REPORT

PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER

Quarterly Report No. 7

1 July 1969 – 30 September 1969

Contract NSR 06-004-063

DENVER RESEARCH INSTITUTE
UNIVERSITY OF DENVER

This is the seventh report in a series prepared for the Office of Technology Utilization, National Aeronautics and Space Administration (NASA). It presents the results of three months of research on technology transfer conducted by the Industrial Economics Division of the University of Denver's Research Institute (DRI).

Material presented in this report was gathered and analyzed as a part of the Project for the Analysis of Technology Transfer (PATT). PATT was established in November 1967 to provide a better understanding of the technology transfer process by examining nonspace applications of NASA developed technology. To achieve this goal PATT has the following objectives:

(1) To collect data on actual and potential cases of transfer resulting from NASA's Tech Brief – Technical Support Package Program;

(2) To operate a technology transfer data bank;

(3) To analyze and evaluate information collected;

(4) To document specific cases of technology transfer;

(5) To perform a series of related research tasks;

(6) To report research findings.

This report summarizes progress made during the period 1 July – 30 September, 1969 in achieving these goals, and briefly discusses future activities. It builds on data presented in previous PATT reports as well as on results of other DRI technology transfer research.

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REPORT HIGHLIGHTS

- During the third quarter of 1969, PATT personnel continued monitoring the operation of the NASA Tech Brief-Technical Support Package Program; initiated a study of technology transfer within NASA Apollo contractor organizations; completed a study of persons using Gemini and Apollo photographs; and sponsored a seminar on technology transfer (Section I).

- In comparing 1969 with 1968 third quarter Technical Support Package (TSP) requests, it was learned: (1) that substantially fewer TSP requests were made in 1969; (2) that proportionately more 1969 requests came from smaller organizations (employing less than 500 persons); (3) that substantially more of the 1969 requests were for TSP's originating at the Marshall Space Flight Center; and (4) that during 1969 the Small Business Administration played a much stronger role in announcing the availability of specific TSP's (Section II).

- A content analysis of 350 interviews with TSP users revealed: (1) that 118 persons reported the occurrence of actual cost reductions; (2) that 32 of the 118 interviewees reported specific cost reductions totaling $645,260; and (3) that, based on certain assumptions, overall cost reductions associated with the use of TSP's during the time period analyzed could be estimated to have totaled $8.4 million (Section III).

- In recontacting TSP requesters originally indicating a future use of NASA-generated technology, approximately one-fourth reported that actual applications had occurred (Section IV).

- A study of 326 persons acquiring Gemini and Apollo photographs showed: (1) that approximately one-half of the requesters worked in academic organizations while another 25 percent were associated with industrial firms; (2) that they used the photographs primarily for classroom teaching and geological exploration; and (3) that most requesters derived benefits equal to or greater than the cost of the photographs (Section V).

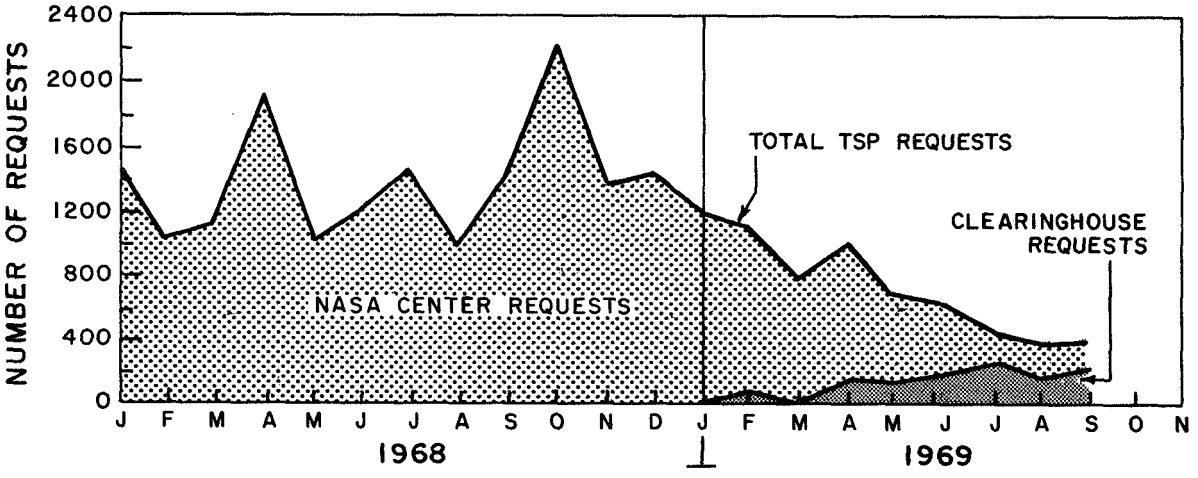
SECTION I. PATT THIRD QUARTER 1969 RESEARCH ACTIVITIES

This section presents an overview of PATT research activities conducted during the third quarter of 1969.

Transfer Data Bank Operations

After a marked downward trend in requests for Technical Support Packages (TSP's) during the first six months of 1969, the number of TSP requests leveled off during the past quarter. At the same time, the absolute number of 1969 TSP requests remained far below the number reported one year ago. Figure 1 shows the volume of requests made directly to NASA centers and to the Federal Clearinghouse from January 1968 through September 1969.

FIGURE 1. REQUESTS FOR TECHNICAL SUPPORT PACKAGES, 1968 AND NINE MONTHS OF 1969



During the third quarter of 1969, PATT processed 2,647 requests for TSP's. One thousand questionnaires were mailed to TSP requesters during the same period; 632 (61.7 percent) of the questionnaires were completed and returned.

Beginning in September, the recently revised TSP questionnaire was used.* Initial responses to the new questionnaire will be analyzed and discussed in the next quarterly report.

During the next quarter, the Transfer Data Bank will be expanded to include the technology transfer example files presently maintained at NASA Headquarters. These files, combined with the more than 400 telephone interview write-ups prepared by PATT, will form the basis for a comprehensive bank of examples of technology being transferred from the space program. A system will be developed for analysis and retrieval of information contained in the files.

Telephone Interview Results

PATT staff members completed 56 telephone interviews with requesters who indicated on a returned questionnaire that the TSP was of significant value to them. Reports of the most significant interviews are contained in Appendix A. In addition, 50 requesters who had been contacted in the past were recontacted; 40 of those recontacted had indicated earlier that there was a potential application of the TSP information. A summary of the recontact effort is contained in Section IV. Updated reports of these recontact cases are included in Appendix B.

An effort was made during the quarter to improve case study quality by revising the telephone interview guide. The new guide, presented in Appendix C, is designed (1) to provide more systematic information and (2) to facilitate content analysis of future interviews.

Content Analysis

A major task completed during the third quarter was an analysis of 350 written reports of telephone interviews with questionnaire respondents who had indicated possible use of NASA-developed technology. The results of the content analysis are presented in Section III.

Technology Transfer Library

The Technology Transfer Library contains approximately 1,400 documents. A KWIC (key word in context) index was prepared for

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* A copy of the revised TSP questionnaire was published as Appendix A of PATT Quarterly Report #6.

assistance in retrieving documents from the library. Work is continuing on peparation of an updated bibliography, partially annotated, to be published in February 1970.

Technology Transfer Seminar

A seminar, "The Environment and the Action in Technology Transfer: 1970-1980," was held at Snowmass-At-Aspen, Colorado on September 26-28, 1969. Participants included 38 persons from industrial, governmental, and academic organizations. A report summarizing the results of the seminar is being prepared and should be published early in 1970.

Special Research Tasks Undertaken or Completed

In addition to evaluation of the Tech Brief-TSP Program, PATT personnel conducted a number of special research tasks during the third quarter. The special tasks were aimed at learning more about the ways NASA-developed technologies are disseminated, applied and evaluated.

"A Study of Gemini and Apollo Photography Users" was drafted and distributed for review. The final report is scheduled for publication in November, 1969. Section V of this report contains a summary of the Gemini/Apollo photo users study.

A special study undertaken to determine the reasons behind the popularity of five specific TSP's led to the development of five hypotheses concerning the effectiveness of Tech Briefs (see Section IV of PATT Quarterly Report #6). To test the hypotheses, a sample was selected from all Tech Briefs released between 1963 and 1969, and these are now in the process of being categorized. This task should be completed during January, 1970.

A new task initiated late in September is designed to identify instances of technology being transferred within Apollo contractor organizations. Four specific objectives of the study are: (1) to gain an understanding of the direct (i.e., intra-firm) transfer process within companies holding NASA contracts; (2) to obtain data about the direct impacts of a single, large space program on participating contractors; (3) to identify ways in which the direct transfer process might be improved by NASA stimulation; and (4) to determine the extent to which NASA Apollo contractors use various Technology Utilization channels

(e.g., the Tech Brief-TSP Program, Regional Dissemination Centers). Further effort on this task awaits approval of a proposed questionnaire.

Staff Participants in PATT

Denver Research Institute staff participants in PATT during the past three months, and the primary activities of each individual, were as follows:

DRI Staff Member	Primary Activities
Dean C. Coddington, Research Economist	Project supervision
Richard Ball, Research Assistant	Telephone follow-up interviews
Paul I. Bortz, Research Economist	Design of the Apollo Contractor's study
T. D. Browne, Research Economist	Administrative support and research design
James E. Freeman, Communication Researcher	Research design, data analysis, content analysis, and report preparation
John S. Gilmore, Senior Research Economist	Technology transfer seminar
Terry Sovel Heller, Research Economist	PATT Library, technology transfer seminar
Ronald J. Hensen, Research Engineer	In-depth survey of TSP requesters
William Hildred, Research Economist	Telephone follow-up interviews (recontacting)
Raymond Huey, Research Assistant	Content analysis
Robert Joselyn, Research Economist	Gemini/Apollo photography study
James P. Kottenstette, Research Engineer	Basic research into the technology transfer process, in-depth survey of TSP requesters

DRI Staff Member	Primary Activities
Larry Schafer, Research Assistant	Telephone follow-up interviews
Eileen R. Staskin, Research Assistant	Project administration and report preparation
Harry Zirkelbach, Research Assistant	Telephone follow-up interviews

In addition, John G. Welles, Head, Industrial Economics Division, provided overall technical and administrative support, and participated in the technology transfer seminar.

SECTION II. REQUESTS FOR TECHNICAL SUPPORT PACKAGES

This section summarizes information concerning Technical Support Package (TSP) requests processed by PATT during the third quarter of 1969. Two aspects of the Tech Brief-TSP Program were emphasized during the quarter: (1) monitoring TSP requests and questionnaire responses, and (2) comparing the characteristics of persons requesting TSP's from the Federal Clearinghouse with those requesting TSP's from NASA field centers.

TSP Requests and Questionnaire Responses

Some major characteristics of third quarter TSP requests are described below. For comparative purposes, third quarter 1968 TSP request data are included. The data reported were drawn only from those PATT files containing completed TSP questionnaires.

As in all previous quarters, the largest proportion of 1969 third quarter TSP requests came from persons in manufacturing organizations:

Source of Request by Industrial Category	Third Quarter Requests 1969 (N=420)*	1968 (N=1908)*
Manufacturing	55%	65%
Services (including educational)	10	16
Government	7	6
Individuals	5	4
Other	6	4
Not classifiable**	17	5
TOTALS	100%	100%

* These same numbers are used as the basis for calculating percentages in all tables reporting 1969 and 1968 third quarter data.

** Requesters in the "not classifiable" industrial category are most frequently associated with small manufacturing firms (employing fewer than 500 persons). When the unclassified requesters are distributed proportionately through the industrial categories listed above, the resulting proportion in the 1969 third quarter is approximately equal to the 1968 third quarter.

This finding is not surprising since commercial and industrial organizations employ the largest number of scientists and engineers; furthermore, it may be assumed that the strongest motivation for acquiring and applying technological information is to be found among persons in profit-making industrial organizations.

Sizeable differences were noted between the quarters compared, however, in the proportion of TSP requests coming from organizations of different sizes. Proportionately more 1969 requests came from organizations with fewer than 500 employees. This can be partially accounted for by an increased effort on the part of the Small Business Administration (SBA) in transferring technology to smaller firms. However, requesters in organizations employing 10,000 or more persons remained the greatest single source of TSP requests:

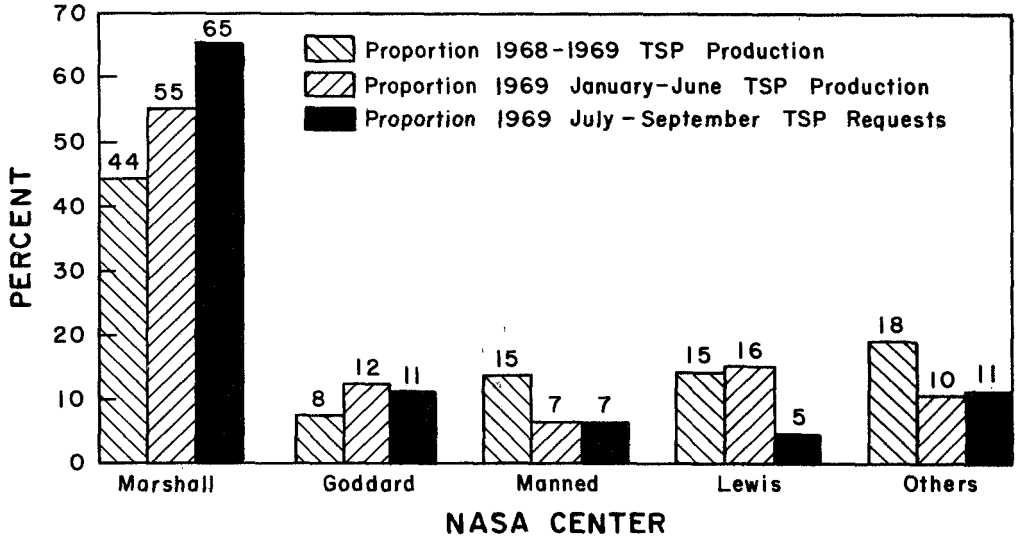
Source of Request by Organization Size (Employees)	Third Quarter Requests 1969	1968
10,000 or more	32%	43%
5,000 to 10,000	6	9
1,000 to 5,000	9	9
500 to 1,000	4	4
100 to 500	7	6
50 to 100	2	1
10 to 50	5	1
1 to 10	11	4
Undetermined*	24	23
TOTALS	100%	100%

* Most organizations in the "undetermined" size category probably employ fewer than 500 persons. Requesters in this category frequently cited the SBA as the source through which they learned about particular TSP's. In addition, new companies or very small organizations often are not reported in standard reference sources.

Nearly two-thirds of 1969 third quarter requests were for TSP's developed at the Marshall Space Flight Center:

NASA Center Originating TSP	Third Quarter Requests 1969	1968
Marshall Space Flight Center	65%	41%
Goddard Space Flight Center	11	7
Manned Spacecraft Center	7	8
Lewis Research Center	5	20
NASA Pasadena Office (JPL)	5	5
Ames Research Center	3	5
Electronics Research Center	2	0
Kennedy Space Center	1	5
Flight Research Center	1	0
Space Nuclear Propulsion Office	0	5
Langley Research Center	0	3
Other Centers	0	1
TOTALS	100%	100%

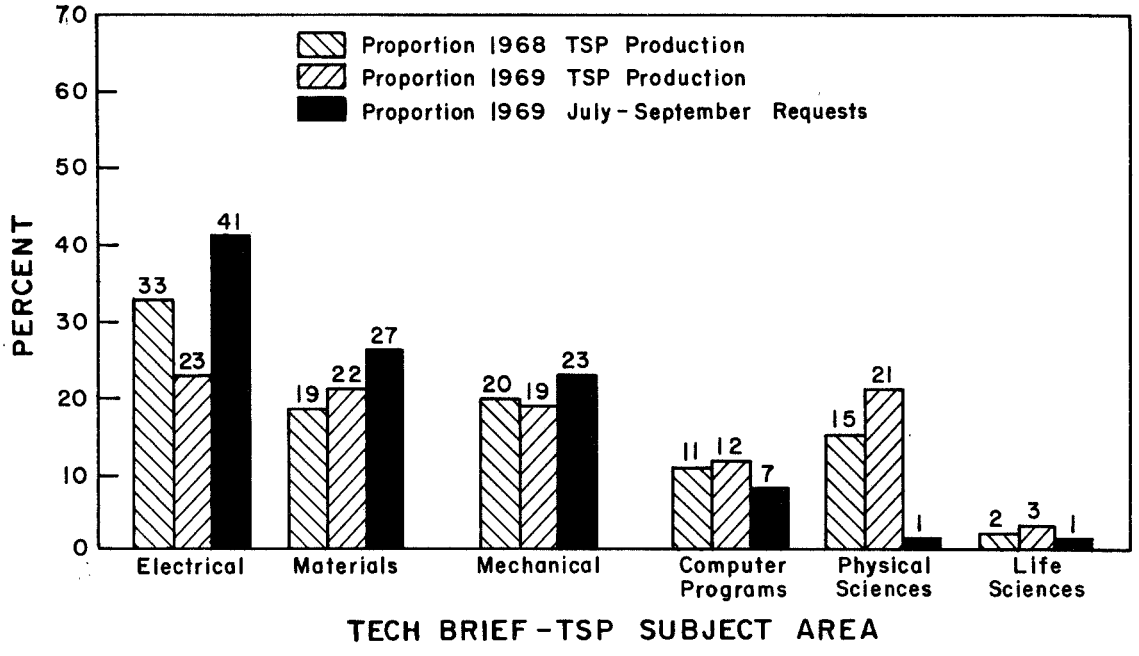
The preponderance of requests for TSP's originating at the Marshall Space Flight Center can be explained partially by the fact that Marshall and contractor personnel have produced proportionately more Tech Briefs-TSP's than all other NASA centers combined. As the following table shows, 1969 third quarter TSP request frequency was related to the rate of 1969 TSP production by the NASA field centers:



Substantial differences were noted in the technical areas of interest to TSP requesters. The most noticeable differences included far fewer requests for TSP's in the materials (chemistry) category, and a much larger number of requests for TSP's reporting mechanical subject matter:

TSP Subject Area	Third Quarter Requests 1969	1968
Electrical (Electronic)	41%	33%
Materials (Chemistry)	27	37
Mechanical	23	13
Physical Sciences	7	10
Computer Programs	1	6
Life Sciences	1	1
TOTALS	100%	100%

The major interest in electrical, material, and mechanical TSP's appears to have been related partially to the number of Tech Briefs and TSP's published in each of the technological subject areas. As the following table shows, however, 1969 third quarter TSP requests for electrical technology far exceeded the proportionate number of electrical Tech Briefs and TSP's published:



Major differences were observed between the two quarters in terms of the sources used by requesters to learn about TSP availability. NASA Tech Briefs and other publications, cited as first source by 59 percent of the 1968 requesters, were specified as source by 45 percent of the 1969 requesters. Again, the technology transfer efforts of the Small Business Administration (SBA) appeared to be a major factor influencing the shifts in sources used by TSP requesters. A sizeable reduction also was noted in the importance of professional and trade publications as generators of TSP requests:

Sources Used to Learn About TSP	Third Quarter Requests 1969	1968
NASA	45%	59%
SBA	21	1
Professional/Trade Press	15	27
Other	19	13
TOTALS	100%	100%

The most frequently requested Technical Support Package during the third quarter of 1969 was one which originated at the Marshall Space Flight Center, "Electromotive Series Established for Metals Used in Aerospace Technology." Other frequently requested TSP's are identified in Table D-1, Appendix D.

