PNL-10519-3

The AMTEX Partnership

Third Quarter Report
Fiscal Year 1995

June 1995

Issued by
The AMTEX Program Office

Douglas K. Lemon, Manager
AMTEX Laboratory Program

and

Richard K. Quisenberry, Executive Director
AMTEX Industry Program

DISCLAIMER

CONTENTS

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

The key activities for the quarter were the initiation of technical work on the OPCon Project, development of a draft of the AMTEX Policies and Procedures document, and a meeting of the Industry Technical Advisory Committee (ITAC).

A significant milestone was reached when a Memorandum of Understanding was signed between the DOE and the Department of Commerce. The agreement signified the official participation of the National Institute of Standards and Technology (NIST) on the Demand Activated Manufacturing Architecture (DAMA) project in AMTEX.

Projects

Computer-Aided Fabric Evaluation

During the quarter, the On-Loom Greige Inspection Task team focused their efforts on completing the On-Loom Greige Inspection System Alpha test, which includes fabric made with both filament and spun yarn. During this period, the CAFE industry research partners completed the review and selection of a Vendor Affiliate that will commercialize the on-loom inspection technologies.

The Critical Path Elements (CPE) team finalized the CPE task and initiated the transition from CPE to System Integration and Commercialization. A cost-and-performance payback model will show the relationships among the performance in defect detection, the Computer-Aided Fabric Evaluation (CAFE) system capital cost, and the break–even time.

The Color Printed Pattern Goods Field test continued during this period with visits to several plant sites. In addition, a study was completed to determine the real-time implementation requirement for detection

algorithms and their impact on hardware selection. Progress was also made in the area of colorimetry and unicolor measurement. Algorithms for color print inspection continued with the preliminary testing phase.

The Knit team received defect samples from its Industry Partners. These defects were digitized and added to the electronic image data base that resides at Oak Ridge National Laboratory (ORNL). In addition, 120 needles were coated with a hard carbon coating and returned to an Industry Partner for testing. Sensors continued to be optimized for knit inspection. Work continues in the design and development of a Machine Diagnostic capability for knitting machines. The Knit Task team continued to develop the defect detection and inspection algorithms for the Knit Fabric Inspection System.

The Material Marking Task team initiated a material marking industry survey. The results of the survey are being collected and will form the basis of the material marking task design approach. The results of the survey clearly indicate the importance to industry to mark defects identified by the inspection system.

Cotton Biotechnology

The Cotton Biotechnology Project is taking several approaches to improve the quality and performance of cotton fiber. The Fiber Differentiation Task has made remarkable progress in learning when fiber cells become committed to their differentiation pathway. This determination should enable researchers to identify the activity of key genes during floral development. It would also provide the possibility of timing the release of internally supplied hormones to positively influence the process. The Molecular Markers Task is producing genetic markers that will be effective in speeding gene transfer to elite varieties and help cotton breeders identify naturally occurring genetic variations that influence fiber properties. The discovery step in developing these markers involves high-volume DNA sequencing. The group performing this task has made considerable progress in refining the associated sequencing and data handling procedures. The databases that store all of the genetic data for the project are now fully structured. The Industrial Research Partners, who represent virtually all of the cotton seed suppliers in the U.S., have met and are actively participating in the project.

Demand Activated Manufacturing Architecture

Demand Activated Manufacturing Architecture (DAMA) project continued significant progress during this past quarter. Highlights from each of the task areas are:

Enterprise Modeling & Simulation - The DAMA Product Line Investigations Teams completed their information gathering for both bedsheets and a man's nylon Supplex® parka. The teams have initiated synthesis of the information and have begun building the process model. Modeling and simulation

efforts continued to develop in terms of methodology, tool development, and scenario definition for pilot testing.

Connectivity & Infrastructure - Demonstrations at Burlington, Cone and Fieldcrest Cannon on the internal use of World Wide Web (WWW) and at Glen Raven Mills on the Reliability of Internet E-mail made significant progress. Burlington established a World Wide Web home page for use in this demonstration.

Support to CBM for delivery of the TEXNET Prototype #2 (P2) accomplishments included; completion of the P2 design, development of WWW-based modules for access and delivery of data, and development of WWW-based modules that provide user interface for creation/modification of Trading Partner Agreements (TPA) and associated methods for data access.

Cooperative Business Management - The TEXNET Prototype #1 (P1) was delivered to $[TC]^2$, which will be distributing the CRADA-protected final deliverables package to industry representatives. In addition, a version of the TEXNET stand alone demonstration was made available on the DAMA internal server. Other milestones met were:

- The TEXNET Prototype #2 (P2) requirements were completed and documented, and a design review conducted.
- Requirements for the pilot phase of the National Sourcing Data Base (NSDB) were developed. The NSDB pilot went live on the Internet June 1.
- Design requirements definition was completed for the Forecasting and Inventory Management Prototype #1 (PIM PI).

Education, Outreach, & Commercialization - Interviews were provided or established with over 10 outlets on the NSDB, quick response, and other U.S. ITC issues.

The course materials supporting the "Strategic Issues: Creating Strategies for Improved Competitiveness" workshop were improved, based on feedback from the pilot session.

The DAMA Video contract was awarded this quarter. The target for distribution of the video is the end of September.

Architecture & Integration - The draft DAMA FY 96 Project Plan and Task Plans were prepared and delivered to the AMTEX Program Office and DOE June 15. A workshop was held May 22-25 to complete plan preparation and for a Red Team review of the plan by several industry, DOE, and laboratory stakeholders.

DAMA was featured in *Apparel Industry Magazine, Bobbin Magazine, Daily News Record, EDI News,* and the *Journal of Commerce.*

A presentation on Coming Soon: The Information Superhighway was presented to the ATMI Quick Response Committee and executives at Hoechst-Celanese. Also, Jim Lovejoy and Leon Chapman gave a conference presentation on DAMA at the American Textile Manufacturers Institute (ATMI) Information Systems Conference. All were extremely well received.

DAMA costing has continued to run behind anticipated budget. Two major factors reported last quarter have continued to contribute:

- The Enterprise Modeling and Simulation task had a significant increase in requirements this fiscal year. Bringing on new staff across three laboratories has been more difficult than anticipated. Two additional staff were recently hired at LBNL which will increase the run rate for the remainder of FY 1995.

- The decrease in FY 1995 funding for DAMA caused a reduction from 9 to 7 laboratories involved for FY 1995. This resulted in a major realignment of task responsibilities in several areas. The addition of new staff in general has taken longer than anticipated, particularly at the ER laboratories.

Embedded Electronic Fingerprinting

The major technical challenge and goal for the Embedded Electronic Fingerprinting (EEF) project for this year is to demonstrate the ability to read data from and write data to 50 tags within one second. This quarter, the tag design and the communications algorithm were successfully demonstrated in a test using seven tags. Using computer simulations of tag interactions, the algorithm and communication protocols were shown to function very well for addressing 50 tags in less than one second.

A second significant event was an exposition held at $[TC]^2$ where several electronic tag vendors made presentations to the laboratory and industry EEF team. Further discussions are planned with vendors as the project moves into the commercialization phase planned for FY96.

Rapid Cutting

The laboratory teams have begun developing alpha prototypes of advanced knife blades. Argonne National Laboratory (ANL),

Lawrence Berkeley National Laboratory (LBNL), and Oak Ridge National Laboratory (ORNL) have fabricated blades with new materials and coatings. A test matrix is being planned to include preliminary lab testing, a limited pre-production run and a test and evaluation sequence in a partner's factory.

ANL, LANL, and LLNL have also completed all trial cuts on apparel textiles using CO_2, YAG: Nd, KrF, and XeFl and Copper Vapor lasers. Preliminary results show improved cut quality and increased efficiency over present commercial systems.

LBNL has fabricated pre-prototypes of magnetic drivers for automated knife-based reciprocating cutting heads, as well as hand-held cutters.

LBNL has built a test fixture to test both blades and drivers for reciprocating cutting machines. A pneumatic motor has been tested. The drivers have higher power-to-weight ratios compared to electric motors. LBNL has identified pressure knife cutting as holding the greatest promise for high-speed, mechanical cutting on a single-ply basis. As such, LBNL has analyzed present limitations of these cutting machines and formulated new ideas for high-speed, pressure knife cutting.

ORNL has continued with work in the area of nickel and iron aluminide alloy development and fabrication. A test method using an Eastman Cutter has been installed for testing the knives being fabricated by ORNL. Both nickel and iron aluminide blades have been fabricated in the Eastman and Gerber configuration.

For Phase One, the effective start date was August 1, 1994. All laboratory teams have begun Phase Two, scheduled from February 1, 1995, to September 31, 1995. An overall project review was held at Los Alamos National Laboratory (LANL) in February. As of June 30, 1995, 78% of the FY95 budget has been expended. This project is on schedule and budget.

Sensors for Agile Manufacturing

The fabric edge sensor developed by Sandia National Laboratory (SNL) has been integrated into a demonstration system that continuously runs a loop of fabric across the sensor, detecting edges with 1/32" resolution. This sensor is currently being integrated to a serging machine. The felled seam sensor prototype is complete and being integrated to a felled seam sewing machine.

The task team for the advanced sewing sensors was assembled at Pacific Northwest Laboratory (PNL). This team traveled to $[TC]^2$ where initial training and discussions were held on the possible requirements for this task. Project staff attended "Blue Sky" meetings sponsored by $[TC]^2$ to identify research that can have a significant impact on the sewn products industry.

Textile Resource Conservation

During the third quarter 1995, progress with respect to milestones has been on schedule. Excellent results have been achieved from work in salt recovery where laboratory runs with dyebath and rinsewater from an Industry Research Partner have produced an 18% brine with highly competitive economics. Up to 94% of the salt can be recovered and the water re-used.

One avenue being investigated in the recovery of fibrous solid wastes has been abandoned after a joint industry/laboratory economic analysis showed this path was not economical. Other approaches continue to show promise.

Investigators on air emissions monitoring are preparing for an upcoming field test, and work on low waste chemical application is nearing a decision point on an in-plant test.

Only minor variances from the project plan have been experienced and these have been related to slight directional changes in research efforts to better align them with industry needs.

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	1,305	226	807	498	62%
DAMA	13,843	2,418	6,787	7,056	49%
CAFE	5,843	1,273	3,823	2,020	65%
TReC	4,292	1,078	2,641	1,651	62%
EEF	777	175	425	352	55%
Cutting	2,041	431	1,016	1,025	50%
Sensors	900	146	464	436	52%
Cotton Biotech	1,724	288	614	1,110	36%
OPCon	528	7	28	500	5%
TA Leaders	46	1	18	28	39%
Uncommitted	0	0	0	0	0%
Total	$31,299	$6,043	$16,623	$14,676	53%

* Total FY95 budget includes carryover from FY94. (For details, see Project Summary Report at the back of this Quarterly Report.)

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

The On-line Process Control (OPCon) project started work this quarter. A kick-off meeting was held in mid-May at the Hoescht-Celanses research complex where the laboratory and industry team members finalized their project scope, objectives, and industry team members. Technical work was initiated.

Press and Media Relations

AMTEX continued to receive coverage in the national and trade press. One article reported that France is looking at AMTEX as a model for a French consortium that would develop an electronic marketplace for their textile and apparel industry.

Policies and Procedures Document

The Program Office staff circulated for comment Draft #3 of the AMTEX Policies and Procedures document to members of the full AMTEX Operation Committee (AOC). This distribution was in preparation for the July AOC meeting where the plan will be presented for approval.

Agreement Between Departments of Energy and Commerce

A Memorandum of Understanding was signed this quarter between DOE and the Department of Commerce. The agreement outlined the parameters whereby the National Institute of Standards and Technology (NIST) would participate in the Demand Activated Manufacturing Architecture (DAMA) project. In AMTEX, the NIST team will play a vital role in the area of standards and protocols for electronic data interchange.

Operating Committee Activities and Actions for the Quarter

Industry Technical Advisory Committee

The Industry Technical Advisory Committee (ITAC) met on April 13 in Charlotte, North Carolina. The industry project directors reported on the progress of plans for their respective projects. Various project budget priorities for FY1996 were discussed.

Laboratory and Government Workshop

The laboratory and government members of the AOC met in Salt Lake City, Utah on May 17-18 to work on the draft AMTEX Policies and Procedures. Comments from the workshop attendees were incorporated in the subsequent drafts of the document.

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

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
Mark Kametches, ITT/803-595-0035

Performance Related to Milestones

A. The CAFE Economic Model was delivered for comment and review.

B. Critical Path Elements Documents were completed and submitted to Project Manager: State Of The Art Assessment (SOTAA), Preliminary Defect Analysis (PDA), and the Economic Model.

C. Completion of the On-Loom Greige Inspection System Filament Alpha test and the initiation of the On-Loom Greige Inspection System Spun Alpha test.

Activities and Technical Accomplishments for the Quarter

On-Loom Greige Inspection System – Oak Ridge (PI/Glenn Allgood), Argonne, Lawrence Berkeley, and Sandia Laboratories

During the quarter the On-Loom Greige Inspection Task Team focused their efforts on completing the On-Loom Greige Inspection System Alpha test which includes filament and spun yarn. The fabric construction for the Filament test was a 150 denier, 68x56 polyester warp and filling. The Spun test construction was a 50/50 polycotton warp and a 1.2 denier polyester fill. The Filament test was completed in June, followed by a warp changeout. The team is currently conducting the Spun Alpha test which will end in July.

The intent of the On-Loom Greige Alpha test is to highlight the operational and functional elements of an On-Loom Greige Fabric Inspection System. The test includes sensor suite mounting, environmental impact on a sensor's performance, machine diagnostic capabilities, system integration, Central Inspection System, and defect feature map, to name a few. All fabric inspection systems, with the exception of one, have passed the operational phase of the Filament test. Two of the remaining three experienced some problems with their

functional tests. These problems, along with the problem that precluded the initial test of the fourth system, have been corrected. All systems are currently ready for the Spun Alpha test.

Two additional systems are being highlighted during the Alpha test. One is Machine Diagnostic; the other is the Central Inspection System. Machine Diagnostics is an integrated system of sensors that provide an assessment of the health of a loom. The Central Inspection System is the integrating element of the CAFE Architecture System.

In addition to Alpha test support, the team has participated in the selection of the Weaving Vendor Affiliate.

Critical Path Elements – LBNL (PI/Craig Fong) and ORNL.

The Critical Path Elements (CPE) Team met in May to finalize the CPE tasks and initiate the transition from CPE to System Integration and Commercialization. During this meeting, the Functional Description and Requirements Document for On-Loom Greige Inspection was revised, mainly to improve readability and its self-explanatory capabilities. However, it became apparent that a need existed to obtain Industry input to finalize the design criteria with regard to false detection rates and false categorization rates. These issues will be addressed at the CAFE Quarterly Meeting in August.

