CAR 93-05

NCC8-18

Technology Transfer from NASA to Targeted Industries

Volume I

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ABSTRACT

This report summarizes the University of Alabama in Huntsville (UAH) technology transfer to three target industries with focus on the apparel manufacturing industry in Alabama. Also included in this report are an analysis of the 1992 problem statements submitted by Alabama firms, the results of the survey of 1987-88 NASA Tech Brief requests, the results of the followup to Alabama submitted problem statements, and the development of the model describing the MSFC technology transfer process.

1.0 INTRODUCTION

On June 10, 1992, the University of Alabama in Huntsville (UAH) joined the technology transfer effort at the NASA Marshall Space Flight Center Technology Utilization Office (MSFC/TUO). Since that time, the UAH contribution has been more than just to provide additional assistance to ongoing MSFC programs, although 76 more technical assistance/problem statements have entered the MSFC system as a result of UAH efforts. More importantly, UAH has introduced the following elements to the MSFC/TU effort:

- Technology transfer focus by industrial segment
- Definition of the MSFC/TUO technology transfer process
- Evaluation of the effectiveness of past technology transfer efforts
- Recruitment of associates to the MSFC/TUO Alabama network

1.1 Technology Transfer by Industrial Segment

Prior to the arrival of UAH, the MSFC/TUO did not concentrate on any industrial segment to recruit clients. The UAH team came on board after three years of state funded service to the Alabama apparel manufacturing industry. Consequently, UAH was able to expose 128 active clients to the possibility of technical assistance from MSFC. UAH also has 92 client firms in its metal fabrication industry data base and 66 firms in the data base for the electronics manufacturing/assembly industry. These three industrial segments provided most of the 76 additional problem statements solicited by UAH.

1.2 Definition of the Technology Transfer Process

The MSFC/TUO technology transfer process has evolved over several years. UAH has developed a model of this process. UAH has also made extensive analyses of the disposition of problem statements in Alabama and the nature of the clientele. These studies have shown that both large and small firms are being served in Alabama.

1.3 Evaluation of Effectiveness of Past Technology Transfer Efforts

In an effort to further improve the technology transfer process, UAH surveyed 1987-88 MSFC Tech Brief data to determine the value gained by the requesters. Similarly, a study was also made of problem statements that have been closed positively in Alabama. The survey results were positive and also identified methods to obtain better data from clients.

1.4 Recruitment of Associates to MSFC/TUO Network

UAH has had years of experience working with various Alabama organizations that are engaged in some form of technology transfer. However, these organizations do not report to, or cooperate with a central state technology

transfer organization. Through UAH involvement, several of the independent state technology transfer organizations have now associated themselves with the NASA MSFC/TUO. These organizations include the Alabama Power Company (APCO), North Alabama Industrial Development Association (NAIDA), Alabama Industrial Development Training (AIDT), and Alabama Small Business Development Consortium (SBDC). The MSFC/TUO now has associates who not only recruit clients for technology transfer but in some cases will themselves assist in resolving problem statements obtained by others.

2.0 TECHNICAL REQUESTS/PROBLEM STATEMENTS

This section presents the results of UAH's activities in soliciting problem statements and in providing technical assistance to problem statements.

2.1 Target Industries

The following three industries were targeted in Alabama:

- Apparel manufacturing
- Metal fabrication
- Electronics manufacturing/assembly

2.1.1 Apparel Manufacturing Industry

UAH has been providing technical assistance to the apparel manufacturing industry in Alabama since 1989. This assistance was supported by the Alabama Department of Economic and Community Affairs (ADECA). ADECA's support was terminated in March 1992. The 1992 final report (Schroer and Ziemke, 1992) gives the details of the technical assistance program.

Activities of the apparel technical assistance program in Alabama prior to March 1992 are:

- 128 active clients
- 43 site visits
- 11 seminars at client sites
- 6 regional seminars
- 23 periodic fact sheets mailed to clients
- 11 technical assistance projects

2.1.2 Metal Fabrication Industry

UAH had a task from the Alabama Center for Advanced Technology Transfer (ACATT) to survey the metal fabrication in Alabama. The purpose of the survey was to identify the industry's training needs and utilization of new technologies. The results of the survey are given in Volume II.

A total of 520 firms were mailed survey questionnaires. Ninety-two firms responded to the survey and are included in the data base of active clients.

2.1.3 Electronics Manufacturing/Assembly Industry

In early 1992 UAH surveyed the electronics manufacturing/assembly industry in Alabama. The purpose of the survey was to identify the training needs and utilization of new technologies. The results of the survey are given in Volume II.

A total of 260 firms were mailed survey questionnaires. Sixty-six firms responded to the survey and are included in the data base of active clients.

2.2 Solicited Problem Statements

The UAH team has been responsible for 79 problem statements being submitted to MSFC. Of this total, 58, or 73 percent were from Alabama, and 21, or 27 percent, were from other states. Figure 2-1 gives a distribution of these problem statements by month. From June through September the UAH team averaged thirteen problem statements per month. In September, the team was asked to de-emphasize problem solicitation in order to allow MSFC to respond to a growing backlog. As a result, from October through February the UAH team averaged only five problem statements per month. Table 2-1 gives the firms that submitted problem statements as a result of UAH activities.

Starting in February 1993, UAH began visiting county firms in support of the Huntsville Chamber of Commerce. The following problem statements were solicited and forwarded directly to the Chamber:

Jacquard Lace	Huntsville, AL	2 problems
MGV Manufacturing	Madison, AL	3 problems
Lindy Manufacturing	Huntsville, AL	4 problems
Mevatec Corp.	Huntsville, AL	1 problems
Magnetek	Athens, AL	3 problems

2.3 Problem Statements by Industry

As previously stated, the UAH problem solicitation focused on three industries: apparel manufacturing, metal working and electronics manufacturing/assembly. Figure 2-2 gives the problems by industry.

Table 2-2 gives the apparel manufacturing firms that submitted problem statements. Table 2-3 gives the metal working firms that submitted problem statements. In summary:

- 91% were from the targeted industry
- 75% were from the apparel manufacturing firms
- 52% were from Alabama apparel manufacturing firms
- 15% were from Alabama metal working firms

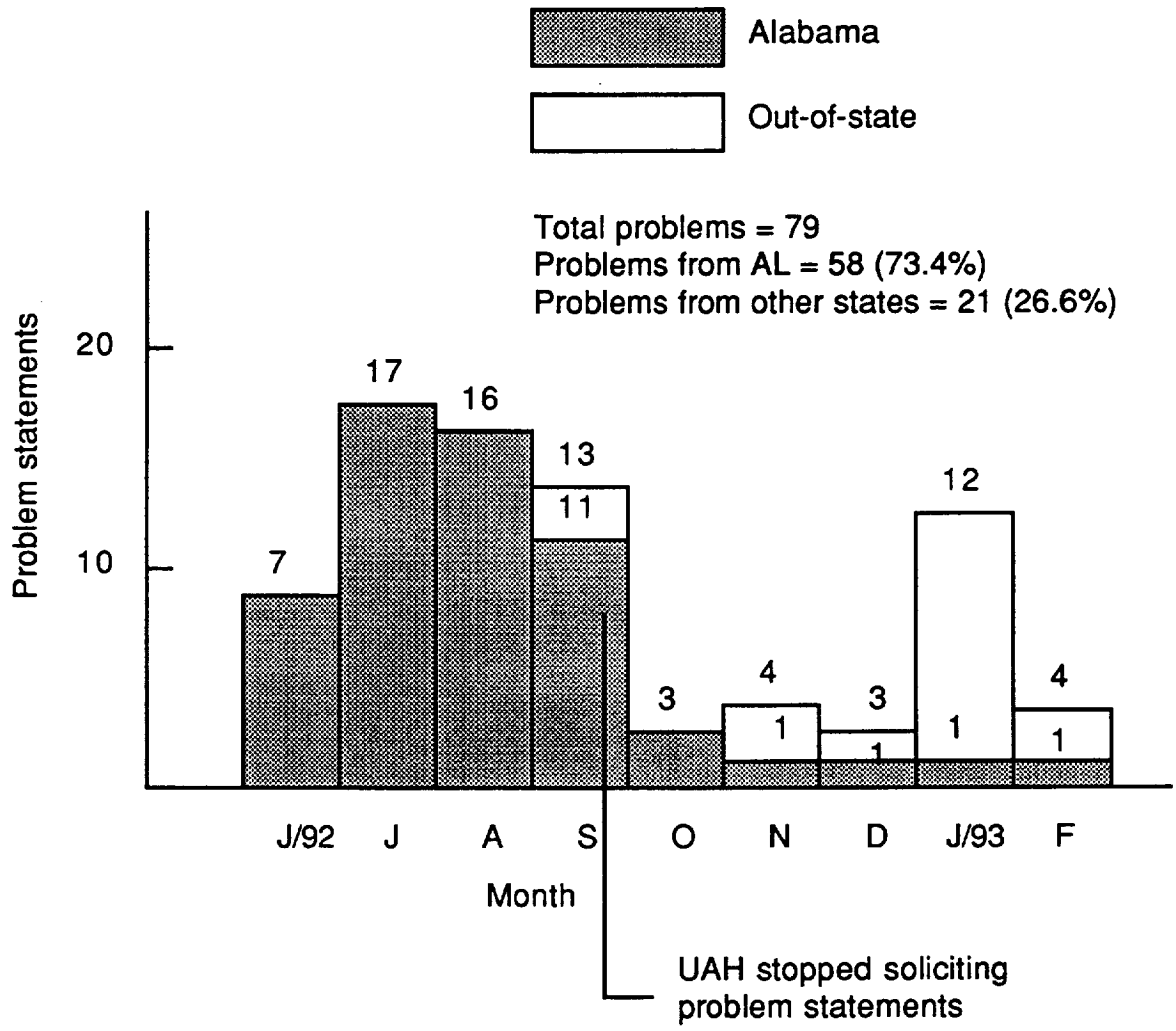


Figure 2-1. Problem statements resulting from UAH contacts

Table 2-1. Technical Requests/Problem Statements Resulting from UAH contacts

Industry Legend
A = apparel manufacturing
M = metal fabrication
E = electronics manufacturing/assembly
O = other

Month	Firm	Location	Problems	Industry
June	Diversified Machine	Huntsville, AL	1 #411	M
	Morgan Research Corp.	Huntsville, AL	1 #416	O
	Kleinerts	Elba, AL	1 #418	A
	Van Heusen	Ozark, AL	1 #419	A
	Wex Tex	Ashford, AL	1 #420	A
	Vanity Fair	Monroeville, AL	1 #421	A
	Total Plastic	Winfield, AL	1 #431	O
			7	
July	Russell	Alexander City, AL	10 #452, 453, 454, 455, 456,457, 458, 459, 460, 461	A
	Kappler USA	Guntersville, AL	6 #441, 442, 443, 444, 445, 446	A
	Andover Togs	Scottsboro, AL	1 #463	A
			17	
August	Vanity Fair	Monroeville, AL	2 #476, 523	A
	Kappler USA	Guntersville, AL	1 #471	A
	Russell	Alexander City, AL	1 #482	A
	SCI	Lacey Springs, AL	1 #483	E
	Abanda	Decatur, AL	1 #487	A
	James Murphree	Ozark, AL	1 #496	O
	Van Huesen	Ozark, AL	4 #497, 498, 499, 500	A
	Brewton Fashions	Brewton, AL	1 #495	A
	CAM Co.	Boston, MA	1 #489	A
	Teledyne	Huntsville, AL	3 #503, 504, 505	A
			16	
September	Dixie Precision	Birmingham, AL	1 #515	M
	Copperweld	Birmingham, AL	4 #516, 517, 518, 519	M
	Mason Corp.	Birmingham, AL	1 #520	M
	Utility Board	Ozark, AL	1 #513	O
	Wiregrass Truss	Dothan, AL	1 #514	O
	Mid South	Gadsden, AL	1 #529	M
	EMCO	Gadsden, AL	2 #530. 531	M
	Gilbert Associates	Atlanta, GA	1 #564	A
	Lee Co.	Lebanon, MO	1 #521	A
			13	
October	Russell	Alexander City, AL	3 #588, 589, 590	A
			3	
November	Aalfs	Sioux City, IO	1 #593	A
	Pridecraft Industries	Enterprise, AL	1 #596	A
	Quest Apparel	Calhoun, KY	1 #604	A
	Hilton Active Apparel	Thomasville, AL	1 #608	A
			4	
December	Speedring	Cullman, AL	1 #612	M
	Sturdy Lite	Bristol, TN	2 #622, 623	O
			3	

Table 2-1. Technical Requests/Problem Statements Resulting from UAH contacts (cont.)

Month	Firm	Location	Problems	Industry
January	Byte Systems	Mauldin,SC	1 #640	A
	Lee Company	Bayou LaBatre, AL	1 #641	A
	Maid Bess Corporation	Salem, VA	1 #643	A
	American Trousers	Columbus, MS	1 #644	A
	Stuffed Shirt	Pass Christian, MS	1 #646	A
	Computer Center	Crossville, TN	1 #647	A
	Lake Butler Apparel Co.	Lake Butler, FL	1 #648	A
	Cachet Sports	Weewhakin, NJ	1 #652	A
	GTRI	Atlanta, GA	1 #651	A
	Stearns Manufacturing Co.	St. Cloud, MN	1 #655	A
	Maybelle Manufacturing Co.	Gulfport, MS	1 #663	A
	Beaulieu of America	Bridgeport, AL	1 #642	A
			12	
February	American Athletic Apparel	Puxico, MO	1 #685	A
	Roberts Curry Associates	Greenville, SC	1 #697	A
	Southern College of Technology	Marrietta, GA	1 #698	A
	Lee Co.	Russellville, AL	1 #709	A
			4	

An additional 13 problem statements were collected by UAH and submitted to Huntsville Chamber of Commerce.

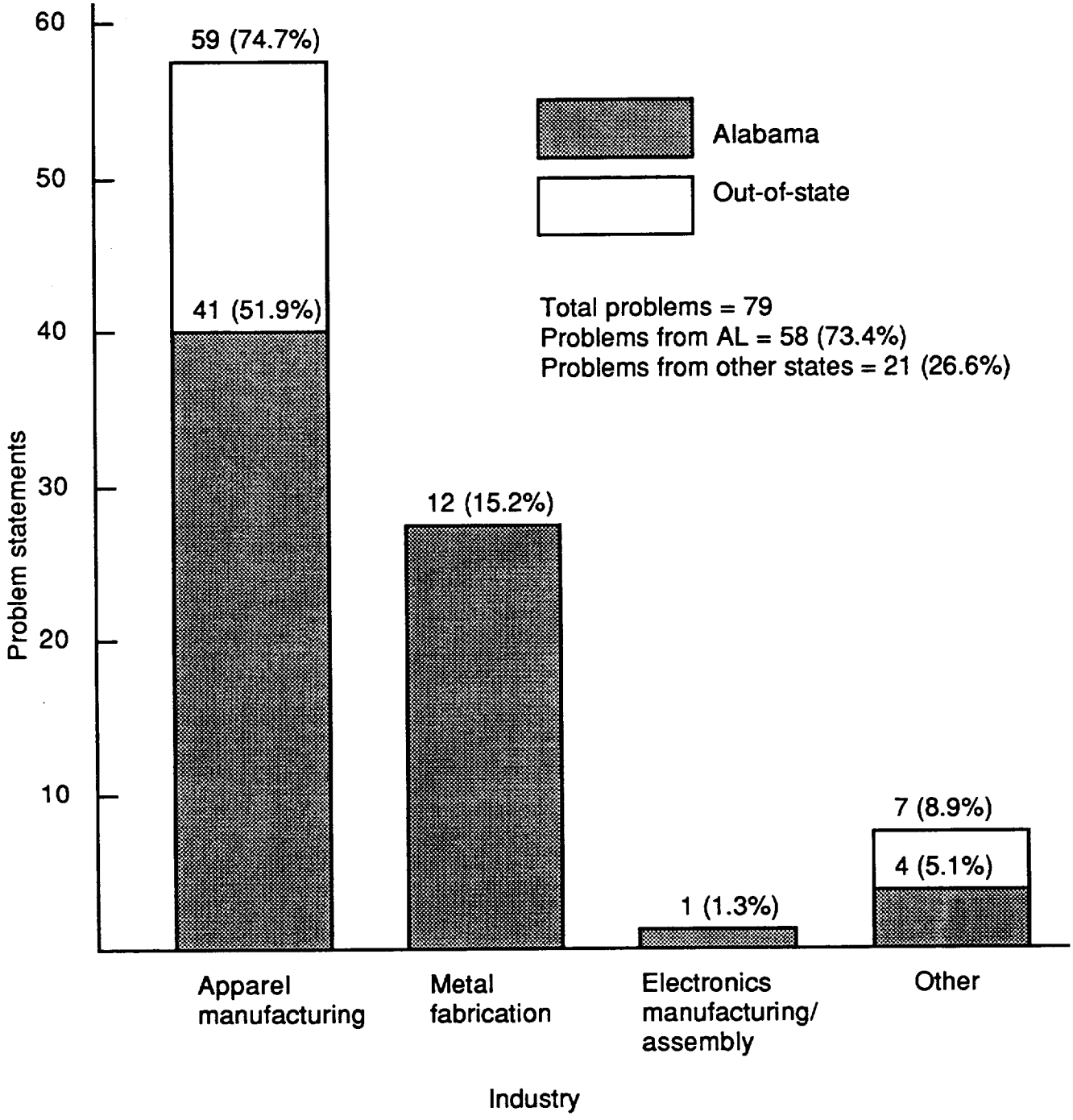


Figure 2-2. Problem statements by target industry

Table 2-2 Impact of Apparel Manufacturing Industry Focus

Apparel Firm	Location	Problems
Kleinerts	Elba, AL	1
Van Heusen	Ozark, AL	1
Wex Tex	Ashford, AL	1
Vanity Fair	Monroeville, AL	3
Russell	Alexander City, AL	13
Kappler USA	Guntersville, AL	7
Andover Togs	Scottsboro, AL	2
Abanda	Decatur, AL	1
Van Heusen	Ozark, AL	4
Brewton Fashions	Brewton, AL	1
CAM Co.	Boston, MA	1
Teledyne	Huntsville, AL	3
Lee Co.	Lebanon, MO	1
Gilbert Associates	Atlanta, GA	1
Aalfs	Sioux City, IO	1
Pride Craft	Enterprise, AL	1
Quest Apparel	Calhoun, KY	1
Hilton Active Apparel	Thomasville, AL	1
Byte Systems	Mauldin,SC	1
Lee Co.	Bayou LaBatre, AL	1
Maid Bess Corporation	Salem, VA	1
American Trousers	Columbus, MS	1
Stuffed Shirt	Pass Christian, MS	1
Computer Center	Crossville, TN	1
Lake Butler Apparel Co.	Lake Butler, FL	1
Cachet Sports	Weewhakin, NJ	1
GTRI	Atlanta, GA	1
Stearns Manufacturing Co.	St. Cloud, MN	1
Maybelle Manufacturing Co.	Gulfport, MS	1
American Athletic Apparel	Puxico, MO	1
Roberts Curry Associates	Greenville, SC	1
Southern College of Technology	Marrietta, GA	1
Lee Co.	Russellville, AL	1
Total		59

Table 2-3. Impact of Metal Working Manufacturing Industry Focus

Metal Working Firm	Location	Problems
Diversified Machine	Huntsville, AL	1
SCI	Lacey Springs, AL	1
Dixie Precision	Birmingham, AL	1
Copperweld	Birmingham, AL	4
Mason	Birmingham, AL	1
Mid South	Gadsden, AL	1
EMCO	Gadsden, AL	2
Speedring	Cullman, AL	1
Total		12

- 1% were from Alabama electronics manufacturing/assembly firms
- A factor contributing to the statements from out-of-state apparel firms was the publicity in national trade publications

2.4 Simulation Software Problem Statements

As a result of working with the apparel manufacturing industry since 1989, UAH developed the following modular manufacturing simulators:

- SSE3 – An excellent training tool for the first-time user of computer simulation to model apparel manufacturing modules. The simulator probably cannot model real world problems.
- SSE6 – Used to model apparel manufacturing modules that are based on the TSS (Toyota Sewing System) where all operators stand and move between stations. Work is done in lots of one garment.
- SSE5 – Used to model manufacturing modules where some operators are fixed at machines while other operators can move between several machines. The moveable operators move based on a defined set of rules such as a time limit, bundle limit, lower WIP, and upper WIP.

