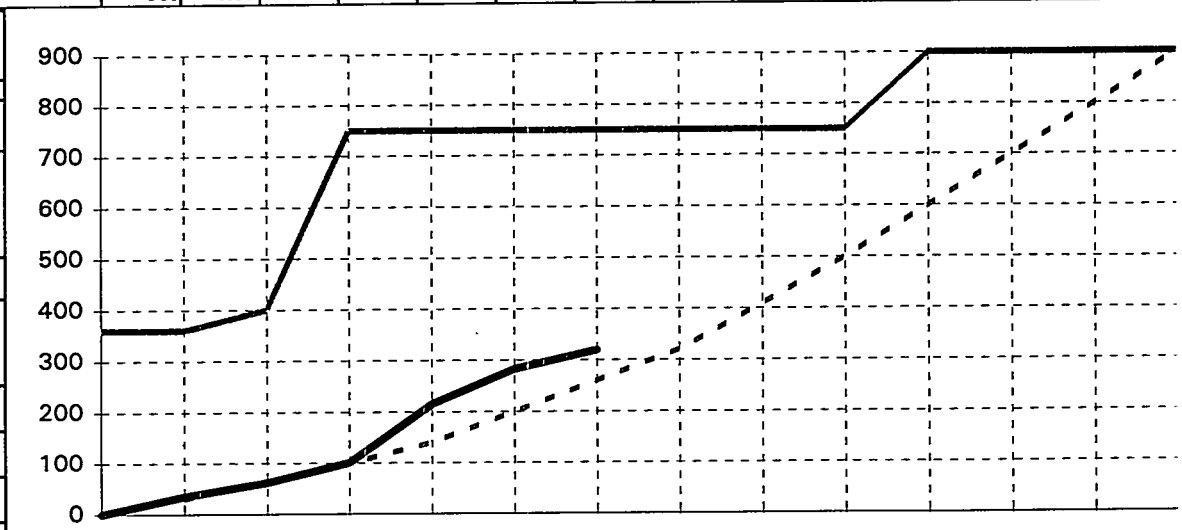
CRAIG FONG (LBL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	SENSORS FOR AGILE MANUFACTURING	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	5. START DATE: OCTOBER 1994 6. COMPLETION DATE: SEPTEMBER 1995

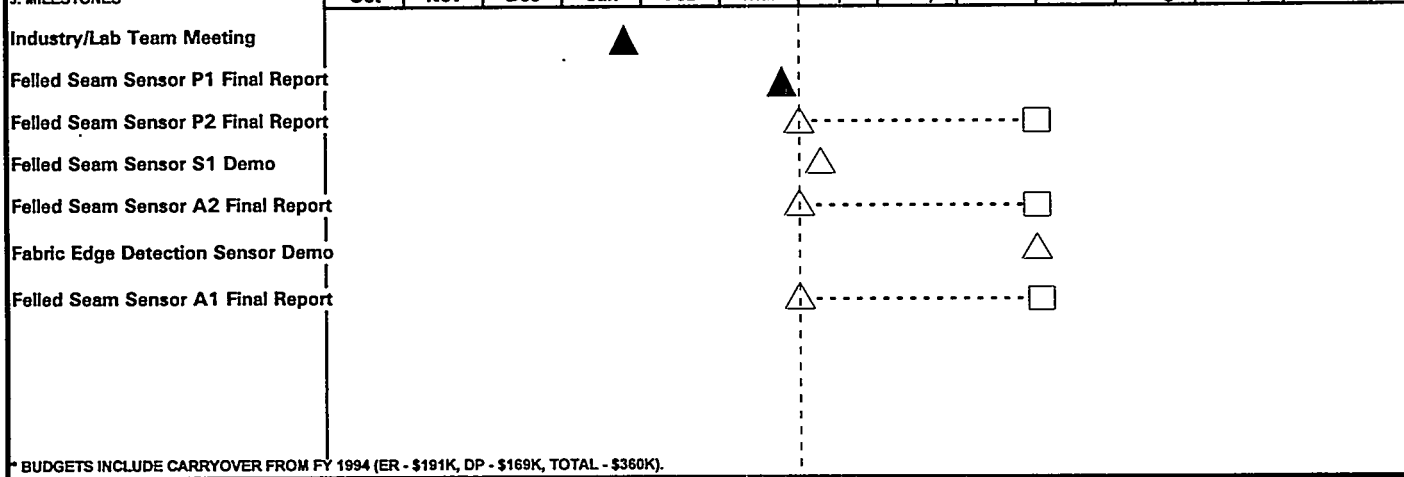
7. PROJECT YEAR	8. COST STATUS	a. $ EXPRESSED IN	b. BUDGET & REPORTING NO./SUB. ACCT NO.	c. FIN. NO.	d. ACTUAL COSTS PRIOR YEARS	e. ER BUDGET *	f. DP BUDGET *	g. ER FUNDS AUTH	h. DP FUNDS AUTH
FY 1995		THOUSANDS	KU-01-00-000 GB-01-06-010		$100	$441	$459	$441	$309