In June, the team met to discuss the content of the draft CAFE System Architecture document. An outcome of this meeting is the development of a cost-and-performance payback model that will tie the level of defect detection performance with the CAFE System capital cost and break-even time.

Color Printed Pattern Goods – SNL (PI/Terry Stalker), LLNL, and ORNL.

During this period, the Color Printed Pattern Goods RGB Field test continued with visits to several plant sites. In each case, refinements and modifications were made to the system to accommodate the different processes encountered.

During the quarter, SNL completed a study to determine the real-time implementation requirements for color detection algorithms and their impact on hardware selection. To facilitate this process, SNL brought together experts in real-time hardware systems and SNL's CAFE algorithm team. The defect detection algorithms were analyzed to determine the underlying image processing functions required and the computational resources needed for real-time inspection. The two basic algorithmic approaches [Lawrence Livermore National Laboratory (LLNL) and SNL being considered] were analyzed. The outcome of the study has been to identify two basic approaches for implementing the algorithms. The first uses a high performance image processing hardware suite. The second use is digital signal processing (DSP) hardware coupled with innovative approaches to reduce throughput. A block level decomposition and mapping of the algorithms to each of the proposed systems was completed. The results of this study conclude

that both hardware systems provide the performance needed for real-time operation. The final decision will be made based on the economic and operational merits of each system.

Progress was made during this quarter in the area of Colorimetry. A survey was conducted to determine the current practice of visual and instrumental color evaluation of the AMTEX CAFE industry members. This summary document has been issued to the CPPG Industry Partners for review and comment and will provide the foundations on which the imaging colorimeter device will be based.

In the area of algorithm development, SNL and LLNL continue to test their respective approaches on real data. LLNL's algorithm is a statistic-based learning algorithm, while SNL's approach involves the use of a priori knowledge derived from a CAD database or other sources. Both approaches require precise registration of camera data relative to a learned or derived exemplar. These algorithms are currently in a preliminary testing phase.

In the area of unicolor inspection, a discussion of industry needs and general requirements was conducted . From this a preliminary list of areas where the laboratories could develop technology were identified. This list will be sent out for comment to the Industry Partners. The task is in advance of expected needs.

The CPPG task team was also involved in the preliminary Vendor's Consortium meeting held at Institute of Textile Technology (ITT). The intent of this meeting was to lay the groundwork for the Vendor Affiliate Selection process.

Knitting – Lawrence Livermore (PI/Jose Hernandez), Argonne, Oak Ridge, Y-12, and Sandia Laboratories

During this period, the Knit Team received knit defect samples from its Industry Partners. These defects were digitized and added to the electronic image database that resides at ORNL.

ANL coated the butts and latches of 120 needles with a hard carbon coat. These needles were provided by Fruit Of The Loom and returned to them for a comparison test between coated and non-coated needles. This test continues through this reporting period. In addition to the coated needles, Argonne continues experimentation to establish the optimum transducer configuration for knit inspection. The approach is to use a two-transducer same side configuration. Implementation of this configuration should be possible on a knitting machine. The computer interface and algorithm developed for On-Loom Greige inspection will be modified for use in this system.

ORNL continued their progress in the design and development of the vision imaging system. Currently, the design is based on the knit machine located at Y-12 and includes speed range, field of view, preferred mounting locations, lighting, and encoder placement. Concepts currently under review provide fount lighting and a smooth viewing area for the camera.

Y-12 continues the design of Machine Diagnostics for a Knit Machine. In particular, they are investigating the use of a sonic probe for evaluating cam wear and the use of an optical array for detecting defective needles and sinkers. The optical device has been bench tested.

LLNL continues the development of the software for the vision–based inspection system. In particular, LLNL has started the design of the feature extraction algorithm. The previous approach localized the defect and returned a small segment of data at the defect location. The feature extraction algorithm isolates the defect from the background texture and generates size, shape, and intensity measurements specific to the defect. The algorithm is currently under testing using images from the ORNL database, including images generated from ANL's sensor. The real-time impact on system performance is also being investigated.

SNL continues in the development of a knit sensor system based on their current loom system concept. The current design consists of two sensor arrays oriented wale-wise and coarse-wise for high resolution in both directions. This approach is very modular and cost effective. Currently, SNL is designing a single array for field testing. SNL also continued developing automatic inspection algorithms for knit products and have been successful in implementing image enhancement techniques, as well as detection and connectivity algorithms to several of the optical images provided by LLNL.

Material Marking – Lawrence Berkeley (PI/Craig Fong), Oak Ridge.

The Material Marking Task team initiated a material marking industry survey. The results of the survey are being collected and form the basis of the material marking task design approach. The results of the survey clearly indicate an Industry desire to mark defects after the inspection system has detected any anomalies. A marking process based on a 4-point system seems to be a common goal among the Industry Partners.

Issues, Major Problems, and Resolutions

An issue has arisen over limited plant access by Industry Partners during data collection. In response to this, a letter was written by the Industry and Laboratory Project Managers outlining the non-exclusion principle that is adhered to by the project and the process by which all decisions related to plant access will be made.

Explanation of Variances

None to report this quarter.

Plans for Next Quarter

Next quarter plans for the On-Loom Greige Inspection Team involve the completion of the On-Loom Greige Inspection System Alpha test (Filament/Spun Fabric), submittal of the CAFE Alpha test After-Action-Report to the Laboratory teams and subsequent meeting, CAFE quarterly meeting (to be held at ANL August 22–24), selection of sensor systems to go into Beta testing, initiation of the System Integration and Commercialization Users Work Group, and selection of CAFE's Weaving Vendor Affiliate.

For the Critical Path Element Team, the next quarter activities include issuing an Industry Survey to obtain a clear understanding of the material marking task requirements. From this survey, a conceptual design for a marking system will be drawn and documented. The CPE team will also meet with the System Integration and Commercialization Task Leader to coordinate next year's transition from Critical Path Elements to System Integration. From this meeting, a plan will be developed highlighting the path forward for commercializing all CAFE Inspection Systems.

The Color Printed Pattern Goods team efforts in the upcoming quarter will include the completion of the RGB field test and submittal of the Operational and Environmental Document for review. The CPPG team will also initiate the design of an imaging colorimetry system. In the area of the algorithm development, SNL and LLNL will continue in their development of color imaging and segmentation. SNL will be conducting a comparative analysis of the two approaches to evaluate effectiveness in supporting the functional needs of the CPPG system from both an economic and an operational standpoint. A decision will be made within the next quarter as to which system to pursue. The team will also continue in the development of the Color System's Defect Feature vector. In the next quarter, the team will also support the Color Printed Pattern Goods Vendor Affiliate Selection activity.

The Knitting Task team will continue preparation for the Knit Alpha test which will commence in January 1996. In support, the team will continue development of detection algorithms at both LLNL and SNL. ORNL will finalize the Alpha vision system hardware configuration based on knit operational parameters. In the area of machine diagnostics, Y-12 will continue the design and development of an optical methodology for detecting defective needles and sinkers. SNL, likewise, will continue the design of their sensor system. Argonne will continue testing their hard carbon coated needles.

General project activities include preparing a technical overview of the CAFE Project for the AMTEX ITAC (July 12-13), preparing a presentation and demonstration of a selected CAFE On-Loom Inspection System for the AOC meeting to be held July 20th in Knoxville Tennessee, completion of the CAFE Project Plan and associated JWS/SOW for each Laboratory, identification of proposed committee members for the CAFE Technical Peer Review Team, and completion of the Color Printed Pattern Inspection System Vendor Affiliate selection process.

Invention Disclosures

None.

Publications/Presentations

Publications:

Publications generated during this quarter pertain specifically to System Design Documents, Defect Analysis, Machine Descriptors, Cost Benefits, and CAFE Economic Model, as they apply to each of the major subsystems being developed for CAFE. These reports are in the final stages of completion.

Presentations:

April 14, 1995 - ORNL Office of Tech Transfer, Oak Ridge, TN
Met with ORNL's Office of Tech Transfer to discuss the status of the CAFE project and to sign the CRADA extension for the period of April 1995 to September 1995. Presentation was made by Glenn Allgood.

May 11, 1995 - American Apparel Manufacturer's Association Meeting, $[TC]^2$, Raleigh, NC
Glenn Allgood and Mark Kametches were invited to present an overview of the CAFE Project to the AAMA's technical advisory staff. This presentation was cleared through the AMTEX/CAFE Industry project office.

June 5, 1995 - Georgia Tech School of Textiles, Atlanta, GA
A CAFE team comprised of Glenn Allgood, Mark Kametches, Joe Gucwa, Jim Goddard, and Ken Tobin visited the Georgia Tech School of Textiles at their invitation. Their staff provided an overview of research currently being conducted with the National Textile Center.

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. The 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

Image Acquisition and Automated Gel Scoring
One of the problems in mapping molecular markers is being able to automate the scoring of segregating bands and having a means to store and recall gel images. John Sutherland's group at BNL provided a first generation transilluminator and CCD camera to acquire images of gels. Software was written so images could be stored as TIFF files and recalled as needed. A second generation of the image acquisition hardware has now been constructed and tested. This system involves illuminating the gels from above, rather than below. Background is decreased and the sensitivity is increased. Software for automated scoring of the TIFF images has been purchased and tested.

Database Structure
In the first and second quarters of the Project, John McCarthy and Donn Davy at LBNL developed and refined database models for the Project. The database has been implemented using the recently released version 4.0 of ACEDB and has been loaded with all of the data accumulated by the Project to date. The structure of the database is compatible with the public Cotton Database which will allow sharing of data as intellectual property rights decisions permit. Current emphasis of the database group is on automating dataflow. Future priority will be placed on acquiring and displaying mapping information.

Activities and Technical Accomplishments this Quarter

Fiber Development:
Jack van't Hof at Brookhaven National Laboratory (BNL) made some remarkable discoveries in the last quarter using chromic irradiation to learn when cells become committed to differentiation pathways. In the first of these, he confirmed that all fiber cells are committed very early in the development of the ovule many days before flowering. He also learned that a second critical step in the development of long fiber cells occurs days before flowering. The significance of these results is that they tell us when to look for activity by critical genes, when internal release of plant hormones might be targeted, and what cell populations are plastic and might be redirected in their development.

Molecular Markers
The goal of this task is to provide markers for polymorphic loci in upland cotton. To do this, DNA regions containing simple sequence repeats (SSRs) are used. The Molecular Markers group at BNL has developed enriched libraries of SSR containing clones and sequenced 1400 genomic clones. Of these, 240 have SSRs of sufficient length to be useful and are unique. During this time, the task group has made important advances in template preparation, sequencing gel preparation, and the length and quality of sequences obtained. The BNL group has also examined and chosen software that permits efficient evaluation of raw sequence data files and construction of consensus sequences. These lessons will also have a significant impact on cDNA sequencing that the same team will pursue once sufficient SSRs have been sequenced.

Industrial Partners
The first Industrial Partners meeting was held at BNL on June 26. Of the 11 Partners, 12 were represented. This group represents virtually all of the cotton seed producers in the U.S. Current strategy and progress were reviewed, and funding prospects were discussed. The group visited the labs at BNL, so they could get a firsthand view of the work that was being carried out and discuss results and procedures in detail. The group approved the general strategy, but recommended the cDNA sequencing task not be started until FY96 funding issues were resolved. The group interacted very well and demonstrated they are committed to working together. Andy Ellis of Sure Grow Seed was selected Chairman of the group. The group was asked for a decision of whether or not to protect SSRs. The decision will be made by mail. Additionally, the group is expected to provide input on the varieties that will be used when screening SSRs for polymorphism.

Issues, Problems, and Actions to Resolve Them

Funding in FY96, of course, is the major concern. Should there be no additional funds for FY96, we want to be sure that at least the Molecular Markers task is completed. As recommended, one way to ensure this is to not divert effort into the cDNA sequencing task that has yet to begin. Therefore, we will delay the start of this task until we are assured of adequate funds for FY96. Milestones involving cDNA libraries and enriched fiber clones will not be met by the end of the fiscal year.

Explanation of Variances

No variances to report.

Plans for the Next Quarter

Fiber Development
An important observation made at BNL is that fiber cells still have the potential to divide. Although differentiated, they still have the capacity of having their fate altered. Work in the next quarter is directed at learning when fiber cells lose their ability to divide, and to determine which fiber cells are dividing.

Molecular Markers
During the next quarter, we hope to finish sequencing SSR containing clones. Preliminary work indicated that primers made to only one out of five of these sequences are useful. We believe we need about 200 polymorphic loci to be useful for cotton genetics and breeding. This means that we need at least 1000 unique SSR sequences of sufficient length. We have improved the hybridization conditions that we use for selecting clones to sequence. This appears to select SSRs of sufficient length. We are attempting to overcome the redundancy we have encountered in sequencing the same sequence several times by preparing new and larger primary libraries and avoiding contamination of our

secondary libraries. A subcontract for the synthesis of the oligonucleotide primers should be completed this quarter.

Database
The major efforts for the next quarter involve improving data entry from the automated sequencer and annotating the results. Work will be carried out on the presentation of mapping information and on obtaining reports. Finally, a client-server version of the database will be implemented, so that multiple parties can work on the database at the same time.

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.

Performance: The Product Line Investigation Teams completed information gathering for bedsheets and the Men's Nylon Supplex® Parka. The interim report milestone for June was completed. The report contains CRADA protected information. As such, it is not currently available for general distribution.

Milestone: Complete Textile Industry Simulation Model Version 1.

Performance: Two reports, *Warehouse Distribution Simulation Prototype,* and *Chronological Report of the EM&S Simulation Activity* were prepared this quarter in support of the September final report milestone.

Connectivity & Infrastructure (C&I)

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

Performance: Secure electronic connectivity and messaging technology continues to be utilized and further enhanced on the project. Assessments in these areas were completed n April, completing the Technology Assessment milestone.

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

Performance: As reported last quarter, video conferencing was initially demonstrated on DAMA through a teleconference in March. Additional pilots using video technology are being planned. Completion of the final milestone is anticipated in August or September.

Cooperative Business Management Tools (CBM)

Milestone: Demonstrate and pilot a national sourcing database.

Performance: The National Sourcing Data Base prototype and industry evaluation period concluded in April. The decision was made to accelerate this activity to the pilot stage, and the pilot began June 1 on the Internet using a Netscape interface. The pilot period is expected to continue for about a year. The May milestone completed in April.

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

Infrastructure TEXNET Prototype #2 has completed design and is in development. Industry evaluation will occur during August.

Forecasting and Inventory Management Prototype #1 has completed requirements definition, preliminary design, and is in development. Industry evaluation will also occur in August.