No major differences were noted between quarters in terms of the applications made of TSP information. Nearly two-fifths of the requesters reported using TSP's to maintain their current awareness in particular technical areas.* Another 36 percent reported that the TSP's provided some limited input into their research or development (problem solving) activities. One-fourth of the requesters indicated the TSP's were not at all useful in their work.

Most requesters contacted rated the TSP's "good" in terms of their usefulness. More specifically, TSP's in the mechanical category tended to be rated generally as being of greater usefulness than TSP's in any other subject area. TSP's in the computer programs, physical

* Responses to the revised TSP questionnaire indicate a substantially higher percentage of current awareness use. The difference is at least partially accounted for by a clarification of possible uses in the revised questionnaire.

sciences, and life sciences categories were rated as least useful. Requesters citing professional or trade publications as source strongly tended to rate the TSP's as very useful. On the other hand, one-third of the requesters citing SBA as source rated their TSP's as having been of little or no usefulness. As in the past, persons who reported spending three hours or more reviewing or studying TSP's tended to rate the documents as being more useful than those spending less in evaluation.

TSP Distribution Procedures

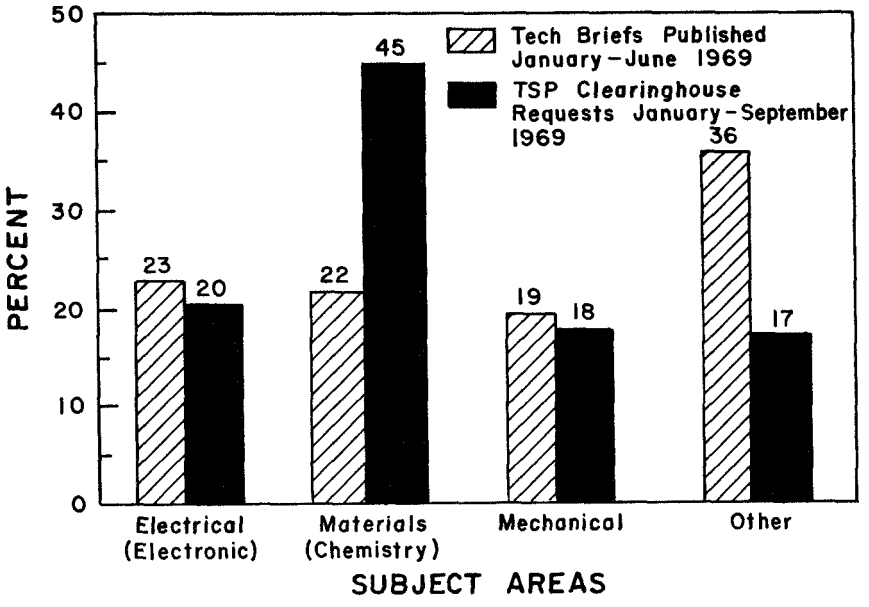
Since early in 1969, TSP's have been distributed by two different mechanisms. TSP's published prior to TSP #68-10500 have been distributed free by NASA field centers; those published since then have been distributed, at $3 per TSP, by the Clearinghouse for Federal Scientific and Technical Information. To gain some insights into the differences between the two approaches to TSP distribution, all available 1969 data were analyzed in terms of the distribution channel used: NASA centers or the Clearinghouse.

Major differences between NASA center and Clearinghouse requests were discovered in two closely related areas: the TSP technical subject area and the specific TSP's of interest to requesters. In general, NASA center requesters ordered about equal numbers of TSP's in the electrical and materials categories. By contrast, Clearinghouse requesters most frequently ordered TSP's in the materials category:

	1969 TSP Requests	
TSP Subject Area	NASA Centers (N=5,642)	Clearinghouse (N=1,197)
Electrical	34%	20%
Materials	33	45
Mechanical	24	18
Other	9	17
TOTALS	100%	100%

Tech Briefs in the materials category published between January and June, 1969, generated more than twice as many Clearinghouse requests as the proportion of Tech Briefs published. At the same time, Tech Briefs in the life sciences, computer programs, and physical

sciences categories generated less than half the number of TSP requests in comparison to the proportion of published Tech Briefs:



NASA center and Clearinghouse requesters differed substantially in terms of the specific TSP's ordered. Only one Technical Support Package, the "Contamination Control Handbook" (#68-10392), was of interest to both groups.*

The two groups of TSP requesters were compared on four additional dimensions: industrial category, geographical location, organizational size, and NASA center preparing the TSP. In these comparisons, there were no major differences between NASA center

* Appendix D, Tables D-2 and D-3, lists the ten most frequently requested Technical Support Packages for each group of requesters. Both the Marshall Space Flight Center (MSFC) and the Clearinghouse distributed the Contamination Control Handbook. Originally, MSFC was sole distributor of the Handbook; however, the Clearinghouse began distributing the Handbook after MSFC had exhausted its supply. The backlog of orders sent to MSFC then were referred to the Clearinghouse.

and Clearinghouse requesters. Thus, requesters in both groups tended to work in large manufacturing organizations located in northeastern and north central parts of the United States, and they tended to order TSP's originating from the Marshall Space Flight Center.

SECTION III. A CONTENT ANALYSIS OF INTERVIEWS WITH 350 USERS OF NASA-GENERATED TECHNOLOGY

An important part of PATT efforts to document transfers of NASA-generated technology has involved interviews with persons acquiring and applying such technology. Three hundred and fifty such interviews had been completed by June 30, 1969. The purpose of this section is to summarize the results of those interviews. More specifically, the intent is to estimate the magnitudes of technical advances and economic gains of cases contained in the PATT transfer data bank.

Research Design

The data presented below were gathered by making a content analysis of the information contained in written summaries of the 350 interviews.* A code for analyzing the cases was generated through a detailed examination of 40 interviews selected at random from the 300 reports completed by May 31, 1969. The resulting analytical code then was used to examine a sample of 100 reports randomly selected from the 300 interviews.** Another code revision was made following the examination of the 100 reports. Subsequently, the contents of 350 interview reports were analyzed.

Limitations

The results of the content analysis are limited by two important and opposing factors. First, the 350 cases examined were not selected randomly from the total number of cases contained in the PATT data bank. At the time the content analysis began in June 1969, the data bank contained 26,740 potential cases of technology transfer. Practically all of those cases dealt with people acquiring technology through the Tech Brief Program. By the same date, 13,511 questionnaires had been mailed to requesters of NASA-generated technology. It was

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* The 350 cases include those that have been updated (see Section IV); however, they do not include the new cases contained in Appendix A of this report.

** Results of the analysis of the 100 interview reports were presented in PATT Quarterly Report #6, Section III.

from 7,782 returned questionnaires that most of the 350 cases were drawn.* Only those returned questionnaires which showed the greatest likelihood of involving technology transfers were selected for interview. This method of sample selection limited the content analysis to cases of probable technology transfer.

Another factor limiting the scope of the content analysis is that respondents sometimes were either unable or unwilling to disclose technical and economic information related to their use of NASA-generated technologies. The tendency to treat such data as proprietary appeared to be strongest in cases involving the development of products within highly competitive markets. This limitation counteracts the first limitation to some extent: although cases involving probable transfer were selected, nonetheless, several interviewees could not or would not disclose the desired information.

Findings

The findings of the content analysis were divided into three categories: (1) technical results, (2) economic results, and (3) factors affecting technical and economic results.

Technical results. Four major types of technical results were identified: developing new materials or products; formulating new techniques or production processes; improving existing products or processes; and finding new applications for existing products.

* Seven of the 350 cases did not involve the Tech Brief-TSP Program; instead, they resulted from leads generated elsewhere, such as newspaper and magazine articles. The seven cases were not treated separately in the content analysis except in instances where they differed significantly from the other 343.

As the figures in the following table indicate, about three-fourths of the cases involved some type of actual or potential technical advance:

Technical Results	Number of Interviews: Actual Transfer	Number of Interviews: Potential Transfer	Number of Interviews: Total	Percent of Total Interviews
New product or material	45	41	86	24.6%
New process	26	23	49	14.0
New application for existing product or process	34	13	47	13.4
Product improvement	16	20	36	10.3
Miscellaneous (e.g., teaching aid developed)	40	0	40	11.4
None	92	0	92	26.3
TOTALS	253	97	350	100.0%

The technical advances reported varied considerably in terms of their development. Forty-seven percent of the technical results were described as actually completed or fully developed; another 28 percent were under development or held potential for completion; in the remaining cases, interviewees stated that no technical advances had occurred or were anticipated.

An attempt was made to determine the extent to which specific technical results occurred in particular subject areas. Using the

subject area categories developed for classifying Tech Briefs, it was found that 75 percent of the 350 cases involved electrical and materials technologies:*

	Technological Subject Area			
Technical Results	Electrical (151)	Materials (113)	Mechanical (43)	Other (43)
New product	27%	20%	23%	30%
New process	12	9	21	26
New application for existing product or process	13	12	7	23
Product improvement	14	9	7	5
Miscellaneous	8	20	7	5
None	26	30	35	11
TOTALS	100%	100%	100%	100%

Economic results. The effort to identify economic results reported in the 350 case studies focused on three areas: monetary savings, time savings, and sales increases. The following table shows that actual economic results were specified in 141 cases, while potential economic results were reported in 105 cases:

	Number of Interviewees Reporting Economic Results			
Status of Economic Results	Monetary Savings	Time Savings	Sales Increases	Totals
Have occurred	74	44	23	141
May occur	34	24	47	105
TOTALS	108	68	70	246

* Data distinguishing actual and potential technical results according to technology subject area are presented in Table E-1, Appendix E.

Monetary savings were reported as actually having occurred in 74 cases. In approximately four-fifths of those cases, however, specific estimates of monetary savings were not presented.* Similarly, specific estimates of time savings were given in only 18 of the 44 cases reporting that actual time savings had occurred.** Finally, specific estimates of dollar amounts involved in actual sales increases were presented in nine out of 23 cases.***

Altogether, 32 respondents reported cost reductions (i.e., monetary and time savings) totaling $645,260 associated with their uses of TSP's.**** These cost reduction estimates obviously represent a fraction of all economic results since only sample data were collected. What, then, were the total cost reductions associated with the use of TSP's during the mid-1966 through 1968 period?

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* Fifteen respondents estimated that they had saved a total of $568,150 in connection with their applications of TSP information (see Appendix E, Table E-2).

** Time savings are assumed to be worth at least $10 per hour to TSP users. Thus, the 7,711 hours in time savings reported in 18 of the 350 cases are estimated to have saved the companies involved $77,110 (see Appendix E, Table E-3). Time savings estimates were combined in the analysis with monetary savings estimates to produce a composite "cost reduction" estimate.

*** The specific cases reporting actual sales increases are listed in Appendix E, Table E-4. Only three of the nine instances of reported sales increases were the result of the Tech Brief-TSP Program. These three cases accounted for $118,000 of the $1,237,150 in sales. The other six cases were added as a part of PATT's efforts to identify other examples of technology transferred from the space program.

**** The savings estimates contain a mixture of one-time occurrences and annual cost reductions. For the purpose of this analysis, however, the savings estimates are all treated as one-time occurrences. In future reports, an effort will be made to separate the two types of savings estimates.

To develop a more complete picture of cost reductions, the results obtained in the content analysis may be extrapolated to all pre-1969 TSP requesters if the following assumptions are made:

(1) It is assumed that those who did not make specific cost reduction estimates experienced the same savings (on the average) as those who did make specific estimates. Thus, 118 respondents reported that cost reductions had actually occurred. Of these, 32 reported specific cost reductions totaling $645,260. Based on the assumption of similarity between estimators and nonestimators, cost reductions in the 118 cases totaled $2.37 million ($645,000 × 118 ÷ 32).

(2) It is assumed that cases reporting potential cost reductions can be converted to cases of actual cost reductions at a 4-to-1 ratio.* Cost reduction predictions were made in 58 cases. Therefore, an additional 15 cases (58 × .25) involved cost reductions totaling $300,000 ($645,000 × 15 ÷ 32). This amount, added to the $2.37 million in (1) above brings the cost reduction total in the 350 cases to $2.67 million.

(3) PATT records indicate that TSP requests totaled 24,529 as of December 31, 1968. Questionnaire responses from persons making those requests totaled 7,782. If it is assumed that requesters receiving questionnaires did not differ markedly from those not receiving** or not returning questionnaires,*** a

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* This assumption is based on the results of second interviews with 40 of the 105 interviewees reporting potential TSP applications. Twenty-five percent of the persons recontacted indicated that their previously predicted TSP application had occurred (see Section IV).

** Questionnaires were mailed to approximately one-half of the 24,529 pre-1969 TSP requesters.

*** PATT made a comparative analysis of questionnaire respondents (QR's) and nonrespondents (QNR's) in 1968 (see PATT Quarterly Evaluation Report #3, Section III). At that time, no important demographic differences were found between QR's and QNR's. No systematic attempt was made, however, to determine the specific uses QNR's made of TSP's. A study will be undertaken by PATT in January 1970 to determine whether QR's and QNR's differ substantially in terms of TSP applications. Available evidence does not indicate the existence of any important TSP application differences between the two groups.

multiplier of 3.15 (24,529 ÷ 7,782) can be applied to the results noted in (2) above. Therefore, total cost reductions associated with the Tech Brief-TSP Program during the period analyzed are estimated to be $8.4 million ($2,670,000 × 3.15).

It should be noted that 343 of the 350 cases were selected from 7,782 returned TSP questionnaires. Although the selection criteria are designed to pinpoint those questionnaire respondents indicating the highest potential for successful transfer, it is obvious that other respondents made use of the TSP materials. The magnitude of applications among this group is unknown, and no basis exists for making a reasonable estimate. Therefore, the cost reduction impact of this group can only be viewed as a plus factor with no dollar amounts or multipliers assigned.

The preliminary estimates of cost reductions will be refined as more cases are added to the transfer data bank, as additional cases of potential transfer are recontacted to learn of actual applications, and as PATT interviewers focus on obtaining estimates of economic benefits.

The estimate of cost reductions presented above does not include any allowance for the monetary value of TSP's used for current awareness purposes. It is possible to roughly estimate the value of the time reported by respondents in reading TSP's. On the basis of preliminary results from the revised questionnaire, it is estimated that 60 percent of all pre-1969 TSP requesters (24,529 as of December 31, 1968) used TSP's to stay in touch with developments in technical areas of interest. The median time spent by each requester using a TSP in this way was three (3) hours. Assuming a $10 per hour average cost to the organization, the monetary value of time invested in current awareness TSP reading is estimated to have been $441,000 ($10 per hour × three hours per TSP × 14,700 TSP's used primarily for maintaining current awareness).

Other findings. The content analysis revealed that interviewees tended to use two major sources to learn about the availability of the NASA TSP's they were using. NASA Tech Briefs were mentioned most frequently (44 percent of the cases) as the primary source. Professional and trade publications were next most frequently cited. Tech Briefs were mentioned as principal source in the majority of cases involving the development of new products, while professional and

trade publications were cited more frequently in cases involving product improvement (see Appendix E, Table E-5).

Four NASA field centers originated almost three-fourths (73 percent) of the technology involved in the 350 cases analyzed. Marshall and Goddard generated approximately 45 percent of the TSP's, while Ames and Lewis developed another 28 percent (see Appendix E, Table E-6).

Future Plans

The content analysis of interviews with secondary users of NASA-generated technology is continuing. Efforts are being made to broaden the sample base and to refine the analytical techniques. Initial results of the analysis suggest that the uses to which NASA-generated technology are put are considerably more varied than would be expected on the basis of earlier studies. Additional findings in the continuing content analysis will be presented in subsequent PATT quarterly reports.

SECTION IV. SECOND ROUND FOLLOW UP WITH POTENTIAL USERS OF NASA-GENERATED TECHNOLOGY

Preliminary content analysis of 350 interviews indicated that 130 respondents referred to potential uses of TSP information. In order to determine how many of these potential applications had actually taken place, 40 of the respondents were recontacted.

Methodology

Selection of the respondents to be recontacted was based on a screening process in which respondents with one or more of the following characteristics were excluded:

(1) The initial follow up was conducted too recently to allow for significant further development.

(2) The technology was to be used only for promotional purposes.

(3) The resulting product would be sold primarily to Federal government agencies.

(4) The transfers were within NASA or from NASA to other Federal agencies.

The screening process reduced the number of high priority cases to 90. Telephone interviews were attempted and 40 respondents were interviewed.

Findings

Of the 40 respondents recontacted, seven reported they had converted predicted applications into actual applications; nine more were continuing work on their projects; 15 respondents indicated they had temporarily suspended application efforts; another nine said they had abandoned attempts to use the technology.

The current status of each case is indicated on the following page. All 40 cases are contained in Appendix B.

Observations

Many respondents had difficulty recalling what they had said in the first interviews concerning their uses of NASA-supplied information.

SECOND INTERVIEWS WITH TSP USERS

	Applications Actually Resulted	Applications May Result	Applications Suspended or Abandoned
NEW PRODUCT	80300436--component lead bender* 80300763--inorganic paint 80505202--optical modulator	80200656--inorganic paint 80203549--fluidic oscillator 80301044--ultraviolet reflector 80504863--tube flare gauge	80200646--inorganic paint 80200654--inorganic paint 80200750--inorganic paint 80300476--inorganic paint 80300511--multivibrator 80302436--inorganic paint 80607188--biotelemetry 80608610--inorganic paint 80707862--borax/plastic 80709925--multiplexer 80812448--cardiotachometer
NEW PROCESS		80403909--Inconel 718 handbook	80607728--reactance measurement
NEW APPLICATION	80100430--galley refrigeration units 80200405--ballistocardiograph	80708024--borax/plastic	80200692--inorganic paint 80200925--recoverable fuse 80201112--recoverable fuse 80300801--inorganic paint 80302882--thermosetting plastic 80506543--spray-on electrodes 80711259--thermosetting plastic
PRODUCT IMPROVEMENT	80302425--inorganic paint 80503920--heat treating process	80300737--inorganic paint 80505737--gasket material	80200384--biotelemetry 80200602--memory core design 80504372--"clean room" air sampler 80505209--phonocardiogram simulator
OTHERS		80404509-11--materials data handbooks	80300535--electroless nickel plating

* The numbers used on this table are PATT case numbers.

Respondents tended to attribute more significance to NASA information during the first interviews than they did during the second contacts.

The most common concern among respondents who suspended or abandoned application efforts was lack of time for development work. In cases where this factor was cited, respondents often commented that the solution of production problems always takes priority over research or development projects.

This limited research effort showed that approximately one-fourth of the predicted applications of NASA-generated technology subsequently occurred. In estimating the actual technical value of predicted applications, therefore, it appears reasonable to assume a four-to-one conversion ratio: for every four predictions of application, one will occur while three will not.

SECTION V. SUMMARY OF THE GEMINI AND APOLLO PHOTOGRAPHY USERS STUDY

A primary purpose of PATT is to enhance the effectiveness of NASA's Technology Utilization Program by developing a better understanding of technology transfer processes. One task designed to help meet this objective involved a study of Gemini/Apollo photographic users who acquired these photographs from the Technology Applications Center (TAC) at the University of New Mexico.* TAC is a NASA-sponsored Regional Dissemination Center which, among other things, has the responsibility to disseminate earth-oriented Gemini/Apollo photographs.