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
i. ER COSTS	PLANNED	15	15	15	20	30	20	20	50	50	50	50	50	56
	ACTUAL	21	9	15	78	20	9							
	VARIANCE	-6	6	0	-58	10	11	20	50	50	50	50	50	56
	CUM PLANNED	15	30	45	65	95	115	135	185	235	285	335	385	441
	CUM ACTUAL	21	30	45	123	143	152							
	CUM VARIANCE	-6	0	0	-58	-48	-37	135	185	235	285	335	385	441
j. DP COSTS	PLANNED	15	20	20	20	30	40	40	40	40	50	50	50	44
	ACTUAL	14	18	24	36	47	28							
	VARIANCE	1	2	-4	-16	-17	12	40	40	40	50	50	50	44
	CUM PLANNED	15	35	55	75	105	145	185	225	265	315	365	415	459
	CUM ACTUAL	14	32	56	92	139	167							
	CUM VARIANCE	1	3	-1	-17	-34	-22	185	225	265	315	365	415	459
k. TOTAL COSTS	PLANNED	30	35	35	40	60	60	60	90	90	100	100	100	100
	ACTUAL	35	27	39	114	67	37							
	VARIANCE	-5	8	-4	-74	-7	23	60	90	90	100	100	100	100
	CUM PLANNED	30	65	100	140	200	260	320	410	500	600	700	800	900
	CUM ACTUAL	35	62	101	215	282	319							
	CUM VARIANCE	-5	3	-1	-75	-82	-59	320	410	500	600	700	800	900

9. MILESTONES



* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $191K, DP - $169K, TOTAL - $360K).

LEGEND: SCHEDULED COMPLETED DEVIATION TIMELINE PROGRESS PROPOSED DEVIATION APPROVED DEVIATION

10. NAME OF PARTICIPANT'S PROJECT MANAGER

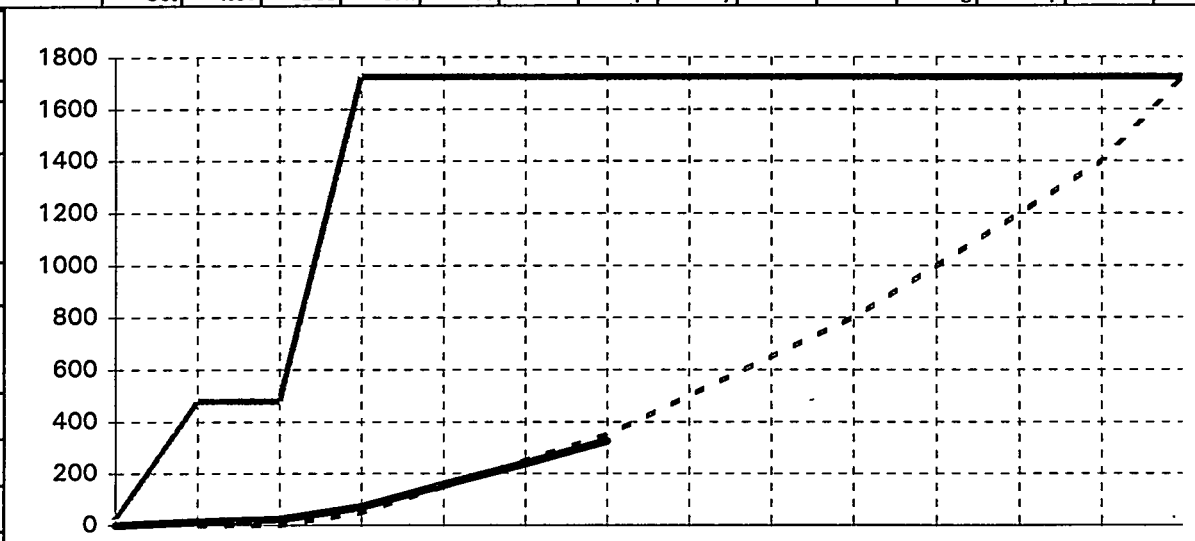
KEVIN WIDENER (PNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	COTTON BIOTECHNOLOGY	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	OCTOBER 1994 6. COMPLETION DATE SEPTEMBER 1995