Architecture & Integration (A&I)

Milestone: Complete updates to:

- *FY 1996 project plan*
- *opportunity assessment*
- *demonstration plan*

Performance: The FY 1996 Project and Task Plan drafts were completed and provided to AMTEX and DOE for review.

The opportunity assessment Vital Issues Panel was held April 2 and 3. A draft report has been prepared, and the DAMA Steering Committee reviewed their results in June. Completion of this milestone is still anticipated in July.

DAMA's plans for demonstrations in FY 1996 were completed as part of the FY 1996 project planning this past quarter. DAMA will support the RISCon and Bobbin Show events. Detailed planning for these events will begin at a meeting in August. This milestone was completed in June.

Education, Outreach, & Commercialization (EO&C)

Milestone: Develop learning laboratory curriculum.

Performance: The Learning Laboratory Curriculum is being developed in two parts: a Strategic Issues course and an Operational Issues course. The Strategic Issues curriculum was finalized in May (original draft in March). Based on results and experiences from the pilot Strategic Issues course in March, completion of the Operational Issues curriculum has been deferred until September.

Milestone: Prepare DAMA briefing materials.

Performance: A DAMA Media kit has been drafted, reviewed, and forwarded to Graphic Arts for final preparation. A DAMA Video contract has been awarded, and the video is slated for distribution to project participants in September.

Activities and Technical Accomplishments for the Quarter

The following accomplishments are in addition to those reported in the Performance Related to Milestones section, and are provided by DAMA Task area.

Enterprise Modeling and Simulation

- Product Line Investigations: The DAMA Product Line Investigation Team information gathering for bedsheets and a man's nylon Supplex® Parka. Companies visited this quarter included Wal-Mart, Springs, Cascade West Sportswear, LL Bean, Malden Mills Industries, and Glen Touch. The teams have initiated synthesis of the information, and have begun the process step model building.

- Modeling: The modeling activities were directed in four areas: 1) developing a top-level business model for domestic/offshore manufacturing scenarios, 2) expanding the scenarios to a level of detail necessary to evaluate the top-level model, 3) evaluating Computer Aided Software Engineering (CASE) tool options, and 4) completing the identification of the costs involved in the domestic/offshore scenarios. Level-1 business model subsystems were completed and development of simple level-2 models began.

- Simulation: Two reports were completed this quarter: "Warehouse Distribution Simulation Prototype, and Chronological Report of the EM&S Simulation Activity. Graphical User Interface (GUI) development for the simulation builder began, including preparation of a requirements document.

Strategic Business Structures

- Simulation: Two reports were completed this quarter: Warehouse Distribution Simulation Prototype, and Chronological Report of the EM&S Simulation Activity. Graphical User Interface (GUI) development for the simulation builder began, including preparation of a requirements document.

- Strategic Business Structures: An interim report summarizing identified logistics-related *best practices* was prepared. The report investigates the utilization of the concept and how the practice could be combined to formulate strategic business structure concepts. Characterization of best-of-class logistics practices shifted from ITC to non-ITC industries. Approximately 200 articles describing logistics in the food industry were obtained. Much of this literature base was produced by the DAMA-equivalent initiative in the food industry known as Efficient Consumer Response (ECR).

Connectivity and Infrastructure

- The *Internal use of World Wide Web (WWW)* demonstration at Burlington and Fieldcrest Cannon moved forward with Burlington establishing a World Wide Web (WWW) home page on their corporate web server: http://www.burlington-ind.com.

- Work on the *Reliability of Internet E-mail* demonstration at Glen Raven Mills focused mostly on working out difficulties with using the UUCP gateway. Software is currently being installed and modified at Glen Raven Mills.

Collaboration with the CBM task accelerated in support of delivery of the TEXNET Prototype #2 (P2). Accomplishments on P2 design and development included: completed P2 design, developed an X500 directory structure to manage TPAs, developed WWW-based modules for access and delivery of P2 data, developed WWW-based modules that provide user interface for creation and modification of TPAs associated methods

- for data access, and completed modification of WWW-based software (gateway) to allow client access to X500 TPA database.

- Development of a WWW-based capability to view a summary of the files on the DAMA file server was completed. This DAMA Catalog can be accessed from the DAMA Home Page at http://dama.tis.llnl.gov/.

Cooperative Business Management

- The TEXNET Prototype #1 (P1) deliverables, including the installation of a stand-alone version of the prototype, were provided to $[TC]^2$ which will be distributing the CRADA-protected final deliverables package to industry representatives. In addition, a version of the TEXNET stand-alone demonstration was made available on the DAMA internal server for use by DAMA members.

- The TEXNET Prototype #2 (P2) requirements were completed and documented, and a design review conducted. One focus for this quarter has been on the design and security requirements for the prototype with the C&I Task.

- Requirements for the pilot phase of the National Sourcing Data Base (NSDB) were developed. Databases integrated to date include the Auburn Apparel & Manufacturers Database, the Electronic Catalog for the Sewn Products Industry, and Davison Textile Blue Book and Gold Book. Cotton Incorporated data has been received and is being incorporated, as well. The NSDB pilot went live June 1 on the Internet using a Netscape Interface.

- Design requirements definition was completed for the Forecasting and Inventory Management Prototype #1 (FIM P1). General program and data flow was finalized. A product flow has been agreed upon which includes eight companies, four sectors, and a total of 18 SKUs. The data gathering team has identified three product lines for FIM P1: women's jeans (cotton, fashion item), basic fleece (blend, stable item), and poly jacket (poly, seasonal item).

Education Outreach and Commercialization

- Interviews were provided or established with over 10 outlets on the National Sourcing Data Base, quick response, and other U.S. ITC issues. Publications and interviews included: *The Journal of Commerce, Daily News Record, Women's Wear Daily,* the *Philadelphia Inquirer,* and *EDI News.* Also, placement of a DAMA pipeline chart photo was negotiated with *Textile World* magazine for their April issue. Work continued with the *Christian Science Monitor* on a major article intended to highlight DAMA within the AMTEX story.

- A news release was drafted with the National Institute of Standards and Technology (NIST) public affairs team on NIST's alliance with AMTEX and their work on the DAMA project.

- An assessment report of the field trial version of the Strategic Issues was worked and distributed. The course materials supporting the Strategic Issues: Creating Strategies for Improved Competitiveness workshop were improved, based on feedback from the pilot session held in March.

- A standard article on DAMA was written and will be provided to DAMA partners to place in their respective publications. The article was based on an excellent article written for Spartan Mills' company paper.

Architecture and Integration

- The draft DAMA FY96 Project Plan and Task Plans were prepared and delivered June 15. The Education and Outreach task was restructured (now Education, Outreach, and Commercialization) for development of these plans. A workshop was held May 22-25 to complete plan preparation, and included Red team review of the project plan by several industry, DOE, and laboratory stakeholders.

- The decision was made by AMTEX and DOE to use a multi-lab CRADA in FY96 for DAMA instead of individual CRADAs with each laboratory, as in the past. Work began by identifying the various steps and issues in accomplishing this CRADA.

- DAMA Management Plan revisions were completed and copies were distributed to DAMA participants.

Issues, Major Problems, and Resolutions

EM&S: Scheduling conflicts on the product teams has continued to present problems, though the product teams are making every effort to accommodate everyone's schedule and to maintain continuity. Meetings are being identified and scheduled further in advance, which has helped the situation significantly.

C&I: The Connectivity and Infrastructure task is currently running at its planned budget, which will leave them without carryover to operate from in early FY96. With the steep ramp-up of TEXNET P2 support, activity in other C&I areas has been reduced. Additional resources are being sought for the remainder of FY95.

Explanation of Variances

DAMA costing continues to run behind anticipated budget. Two major factors reported last quarter continue to contribute to this situation:

- The Enterprise Modeling & Simulation task had a significant increase this fiscal year. Bringing on new staff across three laboratories has been more difficult than anticipated. Two additional staff were recently hired at LBNL which will increase the run rate for the remainder of FY95.

- The decrease in FY95 funding for DAMA caused a reduction from nine to seven laboratories involved for FY95. This reduction has resulted in major realignment of task responsibilities in several

areas. The addition of new staff in general has taken longer than anticipated, particularly at the ER laboratories.

The Learning Laboratory Curriculum milestone has been delayed, as mentioned previously. The curriculum was planned to be developed in two parts: a Strategic Issues course and an Operational issues course. The final curriculum for the Strategic Issues course completed drafting in March, and was finalized in May following feedback and experience from a pilot course conducted in March. It was decided afar the pilot course to defer completion of the Operational Issues curriculum until September in order to focus resources, and more completely apply the experience gained from the Strategic Issues course development. At an even higher level, the Steering Committee is re-evaluating the entire Learning Laboratory concept as it relates to DAMA, also contributing to the decision to defer the Operation Issues course activities.

Plans For Next Quarter

Enterprise Modeling and Simulation

Model completion, analysis, and ultimately simulation of the onshore vs. offshore business scenario will integrate much of the activities for the year in all sub-task areas.

Connectivity and Infrastructure

The emphasis for this task will be on supporting the Forecasting and Inventory Management and TEXNET prototype designs and evaluations.

Cooperative Business Management

The Forecasting and Inventory Management Prototype #1 and TEXNET Prototype #2 will complete initial development and will undergo industry evaluation in August. Once evaluated, follow-on activities will be identified and the next phases initiated.

Education, Outreach, and Commercialization

The DAMA video will be distributed for use by DAMA participants.

The Learning Laboratory will complete the second Strategic Issues course and evaluation, and will develop the Operational Issues curriculum.

Plans will be completed for DAMA participation in the RISCon and Bobbin Show events, both of which occur in September.

Architecture & Integration

The DAMA CRADA for FY96 will complete. This CRADA will be a single one for the project vs. the individual laboratory CRADAs of the past.

The FY96 DAMA Project and Task Plan documents will be completed following DOE and AMTEX reviews.

Invention Disclosures

No invention disclosures were processed during this period.

Publications / Presentations

Publications

- The May issue of Apparel Industry Magazine included a picture of the Process Step for Men's Cotton Pants.
- Other articles appearing that referenced DAMA this quarter were:
  - ⇒ *Bobbin Magazine,* Sourcing in the Year 2000, p. 74
  - ⇒ *Textile World Magazine,* AMTEX Research Survives Budget Cuts, p. 17
  - ⇒ *Daily News Record,* (Gray Maycumbers column, May 4)
  - ⇒ *Journal of Commerce*
  - ⇒ *EDI News,* "Textile Manufacturers Embrace EDI," June 26th issue feature article
- A high-level executive overview of the National Information Infrastructure titled "Coming Soon: The Information Superhighway" was presented to the ATMI Quick.
- A briefing on the National Information Infrastructure was also presented to executives at Hoechst-Celanese and was also very favorably received.
- Jim Lovejoy and Leon Chapman gave a presentation on the current status of DAMA at the ATMI Information Systems Conference May 7-9 at Hilton Head, SC.
- Jim Lovejoy gave a presentation on DAMA at the AAMA Committee meeting mid-June. Seven new companies have since expressed interest in joining DAMA.

Electronic Embedded Fingerprints (EEF)

The Electronic Embedded Fingerprints 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 this fiscal year is to develop 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. This quarter, significant progress has been made in this area. An identification method with seven tags successfully identified the tags. Simulations were used to determine whether the identification method will work with large numbers of tags without conflict in a reasonable amount of time. A prototype reader and the prototype tags were integrated to resolve communication issues. We are now in the process of building 50 tags and are testing our tag and reader system for the Bobbin Show demonstration.

Activities and Technical Accomplishments for the Quarter

In order to more fully test our identification method, a simulation algorithm was developed which can identify large numbers of randomly assigned codes. With this method, the algorithm can be tested to discover how long it will take to identify the tags and how many tags can be identified in a finite amount of time, all without actually building the large number of prototype tags. Toward this end, the identification method was optimized to identify 1500 tags with randomly assigned codes within 60 seconds. With the simulation, 50 tags were identified with randomly assigned codes within 1.5 seconds. With planned improvements in the code, 50 tags are expected to be identified in less than one second.

The powering amplifier, reader antenna, and tag powering circuitry for the tag receiver modules were successfully tested.

A communications link between the reader and the tag was defined and an initial bench-top system operation was verified.

The Bobbin Show exhibit demonstration was designed. It will consist of a conveyor belt system where a box-full of 50 tags will be identified as they pass a point on the belt. A computer will enumerate the items in the box. The components for the system have been procured and the computer interface designed.

An RF Expo was held in June at $[TC]^2$ where four industrial companies described their progress in developing an RF tag. LLNL, PNL, and AMTEX industry partners participated in the discussions. Plans are being made to meet with the industry representatives again to determine the applicability of their approaches to AMTEX user needs and their progress on actual prototypes.

Issues, Major Problems, and Resolutions

The major non-technical issue facing the EEF Project at this time is determining whether or not the commercial organizations represented at the recently held RFID Expo at $[TC]^2$ are adequately addressing, or will address in the near future, the AMTEX EEF partnership's needs and requirements. These are stated in the "User's Needs" statement, compiled by Amy Walker of Levi Strauss and Ron Gilbert of PNL, with input from the 20-member EEF AMTEX partnership. If these needs are not being adequately addressed, then the EEF project team should continue working to achieve those design goals, so the partnership will receive the product which they have requested.

Explanation of Variances

None.

Plans for Next Quarter

Goals for the July-September time frame include:

- Continue communications link development and testing
- Proceed with demonstration tag circuit board layout once final circuit is determined
- Test individual and multiple tags
- Assemble and test 50 tags for Bobbin Show
- Complete construction and development of Bobbin Show hardware
- Complete development of interface code for reader
- Complete software for Bobbin Show computer interface.

Invention Disclosures

Dave Benzel, IL-9790, June 1995.
Mike Doty, addendum to IL-9760, "RF Tags", January 17, 1995.

Publications/Presentations

On May 9th, Ron Gilbert, PNL, visited LLNL to discuss present and future plans. We designed the Bobbin Show display at this meeting.

On April 17-18, Jim Caldwell, $[TC]^2$, Arden Dougan, LLNL, and Ron Gilbert, PNL, demonstrated our FY94 Bobbin Show display at Levi Strauss' Technology 2000 meeting. Following the meeting, Dougan and Gilbert met with J.C. Penny managers to discuss the EEF project.

Ron Gilbert, PNL, presented a description of the system requirements for EEF to the industries represented at the RF Expo June 22nd.

The FY94 Bobbin Show RFID carousel has been is on display at $[TC]^2$ in Cary, North Carolina.