Each of these simulators includes a PC compatible software disk and a users manual (Schroer and Wang, 1992 a and b). A brief description of the simulators is given in Volume II.

Table 2-4 lists the firms that requested copies of the simulators. Ten request were from Alabama firms. Nineteen requests were from out-of-state firms.

2.5 Site Visits

Figure 2-3 gives the distribution of visits by month. Table 2-5 lists the firms visited by UAH. These visits include soliciting problem statements and followups with firms that submitted problem statements. In summary:

- 63 site visits were made to Alabama firms.
- Average of 7.1 visits per month made to Alabama firms.
- Return visits were made to a number of firms including six to Kappler, three to Russell, and three to Vanity Fair. These visits were followups to submitted problem statements.

Starting in February, 1993, UAH began visiting Madison County firms in support of the Huntsville Chamber of Commerce's technology transfer program. The following firms were visited:

- Jacquard Lace Huntsville, AL
- MGV Manufacturing Madison, AL

Table 2-4. Apparel Firms Requesting Modular Manufacturing Simulation Software

Firm (Alabama)	Location	Problem
Vanity Fair	Monroeville, AL	#421
Russell	Alexander City, AL	#458
Andover Togs	Scottsboro, AL	#463
Kappler USA	Guntersville, AL	#471
Abanda	Decatur, AL	#487
Brewton Fashions	Brewton, AL	#495
Pridecraft	Enterprise, AL	#596
Hilton Active Apparel	Thomasville, AL	#608
Lee Co.	Bayou LaBatre, AL	#641
Lee Co.	Russellville, AL	#709
Total		9

Firm (Out of State)	Location	Problem
Mar Bax	Gassville, AR	#494
CAM Co.	Boston, MA	#489
Gilbert Associates	Atlanta, GA	#564
Lee Co.	Lebanon, MO	#521
Aalfs	Sioux City, IO	#593
Quest Apparel	Calhoun, KY	#604
Byte Systems	Mauldin,SC	#640
Maid Bess Corporation	Salem, VA	#643
American Trousers	Columbus, MS	#644
Stuffed Shirt	Pass Christian, MS	#646
Computer Center	Crossville, TN	#647
Lake Butler Apparel Co.	Lake Butler, FL	#648
Cachet Sports	Weewhakin, NJ	#652
GTRI	Atlanta, GA	#651
Stearns Manufacturing Co.	St. Cloud, MN	#655
Maybelle Manufacturing Co.	Gulfport, MS	#663
American Athletic Apparel	Puxico, MO	#685
Roberts Curry Associates	Greenville, SC	#697
Southern College of Technology	Marrietta, GA	#698
Total		19

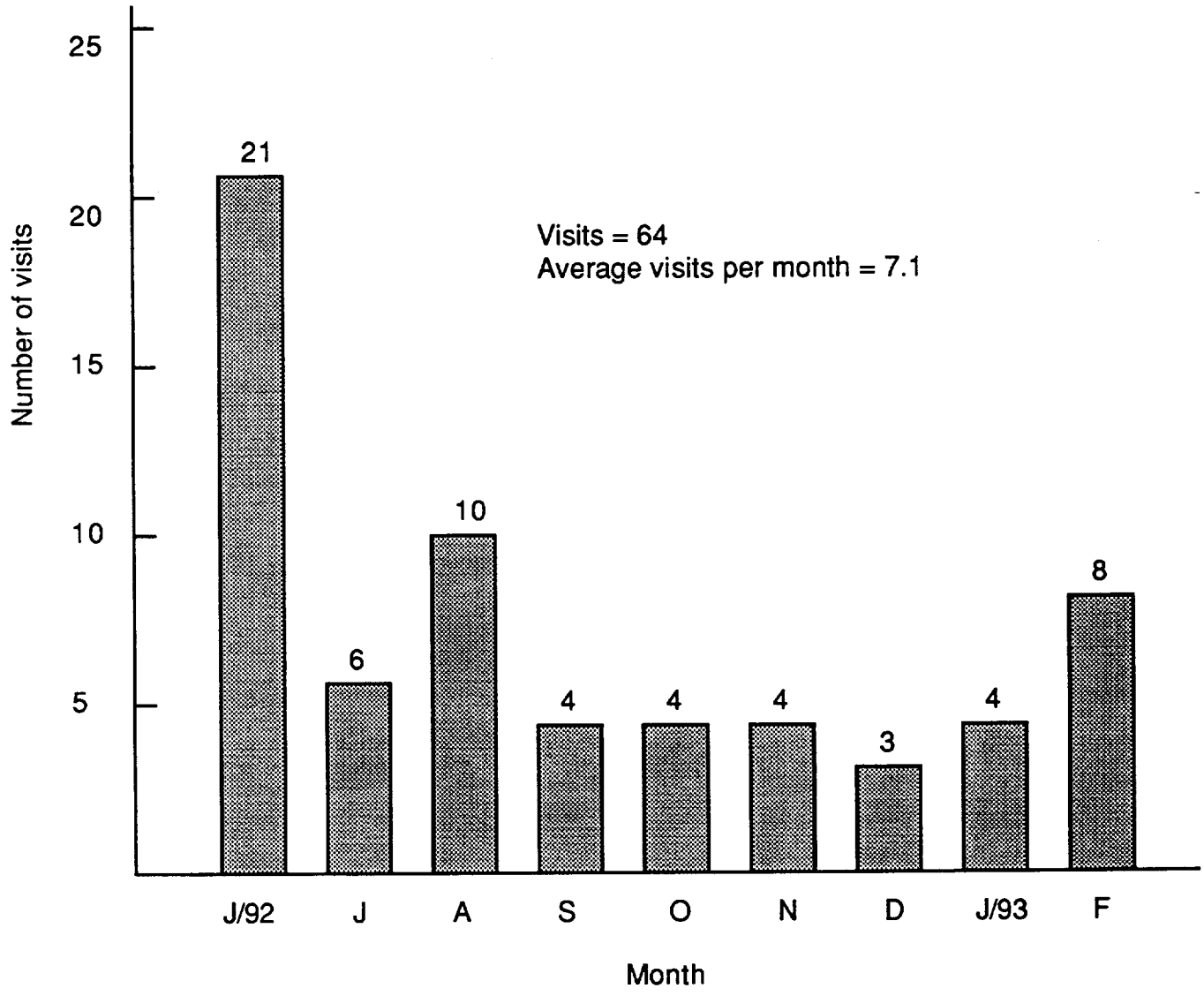


Figure 2-3. Alabama company visits by month

Table 2-5. Visits to Alabama Firms

Date	Firm	Location
June	Diversified Machine	Huntsville, AL
	Maples Sheet Metal	Huntsville, AL
	Wolverine Tube	Decatur, AL
	Bergen Patterson Pipe	Moulton, AL
	Sue Jac	Decatur, AL
	Dixie Metalcraft	Hazel Green, AL
	Parker Fluid Connectors	Huntsville, AL
	Russell	Alexander City, AL
	Vanity Fair (2 visits)	Monroeville, AL
	Alabama Dynamics	Calera, AL
	Harper Lee Machine	Montgomery, AL
	Kleinerts	Elba, AL
	Van Heusen	Ozark, AL
	Wex Tex	Ashford, AL
	Morgan Research	Huntsville, AL
	Lawrence Corp.	Moulton, AL
	Oneita Industries	Fayette, AL
	Alumax	Moulton, AL
	Phase IV	Huntsville, AL
	Dynetics	Huntsville, AL
		21
July	Kappler USA (2 visits)	Guntersville, AL
	Life Guard	Guntersville, AL
	Johnson Machine	Boaz, AL
	Russell	Alexander City, AL
	Andover Togs	Scottsboro, AL
		6
August	UDS	Huntsville, AL
	Southern Research Institute	Birmingham, AL
	Vanity Fair	Monroeville, AL
	Brown International Corp.	Huntsville, AL
	Abanda Corp.	Decatur, AL
	Van Huesen	Ozark, AL
	Brown Manufacturing	Ozark, AL
	Copperweld	Birmingham, AL
	Dixie Precision	Birmingham, AL
	Mason Corp.	Birmingham, AL
		10
September	Utility Board	Ozark, AL
	Wiregrass Truss	Dothan, AL
	EMCO	Dothan, AL
	Mid South	Gadsden, AL
		4
October	Andover Togs	Scottsboro, AL
	Kappler USA (2 visits)	Guntersville, AL
	Paramax	Huntsville, AL
		4

Table 2-5. Visits to Alabama Firms (cont.)

Date	Firm	Location
November	Abanda	Decatur, AL
	Bowden Industries	Huntsville, AL
	DESE Inc.	Huntsville, AL
	United Technology/USBI	Huntsville, AL
		4
December	Hilton Active Apparel	Thomasville, AL
	PEMCO	Birmingham, AL
	SCI	Lacey Springs, AL
		3
January	Kappler USA (2 visits)	Guntersville, AL
	Russell	Alexander City, AL
	Horizon Sportswear	Elkmont AL
		4
February	Jacquard Lace Co.	Huntsville, AL
	MGV Manufacturing, Inc.	Madison, AL
	Lindy Manufacturing	Huntsville, AL
	Mevatec Corp.	Huntsville, AL
	Magnetek	Huntsville, AL
	Lampi Co.	Huntsville, AL
	Mason Hanger	Huntsville, AL
	CFD Research Corp.	Huntsville, AL
		7

- Lindy Manufacturing Huntsville, AL
- Mevatec Corp. Huntsville, AL
- Magnetek Athens, AL
- Lampi Co. Huntsville, AL
- Mason Hanger Huntsville, AL
- CFD Research Corp. Huntsville, AL

2.6 Problem Statement Assistance

Figure 2-4 gives the distribution of problem statements assistance by month. Table 2-6 summarizes the activities of UAH in providing assistance to problem statements. In summary:

- 61 problem statements closed
- 25 followups to problem statements
- Average 6.7 problems closed per month
- Average 2.8 problem followups per month

2.6.1 Morgan Research Corporation

Morgan Research Corporation, Huntsville, AL, submitted problem statement #416 requesting technical assistance in developing a prototype missile guidance section using stereolithography. This problem statement was forwarded to UAH and the Alabama Center for Advanced Technology Transfer (ACATT). The stereolithography system at ACATT was used to "grow" the prototype missile section. The results were documented in UAH Report CAR 93-03, Synopsis of a Stereolithography Project. A copy of the report is given in Volume II.

This project was funded in part by the Alabama Center for Advanced Technology Transfer (ACATT) and UAH. The author, Ms. K. Haught, is a graduate research assistant at UAH.

2.6.2 Hilton Active Apparel

Hilton Active Apparel, Thomasville, AL, submitted problem statement #608 requesting assistance in evaluating two proposed manufacturing modules. The problem statement was forwarded to UAH. The following support was provided to Hilton Apparel:

- Mailed copies of the SSE3, SSE6, and SSE5 apparel manufacturing simulators including the simulation software and users manuals.
- Conducted an on-site seminar on modular manufacturing.
- Analyzed two proposed garment lines using the modular manufacturing simulators.

The results were documented in UAH Report CAR93-04, Transferring Modular Manufacturing Technology to an Apparel Firm. A copy of the report is given in Volume II.

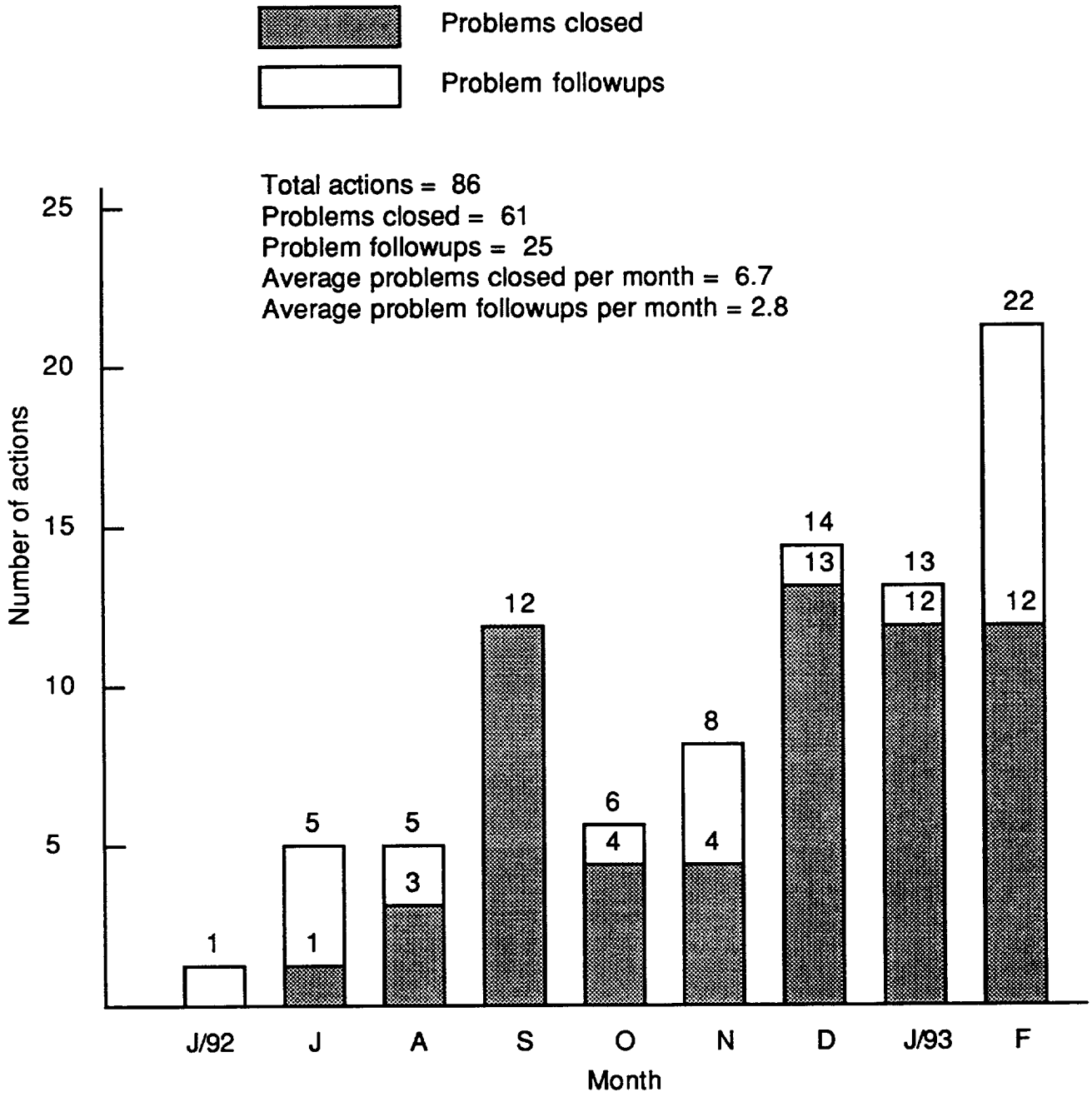


Figure 2-4. Problem statement support by month

Table 2-6. Problem Statement Support Provided by UAH

Date	Firm	Location	Problem	Action
June	Princess Screenprints		400	followup
				1
July	Kleinerts	Elba, AL	418	closed
	Van Heusen	Ozark, AL	419	followup
	Kappler USA	Guntersville, AL	444	followup
	Life Guard	Guntersville, AL	445	followup
	Total Plastic	Winfield, AL	431	followup
				5
August	Kappler USA	Guntersville, AL	471	closed
	Andover Togs	Scottsboro, AL	463	closed
	Wex Tex	Ashford, AL	420	followup
			449	followup
	Abanda	Decatur, AL	487	closed
				5
September	CAM Co.	Boston, MA	489	closed
	Gilbert Associates	Atlanta, GA	564	closed
	Lee Co.	Lebanon, MO	521	closed
	Mar Bax	Gassville, AK	494	closed
	Russell	Alexander City, AL	458	closed
	Morgan Research	Huntsville, AL	416	closed
	James Murphree	Ozark, AL	496	closed
	Kappler USA	Guntersville, AL	441	closed
	Kappler USA	Guntersville, AL	442	closed
	Russell	Alexander City, AL	456	closed
	Van Heusen	Ozark, AL	419	closed
	Wiregrass	Dothan, AL	514	closed
				12
October	Russell	Alexander City, AL	476	followup
	EMCO	Gadsden, AL	530	closed
	Kappler USA	Guntersville, AL	443	followup
	Andover Togs	Scottsboro, AL	463	closed
	Dixie Precision	Birmingham, AL	515	closed
	Total Plastic	Winfield, AL	431	closed
				6
November	Pridecraft	Enterprise, AL	596	closed
	Russell	Alexander City, AL	588	followup
	Russell	Alexander City, AL	589	followup
	Russell	Alexander City, AL	590	followup
	Hilton Active Apparel	Thomasville, AL	608	closed
	Aalfs	Sioux City, IO	593	closed
	Quest Apparel	Calhoun, KY	604	closed
	Wiregrass Truss	Ozark, AL	514	followup
				8

Table 2-6. Problem Statement Support Provided by UAH (cont.)