7. PROJECT YEAR: FY 1995
8. COST STATUS
a. $ EXPRESSED IN: THOUSANDS
b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000
c. FIN. NO.
d. ACTUAL COSTS PRIOR YEARS: $0
e. ER BUDGET*: $1,724
f. DP BUDGET*: $0
g. ER FUNDS AUTH: $1,724
h. DP FUNDS AUTH: $0



LEGEND: PLANNED ACTUAL PROJECTED FUNDS AUTH 90% SPENT

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
i. ER COSTS	PLANNED	0	0	50	100	100	100	150	150	150	200	200	200	324
	ACTUAL	13	9	50	86	82	86							
	VARIANCE	-13	-9	0	15	18	14	150	150	150	200	200	200	324
	CUM PLANNED	0	0	50	150	250	350	500	650	800	1000	1200	1400	1724
	CUM ACTUAL	13	22	72	157	240	326							
	CUM VARIANCE	-13	-22	-22	-7	11	24	500	650	800	1000	1200	1400	1724
j. DP COSTS	PLANNED	0	0	0	0	0	0	0	0	0	0	0	0	0
	ACTUAL	0	0	0	0	0	0							
	VARIANCE	0	0	0	0	0	0	0	0	0	0	0	0	0
	CUM PLANNED	0	0	0	0	0	0	0	0	0	0	0	0	0
	CUM ACTUAL	0	0	0	0	0	0							
	CUM VARIANCE	0	0	0	0	0	0	0	0	0	0	0	0	0
k. TOTAL COSTS	PLANNED	0	0	50	100	100	100	150	150	150	200	200	200	324
	ACTUAL	13	9	50	86	82	86							
	VARIANCE	-13	-9	0	15	18	14	150	150	150	200	200	200	324
	CUM PLANNED	0	0	50	150	250	350	500	650	800	1000	1200	1400	1724
	CUM ACTUAL	13	22	72	157	240	326							
	CUM VARIANCE	-13	-22	-22	-7	11	24	500	650	800	1000	1200	1400	1724

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
Time of Fiber Cell Commitment					▲								
Imaging and Automated Scoring of Gels							△						□
Initial Database Structure								△					
cDNA Libraries Characterized													△
200 Polymorphic Primer Pairs Mapped													△
Enriched Fiber Clones													△
SSR and cDNA Data Entry Mechanisms													△

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $24K, DP - $0K, TOTAL - $24K)

LEGEND: SCHEDULED △ TIMELINE PROPOSED DEVIATION
COMPLETED ▲ DEVIATION □ PROGRESS APPROVED DEVIATION

10. NAME OF PARTICIPANT'S PROJECT MANAGER
BEN BURR (BNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	ON-LINE PROCESS CONTROL (OPCon)	2ND QUARTER FY 1995

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX LABORATORY PROGRAM OFFICE PACIFIC NORTHWEST LABORATORY RICHLAND, WASHINGTON 99352	U.S. DEPARTMENT OF ENERGY WASHINGTON, DC 20585	5. START DATE: OCTOBER 1994 6. COMPLETION DATE: SEPTEMBER 1995

7. PROJECT YEAR: FY 1995

8. COST STATUS

a. $ EXPRESSED IN: THOUSANDS

b. BUDGET & REPORTING NO./SUB. ACCT NO.: KU-01-00-000

c. FIN. NO.:

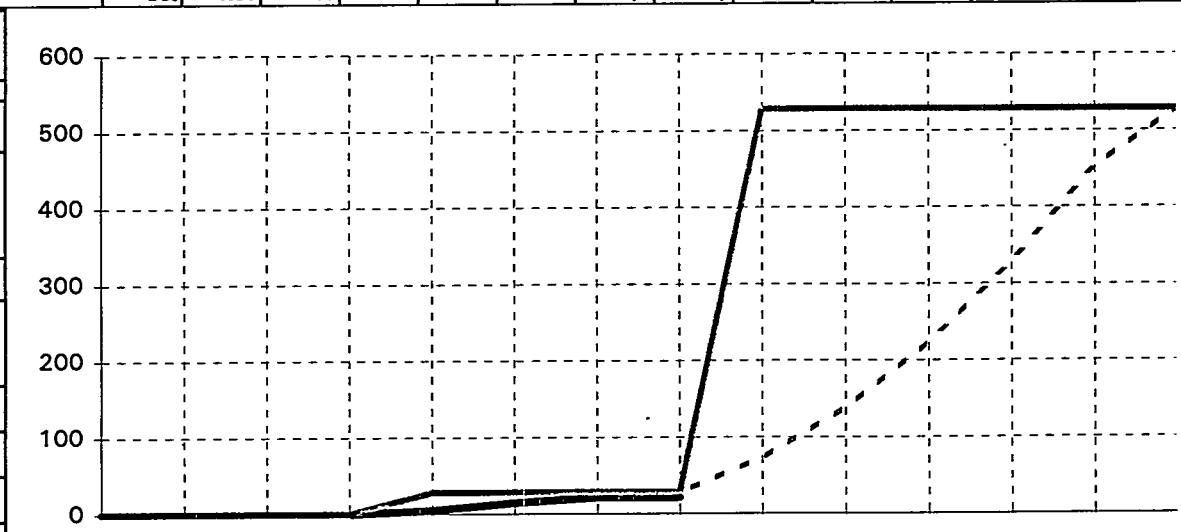
d. ACTUAL COSTS PRIOR YEARS: $0

e. ER BUDGET: $413

f. DP BUDGET: $115

g. ER FUNDS AUTH: $28

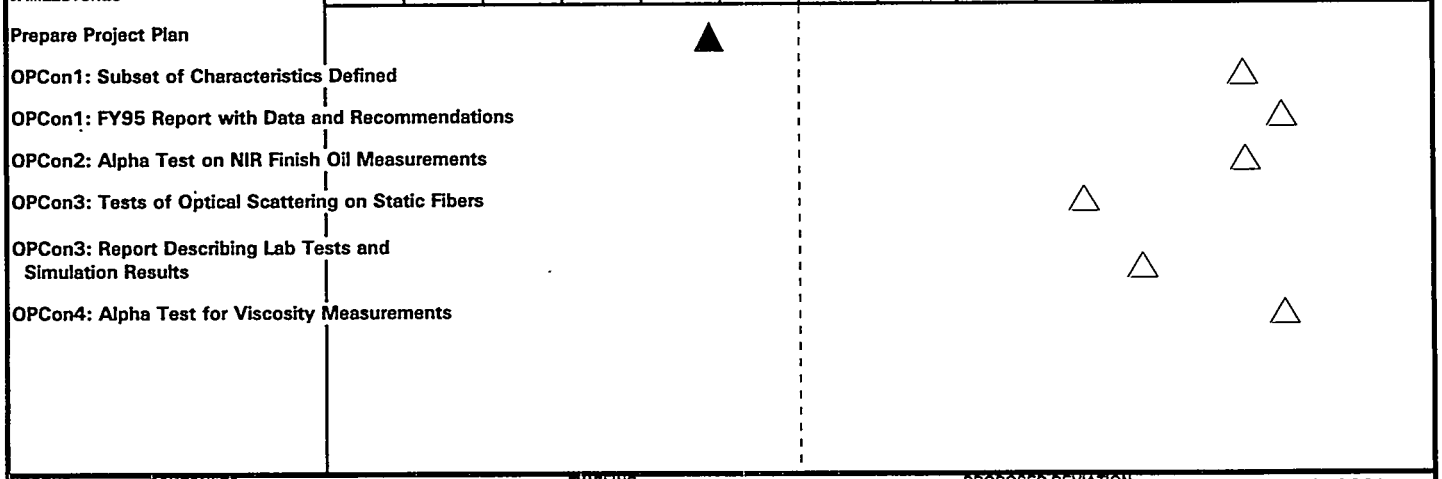
h. DP FUNDS AUTH: $0



LEGEND: PLANNED - - ACTUAL ——— PROJECTED - - - - - - - FUNDS AUTH ——— 90% SPENT ▷

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
i. ER COSTS	PLANNED	0	0	0	5	9	7	7	35	50	65	80	95	60
	ACTUAL	0	0	0	5	9	7	0						
	VARIANCE	0	0	0	0	0	0	7	35	50	65	80	95	60
	CUM PLANNED	0	0	0	5	14	21	28	63	113	178	258	353	413
	CUM ACTUAL	0	0	0	5	15	21	21						
	CUM VARIANCE	0	0	0	0	-1	0	7	63	113	178	258	353	413
j. DP COSTS	PLANNED	0	0	0	0	0	0	0	10	15	20	25	30	15
	ACTUAL	0	0	0	0	0	0	0						
	VARIANCE	0	0	0	0	0	0	0	10	15	20	25	30	15
	CUM PLANNED	0	0	0	0	0	0	0	10	25	45	70	100	115
	CUM ACTUAL	0	0	0	0	0	0	0						
	CUM VARIANCE	0	0	0	0	0	0	0	10	25	45	70	100	115
k. TOTAL COSTS	PLANNED	0	0	0	5	9	7	7	45	65	85	105	125	75
	ACTUAL	0	0	0	5	9	7	0						
	VARIANCE	0	0	0	0	0	0	7	45	65	85	105	125	75
	CUM PLANNED	0	0	0	5	14	21	28	73	138	223	328	453	528
	CUM ACTUAL	0	0	0	5	15	21	21						
	CUM VARIANCE	0	0	0	0	-1	0	7	73	138	223	328	453	528

9. MILESTONES



LEGEND: SCHEDULED △ TIMELINE ——— PROPOSED DEVIATION - - - - - - - -

COMPLETED ▲ DEVIATION □ PROGRESS ——— APPROVED DEVIATION - - - - -

10. NAME OF PARTICIPANT'S PROJECT MANAGER

MARC SIMPSON (ORNL)

APPENDIX B

AMTEX PROJECT POSTERS

Computer-Aided Fabric Evaluation

Goals

- Develop on-line inspection systems for woven and knit fabrics (plain and colored) and yarns.
- Develop on-line inspection systems for printed color and three-dimensional goods.

Industry Impact

- Create customer preference for U.S. products worldwide.
- Guaranteed fabric quality.
- Reduced "second quality" products.