The purpose of this study was to increase the knowledge of the characteristics of users and uses made of Gemini/Apollo photographs. The research was designed to accomplish five specific tasks:

(1) Identification of market segments.

(2) Determination of how customers have used the photographs received.

(3) Evaluation of the economic benefits derived through the use of TAC-supplied Gemini/Apollo photographs.

(4) Measurement of user satisfaction with the quality of photographs and related TAC services.

(5) Suggestions for the marketing of photographic materials.

The information was obtained through the use of a mail questionnaire sent to all past individuals who had ordered Gemini/Apollo photographs from TAC.

The major findings of the study were:

- Almost half of the TAC customers are academicians, primarily at the university level. Industrial users involved in the oil, natural gas, and mineral exploration industries represent the second largest segment of users.

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* A report containing a more elaborate description of the study is scheduled for publication in November, 1969. The report will be titled, "A Study of Gemini and Apollo Photography Users."

- Individuals with disciplinary backgrounds in the earth sciences, primarily geology, comprise nearly 70 percent of past Gemini/Apollo photographic users. Among users there was a general absence of individuals with disciplinary backgrounds in other technical areas, such as engineering and the physical sciences.

- The quality of the photographic materials distributed by TAC appears to be more than adequate for the needs of present users.

- A sizeable portion of past customers think that the quantity and quality of supporting information accompanying the photographs needs improvement. Some respondents thought that there were not enough interpretive aids included.

- TAC's current promotional program lacks balance. The most significant avenue of communication was through advertisements in Geotimes magazine. Only personal contact ranked high as an additional source of inquiry.

- The frequency and volume of additional orders from past TAC customers will be limited by the availability of new photographic coverage. No substantial volume should be expected from past users unless expanded coverage becomes available.

- Over 70 percent of the survey respondents thought that the photographs were worth more than they cost in terms of the economic and noneconomic benefits derived from their use.

Based on these findings the following suggestions were made:

- Expand the photographic coverage now available. To continue to serve the needs of present customers, new photographic materials will be required. To accomplish this, Gemini/Apollo coverage might have to be supplemented by additional photographs from NASA and other government services.

- Deal with the market by class of user rather than as a single entity.

- Increase the effectiveness of the promotional program by using communication channels which will reach potential markets not currently using TAC photographs. For example, engineers have not been a significant user group. Advertisements in professional journals such

as Civil Engineering and presentations at professional seminars may lead to increasing utilization by new user groups. Articles by TAC staff strategically placed in appropriate publications also could increase awareness of application of the photographs and of their availability.

- Increase and improve the data which accompanies the photographs.

APPENDIX A

Reports of Technology Transfer Through the TSP Program

INTERVIEWS WITH TSP USERS

	Applications Actually Resulted	Applications May Result
NEW PRODUCT	80100431--photo receiver 80200408--noble gas 80204793--Industrial Monitoring System 80302988--electronic module packaging 81120128--holding fixture 81220536--electro-optical tracking system 90425032--electrical circuit converter	81119957--circuit design 90323926--DC-to-DC converter 90425000--heat control circuit
NEW PROCESS	80200407--deuterated isotopes 80709548--natural gas liquefication 90323044--contamination control 90323187-88--quality control procedures 90323624--gas leakage measurement 90323673--heat control circuit	80814215--optimal data smoothing
NEW APPLICATION	80300429--Bit Error Rate Detector 80505067--Vis-A-Plan 90324170-71--gas leakage measurement and electromotive series	
PRODUCT IMPROVEMENT	80300441--"Gordon Arc" 80404535--inorganic paint 90323558--fusion welding 90424832--electromotive series 90425078--Inconel 718 handbook	81016959-60--patient monitoring system 81018205--fire-retardants 90425247-48--air bearing design and fluid duct bends
OTHERS	80200412--microcircuit pack 80811865--heat transfer 80917080--optical-data processing 81017290--bellows testing 81221384--integrated circuit testers 90323405--fusion welding 90324172--electromotive series	

Case Number: 80100431
(Supercedes Telephone Follow-up of 1/16/68)

Electro-Mechanical Research, Incorporated, is marketing a photo-receiver that is capable of recording televised photographs of the earth's cloud cover. The photographs are transmitted by cameras aboard meteorological satellites.

Subject	Technology Source
Electro-Mechanical Research, Inc. 5012 College Avenue College Park, Maryland 301-864-6340 Contact: Michael Riggs Marketing Representative	Goddard Space Flight Center

A photo-receiver developed for the Goddard Space Flight Center by Electro-Mechanical Research, Inc., is being sold commercially by this firm. The instrument's function is to provide a series of 15 pictures per day of the earth's cloud cover. These pictures in sequence, record the extent, speed, direction, etc., of clouds and, therefore, can be used as a basis for weather forecasts. The Automatic Picture-Taking (APT) camera aboard the ESSA and NIMBUS meteorological satellites transmit the photographs to earth.

The original units sold by this firm were priced at $5,000 for the receiver and all accessories. By January 1968 ten complete units had been sold. At that time, the company anticipated a market for as many as 400 units, buyers among universities, government agencies, television stations, and foreign governments.

By September 1969 a few more units had been sold; eight complete units were delivered to ESSA and one was sold to a buyer in Italy. The ESSA units will be used at overseas monitoring stations. (Complete stations to support the operation of the receiver are priced at $9,000 to $10,000 and all nine of the recent sales were made at these prices.)

The market for these instruments has not opened up as rapidly as the manufacturer had hoped. A primary problem is that most satellites are still experimental, and potential users are not greatly interested in receiving experimental test patterns. The U.S. Weather Bureau is interested, especially since the onset of the hurricane season this year,

Case Number: 80100431 (Cont.)

and is using the receivers for 24-hour monitoring of hurricanes (using an infrared adapter for night pictures). Aside from weather, other possibilities for pictures relate to education and earth resource surveys. Five universities have made inquiries about the receiver, but they are apparently building their own instruments after getting information about the circuitry from NASA. Electro-Mechanical Research, Inc., has supplied some component parts to the University of Wisconsin.

Mr. Riggs anticipates the market for his firm's receivers will increase, but the speed and magnitude of any expansion will depend upon changes in the amount of use made of satellites. As use of satellite pictures for forecasting becomes more routine, meteorologists will cease to regard satellite picture transmission as a scientific curiosity.

Mr. Oliver of the Weather Bureau, impressed with the potential of satellite pictures for weather forecasting, has achieved excellent forecasting results from satellite pictures. At a recent public display, he gave periodic weather forecasts within two minutes of receiving a picture on the receiver.

Some use is currently made of Weather Bureau pictures by local weather forecasters and television stations but the pictures are available to them only as poor facsimilies with very small print. A local television cameraman has only 15 seconds to make his camera adjustments and get the picture; the small print cannot be used under these conditions. Electro-Mechanical Research, Inc., is developing an eight-inch format recorder to alleviate some of these problems.

WH/RHO:ad
9/10/69

Case Number: 80200408
(Supercedes Telephone Follow-up of 1/25/68)

Peninsular Chemresearch, Incorporated, of Gainesville, Florida, is selling several noble gas compounds, formulations for which were developed at the Argonne National Laboratory.

Subject	Technology Source
Peninsular Chemresearch, Inc. Box 14318 Gainesville, Florida 32601 904-376-8246 Contact: L. Williams Sales Manager	Argonne National Laboratory Tech Brief: 66-10467, "Xenon Forms Stable Compound with Fluorine" Tech Brief: 67-10133, "Xenon Fluoride Solutions Effective as Fluorinating Agents" Tech Brief: 67-10185, "Xenon Fluorides Show Potential as Fluorinating Agents"

In 1962 and 1963, Argonne National Laboratories personnel published two papers in the Journal of the American Chemical Society dealing with preparation of xenon fluoride compounds. Similar information was later published in Tech Brief form. The thrust of the journal articles and the Tech Briefs was that stable noble gas compounds could be made, and that the compounds had considerable potential as fluorinating and oxidizing agents. Their utility is great in small-scale reactions where precise control is required to yield a high purity result, as in laboratory work.

Peninsular Chemresearch, Inc. staff members derived several technical advances in the production of xenon fluorides, following the appearance of the 1962 and 1963 journal articles. The company's 1967 catalog included xenon tetrafluoride and xenon hexafluoride at a minimum unit price of $75 per gram for 10-gram orders. Current prices are somewhat less, but still high enough to restrict use to small-scale laboratory

Case Number: 80200408 (Cont.)

uses. According to Mr. L. Williams, Sales Manager, the 1969 catalog lists the following noble gas compounds:

XeF_2 (Xenon difluoride) - $90 per 5 grams (minimum order)
XeF_4 (Xenon tetrafluoride) - $90 per 5 grams
XeF_6 (Xenon hexafluoride) - $150 per gram (+$50 container deposit)
XeO_3 (Xenon trioxide) - $60 per 100 ml .1 normal solution in water
Na_4XeO_6 (Sodium perxenate) - $50 per gram

The firm has encountered a grave marketing situation which threatens to keep prices high. Demand for the noble gas compounds is very small, and only small quantities are produced. Production of small quantities is inefficient and costly which keeps prices high, and inhibits demand.

Mr. Williams is launching a promotional campaign to stimulate demand. During the next two weeks the firm will mail a reprint of an article concerning noble gases ("What Now Noble Gases?" N. Bartlett, Industrial Research, May 1969, pp. 70-72). A cover letter will solicit feedback concerning market potential among some 500 firms which have inquired of Argonne National Laboratories about the compounds. Mr. Williams hopes that the campaign will stimulate interest sufficient to justify a sizeable engineering program that could achieve economies of large-scale production. Unless there is some assurance of large sales volume it is not likely that the funds would be allocated to develop mass-production capabilities. Williams characterized this as a "chicken-egg" problem, and stated that it should be resolved within six months.

Under present conditions only custom-order two-gram batches are made at any one time, even at the Argonne Laboratories. An additional problem associated with this small quantity production is the occurrence of an occasional explosion which destroys the equipment. If the proper engineering could be cost-justified by sales this problem would also be eliminated.

Peninsular has added three noble gas compounds to its inventory during the past year. Sodium perxenate is the latest addition, and is thought to have a great market potential. (Peninsular manufactures it under

Case Number: 80200408 (Cont.)

license to Malm and Appleman, the patent owners.) The compound is an excellent oxidizing agent. Its ability to convert manganese to permanganate instantaneously has suggested a possible widespread use potential to Mr. Williams. He notes that the storage yards of all steel makers are full of stacks of a variety of steels. These are exposed to the weather and eventually become difficult to identify. A simple spot test with sodium perxenate would oxidize the manganese and indicate the alloy composition of the steel.

Mr. Williams also mentioned the possibility of achieving cost reductions for xenon compounds through increased use of krypton, another of the noble gases. Xenon will become more abundant, therefore cheaper, as more krypton is made and used.

WH/DRL:lj
8/28/69

Case Number: 80204793
(Supercedes Telephone Follow-up of 3/7/68)

Space Craft, Incorporated has applied engineering expertise gained through participation in NASA contracts to the development of the Industrial Monitoring System, a commercial device used in measuring the efficiency of textile looms.

Subject	Technology Source
Space Craft, Incorporated Box 5715, Station B Greenville, South Carolina 29606 803-277-6541 Contact: Reed Presson Manager	Space Craft, Incorporated

"Pick clocks" are used by the textile industry to determine the efficiency of a loom. Each loom is equipped with a "pick clock" which counts the frequency the shuttle passes back and forth across the width of the material. It is the objective of management to keep the looms in operation as much as possible to increase profitability. One woman is normally responsible for the operation of 50 looms within a given textile plant. An average textile plant has approximately 1,000 looms operating within it. The traditional "pick clocks" are subject to abuse and adjustment by the operators and therefore considered to be unreliable. Compensation for the loom operator is somewhat effected by her efficiency.

Space Craft has replaced the conventional "pick clocks" with its Industrial Monitoring System which electronically senses the frequency of the shuttle for all the looms located in a particular plant. Various electronic computations are accomplished by the system, providing the management with an instantaneous indication of overall loom efficiency. The traditional supplier of "pick clocks" attempted to develop its own system for counting the shuttle frequency, but the system failed since there was considerable interference due to electrical noise. Space Craft was able to avoid this interference by applying advance noise reduction techniques to the problem. Personnel productivity has been improved substantially by installing remote indicator units in plant cafeterias. Loom operators tend to be more conscious of their productivity when a measure of their efficiency is known to their peers.

Case Number: 80204793 (Cont.)

Roy Gage, Vice President, indicated that a complete system sells for approximately $100,000. The original system sold for $65,000, but increased demands from the buyers for more sophisticated systems have resulted in a more expensive product. Gage claimed that a 2 percent increase in efficiency would enable a typical plant to pay for the Space Craft system within one year.

Gage reported that the contribution by NASA technology shows up primarily in the printed circuit boards located in the logic circuits and the instrumentation of the overall system. The printed circuit boards are almost identical to the ones developed for NASA when the Space Craft personnel were employed at Huntsville. Similar ones were developed under more recent NASA contracts.

A follow-up interview with Reed Presson, who manages the textile industry applications, indicates that several systems have been sold, and rising demand is foreseen. Many of the textile firms have purchased this system on a trial basis, and their experiences have been uniformly agreeable. The 1-2 percent increase in efficiency projected by Mr. Gage has been achieved in every case, and some applications have achieved as much as a 6 percent increase.

The firm that achieved the most valid payoff makes Oriental rugs. Other fabrics are less amenable to as large efficiency gains.

Despite the concrete evidence of gains for textile manufacturers there is still substantial opposition to system introduction. Many textile firm managers protest that the system "is too sophisticated for my people." Even some firms that have purchased the system are reluctant to acknowledge the improvements in operation and are continuing to "evaluate" before adopting the system for the total plant full-scale operation. Presson estimates that as long as two years may be required to induce conviction even among the firms who are using the system. During this period he is laying a foundation that will facilitate the textile firms' commitment to a concept of total systems management involving software applications to optimize other production control facets.

Special attention is also given the loom tenders. The machine operators have long had a propensity to perform their own "adjustments" on the monitoring devices. The Space Craft system is tamper-proof, but this change does not of itself convert the operators. Consequently,

Case Number: 80204793 (Cont.)

Space Craft addresses special educational programs to the operators in an effort to clarify for them the ways in which they can benefit from the change. Great emphasis is placed on eliminating fears of "The Big Eye," and feedback from the operators is incorporated into the system to bolster their confidence. Potential and actual purchasers of the system are almost entirely larger firms. The small companies lack the financial capacity to consider a purchase. They are not actively cultivated as customers because their future existence is sometimes dubious; merger trends are stronger in the textile industry.

Space Craft's diversification is being extended beyond the textile manufacturing industry. The Industrial Monitoring System is thought to be immediately transferable to firms engaged in cloth finishing and apparel manufacturing. Forty basic industries are being examined by Space Craft as potential markets for monitoring systems. The 40 industries were selected for study on the basis of their lack of technical capabilities available from Space Craft. By providing the equipment (sensors, display equipment, control systems) and systems engineering talent, Presson thinks that his firm will be able to significantly alleviate the technological capabilities of many laggard industries.

Mr. Presson also mentioned that Varian Data Machines has recently published the results of a study of Space Craft's textile industry experience. (Varian is Space Craft's computer supplier.)

WH/RHO:ad
9/2/69

Case Number: 80302988
(Supercedes Telephone Follow-up of 6/7/68)

A Midwest refractory metals manufacturer has used a NASA information package to develop an "integrated package" product for packing electronics equipment.

Subject	Technology Source
A Midwest refractory metals manufacturer	Jet Propulsion Laboratory
Contact: Director of Marketing	Tech Brief: 66-10664, "Packaging of Electronic Modules"

The Director of Marketing for a Midwestern refractory metals manufacturing company reported last year that he was promoting sales of an "integrated package" for packing electronics equipment. NASA information was an important input to the process when the new product was developed. Tech Brief 66-10664 and its associated Technical Support Package explained complex methods of calculating the critical parameters (size, shape, weight) for integrating the electronic products packaging.

New packaging product buyers are exclusively manufacturers of semiconductors and related equipment. The marketing director stated that his product appears to be ". . . just what they want." Sales were about $1 million in 1968, and the marketing director estimated that during the next three to four years sales would increase to $10 to 12 million annually. The national market for similar products is now about $35 to 40 million and should increase to $50 to 60 million in four years.

The NASA information was primarily useful for design concept suggestions. Nevertheless, the company has developed its own proprietary designs. NASA patent licensing has not been sought because ". . . most of (the company's) processes and products are unique." Patents are being sought for these unique designs and processes.

Other information sources utilized during the development process were the Electronics Packaging Conference and the customers to whom the product is sold. The latter are continually contacted and interviewed to discover their peculiar needs for packaging.

Case Number: 80302988 (Cont.)

Supplementary information about the realized sales of the product was not available in September 1969. A new director of marketing was unfamiliar with the product and could not add to the previous report.

WH:ad
9/11/69

Case Number: 81120128

Based upon information received from the Ames Research Center, the Columbia Tool and Instrument Company, Farmingdale, New York, has fabricated a fixture for holding electronic components on a circuit board.

Subject	Technology Source
Columbia Tool and Instrument Company 51 Allen Boulevard Farmingdale, New York 11735 516-249-1623 Contact: John W. Frenzel President	Ames Research Center Tech Brief: 66-10162, "Fixture Aids Soldering of Electronic Components on Circuit Board"

The Columbia Tool and Instrument Company is a small company primarily engaged in tool design and tool manufacturing activities. It also does some subcontract work which requires soldering of small electronic components on to circuit boards. In conjunction with this type of work, it designed and fabricated a fixture to hold components in the desired position.

Mr. Frenzel said that a holding fixture was required and that having the information available from NASA saved approximately $500 in design effort. It also contributed intangible benefits in terms of improved production efficiency. Mr. Frenzel estimated that the fixture cost approximately $500 to make including design, model fabrication, and shop time.

The Columbia Tool and Instrument Company learned of the availability of the NASA information through a pamphlet received from the Small Business Administration. Mr. Frenzel commented that the Technical Support Package was "excellent." He thought the "information was completely clear" and he said he "got more out of the sketch than out of the words."

RB:ad
8/6/69

Case Number: 81220536

The Martin-Marietta Corporation, Orlando, Florida is presently developing a carbon dioxide laser system for tracking aircraft. In conjunction with this development activity, some ideas were used from the information received from the Marshall Space Flight Center on an electro-optical tracking system.

Subject	Technology Source
Martin-Marietta Corporation P.O. Box 5837 Orlando, Florida 32805 305-855-6100 Contact: Robert J. Casey, Ph. D. Senior Research Scientist	Marshall Space Flight Center Tech Brief: 68-10311, "Improved Electro-Optical Tracking System"

The Martin-Marietta Corporation, under a company sponsored program is developing a carbon dioxide laser system for tracking aircraft. According to Dr. Casey, the system will give air traffic controllers the capability of tracking two aircraft at closer proximity to one another than presently is possible. The system uses a conical scanning device and tracks from a zero horizon to straight-up with a range of five to ten miles for aircraft using a corner reflector. However, within the next year, the company expects to have the capability to track aircraft without the use of a reflector on the aircraft.