Date	Firm	Location	Problem	Action
December	Copperweld	Birmingham, AL	517	closed
	Van Heusen	Ozark, AL	499	closed
	Russell	Alexander City, AL	452	closed
	Russell	Alexander City, AL	459	closed
	SCI	Lacey Springs, AL	483	closed
	Russell	Alexander City, AL	461	closed
	Kappler USA	Guntersville, AL	443	closed
	Kappler USA	Guntersville, AL	444	closed
	Kappler USA	Guntersville, AL	445	closed
	Speedring	Cullman, AL	612	followup
	EMCO	Gadsden, AL	531	closed
	Russell	Alexander City, AL	482	closed
	Copperweld	Birmingham, AL	516	closed
	Copperweld	Birmingham, AL	519	closed
				14
January	Byte Systems	Mauldin, SC	640	closed
	Lee Co.	Bayou LaBatre, AL	641	closed
	Maid Bess Corp.	Salem, VA	643	closed
	American Trousers	Columbus, MS	644	closed
	Stuffed Shirt	Christian, MS	646	closed
	Computer Center	Crossville, TN	647	closed
	Lake Butler Apparel	Lake Butler, FL	648	closed
	Cachet Sports	Weewhakin, NJ	652	closed
	GTRI	Atlanta, GA	651	closed
	Stearns Mfg. Co.	St. Cloud, MN	655	closed
	Maybelle Mfg. Co.	Gulfport, MS	663	closed
	Russell	Alexander City, AL	460	closed
	Russell	Alexander City, AL	455	followup
				13
February	Kappler	Guntersville, AL	444	followup
	Geo. Olcott Co.	Scottsboro, AL	649	closed
	Mason Corp.	Birmingham, AL	520	closed
	Russell	Alexander City, AL	455	closed
	Russell	Alexander City, AL	482	followup
	Russell	Alexander City, AL	452	followup
	Teledyne	Huntsville, AL	503	closed
	Vanity Fair	Monroeville, AL	476	closed
	Sheila McCormick	New Orleans, LA	614	closed
	AA, Inc.	Woodbridge, VA	563	followup
	SCI	Huntsville, AL	676	followup
	TNS Mills	Eufaula, AL	656	followup
	TNS Mills	Eufaula, AL	657	closed
	TNS Mills	Eufaula, AL	658	followup
	Speedring	Cullman, AL	612	followup
	Beaulieu of America	Bridgeport, AL	642	followup
	Teledyne	Huntsville, AL	504	closed
	Teledyne	Huntsville, AL	505	closed
	Kappler	Guntersville, AL	443	followup
	American Athletic Apparel	Puxico, MO	685	closed
	Roberts Curry Associates	Greenville, SC	697	closed
	Southern College of Technology	Marrietta, GA	698	closed
				22

This project was funded in part by the Alabama Center for Advanced Technology Transfer (ACATT) and UAH. One of the authors, Mr. Xiaomu Ye is a graduate research assistant at UAH.

2.7 Letters of Support

Letters of support for the technology transfer program have been received from the following firms:

- Andover Togs, Scottsboro, AL
- Morgan Research Corp., Huntsville, AL
- Lee Company, Bayou LaBatre, AL

Copies of these letters of support are given in Volume II.

3.0 PUBLICITY

3.1 Fact Sheets

Table 3-1 lists the fact sheets that were mailed to the three targeted industries in Alabama. The fact sheets were stopped in September since UAH was asked to de-emphasize problem statement solicitation. Copies of the fact sheets are given in Volume II.

Table 3-1. Fact Sheets Sent to Alabama Industries

		Alabama Industry		
Date	Fact Sheet	Apparel Manufacturing	Metal Working	Electronics Assembly
July	Access to NASA technology	X	X	X
	How to do business with government	X	X	X
	Characterizing metal fabrication industry in Alabama		X	
August	Technology transfer in Alabama	X	X	X
	NASA track record on free technical assistance	X	X	X
Firms in data base		127	92	66

3.2 News Releases

Letters were sent to the following organizations requesting publicity on the MSFC technology transfer program:

- American Apparel Contractors Association (AACA)
- National Center for Manufacturing Science
- Alabama Textile Manufacturing Association (ATMA)
- Bobbin magazine
- Apparel Industry magazine

Very little feedback has been received concerning which of the organizations have published the news releases. The AACA did publish a brief news article in its September newsletter.

3.3 Publications

The following publications have resulted from the project:

- "Technology Transfer to a Major Manufacturing Industry: Case Study of A State's Approach," M. Ziemke and B. Schroer, Journal of Technology Transfer, Vol. 17, No. 1, Winter 1992, pp. 25-34.
- "A Closer Look at Modular Manufacturing and Deming Management," M. Ziemke and B. Schroer, Industrial Engineering, August 1992, pp. 55-59.
- "Manufacturing's New Crystal Ball," B. Schroer, Bobbin; Part 1, August 1992, pp. 60-64; Part 2, September 1992, pp. 100-104; Part 3, October 1992, pp. 44-48.

The following research reports were prepared:

- Schroer, B., X. Ye, and M. Ziemke, 1993: Transferring Modular Manufacturing Technology to an Apparel Firm, UAH Report CAR93-04, February 1993.
- Haught, K., 1993: Synopsis of a Stereolithography Project, UAH Report CAR93-03, November 1992.

Copies of these publications are given in Volume II.

3.4 Bobbin Magazine

Bobbin magazine is one of the leading apparel trade journal in the world. Ms. Lisa Cedrone, technical editor, visited MSFC in January 1993 and has prepared the feature article on MSFC's technology transfer program for the March 1993 issue.

3.5 One Stop Access to NASA Technology Brochure

UAH, with assistance from the Alabama Industrial Development Training (AIDT), prepared a brochure "One-Stop Access to NASA Technology." The technology transfer services discussed in the brochures were:

- NASA Tech Brief magazine
- COSMIC
- Data base searches through the Regional Technology Transfer Center (RTTC)
- Technical assistance

This brochure was distributed to clients during site visits. AIDT provided layout support and printing of the brochure. This initial brochure has been replaced by a revised brochure "Access to NASA Technology: A Workbook" describing more of the MSFC technology transfer services.

4.0 TECHNOLOGY TRANSFER NETWORK DEVELOPMENT

4.1 Alabama Resource Center

The Alabama Resource Center in Birmingham is provided by the Alabama Power Company (APCO) as a resource to promote industrial growth throughout the state. This center has been visited several times by UAH to promote technology transfer. The APCO contact is Mr. Brian Langston.

In September, 1992, UAH promoted a visit by the NASA/MSFC TU Office to explain the operation of the technology transfer program at MSFC. Presentations were made by Ismail Akbay and Ken Fernandez. Present were many of the Alabama Power field service representatives. The result was a general agreement to use the Resource Center and Alabama Power representatives in a cooperative effort to promote technology transfer throughout the state. As a result of the meeting, Brian Langston was designated the point of contact for all technology transfer activities between MSFC and Alabama Power.

As a follow up to the meeting, Alabama Power officials visited the MSFC/TU Office in November, 1992. The group was led by Brian Langston. In addition to Earl Cooper of the Alabama Power corporate staff, there were fourteen other APCO members. Attendees were given a tour of the MSFC Manufacturing Productivity Center. As a consequence of these activities, APCO has agreed to work through Brian Langston to promote the use of MSFC problem statements and also to help with power-related problems that come to the MSFC/TU Office.

4.2 North Alabama Industrial Development Association

The North Alabama Industrial Development Association (NAIDA) is composed of public utilities, such as Huntsville Utilities, located in North Alabama counties and served by the TVA. NAIDA seeks to improve industrial development in its service area.

UAH made a visit to NAIDA headquarters in July, 1992. Visited were the Director, J.R. Washburn, Cindy Burns and S. Brooks Kracke. UAH gave a presentation of the UAH background in state technology transfer and the details of the UAH/MSFC contract. NAIDS has thirty members and meets monthly with an existing industrial support committee to seek help for industry members. NAIDS is funded by the fourteen local electric power utilities and reports to this group's board of directors.

As a follow-up to the July, 1992 meeting, a tech-transfer presentation was made at the NAIDA meeting at Belle Mina in August, 1992. Guest speakers were Bernard Schroer and Roger Black of the MSFC/TU Office. In attendance were members of several county development associations, chambers of commerce and three representatives of the TVA offices in Huntsville, Nashville and Chattanooga. As a result of these meetings, NAIDA has agreed to be an associate of MSFC/TU Office in promoting technology transfer in North Alabama.

4.3 Birmingham Chamber of Commerce

UAH made presentations to the two Birmingham Chamber's Manufacturing Round Tables in September and December 1992. After the second Round Table presentation, UAH met with the president of the Birmingham Chamber and discussed the MSFC technology transfer program and MSFC's involvement with the Huntsville Chamber of Commerce's technology transfer program. As a result, the Birmingham Chamber sent a letter to the MSFC Director requesting MSFC participation in a technology transfer program in Jefferson County.

In February a group of six members from Birmingham Chamber's Round Table visited the MSFC/TU office and toured MSFC laboratories. During this visit, further discussions were held concerning the MSFC/Birmingham technology transfer program.

4.4 NIST SE Manufacturing Technology Center

The National Institute of Standards and Technology (NIST) has established the Southeastern Manufacturing Technology Center (SMTC) at the University of South Carolina in Columbia. UAH visited the SMTC in October, 1992, to determine how well the project had succeeded in the transfer of advanced manufacturing technology throughout the Southeast. The UAH team met with James W. Bishop, Executive Director, Dr. Curtis Rhodes, Technical Director and Robert E. Sundius, Director of Technology Planning and Administration.

SMTC had not expanded beyond the borders of South Carolina. About one-half of the requests for assistance from industry were business-related and not technical. Some of these request were referred to local SBDCs. However, the SMTC has two senior business school professors on their Columbia staff.

Recruiting of clients is done by facilitators from the thirteen technical colleges in the state. The SMTC is attempting to become self-sufficient by charging clients for their services. SMTC has only been partially successful at this effort and has yet to execute a big-time "success story" wherein a number of jobs were saved or added.

One of SMTC's developments is the "virtual enterprise" wherein SMTC reformulates a client's business to accept a new technology. SMTC also uses a measuring machine to "reverse engineer" worn-out machine parts for which drawings no longer exist.

It is believed that the SMTC would like to make some sort of teaming arrangement with the MSFC/TU Office so that they can operate in Alabama. The staff indicated an interest to visit MSFC to discuss this possibility.

4.5 Alabama SBDC

In January, 1993, UAH arranged a meeting between Ismail Akbay and John Saudefur, Director of the Alabama Small Business Development Consortium (ASBDC). This consortium directs the actions of ten small business development centers (SBDCs) located throughout Alabama. These SBDCs divide up the 67 counties. Thus when the MSFC/TU Office initiates one of its "county sweep" technology transfer programs, a SBDC is involved. Also at the January meeting were Roger Black, Carl Ziemke and Dr. Ken Fernandez, all of the MSFC/TU Office, and David Day of the ASBDC. It was agreed that MSFC would inform the SBDC of future county sweeps and similar events. In turn, the ASBDC would ensure that one of its members would attend the meeting and provide support.

The MSFC/TU Office will provide the local SBDCs with any client request for business-related services. For their part, the local SBDC personnel will circulate the MSFC problem statement forms for use by their business contacts. This agreement has already begun to operate. In February, 1993, David Day met Roger Black in Jasper to plan the upcoming Walker County visit.

4.6 MSFC/TU Interface with ACATT

The Alabama Center for Advanced Technology Transfer (ACATT) is located in the Huntsville Jetport Industrial Complex. ACATT is funded by the Alabama Industrial Development Training (AIDT) to train industrial employees in CNC machining, robotics and the use of CAD work stations. ACATT has some of the most advanced manufacturing equipment in the state, including a cellular machining station and a stereolithography machine. Through stereolithography,

ACATT can use a laser to make a precision part from plastic directly from software numerical input. The parts are in exact scale and can be up to 10" x 10" x 10".

At UAH, the industrial and systems engineering department has worked closely with ACATT since its opening in 1990. Faculty and students have access to the facility for research. Thus, Dr. Bernard Schroer has worked to associate ACATT with the MSFC/TU Office, especially where training is indicated in problem statements.

Consequently, ACATT has agreed to hold an open house each Thursday at 5:00 p.m. for Alabama firms to visit and tour its facilities. In June, 1992, Dynetics Inc., of Huntsville toured the facility. In September, 1992, several MSFC employees toured the ACATT facilities. Subsequently, Mr. Jeff Sica of ACATT agreed to serve on the MSFC/TU Technical Assessment Board (TAB) and to accept problem statements. One of these problems, from Morgan Research Co. of Huntsville, resulted in ACATT production of a stereolithographed model of a small missile section. This model was very useful to Morgan Research in its marketing efforts.

4.7 Alabama Textile/Apparel Support Team

In October 1992, Governor Hunt directed the formation of a Textile/Apparel Industry Support Team directed by Kara Kennedy of ADECA. Harold Pitts of FCF Enterprises was elected to be the apparel industry representative on the team. Other members included personnel from Gurney Manufacturing, Auburn University and other apparel firms. Also included were Dr. Bernard Schroer and M. Carl Ziemke.

A project of the support team is an enlarged Alabama Apparel Producer's Directory to be completed in time for the September 1993 Bobbin Show in Atlanta. To assist the directory program, UAH provided samples of questionnaires from a commercial apparel contractor matchmaking firm. In February, 1993, UAH attended a meeting of the support team in Montgomery and presented a brief list of UAH support to the textile/apparel industry from October 1992 through January 1993.

5.0 1992 ALABAMA PROBLEM STATEMENTS

This section presents an analysis of the problem statement submitted to MSFC from Alabama for 1992. A total of 155 problem statements were submitted from 86 organizations and including individuals during 1992.

5.1 Problems by Month

Figure 5-1 gives the distribution of the problem statements submitted by month. The largest number of problems were submitted during July through

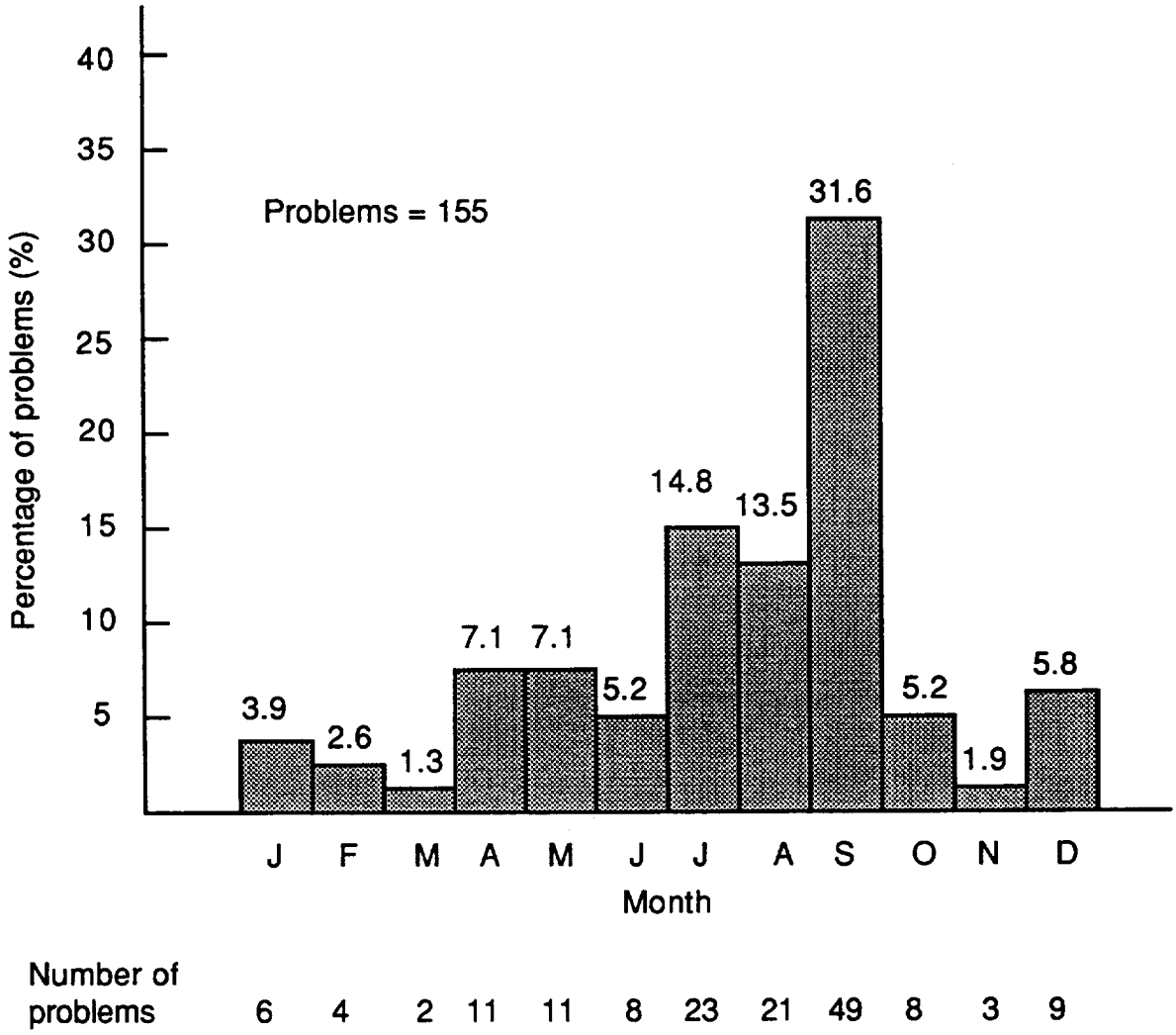


Figure 5-1. Receipt of problems by month (Alabama 1992)

September. In fact, sixty percent of all problems were received during these three months. In summary:

- Factors contributing to the large increase in problems during July through September were the ADECA county visit to Dale county in August and the UAH efforts starting in July to solicit problem statements.
- The decline in problem statements beginning in October resulted from de-emphasis of solicitation to allow reduction of backlog.
- An average of 13 problem statements were received per month.