- Reduced human fatigue.
- Creates new U.S. industry – $500 million business.

Accomplishments

On-line Inspection System for undyed, unfinished fabrics.

- Showed sensor feasibility.
- Developed defect detection methods.
- Tested concepts on an operating loom.
- Developed on-line diagnosis methods.

Color, printed pattern Inspection System

- Developed prototype-printed pattern system.
- Created inspection methods for color patterns.

Commercialization Plans

- Begin on-loom system testing in April 1995.
- Start on-line field testing at manufacuring sites in December 1995.
- Commercial vendors of the on-line systems join the project by mid-1995.
- Commercial prototype systems available in 1996.
- Field testing of the color-printed systems in early 1997.

Benefits to DOE

- Advanced and field-proven sensors, imaging systems and pattern recognition algorithms for national defense and security.

Industry Managing Partner

Institute of Textile Technology

AMTEX Partnership for Success

Cotton Biotechnology

Goal

- Improve cotton fiber performance and plant yield: Longer, stronger, thinner, more uniform fibers.

Industry Impact

- Speed up commercialization of gene discovery and manipulation.
- More competitive textile industry through higher processing efficiencies.
- Improved quality makes U.S. cotton textiles more attractive exports.

Approaches

- Determine why certain seed coat cells become fiber cells while others do not.
- Identify genes that affect fiber properties.
- Provide molecular markers that can be used in breeding cotton.
- Provide a physical map of the sequenced genes.
- Develop a database to manage this information and to provide access to industry research partners.