Rapid Cutting

The Rapid Cutting (RCUT) 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, LBNL/510-486-5298
Jim Caldwell, $[TC]^2$/919-380-2156

Performance Related to Milestones

The next key milestone for this project is scheduled for September 15, 1995. At that point, a year-end technical review of all tasks will occur, the optimum laser source will be identified, prototype tests for magnetic and pneumatic drivers will be complete, and a material handling prototype will be tested. Several peg point activities leading up to this milestone have occurred during this quarter:

1) A laser cutting workshop was held; the specific need for a laser cutting design review on August 8, 1995 was identified. There, the optimum laser will be selected.

2) Alpha prototype tests were completed on the multiple-ply, pneumatic drive cutting head. The team has gone to the additional phase of using the device as an accelerated-wear blade test stand. This test stand will also serve to alpha test the electric voice coil driver.

3) The material handling effort has been redirected to interface with continuous wave CO_2 laser at $[TC]^2$. Because a final cutting architecture will not be finalized until the beginning of FY97,

designing a material handling system for the [TC]^2 facility will showcase the SNL technology in the next year.

The final date for the year-end technical review is now September 21, 1995. With key supporting activities occurring along the way, there is high probability that these milestones will be met.

Activities and Technical Accomplishments for the Quarter

A major quarterly progress review with the laboratory/industry team was held at [TC]^2, Cary, North Carolina, June 23. It was concluded that the present accomplishments and technical scope of the RCUT project were on track.

A laser cutting workshop was held in New Orleans, LA April 4. There, key technical work was reviewed in detail. A path forward toward a laser cutting design review to be held in August, 1995 was recommended.

Field trips by both laboratory and industry partners during this period were made to Haggar, Williamson-Dickie, Levi, and Eastman (North Technologies).

The FY96 RCUT Project Plan was written and submitted for AMTEX Program and DOE review. Also, a working RCUT systems document, describing all salient performance requirements of a rapid cutting system, was generated and reviewed by partners.

Specific activities and technical accomplishments follow.

Blades

LANL lead the effort to develop a pre-Beta laboratory test plan. Input from Industry, ANL, LBNL, and ORNL were consolidated. Blades from an automated cutter were honed and a benchmark was established. Several collaboration meetings were held at the Beta test site at Levi Strauss, Texas.

Pieces of high-speed steel cutting blades and other test pieces were coated with various formulations of hard carbon coatings to a nominal thickness of one micrometer. Thin glass circles were used to measure residual stress of the coatings. Coating stress was compressive and varied from 84 to 209 kpsi. Optical interferometry of test coupons was used to measure film thickness. A pull-type adhesion tester was used to gauge adhesion. In all cases, it was not possible to pull the coatings from the steel blades.

LBNL applied diamond-like-coatings on several pressure wheel cutters. ORNL has extruded both nickel and iron aluminide compositions. These are in the process of final machining for pre-Beta testing. LANL appears to be successful in finding a good material substitution for beryllium.

At ANL, CO_2, and YAG laser cutting on a baseline array of fabrics was completed.

Two different companies were visited by ORNL's new postdoctoral research fellow, Craig Blue. The nickel and iron aluminide cutting blade development work at ORNL is ongoing, with blades being fabricated, and blade performance testing apparatus finished.

Mechanical Cutting

At LBNL, a linear cutter test fixture has been built to measure the performance of newly-developed reciprocating blades and drivers under actual fabric cutting conditions. The pneumatic driver has undergone initial performance testing using this test fixture and shows promise as a lightweight alternative driver for multiple-ply cutting. A financial analysis comparing the costs of different mechanical cutting methods was performed.

LBNL has identified pressure wheel cutting as having the greatest potential for realizing high-speed, mechanical, single-ply cutting. The limitations of existing devices have been studied and understood. Several new ideas for high-speed pressure wheel cutting have been formulated and are now being studied for feasibility.

Laser Cutting

An updated array of textile samples was solicited from the industry partners. Representing materials used in their commodity product line, this condensed array consists of denim from Levi, air bag polyester from American Bag/Millikin, cotton/polyester and pure cotton from Sara Lee and Russell.

Updated trial cuts were conducted using wavelength and pulse characteristics derived from preliminary tests. All textiles were cut using all selected laser sources. Minimum power levels best pulse characteristics for optimal cutting were determined by all participating laboratories.

This completes the laser cutting database. Work from this period to the scheduled laser design review on August 8, 1995 will consist of proposed Alpha prototype and conceptual designs.

LANL reports the following accomplishments:

- Cloth-cutting data using KrF laser at 248-mm wavelength has been compiled. Power requirements to cut at the 200-inches-per-second goal have been determined for six different kinds of cloth.

- Cloth-cutting data using XeF lasers at 351-mm wavelength is complete. Power requirements to cut at the 200-inches-per-second goal have been determined for three different kinds of cloth.

- Data analysis continues as indicated in the Joint Work Statement (JWS) plan.

- Several projection system conceptual designs have been considered. A best choice will not be determined until all cutting data is analyzed.

At ANL:

- Work on obtaining data on fabric cutting with CO_2 and YAG lasers was completed. The results were reported in the RCUT workshop, May 31, 1995, at Salt Lake City, Utah and in the Project Review meeting of June 23, 1995, in Cary, North Carolina.

- For mechanical cutting, six types of hard carbon coatings were deposited on test coupons. Residual stress, thickness, and adhesion measurements were made on the coatings.

  At LLNL, both copper vapor lasers (CVLs) and diode-pumped, solid-state lasers (DPSSLs) were the sources used to optimally cut the revised baseline array of textiles. The use of CVLs as a surrogate closely approximates double-pumped DPSSLs.

Specific accomplishments follow:

- A DPSSL oscillator was operated at 700 Hz at reduced power levels. This was later increased in power to verify theories on threshold power scaling.

- Better cut quality was achieved with CVL as a source. Cut samples were reviewed by Industry. Quality standards were established. Beam transport by conventional fiber optic delivery systems appears to be impractical.

- A simple thermodynamic model of the laser cutting process was generated. Theory was verified with test cutting on a modified (Q-switched) DPSSL oscillator. Here, shorter pulse format and wavelength tend to increase quality of cutting. To verify scaling of power and cutting speed at 200 inches per second, a stationary beam and a rotating platform of target cloth was arranged to determine threshold power levels.

- A 1992 commercialization study of DPSSLs said, based on modest market demands on present continuous save CO_2 systems, the cost is $25.33 per watt is less than 100-watt, single-source modules.

Recent research in other laser manufacturing venues suggest an eight-fold decrease in source price in the next few years. This laser technology may totally fulfill the cost and performance levels mandated by this project.

At ORNL:

The nickel and iron aluminide alloy composition for cutting blade fabrication was identified. Powders of selected compositions were procured, consolidated into bar stock, then rolled into flat product for blade stock. Blades to fit Eastman hand cutters were machined and are currently awaiting testing.

Material Handling

Conceptual designs were generated by SNL to interface with 150 inches-per-second class lasers now under performance development at [TC]^2. Material in this application is transported and cut in approximately 10-foot increments or bites. Here, cut piece parts from a bite advance table would be picked, sequenced and fed into an Eton or other unit production system. The design of this system represents a technical direction as most schemes under conceptual design assume cutting is performed on a continuous material feed basis.

Issues, Major Problems, and Resolutions

None.

Explanation of Variances

None.

Plans for Next Quarter

Blades

Pre-Beta testing of the first suite of blades will provide guidance on optimum configurations for Beta testing by Industry. Test results are planned for review on September 21, 1995.

The scheduled depositions of candidate advanced coatings should also be completed. Nanohardness measurements on the samples and blades will be coated with the most promising coating for testing at LANL and at industrial sites.

Mechanical Cutting /LBNL

The designs will proceed on a pressure wheel cutter for a 200-inches-per-second, single-ply cutter using a modularized architecture. Fabrication of the voice coil driver and power supplies will be completed. Alpha testing will be concluded and ready for reporting September 21, 1995.

The magnetic drivers previously ordered should arrive shortly, and will be incorporated into the test fixture for evaluation. New

technology blades from both LBNL and the other national laboratories will be tested in the linear cutting test fixture against standard Eastman blades, all sharpened similarly.

Laser Cutting
Design review is scheduled for August 8, 1995 at LLNL. Based on test results, a candidate source will be selected to proceed on to alpha prototyping.

The 308-nm XeCl laser cutting will be completed. This data will be compared with the 248- and 351-nm data. A projection system conceptual design will be chosen based on this data.

The final report regarding work on fabric laser cutting will be prepared. It will summarize in a "User's Manual" format, pertinent information on laser cutting of fabrics with existing industrial lasers. In addition, it will include an assessment of the possible use of beam fiber optic transport for both CO_2 and YAG lasers for existing and near-term technologies. The report on laser cutting with existing lasers will be complementary to the RCUT effort on developing future lasers for industrial fabric cutting.

Invention Disclosures

None to report this quarter.

Publications/Presentations

None to report this quarter.

Sensors for Agile Manufacturing

The Sensors for Agile Manufacturing (SFAM) 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

A final letter report pertaining to the development of electromagnetic based felled seam sensing was completed.

Activities and Technical Accomplishments for the Quarter

A letter report outlining the efforts to use electromagnetic sensors in felled seaming was completed. This technique did not prove to be a feasible method of sensing the position of fabric edges, but may be an excellent method of determining the number of fabric plies in a stack of fabric.

The prototype fabric edge sensor was enhanced this quarter. A serging sewing machine was received from Levi Strauss & Co. This sensor will be integrated into this machine. A technician from the Levi Albuquerque plant assisted SNL engineers and technicians in the setup of this machine.

A felled seam sensor is currently undergoing integration into a felled seam sewing machine at SNL. This machine was supplied by $[TC]^2$ and it has the fabric position drives installed to automatically position the fabric.

$[TC]^2$ held two "Blue Sky" meetings in Raleigh, North Carolina during this quarter. The purpose of these meetings was to determine the driving technological factors with making major strides in productivity and quality in the sewn products portion of the textile industry.

SFAM project staff were invited by Levi Strauss & Company to participate in their Technology 2000 show in Dallas, Texas in April. This provided an excellent opportunity to get wide visibility within one of our largest industrial partners. It also provided an outstanding opportunity for laboratory researchers to see other engineering developments and have open discussion with the developers of automation equipment related to apparel.

The task team for the advanced sewing sensors was assembled at PNL. This team traveled to $[TC]^2$ where initial training and discussions were held on the possible requirements for this task. $[TC]^2$ will supply a lock stitch and chain stitch sewing machine for this task. Engineers will use these machines as a test bed for sensor development.

Issues, Major Problems, and Resolutions

None to report.

Explanation of Variances

None to report.

Plans for Next Quarter

Continue integration of the felled seam sensor on the felled seam sewing machine and the fabric edge sensor on a serging machine.

A meeting will be held in Dallas in July to set the system performance requirements for the advanced sewing sensors. Representatives from the industry partners, $[TC]^2$, and the laboratory task team will be in attendance.

A requirements document for the advanced sewing sensors task will be completed in the fourth quarter of FY95. This will be followed by a preliminary design review to be held with the industry partners.

Project status will be presented at the AMTEX Industrial Technical Advisory Committee meeting to be held in Charlotte, North Carolina and the AOC meeting to be held in Knoxville, Tennessee. Both of these meetings are to be held in July.

Invention Disclosure

No invention disclosures this quarter. An invention disclosure on the felled seam sensor is currently pending at Sandia.

Publications/Presentations

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

Project staff participated at Levi Strauss & Co.'s Technology 2000 exposition in Dallas, Texas.

Textile Resource Conservation

The objective of the Textile Resource Conservation (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. The Slashing Initiative proposals were reviewed by an industry group and the Savannah River Technology Center (SRTC) lead team was judged to have the best overall approach. Development of design for a salt recovery prototype to be taken into a textile mill is behind schedule, pending the industry decision confirming the location of the test site and the participation of the Industry Research Partners in the acquisition of the test unit. Tests on spent dyebath and rinse water from one of the partners to firm up process design parameters is

underway and only slightly behind schedule due to some delay in acquiring samples.

A joint industry/laboratory review of one approach being explored for the recovery of fibrous solid wastes determined the specific approach was uneconomical. Therefore, an industry recommended change in direction has resulted in the milestones for this task being delayed.

Metals speciation methods development is on schedule with samples being received from industry partners for methods validation.
All other tasks within the TReC Project are performing according to the project plan and did not have milestones within this quarter.

Quarterly Activities and Technical Accomplishments

The AMTEX TReC Project had its annual Industry/Laboratory Review meeting in Charlottesville, Virginia on June 27-28, 1995. Salt recovery researchers have reported being able to obtain 90-95% recovery of salt from dye bath and rinse water, with the salt recovered as an 18-19% brine solution. Treated water has salt concentrations <1% and has been deemed by the Industry Research Partners as suitable for reuse in other parts of the textile manufacturing process. Dye recovery techniques have been able to remove >90% of the dye from spent dyebath streams and recover these dyes in concentrated forms for potential reuse.

The fibrous solid waste recovery task team has performed an economic analysis on a chemical recovery process being explored. The results of the analysis have indicated, at the present state of technology, that the costs of process operation did not warrant the economic gains in this approach. Accordingly, the laboratories involved have ceased this line of effort and directed the research into more promising avenues.

Air emissions monitoring researchers are making progress in packaging their sensors for field testing. A field test to characterize certain emissions from a finishing process is scheduled for an industry partners plant in July.

Low waste chemical applications work is proceeding , although with some disruption to the program at ORNL due to the loss of the main principal investigator to take a position at a university. This work in an advanced application system has been assumed by another investigator on the task and the work is proceeding, although slower than preferred. Advanced washing technique research is proceeding to the industry's' satisfaction with water/cloth ratios brought down to less than 5:1.

Alternative cleaning tasks have shown progress with the work at the Idaho National Engineering Laboratory (INEL) being geared up for an in-plant test in August. Spinnerette cleaning techniques have been developed for polyester coated spinnerettes and the initial industry quality evaluation is promising. These techniques will be extended to

polypropylene removal with an in-plant field test expected in early FY 1996.

Several meetings have been held with regard to the formulation of Environmental Decision Tools Models and the development of a program to implement these models in the textile industry. A joint industry/laboratory meeting to explore industry needs for these tools and the capabilities of the laboratories to supply them took place in April and helped to solidify several issues.

The Slashing Initiative proposals were reviewed by an industry team and the needs of the industry were prioritized in order to help select the team approach which best fit the industry needs. The textile industry review team felt that the team headed by the SRTC, and including Argonne and ORNL, had the proposal that best fit the priority needs. The industry team also recommended the innovative work proposed by the INEL be included in the new Slashing Initiative.

Issues, Major Problems, and Resolutions

Issues that have arisen this quarter primarily center around the delays experienced by some 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.