According to Dr. Casey, he became aware of the NASA information on the electro-optical tracking system through a visit to the Goddard Space Flight Center. Unfortunately, Martin had progressed too far with its own development activities for the NASA information to be of much value. Dr. Casey estimated that what few ideas they were able to use from the NASA information may have saved one man-month of effort or approximately $2,000.00. He also expended between 20 and 30 hours in reviewing the NASA information. Dr. Casey expressed the feeling that the NASA information had some very interesting ideas which may be used in later development activities on other programs.

The Martin-Marietta Corporation regularly receives NASA publications through its library where they are maintained on file. In addition, NASA publications are received directly by individuals in the research division and these are routed to other scientists and engineers within the division. Dr. Casey believes that the report on the electro-optical

Case Number: 81220536 (Cont.)

tracking system "could have been a little more complete if the interim reports had also been included" in the Technical Support Package. However, in general, Dr. Casey thinks "the NASA Tech Brief system is a pretty good system and quite satisfactory."

RB:ad
8/1/69

Case Number: 90425032

At the University of Rochester an electrical circuit developed at Goddard Space Flight Center is being used to convert analog signals received from a pressure sensor into pulse-width signals.

Subject	Technology Source
The University of Rochester Department of Physics and Astronomy River Campus Station Rochester, New York 14627 716-275-2121 Contact: Mr. James A. Geissinger Senior Engineer	Goddard Space Flight Center Tech Brief: 68-10003, "Linear Analog DC Voltage-to-Pulse-Width Converter"

The Department of Physics and Astronomy at the University of Rochester is conducting experiments in cosmic ray studies. Instrumentation for these experiments is carried aloft by satellites or balloons in which space and weight are limited so that only low power sources can be utilized.

James A. Geissinger, a Senior Engineer in the Department, required a low power analog-to-digital converter for use in connection with these experiments. He spotted Tech Brief 68-10003 and requested the TSP because it seemed to have the information needed. The TSP describes a circuit that will convert an input DC analog signal into a proportionate pulse-width signal. Currently, this engineer is using the circuit to convert information received from a pressure sensing device.

Mr. Geissinger estimated that about $20 had been spent to buy components for each converter. He anticipates a savings of approximately $200 and 80 man-hours per experiment with three or four experiments being performed yearly. The information contained in the TSP was evaluated by Geissinger as five percent input to the total system, but he noted that the system couldn't operate at all without this input.

LS:ad
9/23/69

Case Number: 80200407
(Supercedes Telephone Follow-up of 4/2/68)

Deuterated algal products are produced and available for commercial purchase from Merck, Sharp & Dohme of Canada, Ltd. The process for cultivating deuterated algae originated at Argonne National Laboratory.

Subject	Technology Source
Merck, Sharp & Dohme of Canada, Ltd. 350 Selvy Street Montreal 6, Quebec, Canada 514-695-7550 Contact: Art Morris Production Manager	Argonne National Laboratory Tech Brief: 67-10304, "Cytology is Advanced by Studying Effects of Deuterium Environment"

Three Argonne scientists published "Mass Cultivation of Algae in Pure Heavy Water" in Biotechnology and Bioengineering (Vol. IV, pp. 281-297) in 1962. The article described the work of Homer Daboll, Henry Crespi, and Joseph Katz at Argonne National Laboratory, the results of which was the successful mass culturing of several kinds of algae in pure deuterium oxide (D_2O). In 1967, a Tech Brief was promulgated in which Katz and others described the significance of fully deuterated organisms for scientific research in cytology.

Merck, Sharp, and Dohme of Canada, Ltd. scientists used the 1962 paper as a basis for development of a capability to mass-produce deuterated algae. The paper provided 100 percent of the initial information input, and subsequent personal contact with the Argonne scientists added to the information base. After five years of experimentation and production activities, Mr. Art Morris estimates that at least 50 percent of the technical inputs related to the final product are attributable to Argonne.

The firm has invested considerably in laboratory facilities, and five chemists have been assigned to the development project and production duties for the last five years. Some sales have been made, but they are insignificant. The parent company has been using the total output, but additional demand could easily be met because the deuterated organisms are already mass-produced for the parent firm. Demand from other firms is thought to be small because few laboratories possess the sophisticated instrumentation required to conduct research with

Case Number: 80200407 (Cont.)

deuterated isotopes. Rising demand is anticipated, partially because of publication in scholarly journals of the results of research using deuterated organisms (for example, Katz and Crespi, "Deuterated Organisms: Cultivation and Uses," Science, Vol. 151, No. 3715, March 1966, pp. 1187-1194). A large sales volume will probably be realized in another two or three years.

WH:ad
9/16/69

Case Number: 80709548

Mr. V. C. Williams, a consulting engineer for the natural gas industry, has developed a new process for the liquefication of natural gas. NASA's cryogenic handbook was a significant factor in determining the properties of liquid methane and liquid nitrogen.

Subject	Technology Source
103 Frontenac Forest St. Louis, Missouri 63131 314-432-4932 Contact: V. C. Williams Consulting Engineer	Kennedy Space Center Tech Brief: 67-10610 "Handbook of Cryogenic Data in Graphic Form"

As a consulting engineer in the cryogenic and natural gas field, Williams develops ideas and then markets these to major companies. Although he has been employed by a natural gas company, he is now an independent operator.

Mr. Williams has developed a new process to replace the conventional classical cascade cycle process for liquefying natural gas which is currently being used throughout the world. Mr. Williams indicated that this traditional cascade method does a good job, but that it requires six heat exchangers, which are a large portion of the capital investment involved in a field site. The method Williams designed requires only one heat exchanger. If the Williams method is adopted, the overall capital investment involved in erecting a field site will be reduced by over 50 percent. The capital investment currently required in the construction of a field site is in the neighborhood of $100 million.

Williams also indicated that annual cost would be significantly lowered with his method. Annual costs are typically in the neighborhood of $40 million.

With the classical cascade cycle process, the natural gas is liquefied at a field site and then shipped to a location where it will be used. When the liquefied gas is delivered, it is steam heated to get it to the ambient range. Essentially, the liquefied gas is heated by a steam process to get it back to a gaseous state.

Case Number: 80709548 (Cont.)

Williams' system, however, would use a cross current of air to heat the liquefied gas. Through this process, the gas is heated and the air is liquefied by cooling or heat exchange. The liquefied air is then separated into its component parts and liquefied nitrogen is placed back aboard the vessel which delivered the liquefied natural gas. The liquid nitrogen is then returned to the field site and used in the process of liquefying more natural gas. Williams' method essentially "saves some of the cold." By saving some of the cooling effort at the field site, you can eliminate heat exchangers and thus save a great portion of the capital investment involved.

Williams estimates that the whole process would deliver natural gas to major U. S. markets from a country such as Algeria at one third the capital investment currently involved. If his figures are accurate, the savings over time are so large as to be almost indeterminable.

One portion of Williams' design of the field site equipment involves a turbine pump which is used to pump liquid nitrogen and liquid methane. Williams stated that the original design included standard turbine pumps, although he was not sure whether they would work properly with these liquid gases. Williams indicated that this part of the project was stalled until he could determine the properties of liquid nitrogen and liquid methane. It was in this area and with this problem that the NASA cryogenic handbook helped Williams in his design.

Williams indicated that this handbook did contain the necessary information on the properties of the liquid nitrogen and liquid methane that he needed. He stated that the information indicated that they could use the pump currently in the design, and that the handbook had saved him four months of constant work and testing. Although the turbine pump is only a minor part of Williams' overall design, he stated that he felt that the cryogenic handbook had been a moderate input in the entire project. He indicated that the design could not be complete until the information in the handbook was known.

Mr. Williams indicated that the design as of the moment was complete, and that it was being reviewed by Chemical Construction Corporation. He indicated that all patents on this process were not under the

Case Number: 80709548 (Cont.)

exclusive option of Chemical Construction. Information received from Mr. Williams indicates he has patents in five countries, and pending applications in 30 additional countries.

RJ:lj
9/11/69

Case Number: 90323044

The Electronic Materials Division of Bell and Howell Corporation manufactures photoplates and other micro-surfaces which are used in the production of semiconductor circuits. A member of this Division requested the Contamination Control Handbook from Marshall Space Flight Center for use in connection with clean room operations.

Subject	Technology Source
Electronic Materials Division Bell and Howell Corporation 360 Sierra Madre Villa Pasadena, California 91109 213-796-9381 Contact: Chester G. Northrup Director of Manufacturing Micro-Surfaces	Marshall Space Flight Center Tech Brief: 68-10392, "Contamination Control Handbook"

The Electronic Materials Division manufactures photoplates used for semiconductor circuits. The basic process involved in this production is the deposition of a variety of thin films on glass or on some other substrate. These operations have to be carried out in a clean room environment. High purity in depositing the thin films is required to achieve the very high quality photographic surfaces necessary to development of micro-circuitry.

The Tech Brief contains a reference to the Contamination Control Handbook prepared by Sandia Corporation under contract to Marshall Space Flight Center. Mr. Northrup ordered this handbook for use as a general reference in the conduct of clean room operations and was quite satisfied with it. However, he stated that reproduction of the document was poor and there were problems in reading figures and tables. He also said that he had seen the material elsewhere that is included in the handbook; the handbook lags behind the trade publications by 6 months to a year.

A booklet which Mr. Northrup found to be of great value is NASA SP-5074, entitled "Clean Room Technology." The descriptions in this booklet are written on a nontechnical level, and he felt that this was excellent for the semi-skilled workers in the clean room. He plans to order 50 copies of this particular reference. Although he could not cite a specific dollar amount, Mr. Northrup stated that there were cost savings which could be credited to use of the Contamination Control Handbook,

Case Number: 90323044 (Cont.)

and the Clean Room Technology Handbook. These savings resulted from increased efficiency in production. He commented that the value of the NASA Clean Room Technology document was enhanced for his workers in the production room by NASA's credibility as a source. He felt that the need for clean-room techniques outlined in the booklet was more readily accepted by his workers because of their respect for NASA.

Mr. Northrup was quite satisfied with the NASA Tech Brief Program except for time delays in publication. He was not concerned with the fees required to obtain information through the Clearinghouse or the two to three week's delay in receiving the information.

PB:lj
8/27/69

Case Numbers: 90323187, 90323188

The librarian at Barden Corporation circulated Marshall Space Flight Center documents on Nondestructive Testing and Contamination Control to management responsible for production and quality control procedures in precision ball bearing manufacturing. Company procedures were up-graded because of these references.

Subject	Technology Source
Barden Corporation Danbury, Connecticut 26810 203-744-2211 Contact: Mrs. Bernice P. Lucas Technical Librarian	Marshall Space Flight Center Tech Brief: 68-10391, "Training Manuals for Nondestructive Testing Using Magnetic Particles" Tech Brief: 68-10392, "Contamination Control Handbook"

Extremely narrow tolerance is required in the production of anti-friction precision ball bearings sold by Barden Corporation. Quality control procedures and control of contamination, priority concerns with management, are the subjects of two Technical Support Packages. Both documents were evaluated by the users as excellent.

"Training Manuals for Nondestructive Testing Using Magnetic Particles" was reviewed in six two-hour sessions. The technology, although not being used at Barden now, is believed to be of future value and will be retained as a reference. The engineers found these documents to be "an excellent refresher on magnetism and relevant to some present Barden procedures."

Barden production and quality control engineers used the "Contamination Control Handbook" to evaluate and improve existing cleaning systems in vacuuming, laminar flow cleanroom, cleanrooms within cleanrooms. An excess of 100 hours were spent in applying the technologies of this document to Barden's production tolerances.

A monetary value and time savings could not be attributed to these two documents. Their impact on total production technique is estimated as small to the point of being insignificant, but absolutely essential to "quality standards for making a better product . . . if we are to stay in business."

Case Numbers: 90323187, 90323188 (Cont.)

Mrs. Bernice Lucas, Technical Librarian to the Research Engineer, receives and screens incoming Tech Briefs. She routes Tech Briefs and Technical Support Packages within the company. (Tech Briefs and other NASA documents not of immediate value to Barden are given to a local engineering college for staff and student reference.) Mrs. Lucas is very familiar with NASA publications and remarked: "NASA material is very valuable for our Engineers. The service is excellent from both NASA and the Clearinghouse. We receive everything promptly and in good condition."

HWZ:lj
9/19/69

Case Number: 90323624

The Heating and Air Conditioning Division of Controls Company of America used information obtained from Marshall Space Flight Center to establish a procedure for estimating gas leakage rates.

Subject	Technology Source
Controls Corporation of America 2450 N. 32nd Street Milwaukee, Wisconsin 53245 414-442-2100 Contact: Earl J. Lane Director of Quality Control	Marshall Space Flight Center Tech Brief: 68-10393, "Determining Gas Leakage from Bubble Formations"

Controls Company of America manufactures automatic controls for refrigeration units. A qualitative method was needed to measure gas leakage rates from these control units.

Part of the information contained in the Technical Support Package was adapted by Controls Company to develop an in-line process to measure leakage rates from control units charged with freon gas. The most important factors resulting from the use of the TSP was the improved product quality as well as a reduction in internal quality control costs.

Mr. Lane said that development of a method had been proceeding along lines similar to those in the NASA report. However, the TSP did help firm up the company's ideas. Lane was confident that there would be a savings of time and money due to the information received from NASA, but he was unable, at the time of the interview, to quantify the actual savings.

LS:lj
8/27/69

Case Number: 90323673

A small manufacturing firm has an improved testing capability as the result of knowledge gained from a Technical Support Package.

Subject	Technology Source
Calemco Transformers 585 Fourth Street San Fernando, California 91341 213-365-7733 Contact: Mr. Irvin R. Dockstader Chief Engineer	Marshall Space Flight Center Tech Brief: 67-10097, "Heater Control Circuit Provides Both Fast and Proportional Control"

Calemco Transformers is a small firm (18 employees) engaged in the manufacture of specialty electronic devices in the magnetics field. It performs the majority of its operations on a contract basis but also does market a few consumer items such as DC inverters. The work carried out under contract often requires an environmental test of electrical products under various temperature conditions. Mr. Irvin Dockstader, Chief Engineer of Calemco, stated that knowledge gained from the Technical Support Package was used in the redesign of the controls of an environmental oven.

The improved oven permitted the company to perform the required tests in-plant. He estimated that expenditures of about $250 for parts and engineering time were used to build two control devices. Dockstader estimated monetary savings of over $2,400 per year plus time saved by doing the test in-plant. At least one week would be required if the test were performed outside.

Mr. Dockstader learned about the availability of the NASA Technical Support Package from the Small Business Administration. He said, "they're (SBA) very helpful."

LS:lj
9/12/69

Case Number: 80300429
(Supercedes Telephone Follow-up of 1/8/68)

Space Craft, Incorporated offers for sale a Bit Error Rate Detector which automatically analyzes the capabilities of magnetic tape recorders.

Subject	Technology Source
Space Craft, Incorporated 7705 La Porte Freeway Houston, Texas 77012 713-923-2291 Contact: Gerald Stevens Marketing Manager	Goddard Space Flight Center

The Bit Error Rate Detector was developed by Space Craft, Incorporated for Goddard Space Flight Center. The research was related to instrumentation systems for analyzing the performance of magnetic tape recorders.

A relative measure of performance is indicated by the frequency of transfer and storage errors introduced internally by the tape recorder tested. The Bit Error Rate Detector generates a series of simulated "words" of digital information which is subsequently transferred to, and recorded by the tape recorder. The information is then "read" back from the recorder and compared with the original information. Discrepancies are considered errors and indicated on the detector.

Commercial marketing of the instrument was initiated by Space Craft upon completion of contractual obligations with Goddard Space Flight Center. Initial selling price for the instrument and accessories was $12,500. However, only a few have been sold. Gerald Stevens, Marketing Manager, ascribes the low sales volume to two factors. Potential buyers include users of magnetic tape devices and firms who manufacture recorders. The manufacturers have their own design engineers who build according to company specifications for test equipment. They could probably acquire the test capabilities of this instrument more economically by purchasing it from Space Craft than by re-inventing it in their own facilities.

The remainder of the potential market--those who use but do not make tape recorders--is largely untaped because of institutionalized relationships between suppliers and users of tape recording equipment.

Case Number: 80300429 (Cont.)

Warranties and service contracts in effect remove most of the users' incentive to achieve their own expertise concerning the recording equipment. If faults (such as error propensities) occur, the user need only contact the supplier for remedial action. Users have little incentive to spend their own funds to determine the magnitude or causes of error in the equipment. Only 5 to 10 percent of all the users of magnetic recording instruments appear to be interested in understanding the equipment and its capabilities, beyond the promotional information imparted by equipment suppliers.

The Bit Error Rate Detector remains a laboratory instrument. Space Craft intends to continue to offer the instrument, but until the needs and sophistication of potential customers increase greatly, there is little to be gained from outlays for promotional programs. Custom orders can be filled easily and at little cost since the components are now standardized shelf items.

Space Craft has recently broadened its application of space-related technology in the civilian economy by providing monitoring telemetry and systems management services to the petroleum industry. The firm's experience with stored-program telemetry systems and remote multiplexing for the Air Force and NASA provides the basis for petroleum industry application. Stevens stated that conceptualization and circuitry development involving sophisticated sensors and telemetry equipment is now being used in petroleum production automation and many other refinery and pipeline operations.

In order to enhance the marketability of these services, Space Craft recently bought into Baker Oil Tools and created a subsidiary company, Basic Baker Automatic Systems. According to Stevens, Baker Oil Tools had no electronics capability and had defined a need to acquire it. Baker surveyed 15 electronic instrumentation firms as potential merger partners and settled on Space Craft as the best prospect. Given Baker's reputation as "the best" among oil field equipment suppliers, and Space Craft's aerospace technology base (and successful experience in adapting the technology to the requirements of private industry--see also Case Number: 8024793), Stevens anticipates great success for the new subsidiary.

WH/RHO:ad
9/2/69

Case Number: 80505067
(Supercedes Telephone Follow-up of 10/28/68)

The Consumer and Technical Products Division of Owens-Illinois is using a management technique called Vis-A-Plan in new product development and for contractor performance in demolition work. It has found it very useful and an improvement over PERT.

Subject	Technology Source
Owens-Illinois Technical Center Consumer and Technical Products Division 1700 North Westwood Avenue Toledo, Ohio 43607 Contact: James Marsh Corporate Consulting Industrial Engineer	Kennedy Space Center Tech Brief: 67-10240, "Vis-A-Plan Management Technique Provides Performance-Time Scale"

Nathan Ranck of Trans World Airlines, under contract to Kennedy Space Center, devised a bar-charting technique for representing and evaluating project activities on a performance-time basis. Vis-A-Plan is a rectilinear method of charting that is compatible with and supplementary to PERT. This technique may be used independently in development planning without need for sophisticated machine programming and computer analysis.

Mr. James Marsh of Owens-Illinois Technical Center is using Vis-A-Plan in several R & D activities. The technique performs quite satisfactorily in maintaining schedules. When first implemented it aroused some opposition, since responsibilities and deficient performances were made obvious. Those affected by the system gradually learned to accept it, according to Mr. Marsh.

About 120 hours were used to establish the charting system. One man now spends approximately 30 percent of his time keeping the system going. Savings have surely accrued to the firm, but Mr. Marsh could not specify their magnitude.