5.2 Problems by County

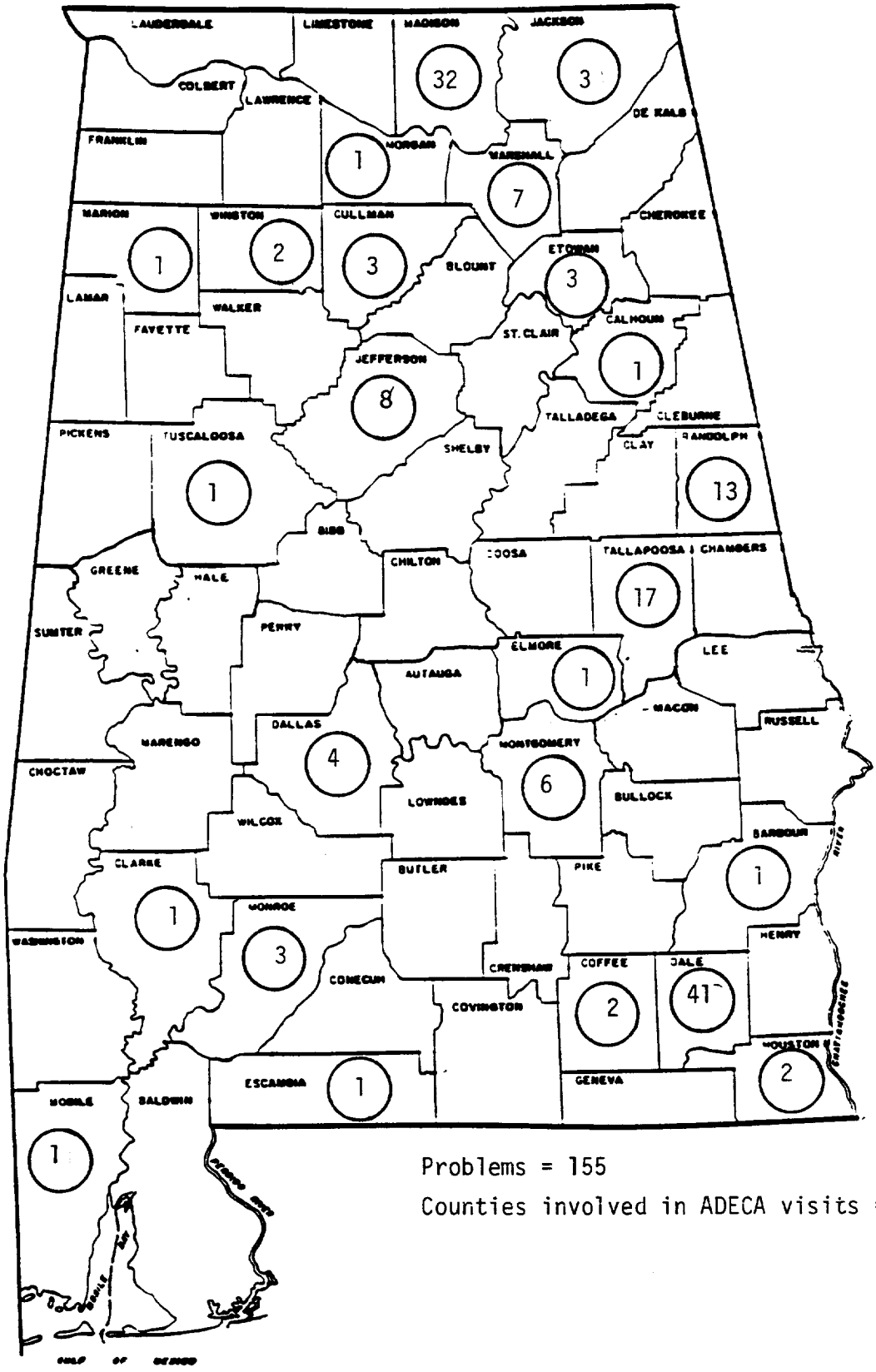
Figure 5-2 gives the number of problem statements submitted by county. Figure 5-3 gives the number of firms by county submitting problem statements. Figure 5-4 gives the distribution of problem statements submitted by firms. In summary:

- Counties having the largest number of firms submitting problems were Madison (31%), Dale (19%) and Randolph (12%). These three counties accounted for 62% of all the firms. Dale and Randolph counties were canvassed by the ADECA county visits.
- Counties submitting the largest number of problems were Dale (26%), Madison (21%), Tallopoosa (11%) and Randolph (8%). These counties accounted for 67% of all the problems.
- Factors contributing to the large number of problems from Dale and Randolph counties were the ADECA county visits.
- 24, or 36%, of the counties had firms submitting problem statements.
- A firm submitted an average of 1.8 problem statements.
- 71% of the firms, including individuals, submitted only one problem statement.
- 20% of the firms submitted 2 or 3 problem statements.
- 9% of the firms submitted 4 or more problem statements.

5.3 Problems by SIC Code

Table 5-1 gives the distribution of problem statements by SIC code. In summary:

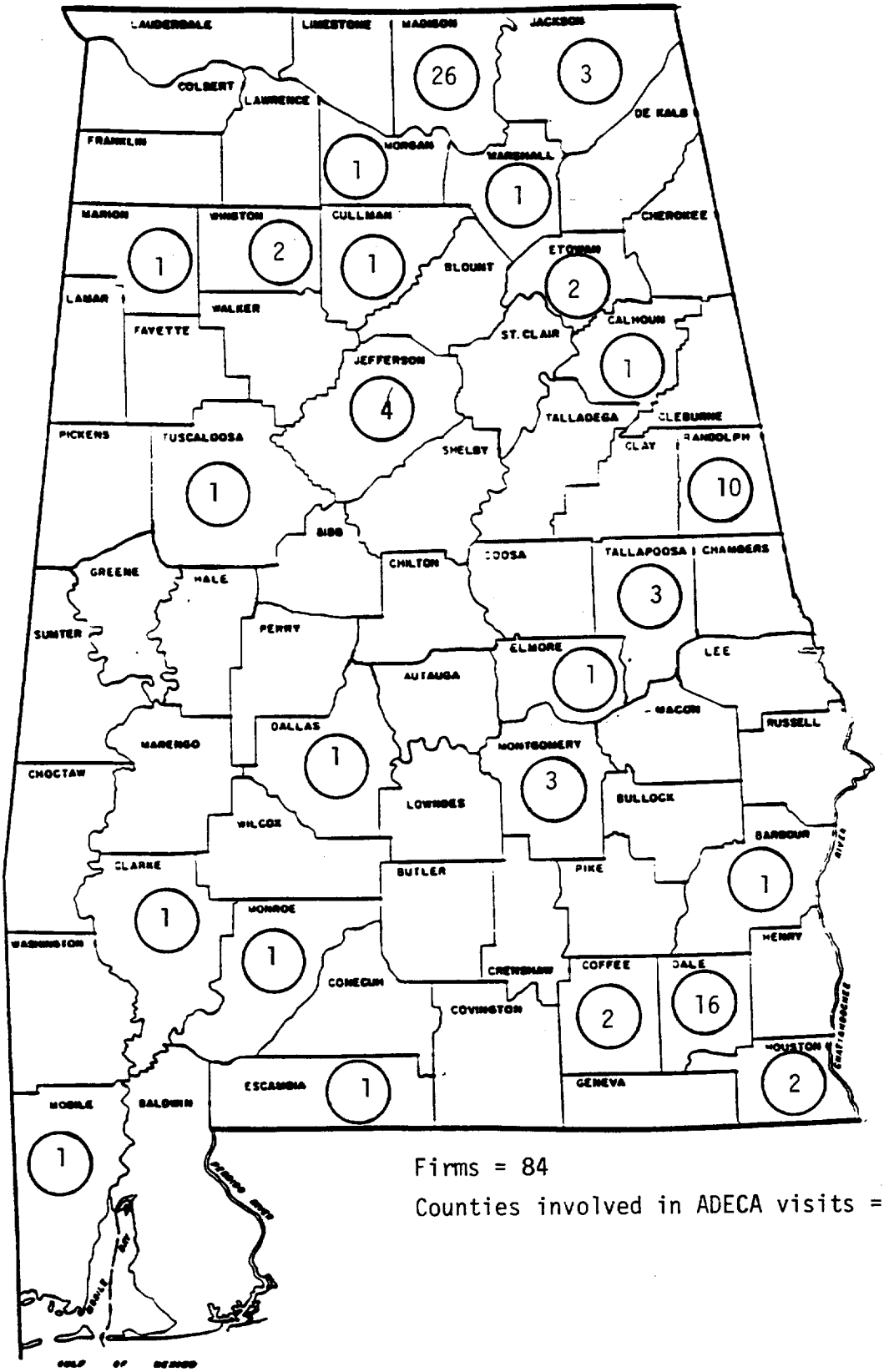
- 30% of problems were from SIC code 23 – Apparel and other Textile Products.
- 17% of problems were from SIC code 37 – Transportation Equipments.
- 10% of problems were from SIC code 34 – Fabricated Metal Products.



Problems = 155

Counties involved in ADECA visits = Dale and Randolph

Figure 5-2. Problems Submitted by County (1992)



Firms = 84

Counties involved in ADECA visits = Dale and Randolph

Figure 5-3. Firms Submitting Problems (1992)

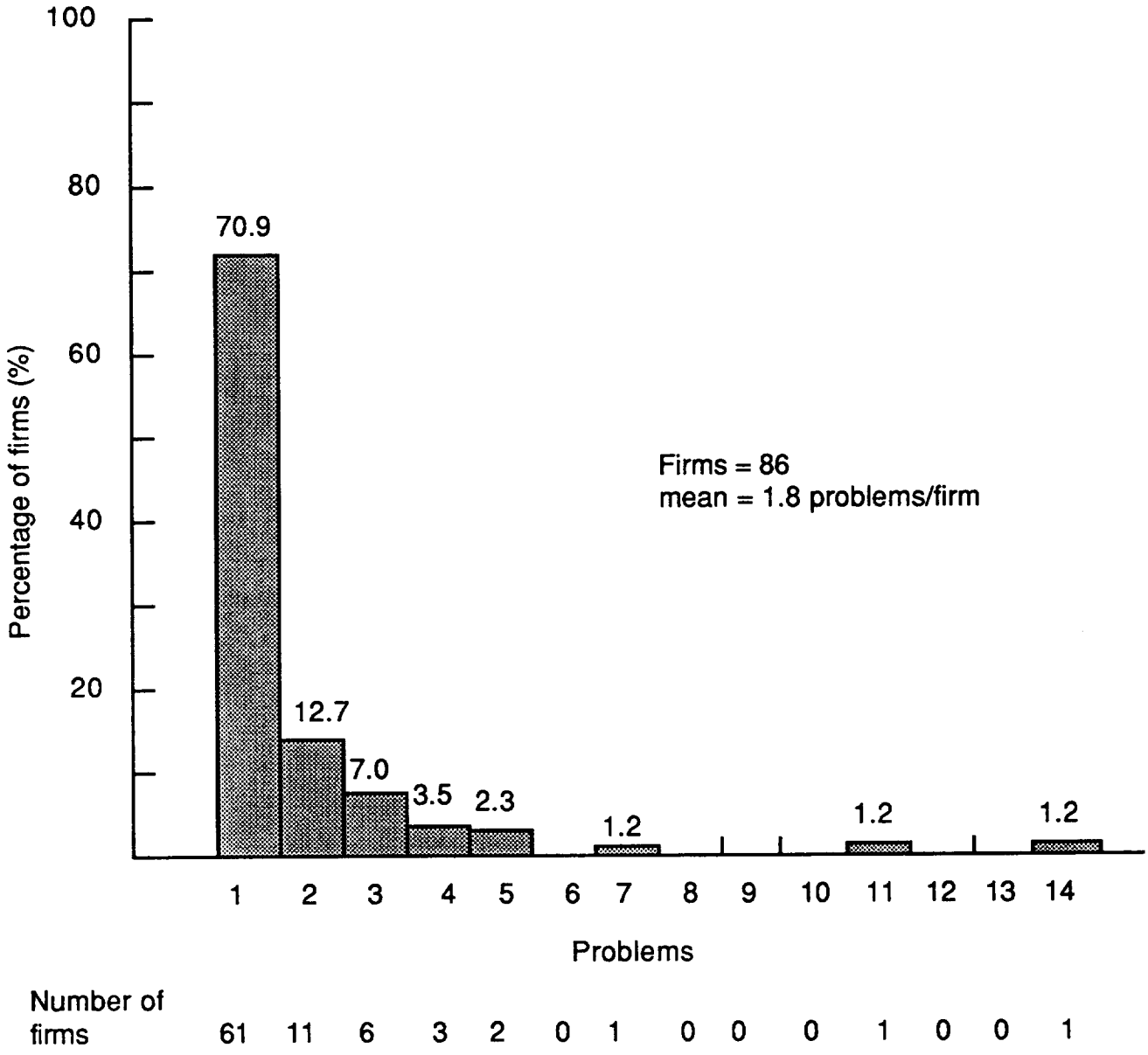


Figure 5-4. Number of problem statements submitted by Alabama firms (1992)

Table 5-1. Problems submitted by company SIC code (Alabama 1992)

SIC Code	Title	Firms	Problems	Problem / firm
22	Textile Mill Products	4	4	1.0
23	Apparel and Other Textile Products	12	37	3.1
24	Lumber and Wood Products	1	1	1.0
25	Furniture and Fixtures	1	1	1.0
27	Printing and Publishing	1	1	1.0
28	Chemicals and Allied Products	1	3	3.0
30	Rubber and Misc. Plastics Products	2	5	2.5
32	Stone, Clay and Glass Products	2	3	1.5
34	Fabricated Metal Products	6	12	2.0
35	Industrial Machinery and Equipment	9	12	1.3
36	Electronic and Other Electric Equipment	1	1	1.0
37	Transportation Equipment	7	21	3.0
38	Instruments and Related Products	2	2	1.0
73	Business Services	1	1	1.0
87	Engineering and Management Services	2	2	1.0
Total		52	106	2.0
Individuals		13	17	1.3
No SIC code		21	32	
Total		86	155	1.8

- 10% of problems were from SIC code 35 – Industrial Machinery and Equipment.
- 23% of all firms submitting problems were SIC code 23 – Apparel and Other Textile Products.
- The large percentage of problem statements from SIC codes 23, 34, and 35 resulted from the UAH focus on the apparel and metal fabrication industries.

5.4 Problems by Employment

Figure 5-5 gives the distribution of problems submitted by company size. Figure 5-6 gives the distribution of firms by company size submitting problems. In summary:

- 46% of firms submitting problems were individuals and less than 50 employees.
- 38% of firms submitting problems had 250+ employees.
- 13% of problem statements from individuals.
- 32% of problem statements from firms with less than 50 employees or individuals.
- 55% of problem statements from firms with more than 250 employees.
- An average of 1.8 problems were submitted per firm.
- Individuals and firms of less than 50 employees averaged 1.3 problems.
- Firms of 250+ employees averaged 2.7 problems.

5.5 Problem Response

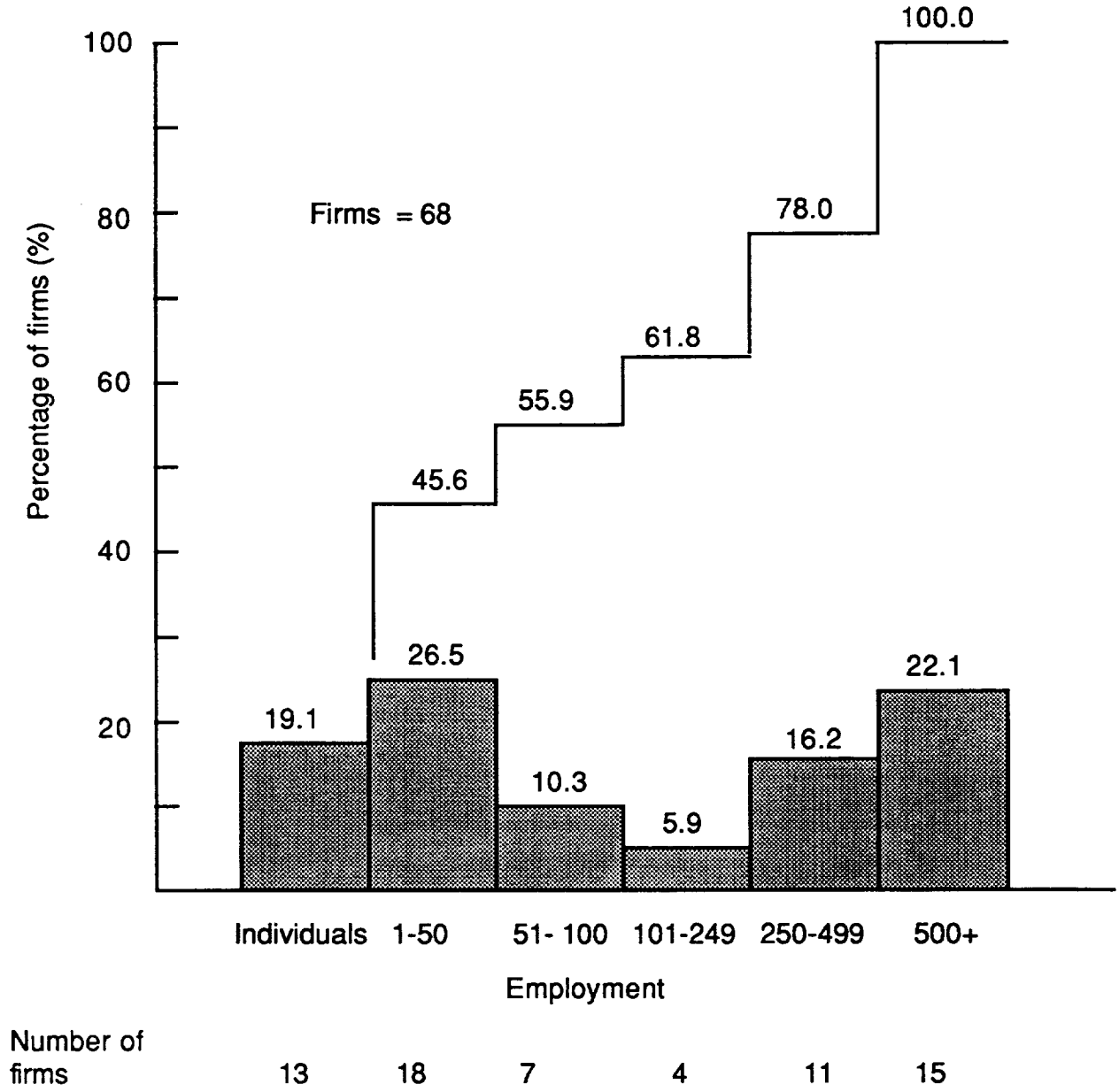
Figure 5-7 gives the status of the problem statements as of January 1, 1993. In summary:

- 77% of all problems statements that have been closed were closed positive.
- 12% of all problems that have been closed were closed negative.
- 11% of all problems that have been closed were closed referral or closed out of scope.
- 44 problems were still open as of January 1, 1993.

5.6 Time to Complete Problems

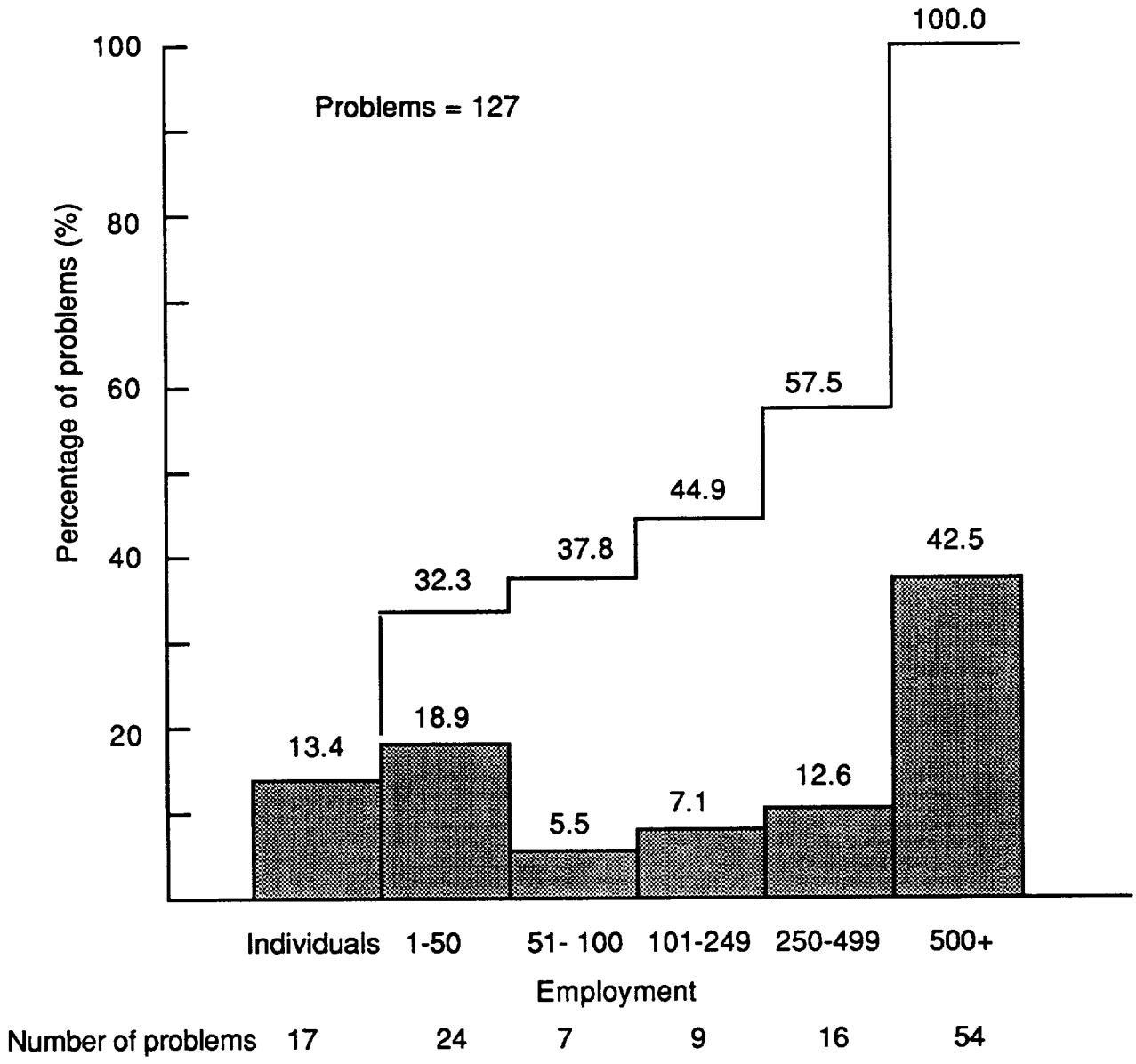
Figure 5-8 gives the distribution of time to complete a response to problem statements. In summary:

- Average time to close a problem statement was 7.5 weeks.
- 14% of problems were closed in two weeks or less.
- 35% of problems were closed in four weeks or less.
- 69% of problems were closed in eight weeks or less.