Early Accomplishments

- Demonstrated the utility of molecular markers based on simple tandem repeats in cotton to speed plant breeding.
- Determined time of initiation of cotton fibers.

Benefits to DOE

Builds on the strengths of DOE sponsored work on the Human Genome project and in Energy Biosciences.

- Advance technologies for automated database entry.
- Improve the construction of large clones.
- Increase basic knowledge of cellulos biosynthesis and the genetic control of fiber growth and differentiation.

Industry Managing Partner

Cotton Incorporated

AMTEX Partnership for Success

Demand Activated Manufacturing Architecture

Goal

By the end of the of the decade, DAMA technologies will link the entire textile industry – fibers, fabrics, fashions and retail – in an electronic marketplace where companies will identify, compare, buy and sell resources, products and services in support of innovative business partnerships.

Industry Impact

- Regain domestic share of fabric and apparel – every 10% gain creates a $10 billion manufacturing business and 124,000 jobs.
- Save an estimated $12 billion annually by cutting in half current losses due to excess inventory, markdowns, shortages and other non-value-added costs.
- Increase responsiveness to customers, reduce time and cost of product development.
- Create new businesses to provide tools and services of the electronic marketplace. Business potential up $100 million annually.

Accomplishments

- Modeled entire textile pipeline for men's cotton slacks.
- Simulated the textile manufacturing pipeline showing how sharing information reduces the product time to market.
- Demonstrated an electronic procurement system that enables small manufacturers to compete more effectively.
- Developed a sourcing database of textile and apparel manufacturers in collaboration with Auburn University.

Commercialization Plans

Commercialization in the following areas will begin in 1996.

- Industry-wide forecasting and inventory management.
- National sourcing database over Internet.
- Marketing applications with world wide web applications.
- Business process modeling and simulations offered through learning laboratories.

Benefits to DOE

- More cost-effective design and operation DOE's flexible, on-demand weapons production complex of the future.
- Enhanced environmental decision making and clean-up activities at DOE sites through improved analysis and sharing of information.
- Accelerated progress in fundamental research through more effective operation of large, networked scientific computer systems.

Industry Managing Partner

Textile/Clothing Technology Corporation $(TC)^2$

AMTEX Partnership for Success

Electronic Embedded Fingerprints

Goal

Develop a miniature, embedded, electronic tag or fingerprint that can accept and transmit data about a product's features (size, color, style), processing history, customer, recycling procedures, and more.

Industry Impact

- Reduced apparel costs due to more efficient tracking and management of products from cradle to grave (fabrication through customer recycling).
- Deter counterfeiting of U.S. name-brand products, thereby increasing American export opportunities.

Accomplishments

- Defined requirements of the textile industry.
- Established design criteria for textile and apparel tag.
- Initiated design of a system able to communicate with several tags at once without removing products from typical shipping containers.

Commercialization Plan

A prototype multiple tag and reader system will be developed and demonstrated in September 1995.

Benefits to DOE

- Effective, reliable tracking and accountability of high-risk, high-value items including canisters of waste products, weapon components and systems, or classified documents.

Industry Managing Partner

Textile/Clothing Technology Corporation $(TC)^2$

On-Line Process Control

Goal

To strengthen the worldwide competitive position of the U.S. fiber manufacturers by identifying and developing technologies that will provide:

- Faster transition between products.
- Efficient production of small lots.
- Improved economics via elimination of off-quality production and off-line testing.

Industry Impact

Lower production costs due to:

- Lower waste and off-spec product.
- Elimination of off-line testing.

More consistent product quality due to:

- Continuous on-line process control.
- Real-time process monitoring.

Greater process flexibility due to:

- On-line process control systems which enable more rapid responses for product changes.
- Increased capability to produce smaller lots.

Benefits to DOE

Enhanced ability to use advanced measurement and control systems for applications in national defense, security, energy, and environment

- Remote sensors for Office of Non-proliferation and National Security.
- Advanced diagnostics for Energy Research-53 (Fusion Energy - ITER).
- Advanced measurement and control for Energy Efficency and Renewable Energy–Utilities and Transportation.
- Advanced sensors and controls for Office of Industrial Technology Industry Partnerships–steel, aluminum, pulp and paper, glass, refining, chemical, and foundries casting.