WH/GEH:ml
9/8/69

Case Numbers: 90324170, 90324171

Improvement was made in systems reliability and operational safety for the NERVA Test-site rocket engine because of information contained in two TSP's.

Subject	Technology Source
Westinghouse Electric Corporation Astronuclear Laboratory Box 2028 Jackass Flats, Nevada 89023 702-986-5011 Contact: J. C. Durrill Manager, NERVA Test Operations (NTO)	Marshall Space Flight Center Tech Brief: 68-10393, "Determining Gas Leakage from Bubble Formations" Tech Brief: 68-10385, "Electromotive Series Established for Metals Used in Aerospace Technology"

Improvements in the operation of the Joint AEC/NASA NERVA test program in Nevada are sought daily. Recently such a contribution was made for the rocket engine testing systems reliability from application of the technology from two Marshall documents. Individually, these contributions were designated as "very minor, but valuable," by Mr. J. C. Durrill, Manager of NTO Westinghouse Electric.

"Determining Gas Leakage from Bubble Formations" was recognized by Durrill as immediately interesting. Gas leakage is a constant project concern since only "miniscule" gas leaks are acceptable and a "hydrogen leak causes a bad safety problem because of the explosive mixture formed." With this document as source, the "general, personal, best-liked measurement systems in use were replaced with an objective, quantitative assessment of gas leak data that everyone could buy-off on." Durrill states the new measurement is simple, procedures are tight and valuable. Safety has been enhanced. Durrill estimates "maybe an hour time saving in evaluating any assembly with a leak."

"Electromotive Series Established for Metals Used in Aerospace Technology" relates to an infrequent technological concern at the test site. The absence of humidity and salt-air at this Nevada location reduces corrosion, and the most common need for this document (about once a month) occurs when a problem arises with "a space age metal" not covered in the standard references.

Case Numbers: 90324170, 90324171 (Cont.)

Durrill is unable to place a dollar value on the contribution made by either the Gas Rate Leakage Technical Support Package (of continuing use at Jackass Flats) or the Electromotive Series text (a semi-permanent file reference).

Durrill said he was the first individual at the NERVA site to receive NASA Tech Briefs. He still reviews them thoroughly, distributing appropriate ones to his personnel, and making copies for mailing to associates where he identifies a potential need.

HWZ:lj
9/22/69

Case Number: 80300441
(Supercedes Telephone Follow-up of 1/18/68)

The Jarrell-Ash Company has available for commercial sale an improved apparatus for controlling the energy source of an emission spectrograph or spectrometer. A highly sensitive DC arc source, offering great precision, is the unique feature of the instrument.

Subject	Technology Source
Jarrell-Ash Company 590 Lincoln Street Waltham, Massachusetts 02154 617-899-4300 Contact: John A. Schuch Vice President, Sales	Lewis Research Center Tech Brief: 67-10404, "Control Apparatus for Spectral Energy Source"

The use of a DC arc as energy source to excite the sample material in spectroscopy guarantees a high degree of sensitivity. However, uncontrolled arcs seriously jeopardize trace analyses since uneven arcing causes relatively large errors in the data. By developing an apparatus to control the output energy of the DC arc source used for spectroscopy, William Gordon of the Lewis Research Center has greatly improved both sensitivity and precision. His discovery has been labeled the "Gordon Arc." Since he had used Jarrell-Ash components to perfect the mechanism, he informed this firm of his discovery. Jarrell-Ash then assumed responsibility for commercial production and marketing of the spectrograph, which sells for about $17,000; the "Gordon Arc" apparatus represents $5,000 of this price.

However, sales of this product have been disappointing. Initial interest appeared to be extensive with users of biomedical instruments, but so far only the University of Colorado Medical School has purchased the instrument. Generally, spectrographic analysis does not require the extreme accuracy (and expense) of the "Gordon Arc." More sales might be made if Jarrell-Ash were able to staff a promotional team. At the time of this interview, Mr. Schuch did not believe the "Gordon Arc."

Case Number: 80300441 (Cont.)

spectrometer would be used very soon except in laboratory demonstrations of what great precision might be achieved with the instrument. It will be difficult to establish routine performance data, convincing as a sales tool, while its only use is limited to demonstrations of the instrument's dramatic sensitivity.

WH:ad
9/11/69

Case Number: 80404535
(Supercedes Telephone Follow-up of 6/6/68)

The Sperex Corporation's second-year sales of an inorganic coating for high-performance automotive applications are 40 percent above the level achieved during the first year.

Subject	Technology Source
Sperex Corporation 2239 Pontius Avenue Los Angeles, California 90064 213-478-1541 Contact: Daniel G. Borre Executive Vice President	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

The Sperex Corporation utilized NASA information about inorganic paints to perfect its own formulations for heat-resistant coatings for racing cars. A two-year development program was nearing completion when the NASA information was discovered. The Technical Support Package was reviewed and the formulations compared with those developed in the company's development program. Overall, the TSP accounted for less than 5 percent of the total information input, but it provided some "tremendously helpful" information that enabled the firm to achieve a better product.

Sperex specializes in silicon resins and markets its coatings almost exclusively for use in truck exhaust systems, oven liners, fire walls, brake drums, engine manifolds, mufflers, furnaces, boilers, electrical motors, generators, transformers, relays, and insulation. Present concentration is in the high-performance automobile market, but some industrial applications are made. The Atomic Energy Commission is writing specifications for the paint to be used for nuclear generating plants. Grumman used the same paint sold in the automotive field for applications on the Lunar Excursion Module (LEM) with the flags, lettering, and docking lights painted with Sperex products. Another product available from Sperex is called "Sea Skin." This is a coating that protects surfaces exposed to underwater conditions against electrolysis and marine growth. Test panels submerged for nine months remained clear of barnacles and other accumulations while control test panels adjacent to the test panels were thickly encrusted. The California Highway Department has specified inorganic coatings for outdoor structural coatings, but Sperex is not actively pursuing this market because

Case Number: 80404535 (Cont.)

of competition from larger firms. A major truck manufacturer uses Sperex paints to coat its trucks in the factory, and another major trucking firm uses the same paint for fleet maintenance. An additional major trucking firm has been cultivated as a potential customer, but its buyers remain convinced that Sperex paint is too expensive for its limited maintenance budget. Similar opposition to the relatively high price has been encountered in dealings with other industrial buyers. Gallon containers of the paint are priced at nearly $50, and a 16 ounce aerosol can sells for $3.25.

Promotion of the product has been most successful in auto magazines. Mr. Borre thought that advertisements placed in trade publications are not very productive because these magazines are not read in a leisurely manner. In contrast, the auto magazines seem to produce many inquiries, perhaps because an engineer or production supervisor has time to think about possible applications of the paint. He thought home reading involves fewer distractions and pressures which divert the readers' attention from such reflection.

Mr. Borre is in charge of technical services for Sperex. He has been a regular reader of Tech Briefs, but commented that he has not received any for over ten months and knew of no reason why his subscription should not still be in effect. He finds many Tech Briefs interesting because of his background with the intricacies of high-performance automobiles. He worked with Andy Granitelli for six years, and has continued his association with the racing industry since moving to Sperex. In 1965 and 1966, he sold the heat-resistant coating then made by Sperex to every car owner who had an entry in the Indianapolis 500. Since then about 60 to 90 percent of all cars in the race have used Sperex paint.

The Small Business Administration has given Sperex some assistance with selling its paint, by providing names of potential customers. However, the SBA was not involved in the initial information transfer about the NASA Technical Support Package.

WH:ng
9/18/69

Case Number: 90323558

A water resources engineer used the "Workmanship Standards for Fusion Welding" to improve his technical skills.

Subject	Technology Source
Water Resources Department State of California Sacramento, California 916-487-9221 Contact: Malcolm Stephens Senior Engineer	Space Nuclear Propulsion Office Tech Brief: 67-10200, "Workmanship Standards for Fusion Welding"

Malcolm Stephens, an engineer with the State of California Department of Water Resources, applied parts of the workmanship standards for fusion welding to set standards for acceptable welding practices. Standards were also derived whereby unacceptable welds were readily identified. The standards were to be used in training of young engineers in design of steel high pressure penstock water conveyances.

Stephens found the document "very valuable for educational purposes." The pictures provided a reference to the designer of "what results looked like, and what could be expected in field conditions." The techniques were not employed due to a change in need within the Department of Water Resources. Eight hours were spent in evaluating the TSP. There were indeterminable time savings in training hours.

This TSP was requested by Stephens because of a known need and mention of it in the trade press (Welding Design and Fabrication). "The trade press is a good source for documentation of space generated technology adaptable to fabrication and construction methods for water conveyance," according to Stephens. Review of this TSP gave Water Resources design engineers the background knowledge to appraise and judge Contractor's proposals and results as welding technologies are transferred to the massive water storage projects.

HWZ:ad
9/16/69

Case Number: 90424832

Cubic Corporation is a manufacturer of antenna systems and various electrical system components. Its equipment frequently is used where the components are exposed to sea air. To avoid problems of galvanic action, Cubic needed information concerning electric potential variations of several metals; the TSP supplied this data.

Subject	Technology Source
Cubic Corporation 9233 Balboa Avenue San Diego, California 92123 714-277-6780 Contact: Dave F. Ciambrone Chemical Engineer	Marshall Space Flight Center Tech Brief: 68-10385, "Electromotive Series Established for Metals Used in Aerospace Technology"

Cubic Corporation's primary products deal with microwave antenna systems. Specific products include the Apollo emergency radio, electronic vote counters, and high speed printers. Some of the equipment that it develops is used at sea.

Serious galvanic effects occur when dissimilar metals are coupled in electrolytic situations such as seawater environments. Cubic needed to know the specific differences in electric potential for the dissimilar metals in order to determine which metals could be used together appropriately.

Mr. Ciambrone is a chemical engineer responsible for the chemical and metallurgical activities at Cubic, and his selection of metals has been based on very limited information. He had data on approximately 50 metals from work that had been done in his own laboratory. The TSP contained data for about 130 metals and was in agreement with that developed by the Cubic Lab so that Mr. Ciambrone was able to stop further research in that area.

The data in the Tech Brief saved Cubic approximately one man-year of effort according to Ciambrone, and will continue to be used as a basic reference source. Mr. Ciambrone and Cubic are regular users of Tech Briefs and subscribe to an RDC. He commented that the Tech Briefs in general are too sophisticated for industrial use. He would like to see

Case Number: 90424832 (Cont.)

less analytical data and more specific applications for the working engineer. He was emphatic in his view that insufficient reporting of experimental procedures seriously affect the value of a TSP.

PB:ad
8/25/69

Case Number: 90425078

Boeing Space Systems Division personnel studied the Inconel Alloy 718 Handbook developed by Marshall Space Flight Center before working with this metal; thereafter, the metallurgical staff reported that it proceeded with added confidence when choosing this alloy over other metals for a product.

Subject	Technology Source
Boeing Company Space Systems Division Materials and Processes Technology Group P.O. Box 3999 Seattle, Washington 98124 206-773-4803 Contact: John Trazil Research Engineer	Marshall Space Flight Center Tech Brief: 67-10282 "Materials Data Handbook, Inconel Alloy 718"

In judging a metal or alloy for use as a product component, the physical properties handbook of the metal often is an indispensable reference in the evaluation. Boeing research engineers requested the TSP on Inconel Alloy 718 in advance of any use of the metal in order, to be fully confident of the use of this metal as a component for any product coming from Boeing's Space Systems Division.

John Trazil found the TSP to be an "all inclusive, quite well done Handbook" on Inconel Alloy 718. In making comparisons of this metal with others, the TSP enabled Boeing research engineers to evaluate and confidently employ Inconel Alloy 718 in a classified Navy contract, a contract with another NASA supplier, and on in-house welding.

The high-strength and toughness of this heat-resistent alloy makes it very valuable to the Research Department in its design of pressure tanks for space vehicles and related products of Boeing's Space Systems Division. The Handbook (TSP) will be referenced in any future use of this alloy; for instance, Trazil's department has already provided the Aircraft Division with Inconel Alloy 718 data for component application in transport aircraft and hydrofoil vehicle design.

Economies in time were realized because of the use of this TSP, although Trazil was unable to assign a value in hours to this saving.

Case Number: 90425078 (Cont.)

The staff using the TSP would have preferred "a more complete documentation of the hardening mechanism in the alloy" but were otherwise complimentary to this TSP.

Boeing receives Tech Briefs and makes them available to personnel through its library. However, neither Tech Briefs nor a summary of titles are circulated to Trazil and his staff.

HWZ:ad
9/18/69

Case Number: 80200412
(Supercedes Telephone Follow-up of 1/18/68)

United Aircraft Corporation holds a nonexclusive NASA license to manufacture and sell a "microcircuit pack" developed at Ames Research Center. As yet, no commercial sales have resulted.

Subject	Technology Source
United Aircraft Corporation Electronics Components Division Trevose, Pennsylvania 19047 215-355-5000 Contact: Martin Brunner Marketing Manager	Ames Research Center Tech Brief: 66-10309, "High-Performance RC Bandpass Filter is Adapted to Miniaturized Construction"

A West Coast representative of United Aircraft Corporation introduced to the company a "microcircuit pack" invented by W. J. Kerwin. The firm obtained a license to manufacture and sell the device, but has not sold it commercially. Brunner stated that one or two deliveries to NASA constituted the entire volume of sales to date. The firm had anticipated sales potential among several other firms who had made inquiries about the product. Brunner noted that all of these companies were NASA contractors. No purchases by these firms have occurred.

No difficulties attended the development program and expenditures of time and money have been limited.

WH/DRL:ad
9/8/69

Case Number: 80811865

A group of Aerojet-General engineers plan to use the Fluid Properties Handbook in analysis of heat transfer problems.

Subject	Technology Source
Aerojet-General Corporation Sacramento, California 95809 916-355-3567 Contact: Edward M. Takimori Nuclear Rocket Operations	Marshall Space Flight Center Tech Brief: 67-10440, "Fluid Properties Handbook"

A Project Engineer for Nozzle Design, Aerojet-General, has regular, intermittent need to refer to physical properties data for the gases helium, oxygen, hydrogen and nitrogen. The six references necessary for these data were found by Takimori to be combined in the Fluid Properties Handbook.

The copy Aerojet-General received was unreadable because the individual charts (the complete publication) were of a "fuzzy reproduction." As the charts could not be read, a replacement publication was requested and the use of earlier references have been continued.

Takimori believes this TSP, if readable, could be a valuable reference tool for 20 design engineers in his section. In heat transfer problems, use of the Handbook should provide an estimated 10 percent time savings when researching physical properties for the gases used in missile test work. He suggested this TSP might also be of value to any engineering school.

Regular use is made of TSP's by Takimori and in each other instance he received a document that was "a readable original printing."

Marshall Space Flight Center was advised of this case.

HWZ:ad
9/11/69

Case Number: 80917080

As a result of direct computer recording of experimental data outlined in two TSP's, a Ph.D. candidate in Physics was able to complete research over a greatly expanded range of metals temperatures.

Subject	Technology Source
Cornell University Bard Hall Ithica, New York 14850 607-256-5177 Contact: Raymond T. Sonoff Candidate for Ph.D., Physics	Goddard Space Flight Center Tech Brief: 68-10069 "Principles to Optical-Data Processing Techniques"

Raymond Sonoff, Cornell University graduate student, began a Ph.D. dissertation in Physics on "Point Defects in Metals at Elevated Temperatures." To proceed with this work, he needed a wider range of temperature-time-metal comparisons than could be achieved using standard laboratory data recording procedures; also, for the volume of data he wished to assemble, a computer recording of his experiments with different metals was required.

The procedures of the Goddard TSP used by Sonoff to achieve the necessary computer recordings, and resulted in "a significant time savings" in setting up the experiment; this was primarily due to the capsule explanation of the various disciplines and their interrelations for optical-data processing and computer recording.

High-speed, high-accuracy laboratory equipment was used in measuring his experiments' temperature-time profiles. Recording was done with a small computer from the pick-up developed with the technology of the TSP. Sonoff states "this single reference was more thorough than data I could have collected by reading an almost limitless number of other documents." He will retain this TSP as a continuing reference in teaching, siminar preparation, and writing when it is necessary to call upon the interrelation of disciplines, or the basic knowledge of optical-data processing.

The experiments were successful and data analysis is in process. Sonoff has indicated there may be a potential long range benefit from his experiments through his publishing of a handbook on "Physical Constants

Case Number: 80917080 (Cont.)

for Diffusion Relations in Energies over Extended Temperature Ranges," which he visualizes as being of continuous value to metal physicists.

Sonoff was not familiar with the Tech Brief program before reading this document. Though he noted signs of poor proof-reading in the TSP, he welcomed it as a "substitute to a course on how to find things and keep current in optical-data processing for computer recording."

HWZ:ad
9/10/69

Case Number: 81017290

The Controls and Instruments Division of the I. T. T. Barton Company has been able to avoid costly testing of bellows thanks to bellows testing previously carried out at the Marshall Space Flight Center.

Subject	Technology Source
Controls and Instrument Division I. T. T. Barton Company 580 Monterey Pass Road Monterey Park, California 91754 213-283-6501 Contact: V. N. Lawford Manager, Product Engineering	Marshall Space Flight Center Tech Brief: 68-10229, "Effect of Surface Irregularities on Bellows Fatigue Life"

The I. T. T. Barton Company manufactures pressure and flow measuring instruments. According to Mr. Lawford, the Manager of Products Engineering, the company is "dependent on metallic bellows." All bellows utilized in their flow measuring instruments are manufactured by Barton. Barton is owned by I. T. T., employees 400 people, and has annual sales of over $14 million. Mr. Lawford learned of the testing undertaken at Marshall Space Flight Center through a Tech Brief; he is a regular recipient of NASA publications. The Technical Support Package contained pertinent information to work being done at Barton, and Mr. Lawford stated that the TSP was "very good handling of a difficult subject."

Although Mr. Lawford was not able to discuss particulars during our phone conversation, he did respond to questions regarding Barton's use of the TSP in a letter. The following is taken directly from Mr. Lawford's letter:

1. Cost Savings. The report indicated types of stainless steel (type 321 and 347) were essentially similar in performance. This information will allow interchanging these materials without extensive testing.

   Similarly, the report showed glass-peening of bellows did not offer significant improvement in life of bellows. Again eliminating a test program that had been considered.

Case Number: 81017290 (Cont.)

2. Product Improvement. The extensive test data on bellows defects, such as notches and grooves, revealed how surface irregularities could diminish fatigue-life. This information is applicable to establishing Quality Control standards.

3. Technical Reference. The NASA report has been circulated among our bellows design and manufacturing personnel for reference material.

Mr. Lawford felt that the Technical Support Packages which he had received were very good and thorough, and that the service in obtaining the TSP's had been good. When queried about the charges required when dealing with the Clearinghouse, Mr. Lawford stated that he was under the impression that most of the orders he had placed with the Clearinghouse had been free. NASA publications received by Barton are available to engineers from a company library, and Mr. Lawford also routes information he considers pertinent.

I. T. T. Barton is not an RDC subscriber. The University of Southern California had solicited the company, but Mr. Lawford stated that the company thought the cost of the service was too high.

In closing his letter Mr. Lawford stated that, "I have found the NASA Tech Briefs and reports to be interesting and useful. I hope they continue to be published."

TM:ad
8/19/69

Case Number: 81221384

A small California electronics firm manufactures integrated circuit testers; it is reprinting selected portions of the Goddard document "DC Pin-to-Pin Testing of Integrated Circuits" for use in sales literature keyed to a prime group customer prospects.