Explanation of Variances

Variances in milestones and deliverables from the Project Plan are minor. The changes will better align national laboratory research efforts with textile industry needs.

Plans for Next Quarter

During the next quarter (July-September, 1995) laboratory researchers will continue their programs with directions which are modified slightly based on the TReC Industry/Laboratory Review meeting in June. Field tests are planned for air emissions monitor testing and the advanced cleaning of a dye machine during the months of July and August. The FY1996 Project Plan will be finalized, based on funding information from the DOE and the project presentation to the ITAC. Several task assignments which will not be continuing into FY1996 will be finishing their work and preparing final reports during this quarter.

Invention Disclosures

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

Publications/Presentations

No publication or presentations were reported during this quarter to the Project Managers Office.

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	3RD 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.:

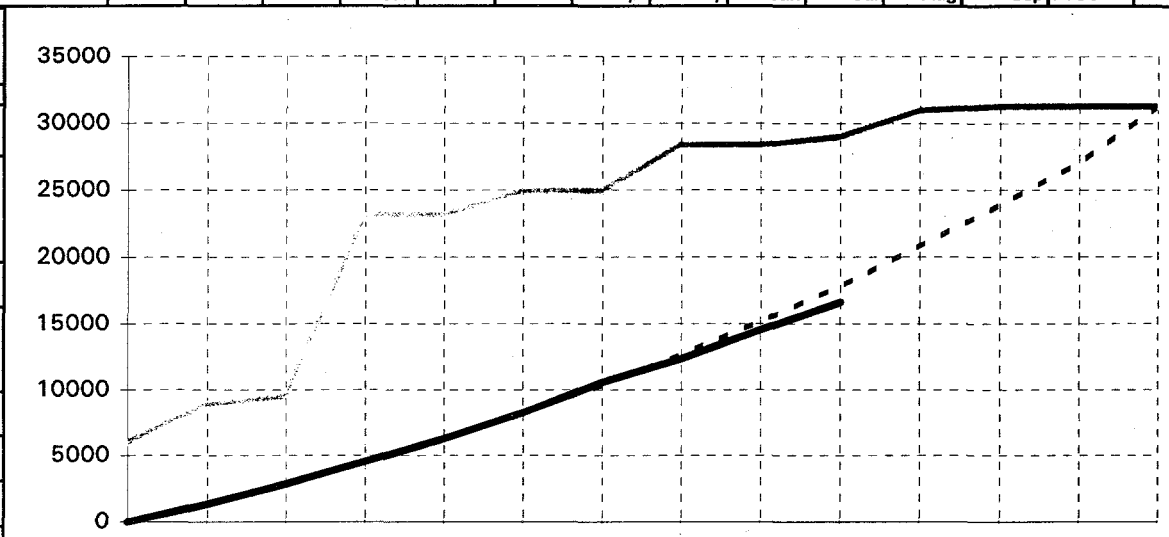
d. ACTUAL COSTS PRIOR YEARS: $13,863

e. ER BUDGET *: $19,061

f. DP BUDGET *: $12,238

g. ER FUNDS AUTH: $18,866

h. DP FUNDS AUTH: $10,134



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	711	860	1006	1125	1234	1232	1426	1499	1649	1809	1884	1956	2670
	ACTUAL	721	867	987	1106	1162	1059	1038	1174	1176				
	VARIANCE	-10	-7	19	19	72	173	388	325	473	1809	1884	1956	2670
	CUM PLANNED	711	1571	2577	3702	4936	6168	7594	9093	10742	12551	14435	16391	19061
	CUM ACTUAL	721	1587	2574	3680	4842	5901	6939	8113	9289				
	CUM VARIANCE	-10	-16	3	22	94	267	655	980	1453	12551	14435	16391	19061
j. DP COSTS	PLANNED	585	620	680	700	730	860	890	1010	1040	1170	1185	1220	1548
	ACTUAL	604	645	703	631	830	1266	737	997	921				
	VARIANCE	-19	-25	-23	69	-100	-406	153	13	119	1170	1185	1220	1548
	CUM PLANNED	585	1205	1885	2585	3315	4175	5065	6075	7115	8285	9470	10690	12238
	CUM ACTUAL	604	1249	1952	2583	3413	4679	5416	6413	7334				
	CUM VARIANCE	-19	-44	-67	2	-98	-504	-351	-338	-219	8285	9470	10690	12238
k. TOTAL COSTS	PLANNED	1296	1480	1686	1825	1964	2092	2316	2509	2689	2979	3069	3176	4218
	ACTUAL	1324.5	1511.7	1690	1737	1992	2325	1775	2171	2097				
	VARIANCE	-29	-32	-4	88	-28	-233	541	338	592	2979	3069	3176	4218
	CUM PLANNED	1296	2776	4462	6287	8251	10343	12659	15168	17857	20836	23905	27081	31299
	CUM ACTUAL	1325	2836	4526	6263	8255	10580	12355	14526	16623				
	CUM VARIANCE	-29	-60	-64	24	-4	-237	304	642	1234	20836	23905	27081	31299

9. MILESTONES

(REFER TO INDIVIDUAL PROJECT REPORTS)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $4,011K, DP - $2,238K, TOTAL - $6,249K).

10. NAME OF PARTICIPANT'S PROGRAM MANAGER

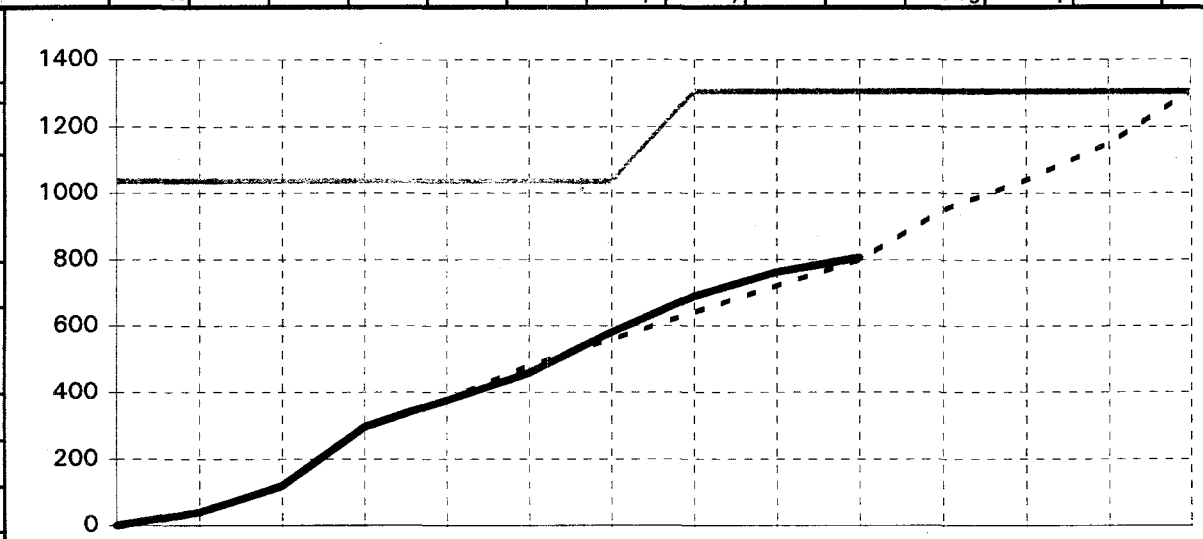
DOUGLAS K LEMON

PROJECT SUMMARY REPORT

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

4a. PARTICIPANT NAME AND ADDRESS	4b. CLIENT NAME AND ADDRESS	5. START DATE / 6. COMPLETION DATE
AMTEX 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
c. FIN. NO.:
d. ACTUAL COSTS PRIOR YEARS: $1,659
e. ER BUDGET *: $1,305
f. DP BUDGET *: $0
g. ER FUNDS AUTH: $1,305
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	40	80	180	80	100	80	80	80	80	150	90	110	155
	ACTUAL	41	80	177	78	83	123	108	74	44				
	VARIANCE	-1	0	3	2	17	-43	-28	6	36	150	90	110	155
	CUM PLANNED	40	120	300	380	480	560	640	720	800	950	1040	1150	1305
	CUM ACTUAL	41	121	298	375	458	581	689	763	807				
	CUM VARIANCE	-1	-1	2	5	22	-21	-49	-43	-7	950	1040	1150	1305
j. DP COSTS	PLANNED	0	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	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	0	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	40	80	180	80	100	80	80	80	80	150	90	110	155
	ACTUAL	41	80	177	78	83	123	108	74	44				
	VARIANCE	-1	0	3	2	17	-43	-28	6	36	150	90	110	155
	CUM PLANNED	40	120	300	380	480	560	640	720	800	950	1040	1150	1305
	CUM ACTUAL	41	121	298	375	458	581	689	763	807				
	CUM VARIANCE	-1	-1	2	5	22	-21	-49	-43	-7	950	1040	1150	1305

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
AMTEX Quarterly Report				▲			▲		▲		△		
AMTEX Policies & Procedures Manual										△			
AMTEX FY 1996 Operating Plan											△		

* BUDGETS INCLUDE CARRYOVER FROM FY 1994 (ER - $39K, DP $0K, TOTAL - $39K).

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	COMPUTER-AIDED FABRIC EVALUATION (CAFE)	3RD 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.:

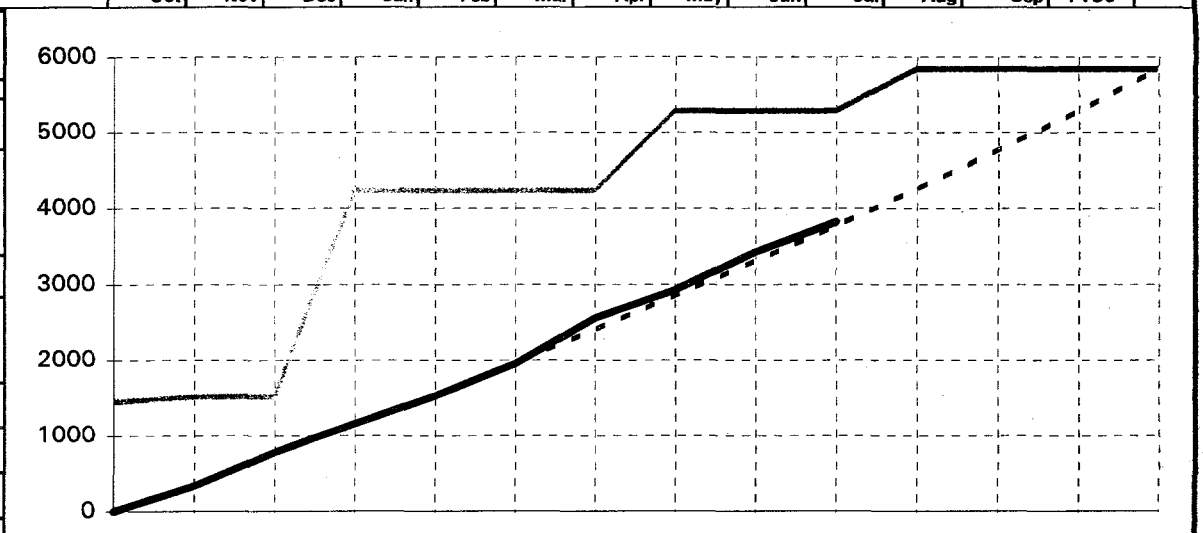
d. ACTUAL COSTS PRIOR YEARS: $1,906

e. ER BUDGET *: $2,597

f. DP BUDGET *: $3,246

g. ER FUNDS AUTH: $2,597

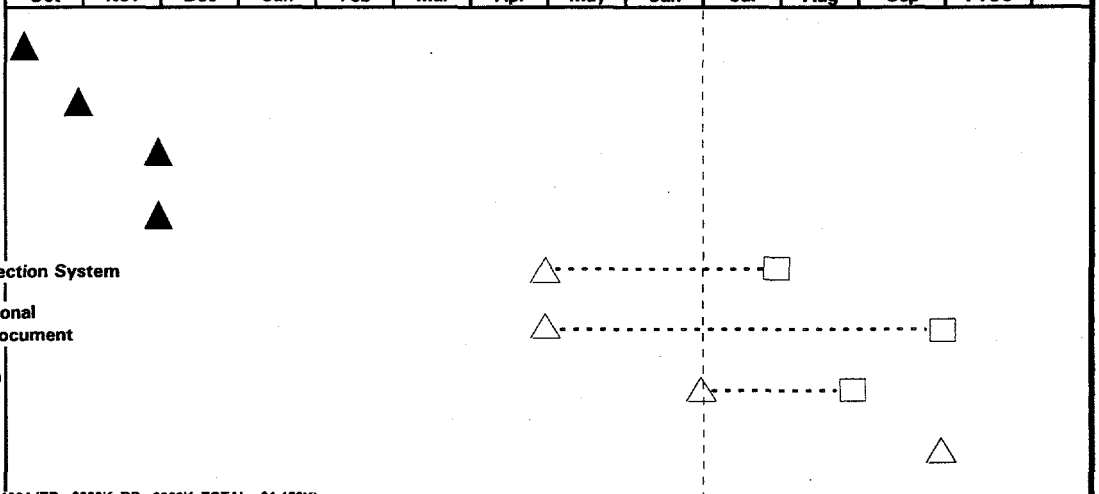
h. DP FUNDS AUTH: $2,686



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	184	271	202				
	VARIANCE	5	-4	-4	-53	-29	7	17	-71	-2	220	240	240	227
	CUM PLANNED	190	450	560	710	890	1070	1270	1470	1670	1890	2130	2370	2597
	CUM ACTUAL	185	449	563	766	975	1148	1332	1602	1804				
	CUM VARIANCE	5	1	-3	-56	-85	-78	-62	-132	-134	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	191	231	195				
	VARIANCE	-1	-4	5	72	27	-171	59	29	66	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	1593	1825	2019				
	CUM VARIANCE	-1	-5	0	72	99	-72	-13	15	81	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	375	502	396				
	VARIANCE	4	-8	1	19	-3	-164	76	-42	64	490	510	520	553
	CUM PLANNED	340	780	1160	1550	1970	2400	2850	3310	3770	4260	4770	5290	5843
	CUM ACTUAL	336	784	1163	1534	1956	2551	2925	3427	3823				
	CUM VARIANCE	4	-4	-3	16	14	-151	-75	-117	-53	4260	4770	5290	5843

9. MILESTONES



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

LEGEND: SCHEDULED, COMPLETED, DEVIATION, TIMELINE, PROGRESS, PROPOSED DEVIATION, 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	COTTON BIOTECHNOLOGY	3RD 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.:

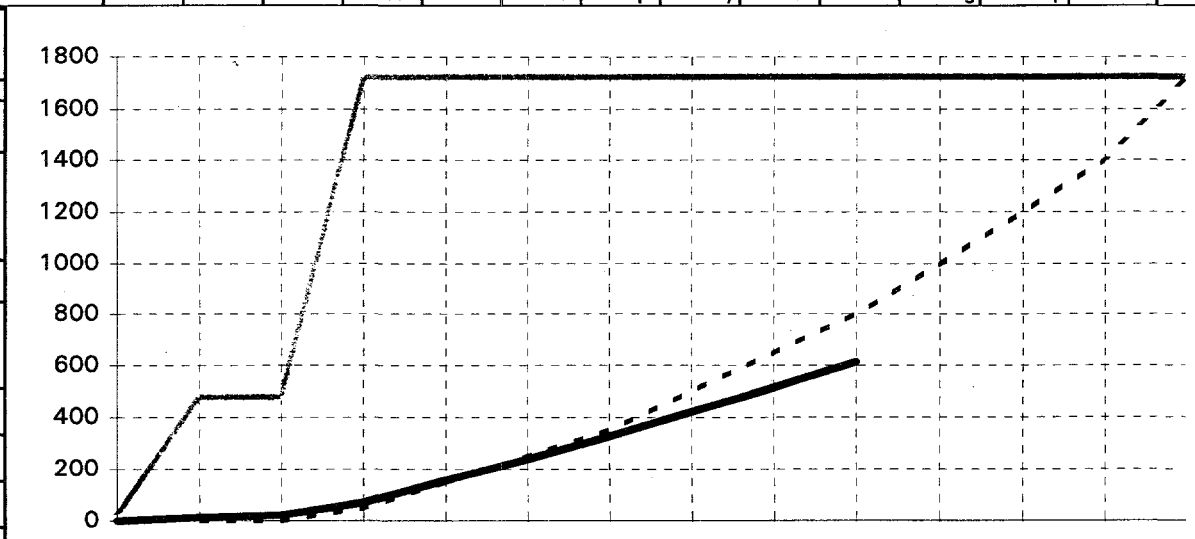
d. ACTUAL COSTS PRIOR YEARS: $0

e. ER BUDGET *: $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	95	93	101				
	VARIANCE	-13	-9	0	15	18	14	55	57	50	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	420	513	614				
	CUM VARIANCE	-13	-22	-22	-7	11	24	80	137	186	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	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	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	95	93	101				
	VARIANCE	-13	-9	0	15	18	14	55	57	50	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	420	513	614				
	CUM VARIANCE	-13	-22	-22	-7	11	24	80	137	186	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

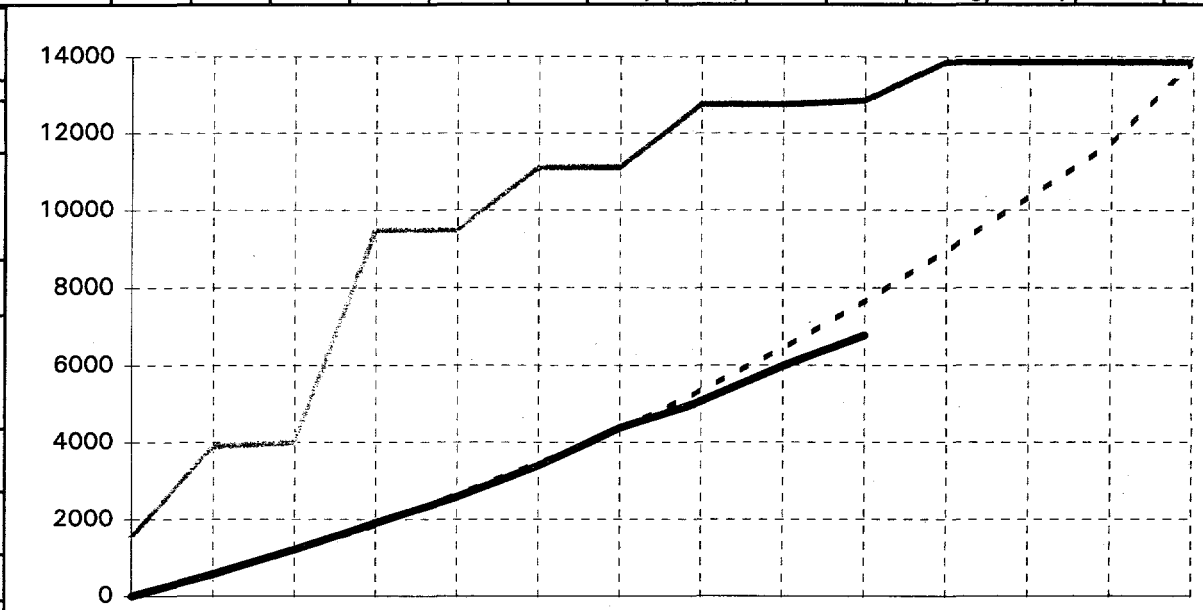
BEN BURR (BNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	DEMAND-ACTIVATED MANUFACTURING ARCHITECTURE (DAMA)	3RD 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

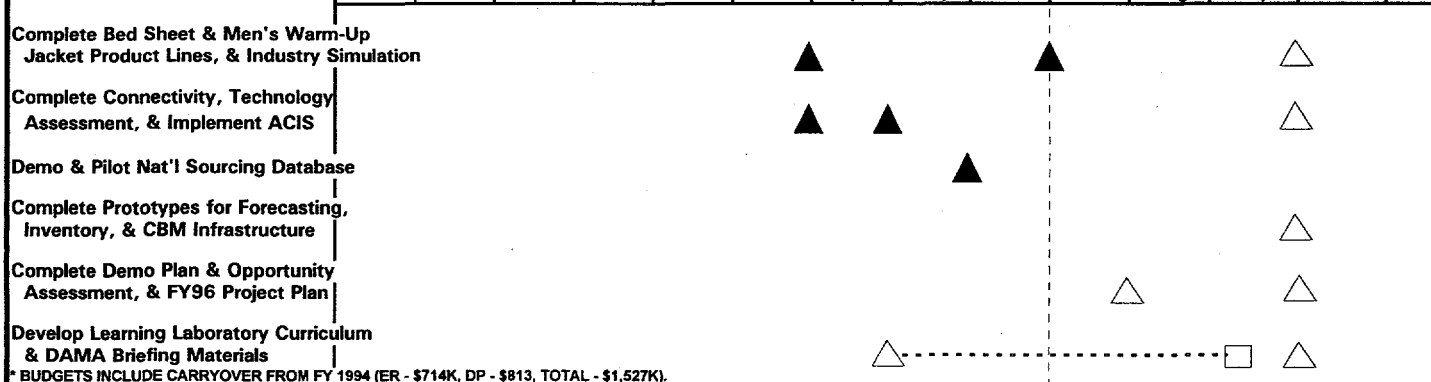
7. PROJECT YEAR	8. COST STATUS	a. $ EXPRESSED IN	b. BUDGET & REPORTING NO./SUB. ACCT NO.	c. FIN. NO.	d. ACTUAL COSTS PRIOR YEARS	e. ER BUDGET *	f. DP BUDGET *	g. ER FUNDS AUTH	h. DP FUNDS AUTH
FY 1995		THOUSANDS	KU-01-00-000 GB-01-06-010		$7,527	$7,834	$6,009	$7,834	$5,004



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	325	381	336				
	VARIANCE	2	-1	7	143	107	149	275	219	364	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	2408	2789	3125				
	CUM VARIANCE	2	1	8	151	258	407	682	901	1265	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	380	529	467				
	VARIANCE	-17	-24	-22	-16	-115	-231	20	-29	33	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	2665	3194	3661				
	CUM VARIANCE	-17	-41	-63	-79	-194	-425	-405	-434	-401	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	705	910	803				
	VARIANCE	-15	-25	-15	127	-8	-82	295	190	397	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	5073	5983	6786				
	CUM VARIANCE	-15	-40	-55	72	64	-18	277	467	864	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	ELECTRONIC EMBEDDED FINGERPRINT (EEF)	3RD 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: 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.:

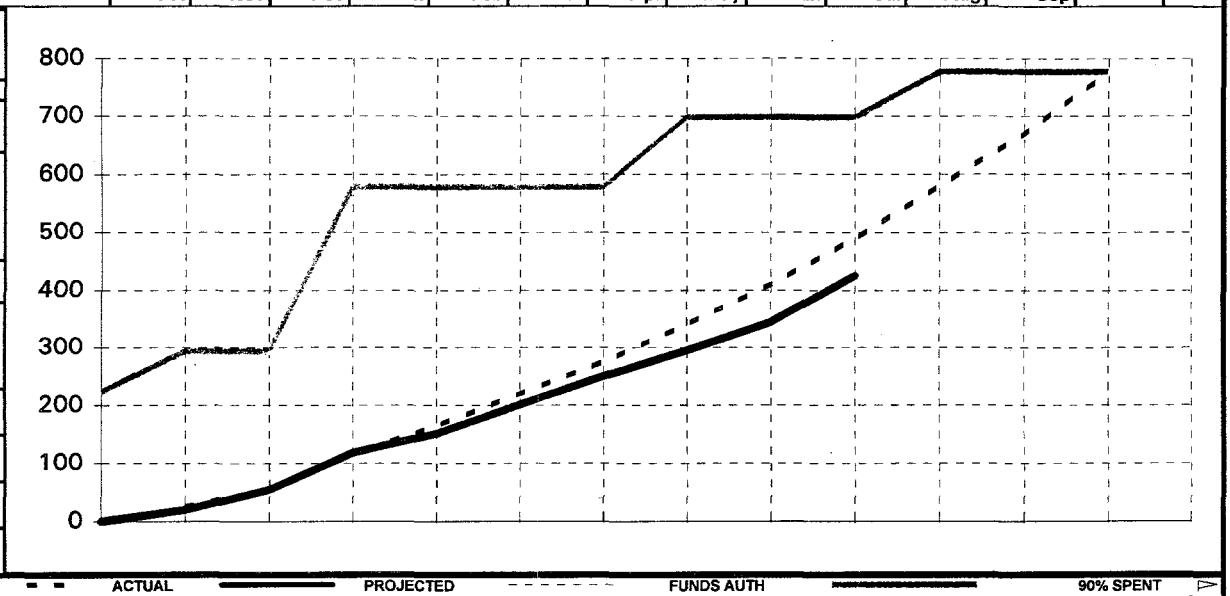
d. ACTUAL COSTS PRIOR YEARS: $107

e. ER BUDGET *: $232

f. DP BUDGET *: $545

g. ER FUNDS AUTH: $232

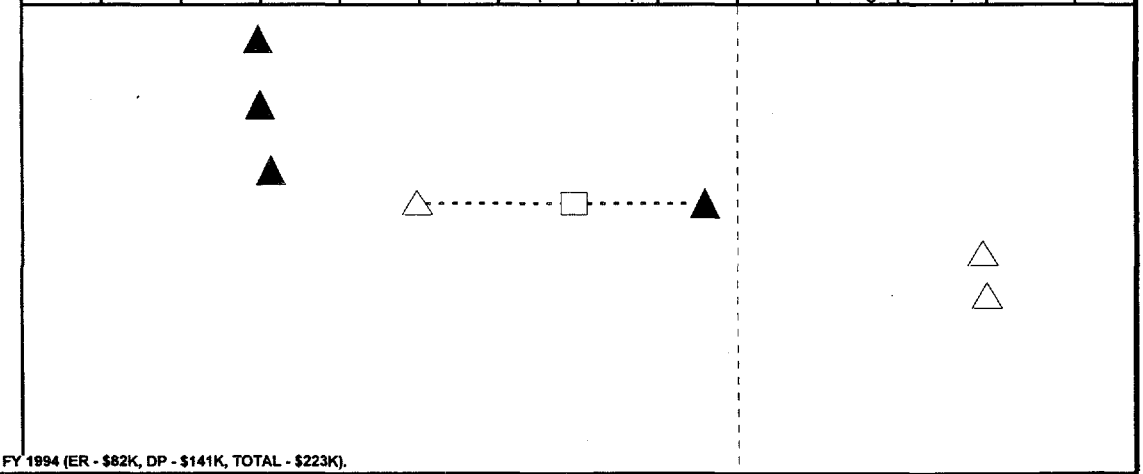
h. DP FUNDS AUTH: $466



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	12	9	18			
	VARIANCE	2	-2	1	6	6	3	3	11	8	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	72	81	99			
	CUM VARIANCE	2	-1	1	7	12	15	18	29	36	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	33	40	64			
	VARIANCE	4	-3	-4	10	0	3	18	10	-9	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	223	263	326			
	CUM VARIANCE	4	1	-3	7	7	10	27	37	29	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	45	49	81			
	VARIANCE	5	-5	-3	16	5	6	20	21	-1	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	295	344	425			
	CUM VARIANCE	5	0	-2	14	19	25	45	66	65	580	670	777

9. MILESTONES



* 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	ON-LINE PROCESS CONTROL (OPCon)	3RD 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.:

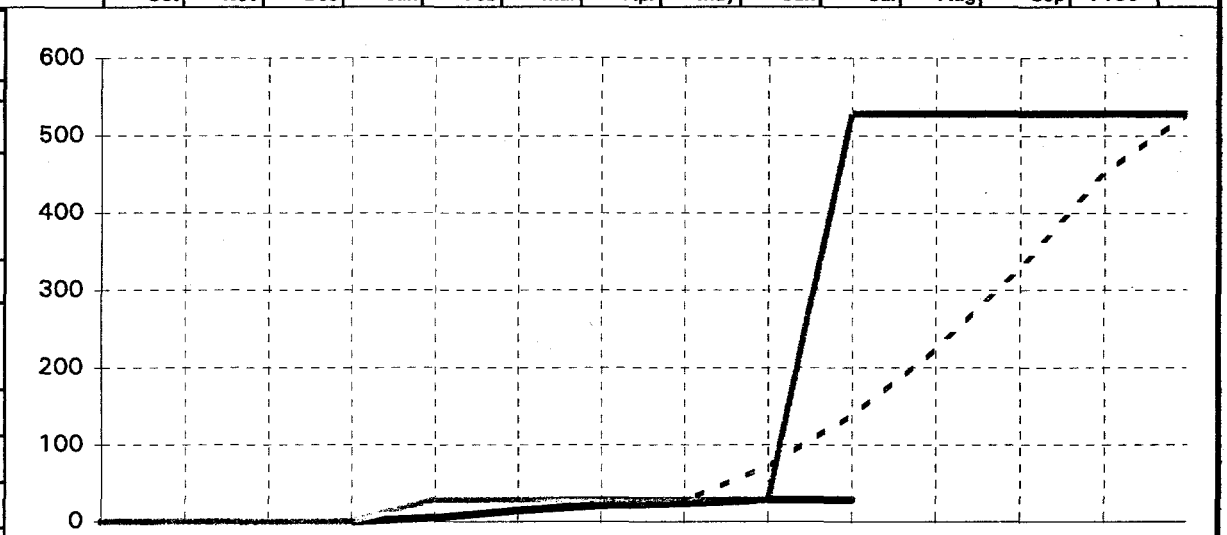
d. ACTUAL COSTS PRIOR YEARS: $0

e. ER BUDGET: $413

f. DP BUDGET: $115

g. ER FUNDS AUTH: $413

h. DP FUNDS AUTH: $115



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	3	4	0				
	VARIANCE	0	0	0	0	0	0	4	31	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	24	28	28				
	CUM VARIANCE	0	0	0	0	-1	0	4	35	85	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	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	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	3	4	0				
	VARIANCE	0	0	0	0	0	0	4	41	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	24	28	28				
	CUM VARIANCE	0	0	0	0	-1	0	4	45	110	223	328	453	528