Industry Managing Partner

Textile Research Institute

AMTEX Partnership for Success

Rapid Cutting

Goal

Develop cost-effective, rapid cutting technologies for sewn-product manufacturers using laser cutting, mechanical cutting, and rapid material-handling systems.

Industry Impact

- Ability to rapidly manufacture small quantities of apparel in response to market demand.
- Create new U.S. industries to supply cutting systems. Market opportunity in excess of $20 million.

Accomplishments

- Demonstrated laser cutting of fabric using several laser techniques.
- Created long-life knife blades using advanced materials.
- Tested prototype motor drivers.
- Designed high-speed mechanical handling system.

Commercialization Plan

- Identify technology solutions through lab and field evaluations.
- Field-test technologies in three stages: laboratory prototypes, beta prototypes at industry partner facilities, and pre-production prototypes.
- Select equipment manufacturers who will turn prototypes into commercial products.

Benefits to DOE

- Proven and flexible laser-cutting systems required to implement DOE's flexible, on-demand, weapon's manufacturing complex of the future.
- Laser capabilities for automation needs in environmental restoration and waste processing.
- Advanced coatings and amorphous materials with proven industry performance that can be applied in other harsh, environmental and high-wear applications – automobiles, aircraft, waste storage containers and weapons components.

Managing Industry Partner

Textile/Clothing Technology Corporation $(TC)^2$

AMTEX Partnership for Success

Sensors for Agile Manufacturing

Goal

Develop sensors and feedback control methods to enhance productivity, flexibility and safety of sewing operations.

Industry Impact

- Improve quality and productivity in apparel manufacturing.
- Improve machine operators' work environment.

Accomplishments

- Selected sensor technologies for monitoring fabric position during seam formation.
- Developed a laboratory felled seam sensor.
- Developed a laboratory fabric edge sensor.

Commercialization Plan

- Demonstrate sensor concepts in the laboratory.
- Test successful concepts in industrial settings by September 1995.
- Evaluate commercial prototypes in industrial settings by FY 1996.
- Equipment vendors commercialize technology.

Benefits to DOE

- Enhanced automated (robotic) handling and processing during manufacturing of weapons or treatment of hazardous wastes in DOE operations.
- Improved control of automated processes in weapons production, energy conversion and environmental restoration.

Industry Managing Partner

Textile/Clothing Technology Corporation $(TC)^2$

AMTEX Partnership for Success

Textile Resource Conservation Project

Goal

Develop resource-efficient manufacturing processes that use less energy and natural resources and discharge no net waste to the environment.

Industry Impact

- Recover and reuse more than 100,000 tons of knit fabric waste valued at $474 million annually.
- Reduce the 133 billion gallons of water consumed annually including 50 billion gallons sent to waste treatment at a combined cost of $146 million.
- Recover valuable raw materials – over $66 million annually in reactive dyes alone.

Accomplishments

- Developed processes for recovering dyes and colorants.
- Identified a process for recovering and reusing salt and fresh water from spent dye baths.
- Demonstrated on-line cleaning of membranes resulting in lower operating costs and increased operating times.
- Developed a process for recovering and reusing polyester and cotton from scrap fabric and apparel.
- Demonstrated methods that greatly reduce the amounts of chemical, water and energy needed to scour, wash and finish fabrics.
- Developed a spinneret cleaning method that is three times faster than current methods.
- Developed water-based methods for removing oil and grease from fabric thereby eliminating use of volatile solvents.

Commercialization Plans

By the end of September 1995, in-plant demonstrations will be performed on:

- Low-waste methods of applying chemicals to fabric.
- Analytical methods for metals speculation.
- Recovery of dyes and salts.
- Parts, machine and fabric cleaning methods.
- Air emission sensors.
- An ultra low-water fabric washing technology.

Transfer to commercial vendors will occur in 1996.

Benefits to DOE

- These AMTEX-developed techniques will enhance DOE capabilities to clean up buried or mixed waste.
- Air emission sensors will enable DOE to more effectively meet provisions of the Clean Air Act.

Industry Managing Partner

Institute of Textile Technology

AMTEX Partnership for Success

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