Subject	Technology Source
Miracle-Hill Electronics 320-B Martin Avenue Santa Clara, California 95050 408-296-1730 Contact: Robert Youden Chief Engineer	Goddard Space Flight Center Tech Brief: 68-10001, "DC Pin-to-Pin Testing of Integrated Circuits"

William Hill, a co-founder of a small manufacturer of integrated circuit testers, became aware of the TSP from an article in Evaluation Engineering. His associate, James Miracle, and their Chief Engineer Robert Youden, studied the TSP and concluded that parts of the document were "the best testimonial available on the value and applications of our sole products," which is integrated circuit testers.

Selected parts of the TSP will be printed as promotional and sales literature for their IC test equipment (which has a selling price from $750 to $6,000). Each of these three men in top management found the TSP extremely useful, "providing an additional way of looking at testing devices for integrated circuits to improve the results." Youden expects the reprint to increase product sales though he was unwilling to predict an increase in annual revenues.

The TSP, evaluated over a period of 15 hours, is viewed as being very valuable to Miracle-Hill Electronics. Tech Briefs are not received as this firm relies on the trade publications for information and announcements on new technologies.

HWZ:ad
10/7/69

Case Number: 90323405

A General Foreman obtained this TSP to update his knowledge to the current state-of-the-art in welding technology

Subject	Technology Source
McGraw-Edison Company Adams Avenue Canonsburge, Pennsylvania 15317 412-745-9100 Contact: Mr. William E. Daufenbach General Foreman	AEC-NASA Space Nuclear Propulsion Office Tech Brief: 67-10200, "Workmanship Standards for Fusion Welding"

McGraw-Edison Company is a manufacturer of large power transformers and oil circuit breakers which are purchased primarily by utility companies for use in power stations. Mr. William Daufenbach, a General Foreman in charge of the company's Tank Plant, regularly reviews the welding trade press for current information to keep abreast of recent welding techniques. He requested the TSP for this purpose.

This TSP contains a compilation of general weld information and photographs of various weld samples. Daufenbach said that about 40 man-hours were spent reviewing the TSP and that it is presently being used as a reference source.

LS:lj
10/10/69

Case Number: 90324172

The Materials Technology Department of IBM is using a TSP as a general reference and as a guide to indicate research areas that have been previously investigated.

Subject	Technology Source
IBM Corporation Systems Development Division P. O. Box 390 Poughkeepsie, New York 12602 914-485-7893 Contact: Mr. A. W. Grobin, Jr. Senior Associate Chemist	Marshall Space Flight Center Tech Brief: 68-10385, "Electromotive Series Established for Metals Used in Aerospace Technology"

The Systems Development Division of IBM is involved in the development of new products and the improvement of existing products. One of the groups supporting this activity is the Materials Technology Department. This group is responsible for the selection of proper materials to be used in any IBM product to insure that the item will function as required throughout its designed life. In support of this responsibility, studies are made to evaluate the wear- and life-potential of numerous metals.

Mr. A. W. Grobin is a Senior Associate Chemist at IBM. He learned of this Technical Support Package in Plating Magazine, a monthly publication of the American Electroplater's Society. The report was prepared by North American Rockwell Corporation under contract to NASA's Marshall Space Flight Center and describes an experimentally established electromotive series for about 130 metals commonly used in aerospace technology. This information is useful in predicting the probability of serious galvanic effects when dissimilar metals are coupled in electrolytes such as seawater. Mr. Grobin said IBM wants to study additional alloys and additional conversion coatings which are not included in the TSP.

About 160 hours have been spent studying the Technical Support Package since IBM received it. It has been used primarily as a reference document, and Grobin estimated that it has saved at least six months of research time. He has contacted the Materials Labs at other IBM plants

Case Number: 90324172 (Cont.)

to notify them of the availability and content of this TSP. He said, "It (TSP) was clear . . . well written . . . well prepared."

LS:lj
9/25/69

Case Number: 81119957

Crystalab Products Corporation, Rochelle Park, New Jersey, might incorporate an improved circuit design into a new product it is developing. This improved circuit design is based upon information received from the Manned Spacecraft Center.

Subject	Technology Source
Crystalab Products Corporation 19 Legion Place Rochelle Park, New Jersey 17662 201-843-5780 Contact: Robert Goldstein President	Manned Spacecraft Center Tech Brief: 64-10024, "Efficient Circuit Triggers High-Current, High-Voltage Pulses"

Crystalab Products Corporation, a small electronics firm, regularly reviews NASA publications for information on new technology or innovations that might be adaptable to new products that it is interested in developing. Such was the case with the information received from NASA on the improved circuit design which it may use in a pulse generator for driving a light modulator in a laser application. Mr. Goldstein thinks that this circuit might be what the company is looking for and it is considering possible development activities.

Mr. Goldstein was not able to forecast the potentials of the circuit at this time. However, he said that due to the NASA information the company might be able to save development time and money depending upon the actual use of the circuit and how it might be modified. The information did yield intangible benefits since it gave knowledge that such a device could be built and that the required components are available. The company has expended approximately 24 hours labor so far in studying possibilities of the circuit. If it is decided this circuit design is what is needed, the company will then go into a development and testing program to confirm that the circuit can be used.

According to Mr. Goldstein most NASA publications are quite complete and useful; however, he stated that the Technical Support Package received on the circuit was "quite poor" since it only consisted of another copy of the Tech Brief. He expected the Technical Support

Case Number: 81119957 (Cont.)

Package would, at a minimum, have contained some information regarding development and testing data which would have been helpful.

RB:ad
7/24/69

Case Number: 90323926

The Control Data Corporation, Cedar Engineering Division, has received information from the Marshall Space Flight Center on a DC-to-DC converter which it expects to use in a new product.

Subject	Technology Source
Control Data Corporation Cedar Engineering Division 5806 W. 36th Street Minneapolis, Minnesota 55416 612-929-1681 Contact: C. R. Turner Engineering Supervisor	Marshall Space Flight Center Tech Brief: 68-10017, "Regulated DC-to-DC Converter Features Low Power Drain"

The Control Data Corporation plans to use information received from the Marshall Space Flight Center in developing a circuit which will convert DC to AC and back to DC. The circuit will be used in a new product which Control Data is presently proposing to the military. Therefore, Mr. Turner was not at liberty to disclose any information at this time relative to the product and the specific use of the circuit. Mr. Turner did say that the NASA information gave the company a good starting base and that it significantly reduced engineering effort. However, it will go through an engineering model stage and qualification testing. Mr. Turner also expects to make certain temperature compensations. Since the development activities associated with this circuit have not progressed very far, Turner could not estimate the benefits derived from using the NASA information. According to Turner, present schedules require completion of these activities by late December 1969.

NASA publications are received regularly by the library at Control Data Corporation. These publications are routed to Turner and other engineers at the Cedar Engineering Division. Copies are also maintained for future reference. Mr. Turner commented that many of the NASA publications he has reviewed "seemed a little hazy in areas which left certain unknowns" in his mind.

RB:lj
8/6/69

Case Number: 90425000

An Eastern firm may use the circuit described in the Technical Support Package to control oven temperatures and may decide to produce the circuit as an addition to its product line.

Subject	Technology Source
International Crystal Labs 120 Coit Street Irvington, New Jersey 07111 201-373-4242 Contact: Mr. Louis Musicant President	Marshall Space Flight Center Tech Brief: 67-10097, "Heater Control Circuit Provides Both Fast and Proportional Control"

Mr. Musicant is a chemical engineer and President of International Crystal Labs, a small firm (11 employees) engaged in the production of optical crystals for use in infrared spectrophotometers. These crystals are grown in ovens under close temperature control. A spectrophotometer is an instrument used for comparing the color intensities of different spectra.

Mr. Musicant requested the TSP because he thought the control circuit might be applicable to International's ovens. He has turned the idea over to another firm who will evaluate this and other control techniques and will develop a control system for International. Mr. Musicant has also considered producing the control circuit, but has not taken any definite steps toward actual manufacture.

Mr. Musicant does not regularly receive Tech Briefs, but has information about the services available to industry through NASA's Technology Utilization Program and is thinking about subscribing to it. He said this TSP was "quite good, quite well presented."

LS:lj
9/22/69

Case Number: 80814215

A systems analyst at Bendix Corporation plans to use the TSP on optimal smoothing of data in the assessment of a similar data reduction technique associated with a radar system.

Subject	Technology Source
Bendix Corporation Communications Division East Joppa Road (Towson) Baltimore, Maryland 21204 301-823-2200 Contact: Mr. Charles O. Hoffman Principal Engineer, Systems Analysis	Manned Spacecraft Center Tech Brief: 68-10060 "New Technique for Optimal Smoothing of Data"

The Communications Division of Bendix Corporation is developing a radar system under contract with the U.S. Air Force. Mr. Charles Hoffman, a Principal Systems Engineer, stated that a data smoothing technique is now being used in connection with this system; this is a mathematical technique which minimizes the effects of random outside "noise" and results in optimum smoothing of monitored data.

The present technique has exceeded the minimum design specifications, but Bendix is now reevaluating the system's performance and further refining where possible. Later this year, Hoffman plans to compare results of the present smoothing technique with those of the method presented in the TSP. He said that Bendix will adopt the new technique if it is more accurate than the present method or if it requires less radar power to achieve the same accuracy.

Mr. Hoffman considered this Technical Support Package to be "quite valuable" and above average. He estimated that, if adopted, the knowledge gained from the TSP would amount to about three percent to five percent of that involved in this radar system design.

LS:ad
9/5/69

Case Numbers: 81016959, 81016960

Scientists and Engineers of the Test Instruments Division of Honeywell, Incorporated, reviewed two NASA Technical Support Packages relevant to a patient monitoring system Honeywell now markets commercially.

Subject	Technology Source
Honeywell, Incorporated Test Instruments Division Box 5227 Denver, Colorado 80217 303-771-4700 Contact: William G. Royce Scientist-Research Engineer	Ames Research Center Tech Brief: 68-10065, "Multichannel Implantable Telemetry System" Tech Brief: 68-10131, "Automated Patient Monitoring System"

Through wires connected to a patient, a Honeywell patient care product provides a continuous, permanent record of ECG and related blood pressures. Two TSP's evaluated by William Royce and his staff, provide similar monitored patient medical data thru telemetry.

Honeywell's interest in these TSP's concerned the potential competitive position of existing commercial products as well as the developed technology in telemetering of signals. The TSP, 68-10065 (the primary application today is as an implant for animal research), was evaluated by Royce as an exceptionally clever, simple, tiny efficient circuitry to maintain a sequential synchronized system. Technical Support Package 68-10131 (in concept similar to the present Honeywell product) provides a new approach to lightweight telemetry equipment within a patient care system easily adapted and comfortable to an ambulatory or bedridden patient.

After review, Honeywell elected to maintain their existing patient monitoring system without modification. No new patient monitoring product is planned.

Knowledge gained from these analyses has other value to the Research and Development efforts at this Honeywell Division where commercial products involving telemetry account for more than five times the revenues of the patient monitoring equipment. A direct application of the telemetry systems of these TSP's has not been made to any product. However, segments are being analyzed and Honeywell might utilize one or more factors of either.

Case Numbers: 81016959, 81016960 (Cont.)

Royce, a regular receiver of Tech Briefs, found these two publications "clearly delineated, very well done." He stated the documents from NASA are readily available and promptly delivered.

HWZ:ad
9/2/69

Case Number: 81018205

Electronized Chemicals Corporation obtained the Technical Support Package (TSP) to examine the possibility of using saran film as a fire-retardant electrical wire bundle wrapping.

Subject	Technology Source
Electronized Chemicals Corporation South Bedford Street Burlington, Massachusetts 01803 617-272-2850 Contact: Mr. Chester A. Brown, Jr. General Sales Manager	Manned Spacecraft Center Tech Brief: 68-10177, "Saran Film is Fire-Retardant in Oxygen Atmosphere"

Electronized Chemicals Corporation (ECC), a subsidiary of High Voltage Engineering Corporation, is engaged in the manufacture of radiation products in both commercial and space areas. ECC learned of the TSP from a customer, Potter and Brumfield, that offered the opinion that saran could possibly be used in the products which it purchases from ECC.

Mr. Brown, a chemist now in the technical marketing area, doubts that saran could be incorporated into its products as a fire-retardant wire wrapping. In his opinion, saran would degrade under radiation thus rendering it useless for space purposes. Mr. Brown stated that, if saran was found to be suitable, considerable cost savings would result since it is cheaper than the material currently used. Consequently, he has sent the TSP to a technical department for further study.

Mr. Brown was not satisfied with the TSP. He stated that the test procedures should have been described more completely and the information given was not specific enough for his purposes.

LS:ad
9/2/69

Case Numbers: 90425247, 90425248

VLM Corporation of Fort Worth, Texas, has reviewed NASA Technical Support Packages on various topics relevant to a VTOL vehicle. Construction recently began on a prototype aircraft, and will include a design variation of the air bearing concept from a TSP.

Subject	Technology Source
VLM Corporation 310 Seminary South Office Building Fort Worth, Texas 76115 817-924-3293 Contact: Russell L. Maxwell Engineer	Marshall Space Flight Center Tech Brief: 68-10395, "Design of Fluid Duct Bends with Low Pressure Loss" Tech Brief: 68-10442, "Air Bearing Lift Pad"

Design of a VTOL vehicle at VLM Corporation, in progress for several years, incorporates a rotor system using an air bearing between the stationary center body and the rotor system that provides a near frictionless power transmission. Several air bearing reports obtained from NASA have reinforced the VLM initial design concept. In addition, Russell Maxwell states "the documents have been invaluable as far as we're concerned, adding a bit here and there to our knowledge on what's going to make the machine fly."

A vehicle prototype has been started, and completion is expected within sixteen months. In addition a test stand is being made to evaluate various air bearing designs. At this time the air bearing lift pad design from Marshall Space Flight Center does not appear as promising to VLM as does an earlier "washer" design obtained from another NASA document.

However, a number of operational air bearing designs will be tested. A small, four-inch model has already been tested and proved to be "practically frictionless and real stable." Maxwell states he has no preconceived idea of the final air bearing design but sees the knowledge gained from the NASA documents as essential to the VTOL propulsion system.

The VTOL will be pneumatically driven. As all piping and ducts will be for a controlled air flow, the Marshall document "Design of Fluid Duct Bends With Low Pressure Loss" was evaluated. The results were inconclusive.

Case Numbers: 90425247, 90425248 (Cont.)

Much duct work will be external and the aerodynamic effect of an analytically designed bend may more than offset the low pressure loss for the air fed to the propulsion system. Design of the rotor system will influence the duct shape and Maxwell believes the greatest overall duct efficiency may come from "merely bending the tubes."

Each Air Bearing TSP has been easily understood by VLM personnel. However, the Duct Bend publication was judged as "difficult to follow, not detailed enough, a little bit sketchy." A number of readings were required because the report was not clear.

Tech Briefs are obtained by VLM from a second party. Maxwell looks at a good number and while he supports the program enthusiastically, he believes "titles should be more specific as some have been very misleading."

HWZ:ad
9/16/69

APPENDIX B

Reports of Second Interviews with TSP Users

SECOND INTERVIEWS WITH TSP USERS

	Applications Actually Resulted	Applications May Result	Applications Suspended or Abandoned
NEW PRODUCT	80300436--component lead bender 80300763--inorganic paint 80505202--optical modulator	80200656--inorganic paint 80203549--fluidic oscillator 80301044--ultraviolet reflector 80504863--tube flare gauge	80200646--inorganic paint 80200654--inorganic paint 80200750--inorganic paint 80300476--inorganic paint 80300511--multivibrator 80302436--inorganic paint 80607188--biotelemetry 80608610--inorganic paint 80707862--borax/plastic 80709925--multiplexer 80812448--cardiotachometer
NEW PROCESS		80403909--Inconel 718 handbook	80607728--reactance measurement
NEW APPLICATION	80100430--galley refrigeration units 80200405--ballistocardiograph	80708024--borax/plastic	80200692--inorganic paint 80200925--recoverable fuse 80201112--recoverable fuse 80300801--inorganic paint 80302882--thermosetting plastic 80506543--spray-on electrodes 80711259--thermosetting plastic
PRODUCT IMPROVEMENT	80302425--inorganic paint 80503920--heat treating process	80300737--inorganic paint 80505737--gasket material	80200384--biotelemetry 80200602--memory core design 80504372--"clean room" air sampler 80505209--phonocardiogram simulator
OTHERS		80404509-11--materials data handbooks	80300535--electroless nickel plating

Case Number: 80300436
(Supercedes Telephone Follow-up of 1/23/68)

Western Electronic Products Company, San Clemente, California, is selling two models of an electronic component lead bender invented by C. G. Glenn of NASA.

Subject	Technology Source
Western Electronic Products Company 107 Los Molinoi San Clemente, California 92672 714-492-4677 Contact: Mr. A. Schreiber President	Marshall Space Flight Center Tech Brief: 66-10346, "Tool Forms Right Angles in Component Leads"

Round nose pliers used to form right angle bends in leads of components such as resistors and capacitors often damage the component. In searching for a method to avoid this damage, C. G. Glenn at Marshall Space Flight Center developed a component lead bender which holds the leads of an electronic component firmly while forming a precise bend in the lead. The tool has a number of component holding dies to accommodate various component lengths. This tool facilitates the formation of an exact radius in the lead while avoiding damage to the component or lead.

Mr. Floyd Bulette of Marshall Space Flight Center introduced the tool to the Western Electronic Products Company, which modified the design for commercial marketing. The original Glenn designed was primarily suitable for prototype and small-batch work. The Western Electronic modifications allow for bench mounted production operation, and include a lead cutter. Patented features are produced under license to Mr. Glenn, who holds the patent.

A market gap was foreseen by Western Electronic Products personnel, and the tool was expected to fill this gap. Competitive hand operated devices were selling for $50, and a competitor's automatic tool cost over $1,000. Two versions of the Glenn tool are now being sold by Western Electronic Products Company at prices of $85-$120 and $100-$150. Although the tool has been available nationwide and in export markets for about a year, Schreiber stated that sales have not yet become "phenomenal." He anticipates an improvement in sales volume.

Case Number: 80300436 (Cont.)

Costs associated with development and marketing the lead bender have been insignificant, and no technical difficulties were experienced.

This firm also sells a coaxial cable stripper based on a Tech Brief. Schreiber stated that sales of the cable stripper are substantial. He is now ready to market a motorized variant of the cable stripper, after a Tech Brief describing a twirling device stimulated his thinking about methods to improve the cable stripper currently sold by his firm. The Tech Brief served only to "provide a spark," and none of the principles in the Tech Brief are being incorporated into the motorized stripper.

Mr. Schreiber receives Tech Briefs from W. M. King of Douglas Aircraft, and occasionally the Small Business Administration has documents sent to him.

WH/ROM:ad
8/26/69

Case Number: 80300763
(Supercedes Telephone Follow-up of 5/13/68)

An East Coast paint manufacturer is marketing an inorganic paint based in part on information developed at Goddard Space Flight Center.

Subject	Technology Source
An East Coast paint producer Contact: Plant manager	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

Money expenditures of "several thousand dollars" and more than 150 laboratory man-hours have enabled an Eastern paint manufacturer to place on the market an inorganic paint. The information received from the Tech Brief was a minor input into the development project.