Note: there were 19 additional firms with no employment data

Figure 5-5. Firms submitting problems by company size (Alabama 1992)



Note: there were 28 additional problems with no employment data

Figure 5-6. Problems submitted by company size (Alabama 1992)

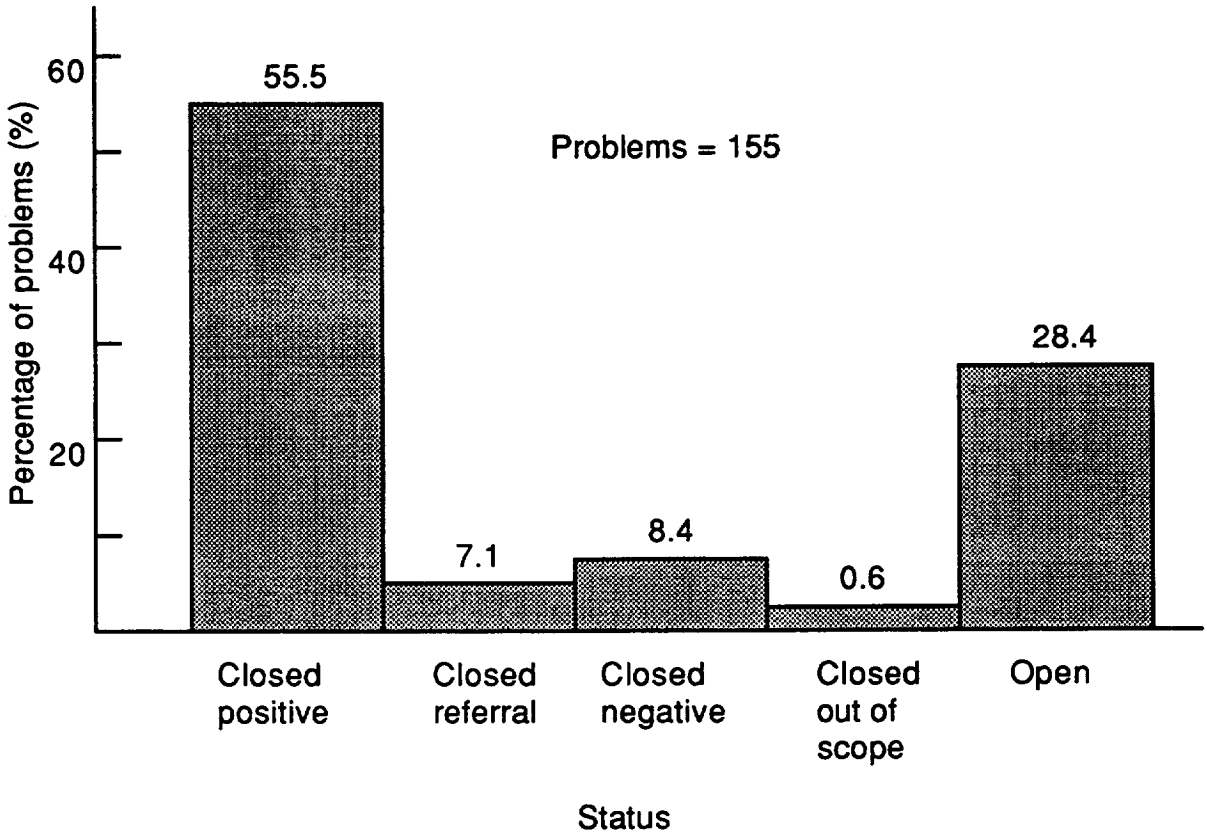


Figure 5-7. Status of problem statements as of January 1, 1993 (Alabama 1992)

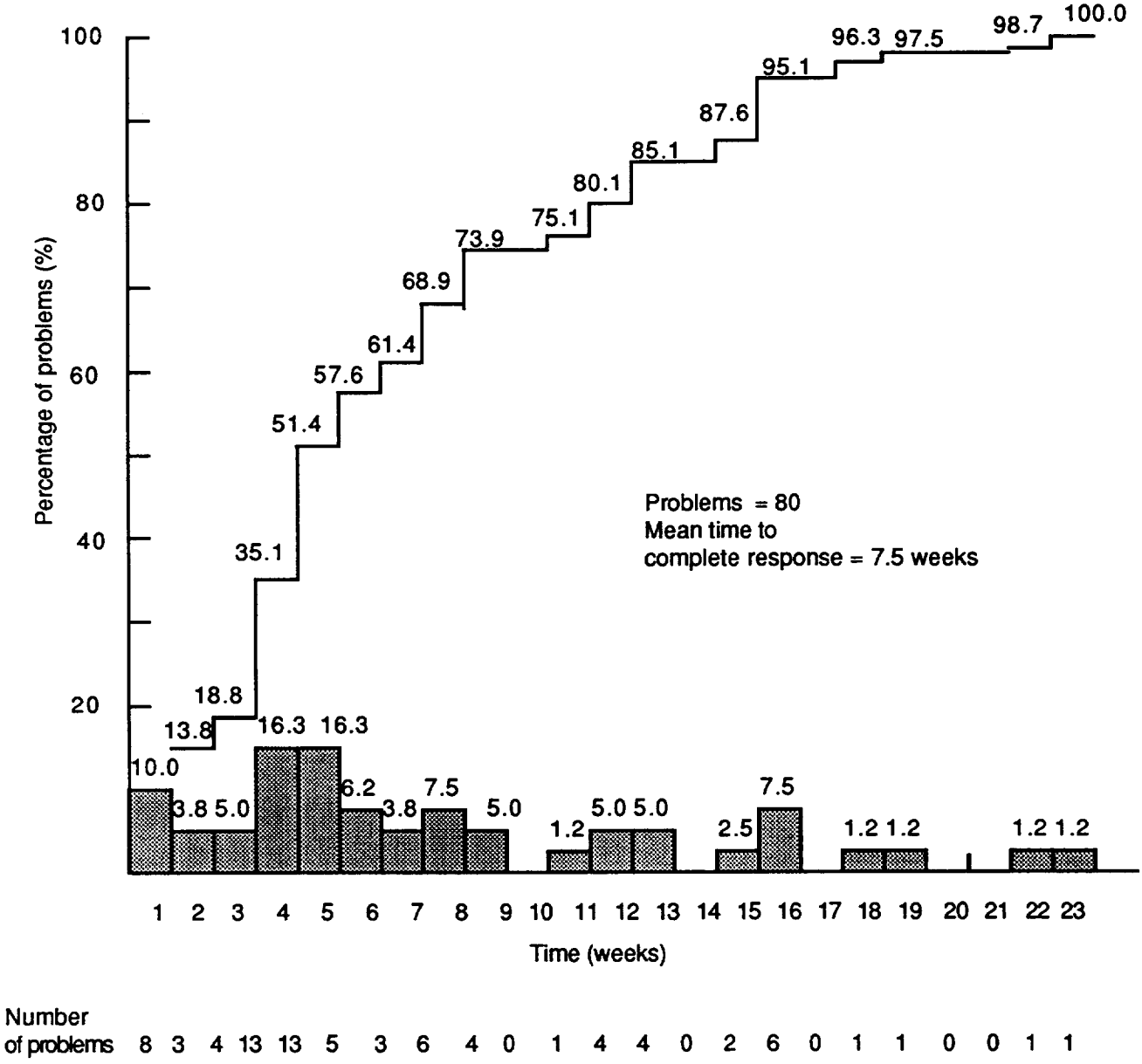


Figure 5-8. Time to complete response to problem statement (Alabama 1992)

- 12% of problems took sixteen or more weeks to close.

Figure 5-9 gives the distribution of the time that open problem statements have been in the system as of January 1, 1993. In summary:

- Open problems have been in the system an average of 11.7 weeks.
- 18% of problems have been in the system four or less weeks.
- 27% of problems have been in the system eight or less weeks.
- 14% of problems have been in the system twenty-one or more weeks.

It should be noted that as of the February 17, 1993, MSFC Technical Assessment Board (TAB), seventeen of the forty-four 1992 open problem statements have been close for Alabama. Of the twenty-seven open problems, seven were received in December 1992, five in November, one in October, six in September, four in August, and four in July.

6.0 PROBLEM STATEMENT FOLLOWUP SURVEY

A detailed followup was done of all Alabama problem statements that were closed positive between 1989 and October 1992. The results of this survey were submitted to MSFC as a separate report. Therefore, this report is given in Appendix A of this volume.

7.0 NASA TECH BRIEF SURVEY

A detailed survey was made of requests for NASA Tech Brief information between 1987-88. The results of this survey was submitted to MSFC as a separate report. Therefore, a copy of this report is given in Appendix B of this volume.

8.0 MSFC TECHNOLOGY TRANSFER MODEL

The MSFC technology transfer model was submitted to MSFC as a separate report. Therefore, this report is given in Appendix C of this volume.

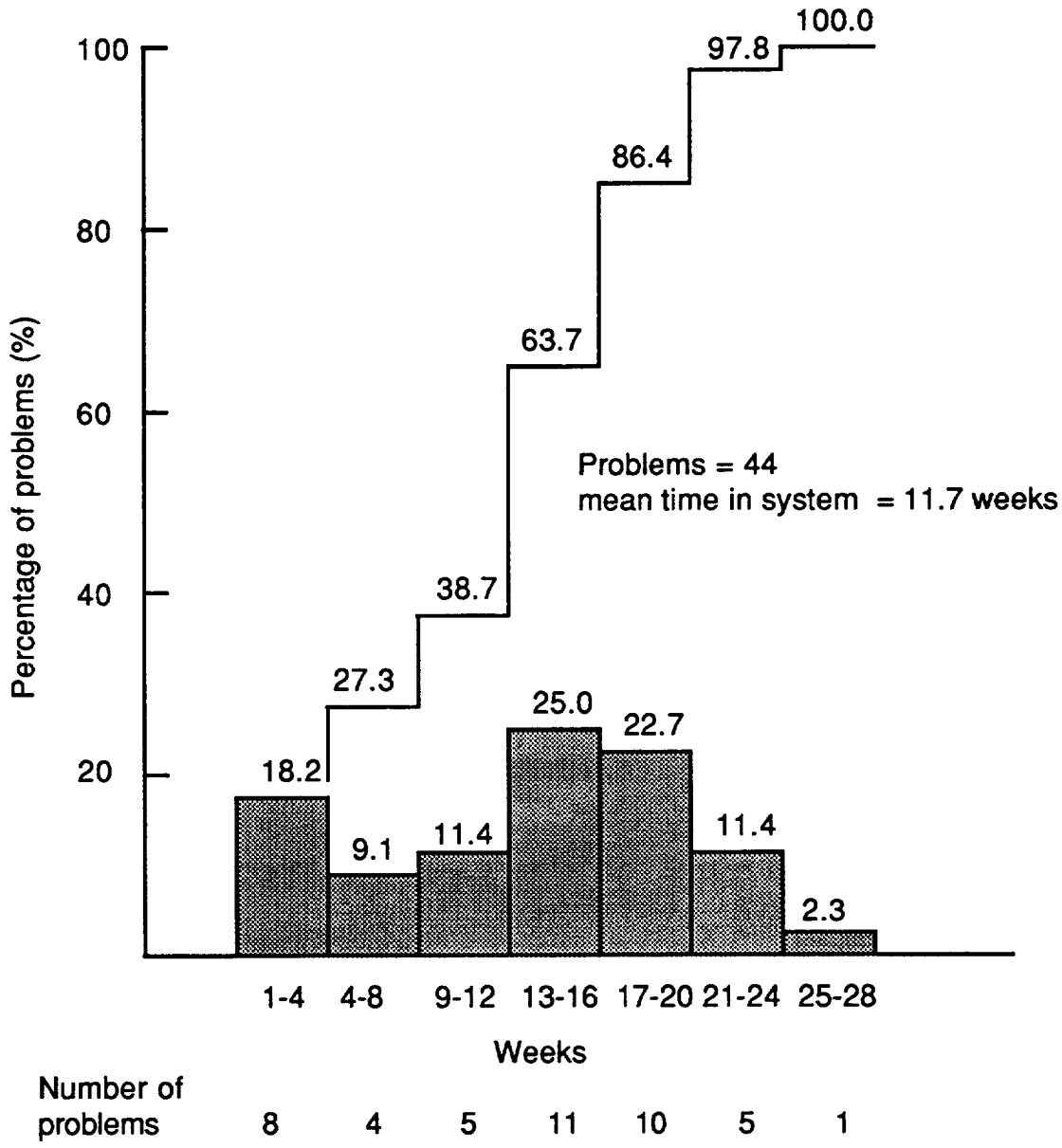


Figure 5-9. Time open problem statements have been in system (as of January 1, 1993)

9.0 REFERENCES

1. Schroer, B. and M. Ziemke, 1992: *Technical Transfer to the Apparel Manufacturing Industry III*, volumes 1 and 2, UAH Report CAR92-01, March 1992.

2. Schroer, B. and J. Wang, 1992a: *Simulation Support Environment for Modular Manufacturing Systems SSE5*, UAH Report CAR92-03, October 1992.

3. Schroer, B. and J. Wang, 1992b: *Simulation Support Environment for Modular Manufacturing Systems SSE3 and SSE6* , UAH Report CAR92-04.

APPENDIX A
Alabama Problem Statement Follow-up Survey

TECHNOLOGY TRANSFER FROM NASA TO TARGETED INDUSTRIES

ALABAMA PROBLEM STATEMENT FOLLOW-UP SURVEY

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Contract NCC8-18

March 1993

1.0 INTRODUCTION

The purpose of this work was to survey individuals in Alabama firms who had submitted Problems Statements that had been "closed positive" by the Marshall Space Flight Center's Technology Utilization Office (MSFC/TUO) from 1989 to October 31, 1992. "Closed positive" is an assessment by the principal engineer assigned to a Problem Statement that the client's request has been satisfied. The initial intention of the survey was two-fold: (1) to determine how the technical information supplied to the client was used and (2) to assess client satisfaction with the efforts of the MSFC/TUO. As the work evolved a third purpose emerged: to begin to assess the economic impact of the technologies transferred. Some survey questions were pilot tested to determine how well clients were able to assign an economic value to the services they received and if they were able to estimate some economic impact on their firm's performance as a result of the technical assistance received.

MSFC/TUO began to keep records of their transfer efforts in 1989, and this year represented the starting point of our study. Clients of Problem Statements closed positive after October 31, 1992 were not surveyed because we wanted to allow the client enough time to utilize the technology and to have some experience with its performance.

2.0 METHODLOGY

A questionnaire (Appendix 1) was designed and used in telephone interviews. The sample was obtained from the MSFC/TUO's Problem Statement data base. From the data base, we found 60 Problem Statements for Alabama clients that had been closed positive from 1989 to October 31, 1992. Repeated attempts were made to reach each of these clients. On average, it took two calls to reach a client. With the client's permission, the calls were tape recorded and later transcribed for further analysis.

In January 1993, a second set of questions was added to the original survey. These questions were designed to determine if clients could estimate the economic value of the services provided by MSFC/TUO and if they could determine if these services had an economic impact on their firm's performance. The questions were intentionally preliminary and were pilot tested on the last 14 clients telephoned. (Appendix 2).

3.0. RESPONSE RATE

Of 60 Problem Statements, 1 was submitted in 1990, 7 in 1991, and 52 in 1992 before October 31. Listed below in Table 1 is a tally of the survey status of

the clients for the 60 Problem Statements. The response rate on the telephone survey was 77% (46/60).

Table 1: Status of Telephone Survey Non-Respondents and Respondents

Status	Number of Clients
Client no longer at firm or phone no longer in service	4
Incomplete information, unable to call	3
Not a true closed positive problem statement	2
Closed to an application project	2
Repeated tries; client not available	3
Total clients not contacted	14
Total clients contacted	46
Total clients	60

4.0 SURVEY FINDINGS

4.1 Technology Utilization

One of the primary purposes of the survey was to determine how the technology transferred to the clients was utilized in the client's firm. The responses fell into the 5 categories summarized in Figure 1 below. 15% of the sample reported that the information they received was used to improve on-going processes in their firms. Another 15% reported that they were in the midst of developing the technologies further. Most of these clients had plans to develop new products, but no one reported actually having developed any new products or having modified any existing products with the technology received. An additional 13% of the sample reported getting help with product or process testing. This help could have been contacts with suppliers for test materials, help in getting materials or actual tests performed at MSFC. 22% of the sample used the technical information they received to help them make decisions. Occasionally the information stimulated new ideas or confirmed an idea or solution for the firm's owner or employees. But in all the above cases, the technologies were used either directly or indirectly.

Finally, 35% of the sample reported that the technical information they received did not really fit their need or their own specific application. In a few instances, the firm did not have the resources to implement the solution suggested by the MSFC/TUO.