9. MILESTONES

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY96
Prepare Project Plan	▲												
OPCon1: Subset of Characteristics Defined										△			
OPCon1: FY95 Report with Data and Recommendations											△		
OPCon2: Alpha Test on NIR Finish Oil Measurements										△			
OPCon3: Tests of Optical Scattering on Static Fibers											△		
OPCon3: Report Describing Lab Tests and Simulation Results										△			
OPCon4: Alpha Test for Viscosity Measurements											△		

LEGEND: SCHEDULED △ TIMELINE PROPOSED DEVIATION

COMPLETED ▲ DEVIATION □ PROGRESS APPROVED DEVIATION

10. NAME OF PARTICIPANT'S PROJECT MANAGER

MARC SIMPSON (ORNL)

PROJECT SUMMARY REPORT

1. IDENTIFICATION (CONTRACT NO.)	2. TITLE	3. REPORTING PERIOD
21286	RAPID CUTTING	3RD 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: 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.:

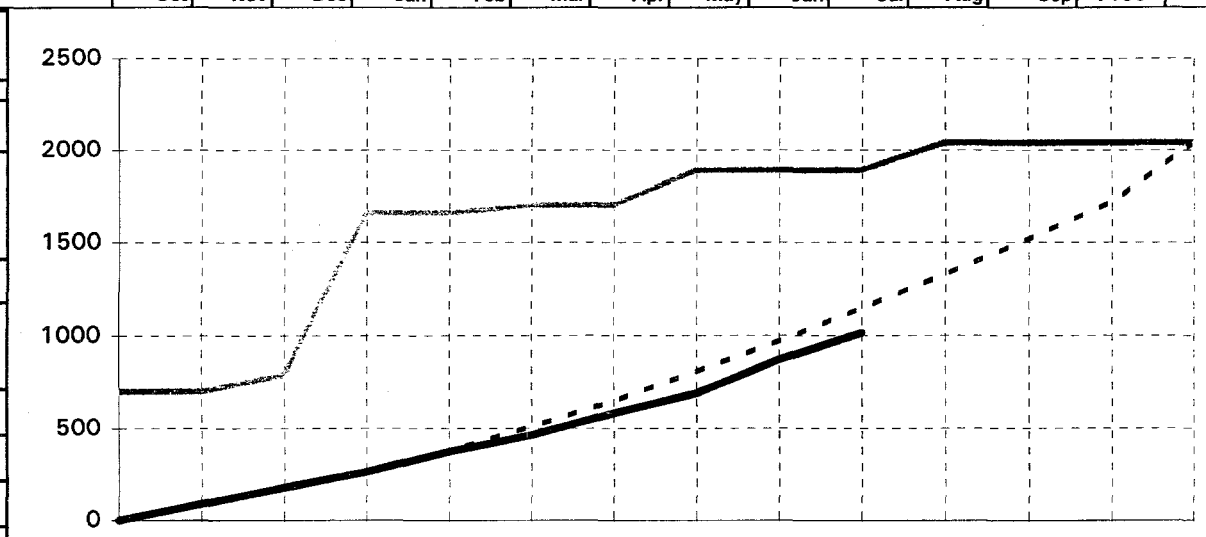
d. ACTUAL COSTS PRIOR YEARS: $209

e. ER BUDGET *: $1,132

f. DP BUDGET *: $909

g. ER FUNDS AUTH: $1,132

h. DP FUNDS AUTH: $759



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	61	62	54	82	56	55	52	83	62				
	VARIANCE	-1	-2	6	-22	14	25	28	-3	29	90	90	100	212
	CUM PLANNED	60	120	180	240	310	390	470	550	640	730	820	920	1132
	CUM ACTUAL	61	122	176	258	315	369	421	504	566				
	CUM VARIANCE	-1	-2	4	-18	-4	21	49	46	75	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	54	101	80				
	VARIANCE	-1	3	0	20	27	-5	26	-21	10	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	269	370	449				
	CUM VARIANCE	-1	3	3	23	50	46	71	50	61	600	700	800	909
k. TOTAL COSTS	PLANNED	90	90	90	110	130	140	160	160	180	180	190	200	321
	ACTUAL	91	88	84	111	89	120	106	184	141				
	VARIANCE	-1	2	6	-1	41	20	54	-24	39	180	190	200	321
	CUM PLANNED	90	180	270	380	510	650	810	970	1150	1330	1520	1720	2041
	CUM ACTUAL	91	180	264	375	464	584	690	874	1015				
	CUM VARIANCE	-1	0	6	5	46	66	120	96	135	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 - $194K, 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	3RD 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.:

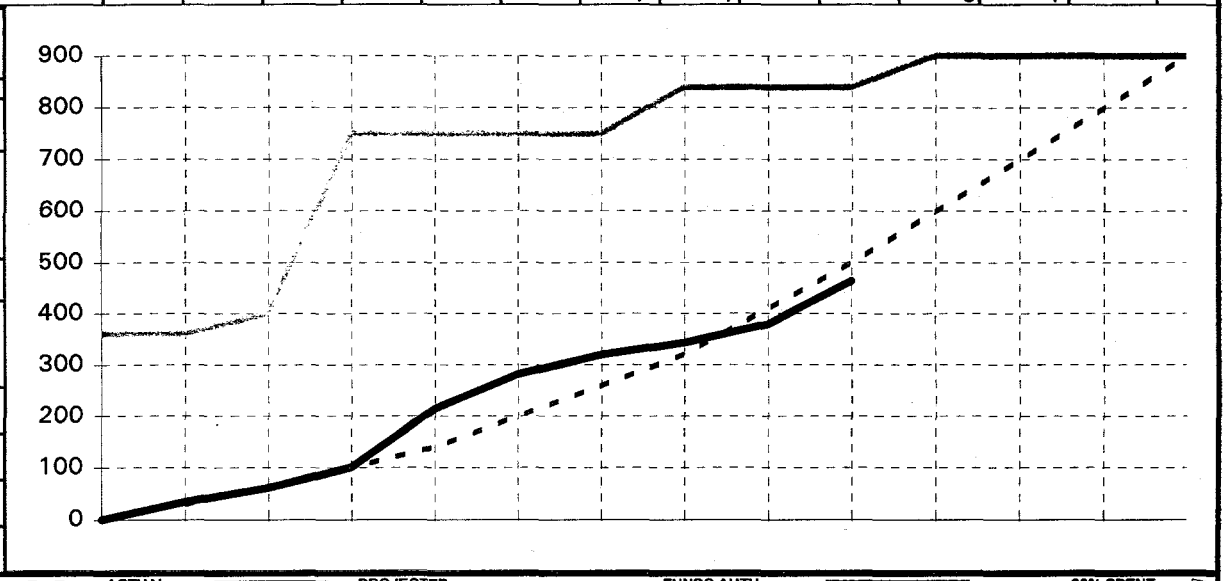
d. ACTUAL COSTS PRIOR YEARS: $100

e. ER BUDGET *: $441

f. DP BUDGET *: $459

g. ER FUNDS AUTH: $441

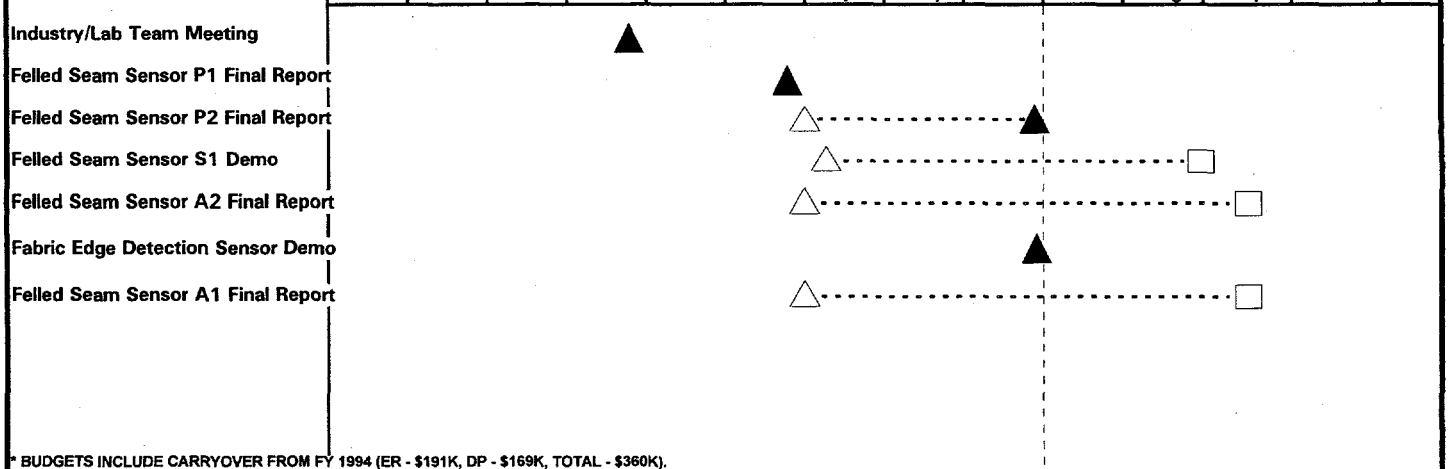
h. DP FUNDS AUTH: $399



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	13	24	60				
	VARIANCE	-6	6	0	-58	10	11	7	26	-10	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	166	189	250				
	CUM VARIANCE	-6	0	0	-58	-48	-37	-31	-4	-15	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	11	12	25				
	VARIANCE	1	2	-4	-16	-17	12	29	28	15	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	178	190	215				
	CUM VARIANCE	1	3	-1	-17	-34	-22	7	35	50	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	24	36	85				
	VARIANCE	-5	8	-4	-74	-7	23	36	54	5	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	344	379	465				
	CUM VARIANCE	-5	3	-1	-75	-82	-59	-24	31	35	600	700	800	900

9. MILESTONES



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

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

COMPLETED ▲ DEVIATION □ PROGRESS ▬▬▬ 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	TEXTILE RESOURCE CONSERVATION (TReC)	3RD 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.

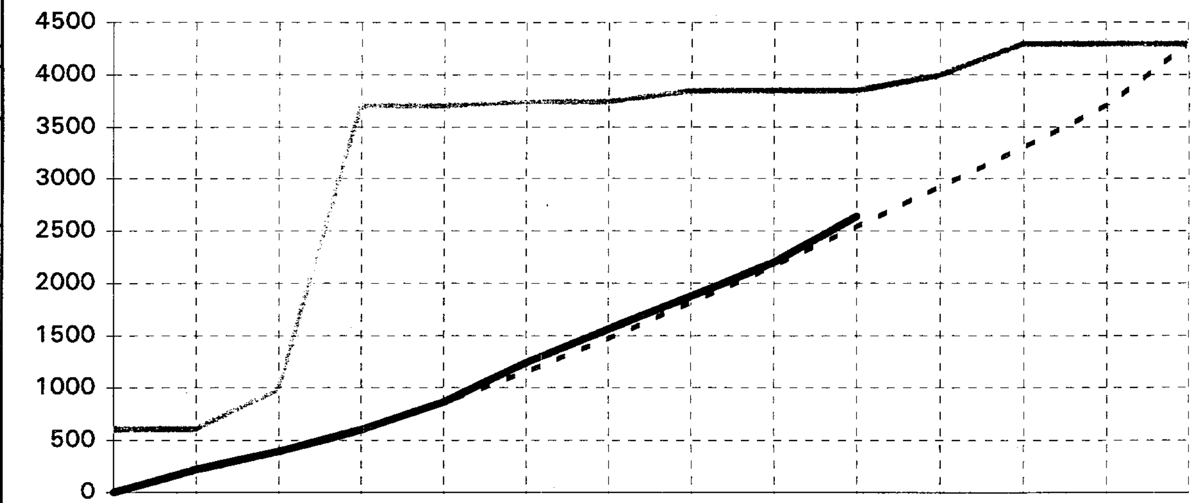
d. ACTUAL COSTS PRIOR YEARS
$1,782

e. ER BUDGET *
$3,352

f. DP BUDGET *
$940

g. ER FUNDS AUTH
$3,157

h. DP FUNDS AUTH
$690

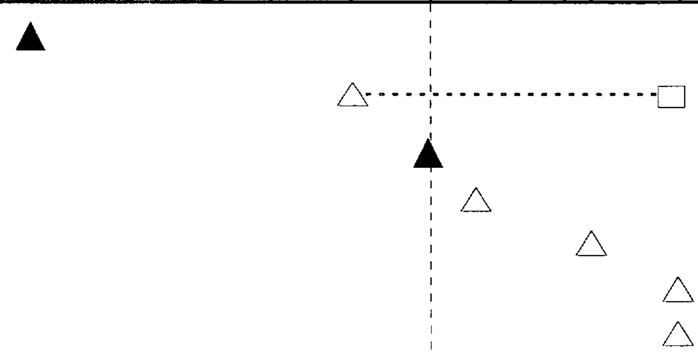


LEGEND: PLANNED — ACTUAL — PROJECTED — FUNDS AUTH — 90% SPENT

		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	245	236	356				
	VARIANCE	3	5	4	-12	-65	13	25	44	-56	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	1388	1624	1979				
	CUM VARIANCE	3	8	12	-1	-66	-53	-28	16	-39	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	68	84	90				
	VARIANCE	-5	1	2	-1	-21	-14	2	-14	-10	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	487	571	661				
	CUM VARIANCE	-5	-4	-2	-4	-25	-39	-37	-51	-61	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	312	320	446				
	VARIANCE	-2	5	6	-14	-86	-1	28	30	-66	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	1874	2195	2640				
	CUM VARIANCE	-2	4	9	-4	-91	-92	-64	-35	-100	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 △ COMPLETED ▲ DEVIATION □ TIMELINE —— PROGRESS —— PROPOSED DEVIATION ······ APPROVED DEVIATION — — —