Ninety-five percent of the firm's paint sales are to the marine industry. The initial market for which the inorganic paint was intended was as an exterior coating for steam lines on tankers. Steam is required for the cargo temperature control system on tankers, and many of the steam lines are exposed to the environmental extremes of the ocean. Temperature inside the steam lines is maintained at 275 degrees, and the lines are often awash with seawater at a temperature of 40 degrees. A zinc silicate inorganic paint is ideal for the steam lines, and it has been equally successful in applications to deck plates and superstructures. It has excellent protective properties and resists the corrosive effects of salt water. When applied as a base coat, it holds an appearance-enhancing top coat quite well. Because of its unparalleled protective qualities, the zinc silicate formulation is also being sold for coating off-shore oil rigs.

The only problem encountered in developing this paint for commercial use is not unique to inorganic paint. The difficulty of achieving a long shelf life is common to many chemical formulations, and posed no unusual difficulties. The product is sold in a two-package system, and shelf life of the components is dependent upon maintenance of certain temperature ranges. This requirement has been a problem for buyers located in the hot Gulf Coast region.

Case Number: 80300763 (Cont.)

In addition to having developed a new product, this firm acquired several unexpected benefits from the development program. Among these are improvements in technique for measuring film thickness, and modifications of cleaning and topcoating procedures. Technical characteristics of the inorganic paint necessitated these kinds of changes in technique, and the new practices have been successfully transferred to other applications.

WH:ad
8/27/69

Case Number: 80505202
(Supercedes Telephone Follow-up of 9/11/68)

A small, East Coast electro-optical firm is selling a new, low-power light modulator. Some development data for this product came from a TSP.

Subject	Technology Source
A small electro-optical firm Contact: President	Marshall Space Flight Center Tech Brief: 67-10289, "Wideband, High Efficiency Optical Modulator Requires Less than 10 Watts Drive Power"

Engineers at Sylvania Electronic Systems developed a wideband, high efficiency, optical modulator under contract with NASA. This instrument requires only 10 watts of drive power, a significant achievement when contrasted with earlier models which have required as much as 270 watts.

Prior to publication of the Tech Brief, the President of a small electro-optical company had communicated with B. K. Yap (one of the Sylvania report authors) about the innovation. He was promised a copy of the report but did not receive it, so began a close scrutiny of new issues of Tech Briefs; he found the pertinent Tech Brief and acquired the TSP.

The development by this optical firm of a new light modulator began with receipt of the NASA document. Other sources of information were also used, including several articles which appeared in Quantum Electronics. Treatment and alignment of the crystals used in the prototype were guided initially by the NASA information. Later, the work was redirected to development of a different modulator, and the TSP became a general reference work. About five percent of the total information input for final product development is judged to be attributable to this TSP.

Much of the development work was funded by customers of this firm who were interested in purchase of the final product. The project required about 250 man-hours and $7,500 for materials. Thus far, two of these instruments have been sold for $3,600 each; expectations for future sales range from 20 to 100 units per year, with pricing from $3,200 to $3,600 per unit on the present market.

Case Number: 80505202 (Cont.)

The President of this firm is also the Engineering Manager. He reviews Tech Briefs regularly and has found them to be "excellent" for basic information and further leads. The abstract format is "perfect" because he is able to find useful information "without being inundated" by extraneous material.

WH:lj
9/16/69

Case Number: 80100430
(Supercedes Telephone Follow-up of 1/25/68)

The Garrett Corporation's AiResearch Manufacturing Division has developed an inexpensive, trouble free, aircraft galley refrigeration system that uses liquid nitrogen for cooling and atmospheric control.

Subject	Technology Source
The Garrett Corporation AiResearch Manufacturing Division of Los Angeles 9851 Supulveda Boulevard Los Angeles, California 90009 213-670-7451 Contact: Robert Hunt Sales Manager	Garrett Corporation

The Garrett Corporation developed a system to provide cooling and ventilation for suited personnel handling toxic fuels at missile sites. The system was later incorporated into the suits worn by Gemini astronauts during their extravehicular activity. Finally, this same technique was adapted to a galley refrigeration system. The same concepts inherent in the garment applications are utilized again except that the enclosure in this instance is an insulated compartment containing perishable rather than a suit enclosing a man.

The operation of the functioning unit is simple and reliable. Liquid nitrogen is vaporized in a heat exchanger and vented into the compartment through a jet pump ejector. The stream of vaporized nitrogen then mixes with compartment air and the resulting mixture is cooled as it flows across the heat exchanger. This cooled gas recirculates through the compartment providing continous forced low-velocity circulation capable of maintaining temperatures between 2 degrees F.

The system has several unique features. It is self-contained, requires no batteries or external power supplies, mechanical maintenance is eliminated, fan and pump noises are avoided and the use of a nitrogen atmosphere retards decay of food stuffs. Operational costs are low: the amount of liquid nitrogen necessary to maintain galley refrigeration for 24 hours is available for as little as 27¢.

Case Number: 80100430 (Cont.)

By June 1968, this system had been installed in 25 Boeing 737 aircraft at a price of $4,000 each and worked so well that modifications were made for its 707 and 727 aircraft. Sales for these aircraft have been slow, however, so that only 30 new units have been installed at a unit price near $9,000.

Modifications are planned for cargo applications. Conceptually, the system should be very useful for perishable shipments since it can be used at any point from the field to the consumer. "Igloo" containment makes this possible. No problems are posed when dock-side delays are encountered since no external power source is required to maintain the cooling operation. The greatest obstacle to widespread use of this system is in the consumer market. It will be necessary to convince consumers that for a small increase in price they can purchase a much higher quality and fresher produce. There are experiments underway to determine customer support and initial results are promising. One experiment involved a major airline and a large California grocery chain; the airline flew vine-ripened Hawaiian pineapples to California where they were immediately put on display. Within a few weeks pineapple sales for this grocery chain were up 40 percent, despite a price increase of 5¢ per pound. Most of these consumers had never tasted a fresh vine-ripened pineapple and the experience was evidently so gratifying that premium prices were no obstacle.

Mr. Hunt stated that, "it took two years to get the Hawaiian growers and the grocery chain executives to try this experiment; it will take more time to convince people of the right so that the system can be put into use generally."

The degree to which NASA-related work was responsible for the development of this system was impossible for Mr. Hunt to specify. The product grew out of a variety of work for NASA and the Air Force; isolation of particular inputs for the final civilian market application is not possible.

WH/RHO:ad
9/10/69

Case Number: 80200405
(Supercedes Telephone Follow-up of 1/19/68)

The United States Technical Developments Company is marketing a ballistocardiograph invented by Vernon Rogallo of Ames Research Center.

Subject	Technology Source
United States Technical Developments Company, Division of U.S. Banknotes Corporation 345 Hudson New York, New York 10014 Contact: William Robson Philadelphia 215-426-9400	Ames Research Center Tech Brief: 64-10004, "Ultra Sensitive Transducer Advances Micro-Measurement Range"

Initial contact with Ames Research Center was made in February 1967 by Virgil P. Barta, West Coast representative of United States Technical Developments Company. Mr. Barta was conducting an informational literature search from his Palo Alto office and requested patent information. Through this and continuing correspondence, the company obtained and utilized Tech Brief 64-10004 which describes the avian ballistocardiograph. NASA SP5007, which describes Mr. Rogallo's original experiments with the instrument, supplemental information giving construction details, and a film titled, "The Piezoelectric Transducer," were also helpful. This information and contact with Mr. Rogallo resulted in the granting of a royalty patent in September 1967.

Mr. William Robson of the firm's Philadelphia office reported in September 1969, that several instruments had been sold; among the customers are the Food and Drug Administration (use in drug tests), the University of Buffalo, Eli Lilly Laboratories, Texas A & M University, and the University of California. The drug tests are among the most interesting applications of the instrument. Some difficulties have been encountered in this application such as an inability to distinguish between a sound originating in the heart as against one picked up from an aorta.

WH/DRL:ad
9/16/69

Case Number: 80302425
(Supercedes Telephone Follow-up of 5/13/68)

The J. W. Mortell Company has an inorganic paint on the market, based partially on a NASA formulation.

Subject	Technology Source
J. W. Mortell Company Kankakee, Illinois 815-933-5514 Contact: D. J. Yovich Technical Director	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

An inorganic paint developed under NASA auspices has been adapted to a commercial product by the J. W. Mortell Company. Builders, contractors, and industrial purchasers are considered potential buyers with expected sales reaching $500,000. Product promotion is now underway.

The innovation required about 40 man-hours in the laboratory. Experimentation has also yielded information of great utility in production processes for existing products, and Mr. Yovich said this was the most significant result. Successful product development has now brought all divisions (management, marketing) into action concerning the innovation.

Little interest has been shown by potential customers, according to Mr. Yovich. However, active promotion has been minimal.

WH:ad
9/12/69

Case Number: 80503920
(Supercedes Telephone Follow-up of 8/7/68)

The Lisk-Savory Corporation, Kelley Machine Division, used a NASA literature review concerning hydrogen embrittlement to specify a procedure to improve high tensile fasteners.

Subject	Technology Source
Lisk-Savory Corporation Kelley Machine Division 1165 Clinton Street Buffalo, New York 14240 716-825-8300 Contact: E. L. Klopfer Chief Engineer	Marshall Space Flight Center Tech Brief: 67-10141, "Study to Minimize Hydrogen Embrittlement of Ultrahigh-Strength Steels"

Mr. Ed Klopfer, Chief Engineer of the Kelley Machine Division, Lisk-Savory Corporation, had been concerned for some time with failures of high tensile fasteners used in small construction equipment manufactured by his company. He ascribed some of the failures to poor quality control by vendors of the fasteners, but also suspected that hydrogen embrittlement might be the cause of many failures.

Hydrogen embrittlement is a generic term for a variety of brittle failures of ultrahigh-strength steel under relatively low stress conditions. The phenomenon is caused by the presence of atomic hydrogen in the steel, and entry of the hydrogen occurs easily unless tight controls are used during cleaning, pickling, and electroplating processes. However, it is possible to correct for excessive hydrogen content.

Mr. Klopfer was working on corrective procedures involving post-heat treatment when he became aware of the NASA document. He reviewed the material for three hours and was assured that his methods were properly directed. The main benefit of the NASA document was that it enabled him to alter the temperature limits of his treating process and achieve optimum control. No other time or monetary inputs were necessary, and the treating process has been operational for over a year.

It was thought necessary to withhold judgment on the effectiveness of the new process until at least a full year's observation had been completed. This would allow for use of the equipment under a full range of

Case Number: 80503920 (Cont.)

weather, temperature, and operating conditions. During the past year, there has not been a single instance of failure. Mr. Klopfer is unable to establish the degree to which the elimination of failures is a result of the treating process. Simultaneous with the introduction of the process, Lisk-Savory conversed "rather strongly" with the supplier of the fasteners about his quality control procedures. Assuming that the supplier improved his practices, it is impossible to specify the degree to which the new treatment process is responsible for eliminating the failures.

Mr. Klopfer perceives two benefits to the company resulting from elimination of fastener failures. The most significant benefit is the restoration and enhancement of "good will" among users of the machinery. Many customers had been dissatisfied with the machines because of the fastener failures, and some had intimated that they would soon find it advantageous to buy their equipment elsewhere. This situation has been remedied, and Mr. Klopfer counts the incremental good will as "worth a lot." He also noted that the machines are now safer to operate. The second benefit is of minor importance in dollar terms, but does constitute a savings. Since there have been no equipment failures this year, it has not been necessary to dispatch engineers on emergency service calls.

Mr. Klopfer commented that hydrogen embrittlement has been a known problem for years, but definitive information has been quite scarce. The standard materials handbooks are nearly silent on the subject. He considered the NASA document as a uniquely valuable information source.

Kelley Machine Division receives NASA documents regularly. Mr. Klopfer orders them, circulates them throughout the division, and maintains a master file. Tech Briefs and Technical Support Packages have been used by personnel in R & D, engineering, machine shop, and on the production lines.

WH:lj
8/28/69

Case Number: 80200656
(Supercedes Telephone Follow-up of 5/27/68)

A paint manufacturer in the Pacific Northwest is experimenting with NASA information about inorganic paint in order to develop a consumer product.

Subject	Technology Source
A small paint manufacturer Contact: Project Chemist	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

A heavy work load has prevented a small paint manufacturer from completing his experiments to develop a new inorganic paint for the consumer market. Other applications are envisioned in a variety of industrial applications, but the spokesman for the firm was unable to estimate the sales volume that might occur when development is completed.

The "slow season" in the paint business is approaching, and the firm will probably be able to continue the development project on a more intensive basis. With good fortune, he hoped there should be a marketable product within six months.

Aside from the time constraints, the chief problem in the development program has been the firm's inability to find the proper ingredients locally. Several telephone calls were required before the ingredients were obtained from a California supplier.

WH:lj
9/16/69

Case Number: 80203549
(Supercedes Telephone Follow-up of 9/11/68)

The Scott Paper Company is testing a fluidic oscillator for the purpose of measuring humidity in its paper drying processes.

Subject	Technology Source
Scott Paper Company Philadelphia, Pennsylvania 19113 215-724-2000 Contact: W. A. Spraker Chief Research Engineer	Lewis Research Center Tech Brief: 67-10063, "Fluidic Oscillator Used as Humidity Sensor"

The Scott Paper Company is evaluating a prototype fluidic oscillator built from information in a Technical Support Package. While the development is classified as experimental, Mr. Spraker expressed satisfaction with the device's performance in accordance with the description given in the Technical Support Package. A decision to embark upon a complete implementation will not be made for several months.

Scott Paper uses the oscillator to measure the moisture in recirculated air that passes under hoods in the paper drying process. The air is heated to 900 degrees F., and conventional humidity measuring instruments are useless at such temperatures. Accurate humidity measurements would facilitate controlling the humidity and reduce costs for heating the air.

A year ago Mr. Spraker stated unequivocally his willingness to purchase a fluidic oscillator, but noted that no one seemed to be working on product development. These devices would probably be widely used in the paper manufacturing industry. Because the Technical Support Package was so exciting to Mr. Spraker as a unique solution to a vexing problem, he decided to develop a model. An electronics technician spent three months putting together the prototype instrument from commercially available components. Total material cost was about $1,000.

After the initial testing a preliminary economic study was performed, yielding the conclusion that the oscillator can be expected to allow a reduction of five percent in fuel costs. A single drier consumes about 30 million BTU per hour, so the saving would be 1.5 million BTU per hour. At a cost of $0.50 per million BTU, costs would be reduced by $6 per day or $2100 per year for each drier. The total savings for 30 driers would be $63,000 per year. (Note: total cost would be $75,000.)

Case Number: 80203549 (Cont.)

Further development is presently hampered by manpower problems. Other research projects are more important at the moment, and no time is available for this project. Mr. Spraker noted that a further follow-up in six months might be fruitless because he is uncertain about future time availability.

WH:ad
9/4/69

Case Number: 80301044
(Supercedes Telephone Follow-up of 5/3/68)

A method for vacuum depositing uniform thickness films on large substrates has been used as a basis for internal production of ultraviolet reflective surfaces by an Eastern optics manufacturer.

Subject	Technology Source
Optics manufacturer East Coast	Goddard Space Flight Center Tech Brief: 66-10483, "Uniform Reflective Films Deposited on Large Surfaces"

An East Coast optics manufacturer utilized the information contained in a Tech Brief to produce several internally-used reflective surfaces for experimental work in ultraviolet-wavelength research. This firm had used similar reflectors during research projects under contract to Goddard Space Flight Center. During these projects, NASA provided the mirrors used as satellite spectrometer reflectors.

Fabrication of the reflectors for internal research uses cost the firm about $3500 in time and materials. This could probably be recovered easily if the company were to offer these reflectors for sale. It is not likely that the firm will sell the reflectors because commercial demand for any kind of instruments in the ultraviolet wavelength region is small. For the foreseeable future, the only plans pertaining to this invention are to continue using it for colorimetric measurements in basic in-house research.

Some problems were encountered in using the Technical Support Package, since much of the "art" involved in fabricating the reflectors could not be easily expressed in words or published. Albert Toft of Goddard was contacted, and with his help, it was immediately feasible to fabricate the reflectors. (Toft has done considerable work at Goddard with satellite borne ultraviolet spectrometers.)

The only significant problem that had to be overcome was related to the requirements for precise controls in applying the protective layer on the reflective surface. It was necessary for the firm to perfect a sophisticated control system, and experience with this system is adaptable in a variety of other production applications.

Case Number: 80301044 (Cont.)

If this firm were to decide to develop the reflectors for commercial sale, it is estimated that the Technical Support Package would probably save at least six months and perhaps a year's development time. The scientist who fabricated the mirrors estimates that at least 70 percent of the input to the project was from the Technical Support Package. The control techniques were especially crucial.

WH/ROM:ad
9/10/69

Case Number: 80504863
(Supercedes Telephone Follow-up of 10/4/68)

A tool research engineer, employed by a Midwestern manufacturer, is using a Technical Support Package to develop a portable and inexpensive instrument for measuring tube flares.

Subject	Technology Source
A Midwestern manufacturer Contact: Tool research engineer	Kennedy Space Center Tech Brief: 66-10537, "Gage Tests Tube Flares Quickly and Accurately"

The manufacturing research center of a major Midwestern manufacturing company is investigating a new approach for receiving inspection of flared tubing. The idea, developed by Francis D. Griffin, provides a device capable of detecting the accuracy of a tube flare efficiently and economically.

About 450 hours plus $250 for materials have been expended by this firm in its attempt to make the idea workable. A conical "master" has been made in an attempt to calibrate for angularity and ovality of tube flares. This device worked well for measurements of angularity, but poorly for measuring ovality. A very small change in ovality causes a great change in capacitance, making the measurement nearly impossible. The key problem now is to find a material that is durable and has the right capacitance factor. If such a material can be found and the other problems solved, this firm will have achieved the development of a portable and inexpensive instrument for measuring tube flares. Potential savings are expected as reprocessing of finished materials will be eliminated because of better specification conformity.

The NASA document accounts for about 10 percent of the information input to this project. It provided the basic concepts and some mathematical material.

WH/TDB:ad
9/16/69

Case Number: 80403909
(Supercedes Telephone Follow-up of 6/17/68)

An Eastern manufacturer of nickel alloys plans to resume a project that will improve production processes and possibly yield new products. NASA materials data handbooks will be used when work resumes.

Subject	Technology Source
An Eastern Manufacturer of nickel alloys Contact: Research Engineer	Marshall Space Flight Center Tech Brief: 67-10282, "Materials Data Handbook, Inconel Alloy 718"

A nickel alloy manufacturer intends to resume a development program which will enable the firm to forge and further process some of its existing alloys. The project has been suspended for more than a year because high priority work demands have fully occupied key personnel. It is anticipated that experimentation might begin again within nine months, and that a six month program will be required.

A NASA handbook on Inconel 718 will be used as a general reference source. The goal of the project is to develop forging and milling techniques that will enable the firm to make rolled and finished products of its alloys. Other larger companies which are already knowledgeable in the techniques for finishing these alloys are very reluctant to impart their knowledge to anyone else. The handbook may be very useful even though it is a reference work and will not solve specific company problems.

Costs associated with the development plan have been trivial to date, and it is too early to estimate the magnitude of either the future costs or benefits that could flow from the development project.