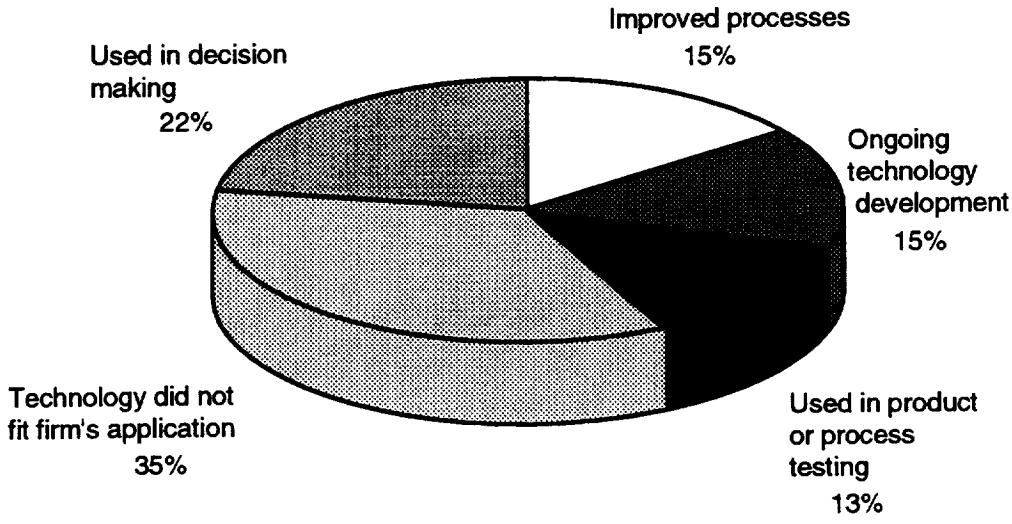

Figure 1. NASA Technology Utilization by Clients in Alabama

4.2 Importance of Problem

Clients were asked about the importance of the problems that had been submitted to the MSFC/TUO. On a scale of 1 (Not Very Important) to 5 (Very Important), the average response was 4.45 indicating that most clients believed that they were asking for assistance with problems that were very important to their firms. Figure 2 below breaks down the responses into the 5 scale values. 68% of the sample reported that their problems were extremely important.

4.3 Importance of MSFC/TUO's Contribution to Problem Solution

Figure 3 below summarizes the responses to the question: How important was the contribution made by MSFC/TUO to the solution of the problem you submitted? The question was asked of only those clients who indicated earlier that they had used the technology they had received in some way. The responses below do not include those clients who responded that the technology received did not fit their application. For about 80% of the respondents MSFC/TUO's contribution was at least moderately important. For almost 60%, MSFC/TUO's contribution was very to extremely important in solving their problems.

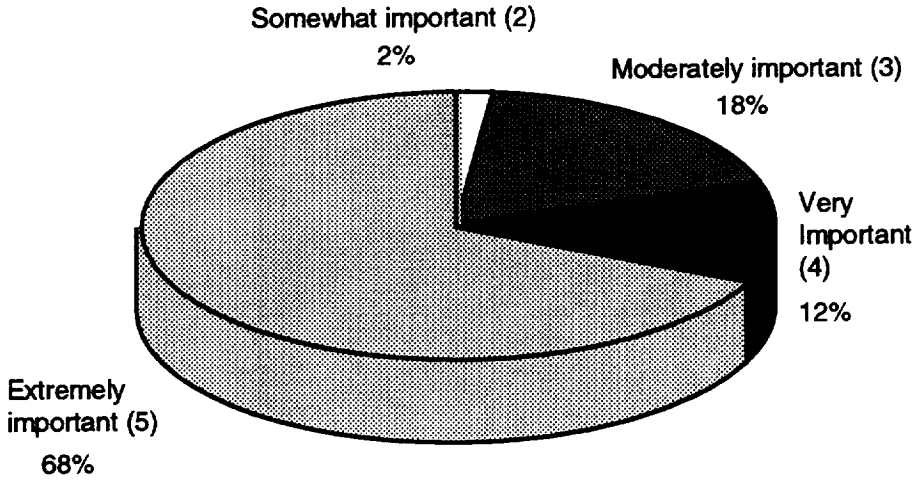

Figure 2. Client's rating of the importance of the technical problems submitted to MSFC/TUO

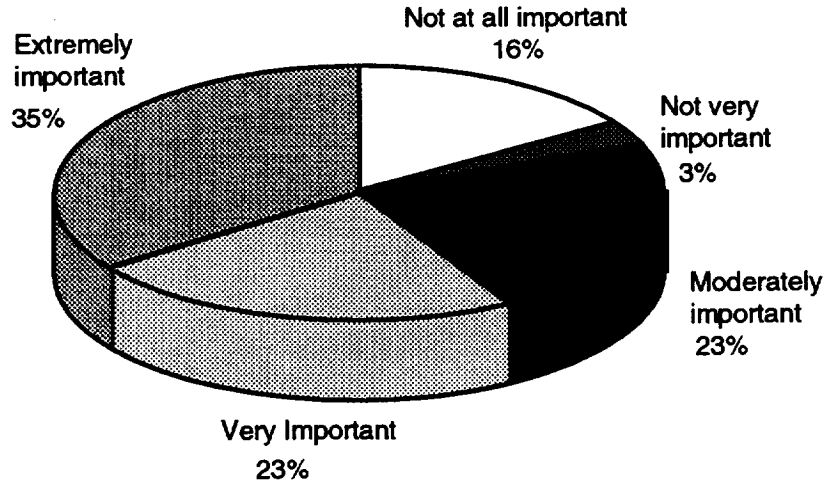

Figure 3. Client's estimation of the importance of the contribution of MSFC/TUO to problem's solution

4.4 Client Satisfaction and Expectations

We asked clients if they were satisfied with the efforts put forth by the MSFC/TUO in responding to their Problem Statements. We also asked if the MSFC/TUO met their expectations. We asked these questions even of clients who had responded earlier that the technology they received did not fit their application. Figure 4 below shows that the great majority of clients were satisfied with the TUO's efforts.

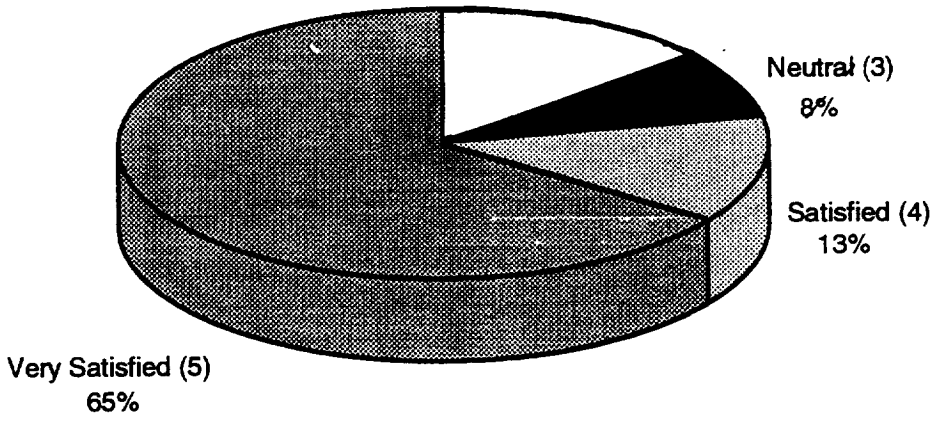

Figure 4. Client satisfaction with MSFC/UTO efforts to solve problem

Many clients expressed a great deal of appreciation for the efforts of the TUO. Some of these comments are paraphrased below.

We got a really good response out of NASA especially Mr. Roger Black. He's been great. I can call him; he'll return my calls and help me with anything. Problem Statement #338

I didn't know what to expect, but they certainly showed a great interest; and I appreciate what they did for us. Problem Statement #391

Without their help we could have never brought our product to market. I had already exhausted all my contacts in the private sector testing labs. It was very fortunate for us that we were able to get hooked up with NASA. Problem Statement #204

It solved a 2 year search for the appropriate technology for a specific application that I had identified. I'd probably still be looking if it wasn't for them. Problem Statement #320

Most clients said that the MSFC/TUO met their expectations. Some were uncertain what to expect and expressed this. About one-fourth said that their expectations were not met. Some of these had very high expectations and indicated that NASA, after all, should be able to solve most technology problems. The responses are tabulated in Figure 5 below.

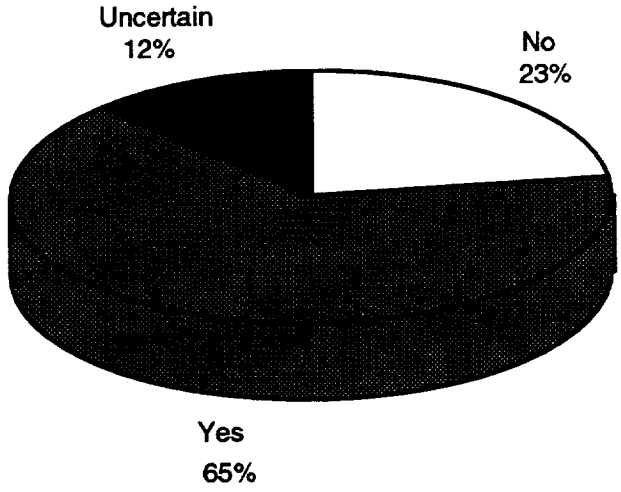

Figure 5. Did the efforts of MSFC/TUO meet your expectations?

4.5 Problem Statement Initiation

Two questions were asked to determine how Problem Statements were initiated. One of these questions was: How did you learn about the NASA Technology Transfer program at MSFC? The responses attest to the growing network of individuals and state organizations that assist the TUO in the efforts to spread the word about technology transfer. Listed in Table 2 below are categories of organizations and individuals who communicated to clients about the possibility

that the MSFC/TUO and NASA technologies might be able to help them solve technical problems in their firms.

We also asked specifically who actually initiated the Problem Statement(s) submitted. These results are summarized in Figure 6. In about half the cases, the clients themselves initiated the problem statement. The other half were initiated by a TUO representative or by a third party such as a SBDC representative.

Table 2. Where Clients Learned About NASA/MSFC Technology Transfer Program

ADECA
Alabama Power Company
Chambers of Commerce
Small Business Development Center
Friend or relative at Marshall
Visit/seminar by Marshall/NASA representatives
NASA Tech Briefs
UAH representatives
Bobbin Magazine
Other state firms assisted by program

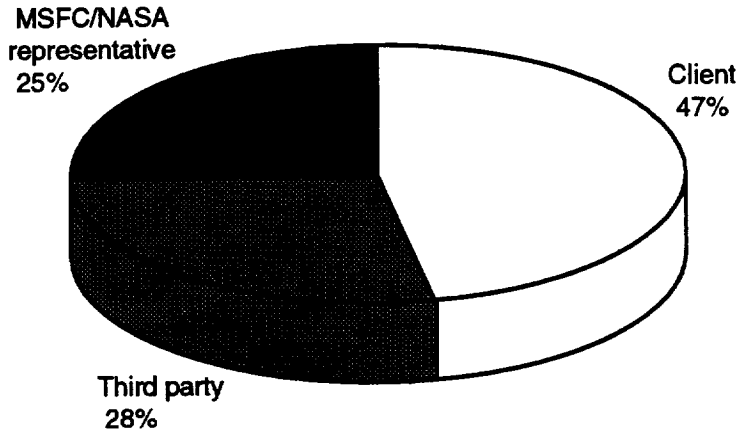

Figure 6. Who initiated problem statement?

4.6 Economic Impact Pilot

On the last 14 interviews done, clients were asked a few pilot questions to determine how to ask questions about economic impact and about the type of questions respondents might be able to answer. Half of the respondents could not estimate a dollar or time value of the technical information received. Some of the responses of the clients who tried to make an estimate are listed below.

Could not have made improvements without the help. If I had to pay, it would have taken lots of hours at $100/hour.

About $60/hour for 2 hours.

About 16 hours of an aerospace engineer's time.

About 40 hours of work at $85/hour.

If I hired an outside consultant, it would have cost me $1000/day. If I did it myself, it would have taken about 3 months of my time.

It would have cost $10,000 to hire a consulting firm to answer my question.

We also asked 3 questions about the clients expectations about the economic impact on the firm with respect to jobs saved or created, revenue enhancement or cost savings. These were questions which required a simple yes or no response. These responses are listed in Table 3 below.

Table 3. Client Expectations About Economic Impact of Assistance

	Yes	No
Create or save jobs	7	7
Increase firm revenue	10	4
Decrease costs	7	7

5.0 CONCLUSIONS

The telephone survey of Alabama clients of the MSFC/TUO who had problem statements closed positive from 1989 to October 31, 1992 indicates that in many areas the Marshall technology transfer program is effective and has the potential to improve to be even more effective. Indications of effectiveness are:

*Alabama business owners and managers trust MSFC/TUO with technical problems that they regard as being of considerable importance to their firms. The problems submitted to MSFC/TUO are not considered trivial to the clients who submit them (Figure 2).

*Those Alabama clients who actually use the technical assistance received responded that MSFC/TUO makes a solid contribution to the solutions to these problems Figure 3).

*The clients who actually use the technical assistance provided by MSFC/TUO are quite satisfied with the services provided (Figure 4).

*Most clients said MSFC/TUO met their expectations, and clients had high expectations of NASA technology and its transfer program (Figure 5).

*The Alabama technology transfer network which enlists the support of established state and local organizations appears to be working. When asked how they found out about MSFC's technology transfer program, clients frequently mentioned state agencies like ADECA, Alabama Power, the Small Business Development Centers and Chambers of Commerce (Table 2). This burgeoning technology transfer network creates cooperation within the state and leverages the resources of all participants.

The most disappointing finding was that 35% of the Alabama client's do not use, either directly or indirectly, the technical assistance they receive (Figure 1). Some of these clients do not utilize this assistance for reasons over which MSFC/TUO has no control. We do not believe that 100% technology utilization is a realistic goal. Other clients, however, do not use the technology transfered because the assistance provided was not quite what they wanted or needed. In these cases, a systematic, institutionalized follow-up survey of closed-positive Problem Statements could identify these clients; and additional attempts could be made to satisfy their requirements. Currently "closed positive" is a judgment made by members of MSFC/TUO. "Closed positive" ideally would be a judgement made by both the TUO and the client.

Finally, this study has analyzed some current practices and could provide a baseline for improvement. Such continuous improvement is at the heart of MSFC's emphasis on quality management.

6.0 RECOMMENDATIONS

We recommend that MSFC/TUO develop a system for the routine follow-up of closed positive Problem Statements. This follow-up could serve the following purposes:

(1) Determine if the client received the assistance desired.

(2) Determine if additional assistance is required.

(3) Assess the level of client satisfaction.

(4) Determine how the technology was used.

(5) Assess the economic impact of the assistance.

Such a system would require pilot testing before being installed. It is possible that due to the length of time required for technology adoption that 2 follow-up surveys be made: the first to assess items 1 through 3 above and a second to assess items 4 and 5 above. After the pilot test, the system should be installed and become a routine part of the Problem Statement process.

APPENDIX 1

TELEPHONE SURVEY OF STATE OF ALABAMA
MFSC/TUO PROBLEM STATEMENTS CLOSED--POSITIVE (1989-1992)

PROBLEM STATEMENT TITLE_____

_____

1. FIRM NAME_____ **2. CLIENT NAME**_____

3. STREET ADDRESS_____ **4.CITY**_____ **5. ZIP**_____

6. PHONE #_____

7. STATUS PHONE CALL (CIRCLE ONE)

1 NO ANSWER (DATES)_____
2 PHONE NO LONGER IN SERVICE
3 CALL BACK ON _____ AT _____
4 CLIENT NO LONGER AT FIRM
5 TALKED TO CLIENT

8. HOW WAS TECHNICAL INFORMATION (TECHNOLOGY) SENT BY MSFC/TUO USED?

1 IMPROVE PROCEDURES
2 MODIFY EXISTING PRODUCTS
3 DEVELOP NEW PRODUCTS
4 OTHER
_____
5 NOT USED

9. IF 1 THROUGH 4 -- DETAILS OF TECHNOLOGY USE

10. HOW IMPORTANT WAS THE PROBLEM MSFC/TUO HELPED SOLVE?

NOT VERY IMPORTANT		MODERATELY		VERY IMPORTANT
1	2	3	4	5

11. HOW IMPORTANT WAS MSFC/TUO CONTRIBUTION TO THE SOLUTION TO YOUR PROBLEM?

NOT VERY IMPORTANT		MODERATELY		VERY IMPORTANT
1	2	3	4	5

12. IF MSFC/TUO TECHNOLOGY WAS NOT USED, WHY NOT?

13. WHAT WOULD IT TAKE FOR TECHNOLOGY TO BE IMPLEMENTED BY FIRM?

14. HOW DID YOU FIND OUT THAT MSFC/TUO HAD TECHNOLOGY AVAILABLE THAT MIGHT HELP YOUR FIRM?

15. HOW WAS PROBLEM STATEMENT INITIATED?

1 BY CLIENT
2 BY NASA OUTREACH
3 BROKER OR MIDDLEMAN
(SPECIFY)_____

16. WERE YOU SATISFIED BY MSFC/TUO EFFORTS TO SOLVE PROBLEM?

VERY DISSATISFIED	DISSATISFIED	NEUTRAL	SATISFIED	VERY SATISFIED
1	2	3	4	5

COMMENTS:

17. DID MSFC/TUO MEET YOUR EXPECTATIONS?

1 NO
2 YES

EXPLAIN

18. HOW LONG DID MSFC/TUO TAKE TO RESPOND TO YOUR PROBLEM STATEMENT?

_____MONTHS

FIRM LEVEL DATA

19. INDUSTRY/LINE OF BUSINESS_____

20. TYPE OF PRODUCTS/SERVICES_____

21. NUMBER OF EMPLOYEES_____

22. YOUR ROLES/RESPONSIBILITIES AT YOUR FIRM_____

APPENDIX 2
PILOT SURVEY ECONOMIC IMPACT DATA

1. Please estimate the value of the services you obtained from MSFC/TUO? How much time would it have taken you or a member of your firm to obtain this information? What would you have had to pay a consultant for the information you received?

2. Do you expect that the assistance you received will help your firm save or create jobs?

1 NO
2 YES

3. Do you expect that the assistance you received will help increase your firm's revenues ?

1 NO
2 YES

4. Do you expect that the assistance you received will help your firm decrease expenses?

1 NO
2 YES

APPENDIX B
NASA Tech Brief Survey

TECHNOLOGY TRANSFER FROM NASA TO TARGETED INDUSTRIES

NASA TECH BRIEF SURVEY

Prepared by:

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Department of Management and Marketing
College of Administrative Science
University of Alabama in Huntsville
(205) 985-6944
FAX (205) 895-6733

Prepared for:

Technology Utilization Office
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812
(205) 544-0553
FAX (205) 544 3151

Contract NCC8-18

March 1993

1.0 INTRODUCTION

In 1991, Marshall Space Flight Center's Technology Utilization Office (MSFC/TUO) performed a survey of the utilization of technologies transferred via the publication of NASA Tech Briefs for requests made during the years 1985 - 1986. Our task was to repeat the 1991 survey using the questionnaire and methodology developed by the MSFC/TUO to survey those who had requested NASA Tech Briefs during 1987 and 1988. Additionally our task included follow-up telephone calls to respondents who might have interesting stories of successful technology utilization for possible inclusion in *Spinoff* Magazine.

2.0 METHODOLOGY

2.1 Mail Survey

Each individual who had requested a NASA Tech Brief during the years from 1987 - 1988 was mailed a survey packet containing a copy of each NASA Tech Brief previously requested, a transmittal letter explaining the survey and its purpose (Appendix 1) and a postcard questionnaire (Appendix 2). Eliminated from the survey were individuals who worked for libraries, identifiable public sector research organizations and other government agencies. The survey was aimed at assessing the utilization of NASA Tech Brief information by private sector firms and individuals.

Survey packets were mailed to 7250 individuals during the months of July and August 1992. Envelops returned as undeliverable were remailed in those cases where a forwarding address was supplied by the U. S. Post Office.

2.2. Mail Survey Response Rate

7250 survey packets were mailed, 668 packets were returned as undeliverable due to address changes and expired forwarding orders, and 1417 completed questionnaires were returned. This represents an effective response rate of 21%.