10. NAME OF PARTICIPANT'S PROJECT MANAGER
PAUL S FARBER (ANL)

No. of Copies

Offsite

12 DOE/Office of Scientific and Technical Information

195 John Adams, President & CEO
Russell Corporation
P.O. Box 272
Alexander City, AL 35010-0272

Fletcher Adamson, Vice President
Research & Development
Russell Corporation
P.O. Box 272
Alexander City, AL 35010-0272

Don Alexander, Director
Institute of Textile Technology
775 Spartanburg Blvd Suite 104
Spartanburg, SC 29301

John Alexander
Idaho National Engineering Laboratory
P.O. Box 1625
Idaho Falls, ID 83425-2214

Glenn Allgood, CAFE Project Manager (2)
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6011

James Anderson
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87185-5400

Robert A. Barnhardt, Dean
College of Textiles
North Carolina State University
P.O. Box 8301
Raleigh, NC 27693-8301

Prakash Bhatt, Vice President
Business System
VF Corporation
P.O. Box 1022
Reading, PA 19603-1022

Diane Bird
U.S. Department of Energy, DP-4.1
1000 Independence Avenue
Washington, DC 20585

E.P. Blanchard, Jr.
P.O.Box C
4684 Chautauqua Avenue
Maple Springs, NY 14756

Jerald A. Blumberg, Sr. Vice President
Du Pont Fibers
E.I. Du Pont de Nemours & Company
P.O. Box 80722
Wilmington, DE 19880-0722

Paul Braxton, Vice President
Textile Products Group
Cone Mills
3101 N. Elm Street
Greensboro, NC 27408

Hal E. Brockmann, Sr. Vice President
& Managing Director
Cotton Incorporated
4505 Creedmoor Road
Raleigh, NC 27612

Edward Burgess, Director Engineering
Lawrence Berkeley Laboratory
One Cyclotron Road/MS:90-1106
Berkeley, CA 94720

Ben Burr, Cotton Bio Project Manager (2)
Brookhaven National Laboratory
53 Bell Avenue
Upton, NY 11973

Peter N. Butenhoff, President (20)
Textile/Clothing Tech Transfer $[TC]^2$
211 Gregson Drive
Cary, NC 27511-7909

Jim Caldwell, Automation Projects Manager
Textile/Clothing Tech Transfer $[TC]^2$
211 Gregson Drive
Cary, NC 27511-7909

Randy Chang
U.S. Department of Energy
Oakland Operations Office
1333 Broadway
Oakland, CA 94612

Leon Chapman
DAMA Technical Project Manager
Sandia National Laboratory
P.O. Box 5800 / MS: 0722
Albuquerque, NM 87185

Distribution

Alan Claflin, Director
Laboratory Management Division
U.S. Department of Energy/LM-10
1000 Independence Avenue
Washington, DC 20585

Deborah Clayton
Technology Transfer
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Jerry Cogan Jr., President
Milliken Research Corp
P.O. Box 1927
Spartanburg, SC 29304-1927

Harry Collins
Vice President of Research
Delta & Pine Land Company
One Cotton Row
P.O. Box 157
Scott, MS 83772

Fred L. Cook, Director
School of Textile &
Fiber Enginneering
Georgia Institute of Technology
Atlanta, GA 30332-0295

Joe D. Cunning, Director
National Textile Center
3640A Concord Pike Rm 201
Wilmington, DE 19803

George C. Dacey
1123 Bernalillo Place
Albuquerque, NM 87123

Pat Danahy, President & CEO
Cone Mills
1201 Maple Street
Greensboro, NC 27405

Joe DaSilva
U. S. Department of Energy
Brookhaven Area Office
53 Bell Avenue
Upton, NY 11973

James Davenport, Chair
Applied Science Department
Brookhaven National Laboratory
2 Center Street/Bldg 179 A
Upton, NY 11973-5000

Jerry Dodson
Lawrence Livermore National Laboratory
7000 East Ave., MS: L-795
P.O. Box 808
Livermore, CA 94550

Thomas M. Duff, President
Fibers Division
Wellman, Inc.
1040 Broad Street, Suite 302
Shrewsbury, NJ 07702

Paul Farber, TReC Project Manager (2)
Argonne National Laboratory
9700 South Cass Ave/ES-362
Argonne, IL 60439

Ritchie Fishburne, Director
Corporate Information Systems
Burlington Industries
P.O. Box 21207
Greensboro, NC 27410

James M. Fitzgibbons, CEO
Fieldcrest Cannon, Inc.
One Lake Drive
Kannapolis, NC 28081

Ronald Foltz, Vice President
Technology
Hoechst Celanese Corporation
P.O. Box 32414
Charlotte, NC 28232-9973

Craig Fong, Rapid Cutting Proj. Manager (2)
Lawrence Berkeley Laboratory
1 Cyclotron Road, MS: 90-2148
Berkeley, CA 94720

Jean Ford, Program Manager
CAIS / PDES Testbed
Nat'l Institute of Standards Technology
U.S. Department of Commerce
Metrology 220/A127
Gaithersburg, MD 20899

Donald Foster, Technology Leader
Lawrence Berkeley Laboratory
1 Cyclotron Road 90-1106
Berkeley, CA 94720

Cheryl Fragiadakis
Lawrence Berkeley Laboratory
One Cyclotron Road / MS: 90-1070
Berkeley, CA 94720

Jim Frede
Mercantile Stores Company, Inc.
9450 Seward Road
Fairfield, OH 45014-2230

Steve Freudenthal (5)
Milliken & Company
P.O. Box 1926, M-149
Spartanburg, SC 29304

Mike Furey
Brookhaven National Laboratory
53 Bell Avenue
Upton, NY 60439

Allen Gant, President
Glen Raven Mills, Inc.
1831 North Park Ave.
Glen Raven, MO 27217

Roger Gilbertson
Program Manager for Basic Research
U.S. Department of Commerce
Mail Code Otexa-H3100
Washington, DC 20230

Rudy Goetzman
Program Development Manager
Westinghouse Savannah River Company
Building 773-42A, Rm 135
Aiken, SC 29808

J. Nicholas Hahn
President & CEO
Cotton Incorporated
1370 Avenue of the Americas
New York , NY 10019

June M. Henton, Dean
School of Human Sciences
Auburn University
210 Spidle Hall
Auburn, AL 36849

John F. Hesselberth, Vice President
Fibers & Reasearch Dept.
E.I. Du Pont de Nemours & Co.
P.O. Box 80721
Wilmington, DE 19880-0721

Robert H. Jackson
President & Director
Textile Research Institute
P.O. Box 625
Princeton, NJ 08540

Gay Jividen, Cotton Bio Project Manager
Cotton Incorporated
4505 Creedmoor Road
Raleigh, NC 27612

Chris Kametches
Fieldcrest Cannon, Inc
Sr. V.P. Mfg Engr & Mfg Svc
One Lake Drive
Kannapolis, NC 28081

Mark Kametches, CAFE Project Manager
ITT Technology Transfer Center
Point West Office Bldg./ Suite 104
775 Spartan Blvd.
Spartanburg, SC 29301

David Koegel
Office of Energy Research / ER-80
U.S. Department of Energy
1000 Independence Avenue
Washington, DC 20585

Martha Krebs, Director
Office of Energy Research
U.S. Department of Energy
ER-1/7B-058
1000 Independence Avenue
Washington, DC 20585

Glenn W. Larson, Executive Vice President
Mfg. & Operations
Biltwell Company, Inc.
2005 Walton Road
St Louis, MO 63114

R. Lehman, President
Textile Fibers
Hoechst Celanese Corporation
P.O. Box 32414
Charlotte, NC 28232-9973

H. Vernon Lemaster, President
Dystuffs & Chemicals Division
Ciba-Geiga Corporation
P.O. Box 18300
Greensboro, NC 27419-8300

Jim Lovejoy, DAMA Project Director
Textile/Clothing Tech Transfer [TC]^2
211 Gregson Drive
Cary, NC 2711-7909

Distribution

Pete Lyons
Los Alamos National Laboratory
P.O. Box 1663 / SM-30 Warehouse
Bikini Atoll Road / MS: J564
Los Alamos, NM 87545

Alexander MacLachlan, Deputy
Under Secretary for R&D Management
U.S. Department of Energy / RM-1
1000 Independence Avenue
Washington, DC 20585

Roger Malkin, Chairman
Delta and Pine Land Company
One Cotton Row
P.O. Box 157
Scott, MS 387725

Thomas Malone, President & COO
Milliken & Company, Inc.
P.O. Box 1926, N-149
Spartanburg, SC 29304

George Manthey
U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831

Kathleen McCaughey, Director
SNL AMTEX Programs/Dept. 2700
Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185-0507

Linda McCoy
U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

Dan McCreight, Vice President
Institute of Textile Technology
2551 Ivy Road
Charlottesville, VA 22903-4614

Daniel McDonald, Director
Instrumentation & Control Division
Oak Ridge National Laboratory
P.O. Box 2008/Bethel Valley Road
Bldg. 3500
Oak Ridge, TN 37831-6005

Charles McKeller, Vice President
Glen Raven Mills
1831 North Park Ave.
Glen Raven, NC 27217

Lewis Meixler, Head
Office of Technology Transfer
P.O. Box 451
Forrestal Campus, Route 1
Princeton, NJ 98543

Mark Miller (5)
U.S. Departmant of Energy/DP 4.1
1000 Independence Avenue
Washington, DC 20585

Roger Milliken, CEO
Milliken & Company
P.O. Box 1926, M-149
Spartanburg, SC 29304

David Nelson
Office of Energy Research
U.S. Departmant of Energy/ER-1
1000 Independence Avenue
Washington, DC 20585

David L. Nichols, CEO
Mercantile Stores Company, Inc.
9450 Seward Road
Fairfield, OH 45014-2230

Joseph W. A. Off
Managing Director
Textile/Clothing Tech Transfer $[TC]^2$
211 Gregson Drive
Cary, NC 27511-7909

Patty Padilla
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, NM 87185-5400

Lucien Papouchado
Savannah River Technology Center
P.O. Box 616
Aiken, SC 29802

Homi B. Patel, President
Hartmarx Corporation
101 N Wacker Drive 23rd Floor
Chicago, IL 60606

Pete Pesenti, Sr. Research Engineer (10)
U.S. Department of Energy/LM-10
1000 Independence Avenue
Washington, DC 20585

Norman D. Peterson
Argonne National Laboratory
9700 South Cass Ave.
Argonne, IL 60439

Charles Pietri
U.S. Department of Energy
Chicago Area Office
9700 South Cass Avenue
Argonne, IL 60439

Martin Piltch
Advanced Optical Systems
Los Alamos National Laboratory
P.O. Box 1663/SM-30 Warehouse
Bikini Atoll Road MS G548
Los Alamos, NM 87545

Larry R. Pugh, Chairman
VF Corporation
P.O. Box 1022
Reading, PA 19603-1022

Richard Quisenberry (20)
Executive Director
AMTEX Industry Program
P.O. Box 4670
Wilmington, DE 19807

John Renfro, Vice President
Inman Mills
P.O. Box 207
Inman, SC 29349

Victor Ries, Assistant Secretary
for Defense Programs
U.S. Deptartment of Energy/DP-1/4A019
1000 Independence Avenue
Washington, DC 20585

Mike Riley, EEF Project Manager (2)
Lawrence Livermore National
Laboratory
7000 East Ave. L-394
Livermore, CA 94583

Douglas V. Rippy, Director
School of Textiles
Clemson University
Clemson, SC 29631

Burton B. Ruby
Chairman
Trans-Apparel Group
5000 S Ohio Street
Michigan City, IN 46360

Preston E. Sasser, Vice President
Fiber Quality Research
Cotton Incorporated
P.O. Box 30067
Raleigh, NC 27612

Norm Sather, ES/362
Director Energy Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439

Nancy Saxer
Office of Technology Transfer
Lawrence Berkeley Laboratory
One Cyclotron Road / MS: 90-1070
Berkeley, CA 94720

Jack Scruggs, OPCon Project Manager (2)
Textile Research Institute (TRI)
129 Coralvine Ct.
Greenville, SC 29116

Marc Simpson, OPCon Project Manager (2)
Oak Ridge National Laboratory
P.O. Box 2008 / MS: 6006
Oak Ridge, TN 37831-6006

Irving Stowers
Science & Technology Advisor
Lawrence Livermore National Laboratory
7000 East Ave., MS L-644
P.O. Box 808
Livermore, CA 94550

John Sullivan, Vice President
Business Development
Hoechst Celanese Corp.
P.O. Box 32414
Charlotte, NC 28232

William Toth
Idaho National Engineering Laboratory
P.O. Box 1625
Idaho Falls, ID 83415-2214

Joseph C. Tucker, Vice President
Manufacturing and Technical
Wellman, Inc.
P.O. Box 31331
Charlotte, NC 28231

James Van Fleet, Director
Off. of Economic Competitiveness/DP 4.1
U.S. Department of Energy
Defense Programs
1000 Independence Avenue
Washington, DC 20585

Brian Volintine / EE-223
U.S. Department of Energy
1000 Independence Ave
Washington, DC 20585

George Waldrep, Executive Vice President
Manufacturing
Burlington Industries
P.O. Box 691
Burlington, NC 27216-0691

William K. Walsh, Head
Textile Engineering Department
101 Textile Building
Auburn University
Auburn, AL 36830

Ted Waroblak, President (5)
Institute of Textile Technology
2551 Ivy Raod
Charlottesville, VA 22903-4614

Frank X. Werber, Nat'l Program Leader
U.S. Department of Agriculture
Bldg. 005/ Rm 219 Barc-W
Beltsville, MD 20705

Pete Woody, Director
Research and Development
Wellman, Inc.
P.O. Box 31331
Charlotte, NC 28231

Anne Marie Zerega
Laboratory Tech Transfer Program
U.S. Department of Energy/LM-10
1000 Independence Avenue
Washington, DC 20585

No. of Copies

Onsite

100 Pacific Northwest Laboratory

E. G. Baker	P8-38
D.M. Boyd	K5-02
M.D. Erickson	K7-02
B.A. Garrett	K8-09
R.W. Gilbert	K5-12
B.J. Harrer	K1-60
P.S. Kaae	K8-18
D.K. Lemon (78)	K7-80
J.R. Lewis	K7-02
W.J. Madia	K1-46
G.B. Morgan	K7-02
R.E. Rhoads	K8-24
J.A. Roberts	K1-45
K.B. Widener	K5-25
W.R. Wiley	K9-95
G.L. Work	K1-52
Technical Report Files (7)	P8-55