2.3 Telephone Follow-up

With the help of the MSFC/TUO's John Richardson, an initial sample of the 214 respondents who reported that they had used Tech Brief information for developing new products was chosen for follow-up telephone calls. With inputs from John Richardson and using *Spinoff* success stories as a guideline for the type of information of interest, some questions were generated for the telephone survey.

A total of 284 phone calls were made to contact 111 NASA Tech Brief survey respondents. On an average, 2.6 telephone calls were made per contact. A list of the respondents called appears in Appendix 3. Table 1 summarizes the number of telephone calls and contacts made.

Table 1. Tally of Telephone Calls and Contacts

	Calls Made	Contacts Made
Possible success story	50	27
No success story	155	84
Additional calls not resulting in contacts	79	
Totals	284	111

3.0 FINDINGS

3.1 Use of Tech Brief Information

Figure 1 below summarizes the responses from the 1417 questionnaires returned. 78% of all the 1987-1988 NASA Tech Brief requesters made use of this information in some way, usually in multiple ways. Most often checked were: stimulate ideas (63%), developed new products (15%) other unspecified uses (13%) and improved procedures (10%).

3.2 Possible *Spinoff* Success Stories

Appendix 4 contains preliminary information on 27 applications of NASA Tech Brief information that are candidates for possible *Spinoff* stories. The appendix contains the name of the respondent, company name and address, telephone number and a brief description of the application of the NASA Tech Brief information. All of the contacts listed are willing to discuss their technology application with other representatives from MSFC/TUO and/or a *Spinoff* writer or editor.

3.3 Other Comments About NASA Tech Briefs

While most of the NASA Tech Brief survey respondents who were called did not have NASA technology-related success stories to tell, most individuals were very enthusiastic about the publication of Tech Briefs and NASA's efforts to transfer technology through this mechanism. Some of these responses are presented in Appendix 5.

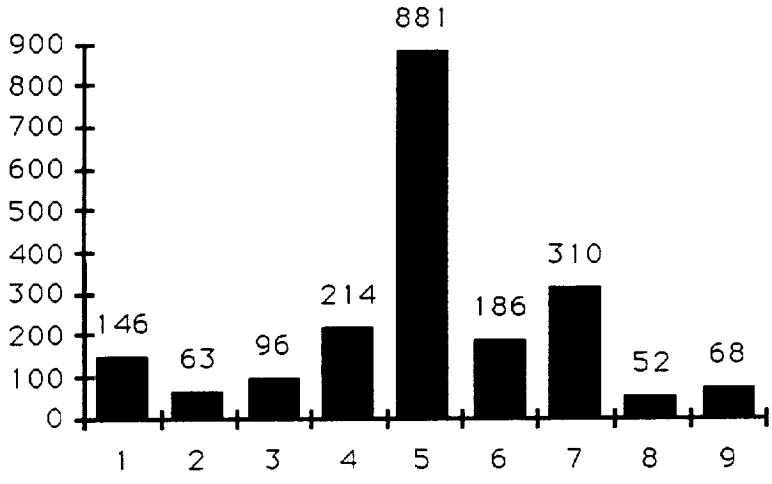

Figure 1: Utilization of NASA Tech Briefs

KEY:

Uses of Tech Brief Information	Number of Responses	Percent*
1 Improved Procedures	146	10.44%
2. Increased Productivity	63	5.40%
3. Modified Existing Products	96	6.86%
4. Developed New Products	214	15.30%
5. Stimulated Ideas	881	62.97%
6. Other Uses	186	13.30%
7. Not Used	310	22.16%
8. Additional information needed	52	3.72%
9. Information not received	68	4.86%

*Percent totals more than 100% as respondents could chose more than one category of response.

4.0 RECOMMENDATIONS

We recommend that the MSFC/TUO conduct a survey, in 1993, of individuals who requested NASA Tech Briefs from 1989-1990. Even with long technology development times, we believe these individuals had enough time to utilize the information they requested. We do recommend that the survey of 1991-1992 requests be postponed until 1994 to allow sufficient time for the NASA Tech Brief information requested to be utilized.

We also recommend the current postcard questionnaire be modified slightly to ask a few questions about the possible economic impact of any process improvements and/or product modifications or developments resulting from the use of NASA Tech Brief information. Appendix 6 is an example of what the new postcard questionnaire might look like. This information would be useful in itself as a strong indicator of the value of NASA Tech Briefs and would also serve to isolate the most promising respondents for follow-up phone calls for possible *Spinoff* stories.

APPENDIX 1
MAIL SURVEY COVER LETTER

July 1992

Dear NASA Tech Brief Reader:

Some time ago you requested information on the enclosed NASA/MSFC (National Aeronautics and Space Administration/Marshall Space Flight Center) Tech Brief(s) initially published in 1987 or 1988. The Technology Utilization Office at NASA/MSFC has asked the University of Alabama in Huntsville to assist them in determining if the information in the enclosed Tech Brief(s) satisfied your requirements and if this information helped your firm improve procedures, increase productivity, modify existing products, or develop new products. If you have used this information, we may be able to help publicize your application in NASA's Spinoff, a widely distributed annual publication which could be helpful in marketing your product(s) or in bringing publicity to your company. We request that you complete the enclosed Tech Brief Follow-Up Postcard and return it as soon as possible.

The Technology Utilization Office at NASA/MSFC would like to take this opportunity to offer further assistance to you. If this office can be of service, please write me or call John Richardson at (205) 544-0964, FAX (205) 544-3151. Thank you for your interest in NASA technology and your help with this survey.

Sincerely,

Mary S. Spann, Ph.D.
Assistant Professor

Enclosures

NASA
National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

Postage and Fees Paid
National Aeronautics and
Space Administration
NASA 451

NASA George C. Marshall Space Flight Center
Technology Utilization Office
AT01
Huntsville, Alabama 35812

1-7-91

TECH BRIEF FOLLOW-UP

My request for Tech Brief information was used to:

- ☐ Improve Procedures
- ☐ Increase Productivity
- ☐ Modify Existing Products
- ☐ Develop New Products
- ☐ Stimulate Ideas

Other: _____

- ☐ Not Used
- ☐ Additional information needed
- ☐ Information was not received

Name _____

Company _____

Address _____

City/State/Zip _____

Telephone No. _____

Benefits to you or your company. Please comment.

MSFC One-Time Form 124

(Fold on dotted line)

1-7-91a

	A	B	C	D	E	F	G
1	Contact's Name	Contact's Firm	Contact Address	Contact Phone	Date/time Contacte	Calls Made	Send SpinOff
2							
3	Basile, Andrew X.	Tekrite	5104 Forest Rd.	(612)934-3798	28 Jan, 1605	1	Y
4			Minnetonka, MN 55345				
5							
6	Byrd, N.R.	McDonnell Douglas	2211 Lewis Ave	(301)881-5374	29 Jan, 1210	2	Y
7			Rockville, MD 20851				
8							
9	Toujimis, Dr. A.J.	Toujimis Research Corp.	2211 Lewis Ave	(301)881-2450	4 Feb, 1405	1	Y
10			Rockville, MD 20851				
11							
12	Sinclair, John	Sinclair Res. Co.	41400 Airport Rd.	(707)937-5404	21 Jan, 1235	1	Y
13			Little River, CA 95456				
14							
15	Musil, Jay L.	Aero/Optimums	157 Wolf Ave.	(216)336-5578	28 Jan, 1345	1	
16			Wadsworth, OH 44281				
17							
18	Gurnsey, Ronald A.	Ron Gurnsey Associates	7503 Ambergate Pl, #1	(703)356-1079	28 Jan, 1435	1	
19			McLean, VA 22102-7503				
20							
21	Engelbrecht, Heinz L	Neundorfer, Inc.	4590 Hamann Parkway	(216)942-8990	28 Jan, 1505	2	
22			Willoughby, OH 44094-5691				
23							
24	Avari, Michael	CTS	225 Cherry Valley Avenue	(516)747-2300	28 Jan, 1450	1	
25			Garden City, NY 11530				
26							
27	Cannon, Bart	Cannon Microprobe	1041 NE 100th St.	(206)522-9233	28 Jan, 1640	1	
28			Sea, WA 98123				
29							
30	Baker, Jorj C.	Digital Animation	3501 Hollyslope Rd.	(818)791-0400	29 Jan, 1235	2	
31			Altadena, CA 91001-3922				
32							
33	Ratcliffe, C.A.	Sancrafter Co.	P.O.Box 1068	(206)378-3650	29 Jan, 1230	3	
34			Friday Harbor, WA 98250				
35							
36	Glett, Bryan L.	Manatech Associates	P.O.Box 37	(513)599-1188	4 Feb, 1255	2	

	A	B	C	D	E	F	G
37			Bellefontaine, OH 43311				
38							
39	Ellis, Jonathan	Analogic Corp.	360 Audubon Rd.	(508)977-3000	F Feb, 1400	1	
40			Wakefield, MA 01880	X 2010			
41							
42	Barth, Jon	Barth Electronics Inc.	1300 Wyoming St.	(702)293-1576	4 Feb, 1510	1	
43			Boulder City, NV 89005				
44							
45	Kirkpatrick, Marc	TRW	1 Space Park MS:E1/4012	(310)814-1777	28 Jan, 1340	2	Y
46			Redondo Beach, CA 90278				
47							
48	Waugh, John	Wautec Inc.	758 Hillside Dr.	(805)688-3295	28 Jan, 1430	2	Y
49			Solvang, CA 93463				
50							
51	Preslar, Mack J.	Dehlar Medical	107 Howell Lane	(919)942-6486	28-Jan	2	Y
52			Chapel Hill, NC 27514				
53							
54	Snow, Dr. David B.	United Tech. Research C	411 Silver Lane	(203)727-7077	21 Jan, 1440	1	Y
55			East Hartford, CT 06108				
56							
57	Rightmyer, Rob	Rightmyer Aviation Co.	5436 Gilling Rd.	(804)743-7782	28 Jan, 1035	1	Y
58			Richmond, VA 23234				
59							
60	McMahon, L.B.	Cox & Co.	33 Mt. Rainier	(516)366-0200	28 Jan, 1040	1	Y
61			Farmingville, NY 11738	X 430			
62							
63	Connors, L.P.	Liberty Polyglas, Inc.	1575 Lebanon School Rd.	(412)466-8611	28 Jan, 1045	1	Y
64			West Mifflin, PA 15122				
65							
66	Burroughs, Jack E.	Seecor, Inc.	2265 Handley-Ederville Rd.	(817)589-1235	28 Jan, 1055	1	Y
67			Fort Worth, TX 76118				
68							
69	Lindsley, T.W.	SMCO, Inc.	4012 W Illinois Ave.				
70			Dallas, TX 75211-0300	(214)337-8911	28 Jan, 1100	1	Y
71							
72	Koch, Ulrich H.	NUPRO Company	4800 East 345th St.	(216)951-7100	28 Jan, 1355	1	Y

	A	B	C	D	E	F	G
73			Willoughby, OH 44094				
74							
75	Phillips, Joseph		513 Holly Ln.	(317)453-6132	28 Jan, 1400	1	Y
76			Kokomo, IN 46902-3332				
77							
78	Hodge, Dr. F. Galen	Haynes International	P.O.Box 9013	(317)456-6000	28 Jan, 1400	1	
79			Kokomo, IN 46904				
80							
81	Granholm, Erik A.	Harris Corp.	P.O.Box 94000 MS: 22/4852	(407)727-6519	28 Jan, 1430	1	Y
82			Melbourne, FL 32902				
83							
84	Broder, Alan	Alan Broder Consulting	108 Corey Lane	(516)579-3795	28 Jan, 1455	1	Y
85			East Meadow, NY 11554				
86							
87	Goldstein, Norton	Boeing Airplane Co.	6542 39th N.E.	(206)477-2656	28 Jan, 1645	1	Y
88			Seattle, WA 98115				
89							
90	Haney, Lewis C.	L.C. Haney Co.	2409 N. Kerby Ave.	(503)287-8652	28 Jan, 1635	1	Y
91			Portland, OR 97227				
92							
93	Kujawa, Pat	MSE, Inc.	P.O.Box 3767	(406)494-7313	28 Jan, 1625	2	Y
94			Butte, MT 59702				
95							
96	Cavalleri, R.	Applied Technology Ass	P.O.Box 149434	(407)894-6151	28 Jan, 1555	2	Y
97			Orlando, FL 32814				
98							
99	Jones, Nelson E.	New Tech Engineering	2729 Austin Ct.	(805)534-9401	21 Jan, 1325	1	Y
100			Los Osos, CA 93402				
101							
102	Mason, Larry	Martin Marietta	P.O.Box 179 MS: B0560	(303)971-9067	28 Jan, 1615	1	Y
103			Denver, CO 80201				
104							
105	Miller, Ken	Prographics	1200 Ladera Way	(415)591-0467	29 Jan, 1225	4	Y
106			Belmont, CA 94002				
107							
108	Gillespie, M.L.	McDonnell Douglas Aero.	Claire Christian	(714)896-2631	21 Jan, 1350	2	Y

	A	B	C	D	E	F	G
109			Periodicals Librarian				
110			5301 Bolsa MS: A3-G441				
111			Huntington Beach, CA 92646				
112							
113	Perez, Jim	McDonnell Douglas Aero.		(714)896-7945	29 Jan, 1250	4	
114							
115	Van/Kersen, C.	Qmax Tech Group	1001 S. Browns School Rd.	(513)890-5231	29 Jan, 1300	4	Y
116			Vandalia, OH 45377				
117							
118	Anthony, Keith D.	USAF/FASTC/TATC	4115 Hebble Ck Rd, Suite 31	(513)257-4268	29 Jan, 1305	4	Y
119			WPAFB, OH 45433				
120							
121	Manitakos, Daniel	Inframetrics, Inc.	16 Esquire Road	(508)670-5555	29 Jan, 1315	2	Y
122			Billerica, MA 01862				
123							
124	Anderson, Morris G.	Allied Signal	P.O.Box 52181 MS: 503/4P	(602)231-5044	4 Feb, 1445	1	Y
125			Phoenix, AZ 85072-2181				
126							
127	Deichert, Michael	Micro-Radian Instrumer	350 Mulberry Drive	(619)744-4133	4 Feb, 1455	1	Y
128			San Marcos, CA 92069				
129							
130	Adams, Steve	APT Engineering	4873 Portrait Pl.	(719)574-1976	5 Feb, 1210	4	Y
131			Colorado Springs, CO 80917				
132							
133	Bashkoff, Bernard	Grumman Space Station	1760 Business Center Dr.	(703)438-5672	5 Feb, 1240	2	Y
134			Reston, VA 22090				
135							
136	Currey, J.R.	UT Pratt & Whitney	5121 Laird Ln.	(407)796-1492	5 Feb, 1245	5	Y
137			Jupiter, FL 33458				
138							
139	Whitlinger, J.E.	BTR Valve Sealants, Inc.	2990 Spruce Ave.	(412)244-5251	5 Feb, 1315	4	Y
140			Allison Park, PA 15101				
141							
142	Gunderson, Darrell L	CRYOVAC	P.O.Box 464	(803)433-2248	5 Feb, 1420	1	Y
143			Duncan, SC 29334				
144							

	A	B	C	D	E	F	G
145	Buyukisik, Osman	GE Aircraft Engines	1 Neumann Way, T36	(513)672-6928	5 Feb, 1440	1	Y
146			Evendale, OH 45215				
147							
148	Kahan, Mark	Optical Research Assoc.	945 Concord St.	(508)872-6001	4 Feb, 1355	1	Y (90-92)
149			Framingham, MA				
150							
151	Bear, M.S.	Bear Engineering Co.	1257 Main St.	(508)668-5629	11 Feb, 1325	2	Y
152			Walpole, MA 02081				
153							
154	Wolff, Peter	GE Aerospace	Lakeside Ave, Rm. 1311	(802)657-6198	11 Feb, 1325	1	Y
155			Burlington, VT 05401-4985				
156							
157	Schutz, Peter	Schutz Engineering Corp	45 River Rd.	(908)277-4100	11 Feb, 1345	1	Y
158			Summit, NJ 07901				
159							
160	Lin, Newman K.	App. Sci. & Eng. Researcl	22648 S.W. 54th Ave.	(407)487-9338	11 Feb, 1410	5	Y
161			Boca Raton, FL 33433				
162							
163	Mandel, Jerry	Partex Corp.	9451 Timberleaf Dr.	(310)331-5556	11 Feb, 1440	1	Y
164			Dallas, TX 75243-6123				
165							
166	Schmelzer, Lynn	LCN Closers	S 121 W. Railroad Ave.	(815)875-3311	11 Feb, 1530	1	
167			Princeton, IL 61356-0100				
168							
169	Trobaugh, Glen	CAE-Link Corp.	2224 Bay Area Blvd.	(713)280-4258	11 Feb, 1545	2	
170			Houston, TX 77058				
171							
172	Dirks, Ken	AlliedSignal	P.O.Box 52181, MS: 503-4K	(602)231-1000	11 Feb, 1600	2	Y
173			Phoenix, AZ 85072-2181				
174							
175	Reader, Paul	Ion Tech Inc.	2330 East Prospect	(303)221-1807	11 Feb, 1625	1	Y
176			Fort Collins, CO 80525				
177							
178	Montreuil, Leo	Scientific Atlanta	4357-J Park Dr.	(404)903-5316	12 Feb, 1440	5	Y
179			Norcross, GA 30093				
180							

	A	B	C	D	E	F	G
181	Poteet, Wade M.	System Specialists, Inc	3125 E. 47th St.	(602)622-7513	12 Feb, 1545	4	Y
182			Tucson, AZ 85713				
183							
184	Larkin, Michael	E.T.E.	3080 Ellis Ave NE	(503)581-0404	12 Feb, 1550	1	Y
185			Salem, OR 97301				
186							
187	Sherikar, Dr. Sanjay	Control Components, Inc	24671 Tarazona	(714)858-1877	12 Feb, 1555	1	Y
188			Mission Viejo, CA 92692				
189							
190	Morris, Terry	Airesearch	12445 Lambert Circle	(310)512-3614	12 Feb, 1400	1	Y
191			Garden Grove, CA 92641				
192							
193	Montalvo, Susan McConnell		20915 Ave San Luis	(818)340-2253	12 Feb, 1605	1	Y
194			Woodland Hills, CA 91364				
195							
196	Duggleby, C. Mark	Podwerks	P.O.Box 5673	(919)233-9247	28 Jan, 1515	3	Y
197			Raleigh, NC 27650				
198							
199	Weitz, Paul	Simmonds Precision	Panton Road	(802)877-4606	4 Feb, 1325	2	Y
200			Vergennes, VT 05491				
201							
202	Scott, G.J.	Boeing	1610 Sunlake	(205)461-5794	18 Feb, 1540	2	Y
203			Huntsville, AL 35824				
204							
205	Diesner, Roy W.	Sundstrand	4747 Harrison, P.O.Box 7002	(815)394-2941	18 Feb, 1545	2	Y
206			Rockford, IL 61125-7002				
207							
208	Autonsen, George	Varian Corporation	1678 S. Pioneer Rd.	(801)973-5154	18 Feb, 1555	5	Y
209			Salt Lake City, UT 84104				
210							
211	Bergman, Keith	Hercules Aerospace	4526 So 5120 W	(801)251-4134	12 Feb, 1540	2	Y
212			WVC, UT 84120				
213							
214	Stanton, Edward	PDA Engineering	2975 Redhill Ave.	(714)540-8900	18 Feb, 1615	3	Y
215			Costa Mesa, CA 92622				
216							

	A	B	C	D	E	F	G
217	Bauccio, Michael L.	Boeing	21110 S.E. 258th St.	(206)655-6360	18 Feb, 1620	1	Y
218			Maple Valley, WA 98038-7520				
219							
220	Obleski, Bert M.	Martin Marietta Aero.	P.O.Box 179 MS: S4021	(303)971-8009	19 Feb, 1505	4	Y
221			Denver, CO 80201				
222							
223	Schmidt, George	G.S.& A.	1852 Kirkby Rd.	(818)242-9756	19 Feb, 1515	4	Y
224			Glendale, CA 91208				
225							
226	Nolan, Paul	Zephyr Ent.	135 Sierra Vista Rd.	(805)969-4393	19 Feb, 1530	5	Y
227			Santa Barbara, CA 93108				
228							
229	Pastushin, Victor F.	Pavco Industries, Inc.	5271 Argosy Ave.	(310)430-3543	19 Feb, 1550	2	Y
230			Huntington Beach, CA 92649				
231							
232	Spencer, Porter	AEC-Able Engineering	93 Castilian Dr.	(805)685-2262	19 Feb, 1555	1	Y
233			Goleta, CA 93117				
234							
235	Pitts, Carl	Xontech, Inc.	7711 Center Ave., Suite 550	(714)894-2286	19 Feb, 1610	1	Y
236			Huntington Beach, CA 92647				
237							
238	Bowerman, Ray D.	Energy Container Corp.	2036 E Dyer Rd.	(714)250-3123	19 Feb, 1615	1	Y
239			Santa Ana, CA				
240							
241	Iceland, Wm. F.	S.F. Enterprises	11711 Reagan St	(310)596-1710	21 Jan, 1220	1	
242			Los Alamitos, CA 90720				
243							
244	Vergason, Gary	VTI	29 Main St, P.O.Box 100	(607)589-4429	21 Jan, 1420	1	Y
245			Van Etten, NY 14009				
246							
247	Schmitt, J.J.	Jet Process Corp.	25 Science Park	(203)786-5130	29 Jan, 1420	2	Y
248			New Haven, CT 06511				

	A	B	C	D	E
1	Contact's Name	Contact's Firm	Contact Address	Contact Phone	Potential Story Topic
2					
3	Pearson, R.K.	DuPont	Experimental Station E1/208	(302)695-4292	Use of NASA computational tools (software) for modeling
4			Wilmington, DE 19880-0101		and process diagnostics for Process Control Systems Group
5					
6	Luddemann-Faris, M.K.	Interdevelopment, Inc.	901 King St, Suite 501	(703)548-1909	Use of NASA software for failure analysis (particle impact)
7			Alexandria, VA 22314		
8					
9	Acosta, A.P.	TRW	1 Space Park MS: 04/1618	(310)814-4374	Identification of technology trends (synthetic aperture
10			Redondo Beach, CA 90278		radar) to develop future threat database for USAF
11					
12					
13	Pexton, Harold W.	Seagate Technology	P.O.Box 12313	(405)324-3277	Use NASA information to improve disc drive
14			Oklahoma City, OK		production and testing
15					
16	Sableman, Eric	Pro-Zooics Research	711 Central Ave	(415)322-855	Use NASA information relating to composite materials in
17			Menlo Park, CA 94025		design of medical devices (rehabilitation R&D).
18					
19	Pilichi, Carmine A.	Rockwell Intl., Space Div	4521 Victoria Court	(310)922-5794	Use NASA information in design of water pump impellers
20			Cypress, CA 90630		and mechanical joints.
21					
22	Murtha, Mike	VALEX	1010 Janetwood Dr.	(805)658-0944	Helpful in developing interests in very large optics. Helped
23			Oxnard, CA 93030	X 216	lead to invention of Bypass Mirrors (patented).
24					
25	Smith, Paul	B.F.Goodrich	RR1, Box 15	(309)364-9479	Helped to identify and solve turbulance flow problem
26			Henry, IL 61537		across banks of pipes in a heat exchanger
27					
28	Shuit, Douglas	Wisconsin Electric Pwr.	4467 S. 15th St	(414)571-3217	Helped develop technique for measuring the amount of
29			Milwaike, WI 53221		carbon in flyash using emitance spectroscopy (measures
30					the efficiency of a coal burning process).
31					
32	Evans, Donald	TRW	1 Space Park MS: 01/7270	(310)813-9216	Classified SDI materials hardening program. Would
33			Redondo Beach, CA 90278		have to be very general article or declassification required.
34					
35	Kallas, R.A.	Northrop	8900 E Washington Blvd E571/3	(310)942-3743	Classified B-2 radar application. Would have to be very
36			Pico Rivera, CA 90660-3737		general article or declassification required.
37					
38	Kruger, Albert A.	Westinghouse Hanford C	R4-03	(509)373-5713	Non-destructive testing information used to introduce such
39			Richland, WA 99352		new technology into firm.
40					
41	Dowell, M.B.	Praxair Advanced Ceran	P.O.Box 94924	(216)529-3962	Used information to construct containers for growth of
42			Cleveland, OH 44101		compound semiconductor single crystals. Used on USML2.
43					

	A	B	C	D	E
44	Elm, Joseph P.	Benton Corp.	176 Thorn Hill Rd.	(412)772-6000	Used information to develop spin motor rotation detector
45			Warrendale, PA 15086		for USAF ATE project (10 years ago!).
46					
47	Bayley, R.D.	Columbia Gulf	P.O.Box 683	(713)444-3115	Used information to develop a probe that could be insertec
48		Transmission Co.	Houston, TX 77001		into a natural gas pipeline (spiral fin idea used).
49					
50	Rybarik, David	Dairyland Power Co-op.	P.O.Box 817	(608)787-1352	Lubricant information used in retrofitting lubricants and
51			La Crosse, WI 54602		hydraulic fluids in a nuclear power plant.
52					
53	Sudbeck, Richard	R Squared Scan System	772 E. Vartikian	(209)436-0177	Used NASA information to suppliment theory information
54			Fresno, CA 93710		on array processors used in medical diagnostic imaging.
55					
56	Malpus, Richard	Rockwell	1205 W.N. Carrier #205	(214)641-8536	Used "good thumbnail description" of background math fo
57			Grand Prarie, TX 75050		circuit analysis to train site personnel.
58					
59	Roller, Norm	ERIM	P.O.Box 134001	(517)797-2614	Used Tech. Brief info on sensing technology for training.
60			Ann Arbor, MI 48113-4001		Now on loan to CIESIN.
61					
62	Dippery, Dr. Richard	GMI Eng. & Mgt. Institut	1700 W Third Ave	(313)762-9500	Uses information when teaching mechanical eng. courses.
63			Flint, Mi 48504-4898		
64					
65	Hillman, Hal	Sensor Technology	100 High St	(201)585-9746	Published newsletter which contained NASA info.
66			Leona, NJ 07605		
67					
68	DePalma, Angelo	Technical Insights	18 Hillside Av.	(201)579-3353	Tech Brief information put into newsletter.
69			Newton, NJ 07860		
70					
71	Margoshes, Dr. Marvin	TechTransfer News	69 Midland Ave	(914)631-2699	NASA information used in medical diagnostics/laboratory
72			Tarrytown, NY 10591		instrument industry newsletter.
73					
74					
75	Rosenthal, Louis A., PE	Brunswick Instruments	384B Stirling Dr.	(609)655-5292	Consultant (37 years as prof. at Rutgers). Possible
76			Cranabury, NJ 08512		"middleman" story. Very supportive of NASA efforts.
77					
78	Van Hemmen, Rik	F.A.Martin & Ottaway, I	90 Washington St.	(212)344-6486	Marine consultant (structures and mechanical design
79			New York, NY 10006		expert witness). Possible "middleman" story.
80					
81	Cafarelli, Eugene		10 Harbourton Mt Airy Rd.	(609)921-0006	Consultant. Possible "middleman" story.
82			Lambertville, NJ 08530-2901		
83					
84	Colley, D.G.	Granan Co.	32 Ocean Av.	(401)294-7969	Consultant. Very interested in putting NASA TU Office in
85			Wickford, RI 02852-4906		touch with the RI Gov to assist in "revitalization program."

APPENDIX 5
COMMENTS ABOUT NASA TECH BRIEFS

Summarized below are a few of the many favorable comments about NASA Tech Briefs and the NASA technology transfer in general. These comments appeared on the Tech Brief survey form or were made during the follow-up telephone calls.

"We are monitoring developments in the area of dual technology and are very interested in all issues of technology transfer." M.K. Luddemann-Faris, Interdevelopment, Inc.

"Excellent indicator of current trends in technology." A.P. Acosta, TRW

"Thank you and please keep up the good work!" Mike Murtha, Valex

"Helped identify and solve a heat exchanger turbulence problem" Paul Smith, B.F. Goodrich

"Only 2 papers of approximately 30 remain unused at this time. Even these will be used!" Douglas Shuit, Wisconsin Electric Power Company

"I find a great deal of material that has application to my work." R.A. Kallas, Northrop

"Having examples of NASA successes with non-destructive testing has made my attempts to introduce new technology into my firm easier." Albert A. Kruger, Westinghouse Hanford Co.

"Tech Briefs provided a good thumbnail description of the background math involved." Richard Malpus, Rockwell International

"A wonderful way to stimulate new ideas and concepts. I have found the Tech Briefs to be well written and of high technical level. Keep it up! This is a genuine worthwhile service of our government." Louis A. Rosenthal P.E., Brunswick Instruments

"...stimulating source for new ideas & procedures. In General structural and mechanical design ideas are most helpful." Rik Van Hemmen, F.A. Martin & Ottaway, Inc.

"Selected Tech Briefs have stimulated consideration of the heat pipe principle for improved thermal energy management in the development of advanced aircraft braking systems." Jay L. Musil, Aero/Optimums

"...is a great source of ideas/solutions & techniques to be used in our systems design & consulting efforts." Ronald A. Gurnsey, Ron Gurnsey Associates

"The many developments in our field (heat pumps, heat transfer, etc.) are useful, but licensing costs and procedures are too onerous for a small company like ours. This aspect of technology transfer should be examined and improved." Michael Avari, CTS

"Tech Briefs have provided information about technologies of interest here not available elsewhere." Bart Cannon, Cannon Microprobe

"I plan to design and build an airplane. NASA Tech Briefs keeps me abreast of evolving technology. I am also very interested in artifical intelligence on computers and do get some vital input from Tech Briefs." Jorj C. Baker, Digital Animation

"This information will be used to improve the life of moving parts and improve the reputation of our manufactured products. This is important to our sales efforts to stay ahead of competition and make entry into foreign markets easier." Jon Barth, Barth Electronics, Inc.

"Besides new ideas, the depth and completeness of the NASA Tech Briefs is excellent as tutorials and as learning tools." L.B. McMahon, Cox & Co.

"Confirms some earlier product research. Excellent data. Thanks" T.W. Lindsley, SMCO, Inc.

"Information was used in my patent searches as required in my patent practice." Joseph Phillips (ret.), Haynes International, Inc.

"Tech Briefs' great variety of new developments gives us an overview of new technology in both science and engineering. We have utilized some of the mechanical ideas in our consulting work and have referenced several clients to items briefed in your publication. We find Tech Briefs most useful." Lewis c. Haney P.E., L.C. Haney Co.

"Helps to not reinvent the wheel." Pat Kujawa, MSE, Inc.

"The Tech Brief publication has been very useful in the past - either in direct applications or in stimulation of our 'think groups'." Nelson E. Jones, New Tech Engineering

"Supplying Tech Briefs is appreciated by our engineers." M.L. Gillespie, Librarian - McDonnell Douglas

"Excellent quality applied technologies." C. Van/Kersen, Qmax Tech Group

"In the research environment here it takes 3-5 years to see new ideas take hold. These Tech Briefs stimulate innovative thinking and encourage us to continue working on difficult problems. For instance, your use of ceramics for rocket engine parts helps allay traditionalists' concern that we can not use ceramics in jet engine parts." J.R. Currey, UT Pratt & Whitney

"The lubrication handbook that we received has become a valuable reference manual." J.E. Whitlinger, BTR Valve Sealants, Inc.

"Validation of FEM models for complex structures is an important part of our work. The experience published in NASA Tech Briefs papers helps us to generate ideas for improving analysis and testing methodology." Peter Wolff, GE Aerospace

"...helps me and my company to decide the new R&D direction.", "Tech Briefs are very good and very sophisticated, but can be hard to commercialize." Newman K. Lin, Applied Science & Engineering Research, Inc.

"Useful for the latest technique for data communication and error correction." Leo Montreuil, Scientific Atlanta

"You provide an excellent means of providing state-of-the-art technology for industry." Terry Morris, Airesearch

APPENDIX C

The NASA Marshall Space Flight Center Technology Utilization Model

The NASA Marshall Space Flight Center Technology Utilization Model

Prepared by:

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Prepared for:

Technology Utilization Office
George C. Marshall Space Flight Center
Marshall Space flight Center, Alabama 35812
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Contract NCC8-18

January 1993

THE NASA MARSHALL SPACE FLIGHT CENTER TECHNOLOGY UTILIZATION MODEL

by
Dr. Wm. E. Souder

Alabama Eminent Scholar Endowed Professor in the Management of Technology, and Director of the Center for the Management of Science and Technology, University of Alabama in Huntsville *

INTRODUCTION

Technology transfer is generally considered to be a multi-faceted process, proceeding in several important stages and involving several important role-functions. This notion is presented in Figure 1 [1]. The key to transfer success is a matter of applying the appropriate role-functions at the proper stages. Maintaining the delicate, optimum balance between roles and stages is a challenging management task. A systematic management approach is required.

The Marshall Space Flight Center (MSFC) has been a leader in developing, implementing and managing an effective system for technology transfer. The MSFC technology transfer system is especially oriented to the transfer of MSFC technologies to small businesses, as a means for stimulating economic development and a resurgence of American technological supremacy. MSFC's system is devoted to improving American industry's new product and process development capabilities and lowering American industry's costs of doing business. The system integrates all the role-functions and transfer stages shown in Figure 1.

The MSFC technology utilization system stresses the application of several role-functions in the stagewise performance of various outreach and inreach activities. Outreach activities recognize the critical need for MSFC to take the initiative in reaching out to the private sector to inform them of available technologies and learn about their problems. Outreach activities are directed at finding and documenting vital firm and generic industry-level problems that may be solved through the application of MSFC technologies. Inreach activities recognize the need for MSFC to reach into its vast storehouse of technologies and knowhow and systematically examine them for relevance to private sector needs. Outreach and inreach activities are linked through a management plan that matches government sponsored technologies with the needs of the private sector, thereby establishing and maintaining a highway of transfers between MSFC and private industry.

* This work was conducted with valuable assistance from Mr. Syed Jafar and Dr. Mary Spann. The author also wishes to thank the many individuals at MSFC for their patience in participating in the data collection for this work. This work was funded by NASA cooperative agreement number NCC 8-18 from the Marshall Space Flight Center in Huntsville, Alabama.

THE MSFC SYSTEM

Figure 2 diagrams the MSFC technology transfer system. The outreach sub-system is grounded in a series of technology transfer Memorandum of Understanding (MOU), as depicted in detail in Figure 2. In 1989, MSFC began forging these MOU with the governors of the surrounding states (Alabama, Tennessee, Georgia, Mississippi, Louisiana and West Virginia). These MOU call for cooperation between MSFC and these states to match local industry problems with MSFC technologies. MSFC contact persons are assigned to each state to work through the state industrial and economic agencies and Chambers of Commerce in visiting local firms and conducting missionary work. This mechanism operates analogously to the early U.S. Department of Agriculture hybrid seed corn extension service efforts, in its snowball recruitment of volunteers and an army of enthusiastic supporters who help spread information about MSFC technologies. This corresponds to the disseminator role at the prospecting stage of Figure 1.

MSFC contact persons assist firms in defining their problems and documenting them in the form of problem statements that can be submitted to MSFC for further analysis and possible solution. Dovetailing with this effort are several reinforcing marketing and publicity efforts, in the form of magazines, data bases, releases and various writing activities (see Figure 2). The thrust of MSFC's outreach system is to locate, define and document industry and individual firm problems that may be amenable to solution through the application of some MSFC technology. The success of their outreach efforts is apparent from the number of problem statements MSFC receives from industry. Problem statements document problems that may be amenable to solution through the application of some MSFC technology. MSFC receives three times the number of problem statements from the six states where it has MOU's than it does from the rest of the U.S.

As Figure 2 shows, these comprehensive outreach efforts feed a sub-system of coordinated inreach activities. These activities occur primarily through two mechanisms: applications projects and the Technology Applications Board (TAB). Applications projects are used to develop NASA technologies and to provide first-hand demonstrations of available MSFC technologies. The TAB controls the traffic on MSFC's technology transfer highway. It may be said that the heart of the inreach sub-system is in fact the TAB. In weekly meetings, the TAB reviews the industry and firm problem statements that arise from the outreach efforts, assigns them to various experts for resolution and tracks their disposition.

Figure 3 depicts the details of the operation of the TAB. Using a comprehensive set of criteria, incoming problem statements are discussed and rated by an interdisciplinary panel of MSFC experts and assigned to a course of action. This course of action

may lead to a range of outcomes. For example, on the one extreme, the problem may be referred to another agency deemed more appropriate to respond. In the other extreme, the problem is assigned to a MSFC employee who works with the client in a consultant-client mode to solve the problem. The problem may be amenable to some MSFC "off-the-shelf" quick solution. Or, the problem may require further study, analysis and search for the resident MSFC experts. The problem may be resolved through the transfer of MSFC know-how, techniques or technologies. MOU's, licenses or other vehicles may be used to facilitate the transfer.

As Figure 4 shows, a Principal Engineer (PE) is one of the key role-functions in the operation of the TAB. The PE, who is generally a member of the TAB, is designated early in the TAB process (see Figure 3). The PE has the lead responsibility for assuming that the customer's problem statement is well defined and well understood. PE's insure that vigorous action is taken on problems and that timely and suitable responses are returned to all customers. The PE reports regularly to the TAB on the status of the problem, its disposition and its close-out.

SYSTEM EFFECTIVENESS

From several standpoints, the system described in Figures 1 through 4 appears to be highly effective. A high volume of problem statements are generated by the outreach sub-system. A large number of MSFC technologies are examined, demonstrated and matched to industry problems in the inreach sub-system. Matches between many different industry problems and MSFC technologies are found and problems are solved. The TAB inreach activity efficiently processes a large volume of problem statements, and all statements are carefully documented and followed. All statements must receive some disposition (solved, referred to other agency, etc.) in a timely fashion.

In general, the system appears to capture the best state of the art in technology transfer depicted in Figure 1 [1]. For additional details on the functioning of the MSFC technology transfer system and discussion of the above aspects, see [2].

REFERENCES

1. Souder, Wm. E. ; Ahmed Nashar and V. Padmanabhan, "A Guide to the Best Technology Transfer Practices", Journal of Technology Transfer, Winter-Spring 1990, pp. 5-16.

2. Marshall Space Flight Center, Transferring Technology from NASA to the Private Sector: The Marshall Model, 1992.