WH:bs
8/29/69

Case Number: 80708024
(Supercedes Telephone Follow-up of 10/31/68)

U. S. Borax Research is concerned with all borax applications. The Tech Brief on dispersion of borax in plastic as a fire retardant heat insulator might provide additional selling features.

Subject	Technology Source
U. S. Borax Research 412 Crescent Way Anaheim, California 92803 714-774-2670 Contact: Dr. Robert J. Brotherton Research Supervisor	Argonne National Laboratory Tech Brief: 67-10016, "Dispersion of Borax in Plastic is Excellent Fire-Retardant Heat Insulator"

U. S. Borax Corporation supplies borax and borax compounds in large quantities to customers as a product and for use as a component in other products. Dr. Robert Brotherton of U. S. Borax Research is concerned with borates research. Borax and borax compounds are by-products of borates.

An AEC idea for the dispersion of Borax in plastic as a fire retardant heat insulator was of particular interest to U. S. Borax Research. A mixture of borax powder and a chlorinated anhydrous polyester resin resists decomposition and exhibits high thermal insulation properties. The borax is used in a quantity of between 30 and 70 parts by weight for 100 parts of resin, with 60 parts of borax being the optimum quality.

Dr. Brotherton was not aware of applications using borax in such high concentration. He thinks that this information contributes to their knowledge and can be used as a sales tool in prompting the use of borax and borax compounds. Considerable interest has been shown by many people with whom he has talked, including plastics manufacturers.
Dr. Brotherton suggested that many firms are probably experimenting with the concepts described in the TSP, but he has no direct acquaintance with such efforts.

WH/GEH:ml
9/3/69

Case Number: 80300737
(Supercedes Telephone Follow-up of 5/1/68)

A Pennsylvania firm has experienced some success in initial experiments involving inorganic paint formulations. Further work is planned.

Subject	Technology Source
A Pennsylvania chemical firm Contact: President	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

The binding principles described in a Technical Support Package about inorganic paint are being applied by a chemical firm to improve the quality of washes supplied to the metal casting industry. The project is in its early stages, but will be carried to completion as soon as possible.

Steel mills and foundries constitute the primary market for the washes which sell for about $16 per 100 pounds.

While no technical problems have been encountered, the president of the firm is quite eager to obtain supplemental information about the paints. He praised the Technology Utilization program since it has been of great value to his small firm.

WH/DRL:ad
9/12/69

Case Number: 80505737
(Supercedes Telephone Follow-up of 9/3/68)

An Ohio firm is attempting to develop an optimum gasket material to prevent fretting corrosion of contiguous metal parts.

Subject	Technology Source
An Ohio power equipment manufacturer Contact: Materials Engineer	Marshall Space Flight Center Tech Brief: 66-10681, "Thin Plastic Sheet Eliminates need for Expensive Plating"

R. L. Stremel of North American Rockwell developed a technique to reduce fretting corrosion in axial joints composed of metals of varying hardness, or wherever alloys with an affinity for each other are in close, stressful contact. The conventional preventive measures used in such cases involve expensive plating on one or both surfaces. Stremel's invention, insertion of a very thin sheet of plastic gasket between the mating surfaces, completely eliminates fretting corrosion and is very inexpensive.

Materials engineers employed by an Ohio manufacturing firm are conducting tests to find an optimum gasket material for a male-female spline. Plastic, nylon, and teflon have been tested, and only teflon has been rejected. It is too soft and does not perform well. Nylon holds some promise, especially if a lubricant is added. A plastic, polyphenylsulfide, has been satisfactory, even though it exhibits a tendency to be squeezed out of the joint.

Experimental results suggest that the gasket idea is an improvement, since wear is no greater than with a metal-to-metal joint, and the gasket absorbs most of the abuse. If successful, the innovation is expected to significantly increase the useful life of the parts involved. These parts are maintenance-free for 1,000 hours under ordinary conditions, and the innovation should increase the maintenance-free period to 5,000 hours. It could affect commercial products and equipment for military aircraft.

The development program is scheduled to continue for six months more. An assessment will be made to determine the need for further testing or

Case Number: 80505737 (Cont.)

production emphasis. Over 1,000 hours, representing a cost of over $12,000, have been devoted to the testing. Another 500 hours is projected.

WH:bs
8/29/69

Case Number: 80404509-11
(Supercedes Telephone Follow-up of 6/14/69)

Robbins and Myers, Incorporated is using five NASA handbooks as reference materials.

Subject	Technology Source
Robbins and Myers, Inc. 1345 Lagonda Avenue Springfield, Ohio 45501 513-323-6461 Contact: F. W. Lins Maintenance Manager	Marshall Space Flight Center Tech Brief: 67-10282, "Materials Data Handbook, Inconel Alloy 718" Tech Brief: 67-10374, "Handbooks Describe Eddy Current Techniques Used in Nondestructive Testing of Metal Parts and Components" Tech Brief: 67-10301, "Materials Data Handbook, Aluminum Alloy 7075"

It was originally hoped that the handbooks might contribute to new product development, and early estimates were that a 25 percent reduction of development time might accrue from using the handbooks. About 13 hours were devoted to analysis of new product potential, but no results were obtained.

At the present time, the handbooks are used only as general reference works. Mr. Lins is "always engaged in the R & D process" and has found the handbooks valuable for guidance in making small changes in production processes. No new products are being developed, and the handbooks' utility is restricted to the small process modifications. Benefits and costs associated with the use of the handbooks are real, but nebulous.

WH:ad
9/2/69

Case Number: 80200646
(Supercedes Telephone Follow-up of 5/27/68)

The U. S. Paint Lacquer and Chemical Company experimented with inorganic paint formulas from a Technical Support Package. The intention was to develop new specialty coatings.

Subject	Technology Source
U. S. Paint Lacquer and Chemical Company Singleton at 21st Street St. Louis, Missouri 314-621-0525 Contact: Ed Hoffman Chief Chemist	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

Mr. Ed Hoffman reports that his firm has conducted some preliminary experiments with inorganic paint formulations based upon the Technical Support Package. No difficulties occurred, but the experimental work is temporarily suspended until a company reorganization is completed. During the past year this firm has acquired several new subsidiaries, one of which has done extensive work with inorganic zinc coatings. Mr. Hoffman thought that the new subsidiary's work was not based upon the NASA findings. After the reorganization is settled, U. S. Paint and the subsidiary will jointly develop inorganic coatings and the NASA information will probably be used. U. S. Paint holds a NASA license to produce the paints described in the Technical Support Package.

Mr. Hoffman formerly received Tech Briefs regularly, but has not received any for several months. He did not know the reason for this termination of his subscription and was eager to have it reinstated.

WH:ad
9/15/69

Case Number: 80200654
(Supercedes Telephone Follow-up of 5/10/68)

The Kiesel Machinery Company, Jennings, Louisiana, has temporarily suspended experiments designed to yield an inorganic paint suitable for off-shore oil rigs.

Subject	Technology Source
Kiesel Machinery Company 434 Lincoln Drive P.O. Box 574 Jennings, Louisiana 318-824-2480 Contact: William Kiesel, Jr. President	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

Mr. William Kiesel, Jr., of the Kiesel Machinery Company, intends to pursue development of an inorganic paint based on the formulations in a TSP. He wants to market the paint for coating off-shore oil rigs. Salt water is quite damaging to conventional coatings and materials, and many man hours are spent sandblasting and repainting the off-shore rigs in the Gulf of Mexico. Mr. Kiesel anticipates a "great volume" of sales if he is successful in adapating the paint to this use. The selling price would be at least $10 per gallon. Interest in his experiments is reportedly widespread in the oil extraction industry.

The development project has been dormant for about eight months because of time limitations. Mr. Kiesel anticipates being able to resume the work within a few months and is agreeable to another follow-up in June 1970, by which time he hopes to have some tangible results. He has encountered no technical problems.

WH:ng
9/3/69

Case Number: 80200750
(Supercedes Telephone Follow-up of 5/1/68)

The Bradley-Van Holm Chemical Corporation hopes to complete its program of testing a new inorganic paint within six months.

Subject	Technology Source
Bradley-Van Holm Chemical Corporation Box 811 45 Elm Street Brattleboro, Vermont 05301 802-257-7971 Contact: John S. McCauley President	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

A new fireproof paint for hotels and motels is being tested at Bradley-Van Holm Chemical Corporation. Market surveys indicate that the paint will be readily accepted by builders and in some electronics applications. Mr. McCauley estimated last year that the paint would account for about five percent of the firm's future sales.

Completed tests have been successful. However, the testing program has been slowed by the resignation of a key chemist. Mr. McCauley hopes to retain him on a consulting basis next month because he is a very skilled chemist with great knowledge about inorganic coatings chemistry. The development program has also been hindered because production demands have diverted the research time of the company's staff.

No technical problems of any consequence have been encountered. He viewed the Technical Support Package as complete in its description of materials and techniques. Also, the firm has drawn on previous experience with similar formulations, and all problems were easily solved. Mr. McCauley estimates that the Technical Support Package will account for a savings of about four weeks in development time, and will constitute about 20 percent of the total information input for the development project.

Mr. McCauley first learned of the NASA information on inorganic paints from a Small Business Administration (SBA) speaker at a meeting of

Case Number: 80200750 (Cont.)

the National Paint and Varnish Association. After requesting and receiving the Technical Support Package, the firm has had no further contact with either NASA or the SBA.

WH:ad
9/17/69

Case Number: 80300476
(Supercedes Telephone Follow-up of 5/20/68)

A small Pennsylvania paint manufacturer is using information from a Technical Support Package to develop a consumer market product.

Subject	Technology Source
A small paint manufacturer Pennsylvania Contact: Company Chemist	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

The company chemist for a small paint manufacturer reported that he has the Technical Support Package describing inorganic paints, and intends to resume experiments as soon as possible to develop a commercial product. He had previously worked with similar formulations while developing a custom order for muffler coatings. He hopes to draw on his previous experience of the NASA document and find a "middle ground." The project is "on the list of things to be done," but is relatively low in priority at the moment.

Progress during the past year has been negligible because of a factory relocation. The move and subsequent efforts to catch up with day-to-day production problems have prevented his continuing the development of the new paint product. The company has recently been expanding its production in familiar area, and little time has been available for more basic research.

The chemist is especially interested in developing zinc silicate formulations as primers for exterior coatings with special utility in seaside applications.

Inorganic formulations development in this firm could not have been undertaken without the NASA information according to the company chemist. In his words, there was a "complete lack" of usable information prior to publication of the NASA document.

Concerning the Tech Brief program, he suggested that promotion of any kind of technological information within the paint industry would be best achieved through the Society for Paint Technology and its Technical

Case Number: 80300476 (Cont.)

Committees which are formed on regional bases. Nonproprietary projects are of general interest to the Technical Committees members. They are explored and information about the results disseminated to industry members.

WH:ad
9/15/69

Case Number: 80300511
(Supercedes Telephone Follow-up of 5/20/68)

Electro-Pacific Incorporated investigated the product potential of a NASA multivibrator.

Subject	Technology Source
Electro-Pacific Incorporated Box 30068 Santa Barbara, California Contact: John R. Lindbery Engineer Manager	Goddard Space Flight Center Tech Brief: 63-10609, "Temperature Sensitive Network Drives Astable Multivibrator"

In May 1968, Electro-Pacific Incorporated identified a specialized multivibrator as a new product for possible development. The multivibrator was being developed from information in a Technical Support Package published by the Goddard Space Flight Center. The company expected to market several hundred multivibrators at about $50,000 a unit.

In the current follow-up Mr. Lindbery reports the multivibrator project has been permanently abandoned. In his opinion, the patent which had been granted to the NASA contractor (Ball Brothers, Boulder, Colorado) became a barrier to product marketing by his firm. Electro-Pacific was unsuccessful in negotiating an acceptable dollar value, for either the patent purchase, or a license agreement.

Mr. Lindbery believes he has seen product ads from Ball Brothers incorporating the multivibrator. This, and the absence of a license agreement, precludes Electro-Pacific from considering the multivibrator as a potential product.

HWZ/WH:ad
8/28/69

Case Number: 80302436
(Supercedes Telephone Follow-up of 8/20/68)

Mr. B. Pinsker, Downey, California, is adapting NASA-developed inorganic paint formulations for use in a commercial product.

Subject	Technology Source
Mr. B. Pinsker 9230 Ratliffe, Apartment 6 Downey, California 90242 213-923-9516	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

Mr. B. Pinsker has engaged in what he calls "kitchen sink" experiments for over four years. During this time he has been trying to develop a formulation of inorganic silicate compounds for a specialized use. In November 1966 he requested information from NASA about silicate paints and received the Technical Support Package developed by J. B. Schutt at Goddard Space Flight Center.

The information provided a "breakthrough" for Mr. Pinsker with respect to the key problem he had encountered. He had been using ingredients identical to those used by Dr. Schutt, but had not achieved the proper mixing technique. The NASA information specified the proper timing for blending in different ingredients and enabled Pinsker to combine his materials in a usable mixture. He explained that his experiments were easy to initiate and conduct at home because the raw materials are quite common, readily available, nontoxic, and nonexplosive. The peculiar problems of compounding these materials seemed insurmountable, however. He had discussed these problems with several highly respected, Ph. D. -level, chemists who universally discouraged him in continuing his research.

The Schutt document provided a means to overcome the only remaining significant obstacle. Mr. Pinsker commented that the formulations in the Technical Support Package are very broad and susceptible to many different applications. He is now preparing to arrange for testing of a variety of formulations in an industrial laboratory in order to find the best formulation for his purposes. Considerable time has elapsed since he achieved the breakthrough in mixing the ingredients, but he has been unable to move to the next step of testing in a laboratory, because of conflicting demands on his time. He is hopeful that the testing will be complete within six months.

Case Number: 80302436 (Cont.)

Mr. Pinsker also mentioned that he had written personally to Dr. Schutt for help in adapting the inorganic formulations to his particular needs. His detailed questions were never answered.

WH:lj
9/8/69

Case Number: 80607188
(Supercedes Telephone Follow-up of 10/15/68)

The Center for Brain Research at the University of Rochester uses intracellular microelectrodes for measuring brain impulses. A NASA Technical Support Package for a miniature electrometer preamplifier has been used to develop a prototype preamplifier for use with the microelectrodes.

Subject	Technology Source
Center for Brain Research The University of Rochester River Campus Station Rochester, New York 14627 716-275-4022 Contact: Lawrence Ota Electrical Engineer	Ames Research Center Tech Brief: 66-10549, "Miniature Electrometer Preamplifier Effectively Compensates for Input Capacitance"

Gordon De Boo and Clifford Burrous of the Ames Research Center developed a negative capacitance preamplifier using a dual Metal Oxide Silicon (MOS) transistor in conjunction with bipolar transistors. The Center for Brain Research at the University of Rochester has built a prototype of this preamplifier for about $100. The preamplifier will be used in a system to measure brain impulses. An attempt is being made to isolate one or two cells of the brain and to record impulses transmitted from the brain.

Offset voltage problems, caused by the microelectrodes, have prevented use of the prototype preamplifier as a DC amplifier. Until the DC offset voltage problem is corrected, only AC voltage can be used, and the preamplifier is AC-coupled to the final amplifier.

It was originally hoped that these problems could be solved, and eight more preamplifiers were planned. Prototype cost and eight additional units were anticipated to be less than $900 as compared with the per unit price of $500 for commercially available units to perform the same task. Total project savings were estimated at $3, 500.

The problems encountered during the first few months are still preventing successful project completion. Mr. Ota is not sure what the cause of the problems might be, but one possible explanation is that he was unable to obtain the transistors specified. The prototype has been

Case Number: 80607188 (Cont.)

used in an actual surgical procedure, but didn't pick up any signals. Another preamplifier was connected in parallel to the same electrodes, and Mr. Ota was certain that the problem was in the preamplifier. He hopes to be able to try the preamplifier again, but is uncertain about the timing of further work.

WH/GEH:lj
9/16/69

Case Number: 80608610
(Supercedes Telephone Follow-up of 10/19/68)

A small Eastern insulation manufacturer has tested laboratory samples of an inorganic paint for indoor building uses, but development is temporarily suspended because of lack of personnel.

Subject	Technology Source
Eastern insulation manufacturer Contact: Director of Research and Development	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

The January 1968 issue of Silicate P's and Q's, published by the Philadelphia Quartz Company, contained a discussion of the potassium silicate paint formulations developed by J. B. Schutt. The director of Research and Development of a small Eastern insulation manufacturing firm read the article and requested more information about licensed vendors and technical details. He attempted to purchase the coating from a Chicago firm to whom he was referred, but was informed that the firm no longer produced the paint. Consequently, he initiated a development program in his own laboratory.

The objective of this company's development program is to perfect a coating for application on interior surfaces of metal buildings. The company is two steps removed from the final market, since it manufactures fiberglas insulation which is used in conjunction with metal panels. The panels are sold to distributors who in turn sell to builders. The firm anticipates that the inorganic interior coating will augment the fiberglas insulation of the panels as well as provide fireproofing for the fiberglas facing.

Personnel shortages have precluded an intensive development program. The laboratory staff consists of one chemist and two technicians; they must spend most of their time on high priority R & D work, and this project is at the bottom of the priority list. About 60 hours have been expended in preparing samples of the paint, and the results were satisfactory. No problems were encountered. The firm would prefer to purchase the paint from someone else, but knows of no one who is manufacturing it. If a supplier can be found who will sell the paint at prices regarded as reasonable, this firm will text the formulations and

Case Number: 80608610 (Cont.)

conduct a marketing study to determine the sales potential of an improved product. It will be necessary to promote the product among distributors and builders, and the potential market is by no means assured.

WH:ad
9/12/69

Case Number: 80707862
(Supercedes Telephone Follow-up of 10/4/68)

Plastic heat shield development for induction furnaces has been suspended by a small Pacific Coast plastics firm.

Subject	Technology Source
A small West Coast plastics manufacturer	Argonne National Laboratory
Contact: Manager	Tech Brief: 67-10016, "Dispersion of Borax in Plastic is Excellent Fire-Retardant Heat Insulator"

Argonne National Laboratory scientists developed a process which improves the fire-retardant characteristics of polyesters. The technique involves dispersion of borax throughout the plastic. The borax improves fire retardance and eliminates black, sooty smoke in the event that the plastic catches fire.

A small plastics firm attempted to use this process to develop a plastic heat shield for aluminum-smelting induction furnaces. The shield must withstand temperature as high as 600 degrees. Antimonium oxide had been used, but it did not provide enough heat resistance. Borax experiments have likewise been fruitless because of problems with plastics. An initial experiment resulted in delamination of the plastic at 300 degrees. It was thought that the plastic may have incorporated a poor resin or that it had not been "wet out enough." A second shield with a different resin was tested but was also unsuccessful. Thus far, no plastic has been found that will withstand the heat, and the project has been suspended until some new resins are found.

Over 400 hours were spent in the experiments and many more will be applied when new resins are found. The president of the firm recently returned from several meetings with potential heat shield customers, and he is both elated and frustrated by their continuing great interest in the plastic heat shield. He anticipates "tremendous" sales potential if he can perfect the product. Every smelter in the country is a potential

Case Number: 80707862 (Cont.)

customer and sales could reach "many hundreds of thousands of dollars." In his opinion, success in this venture will open up a "new era" in plastics technology.

WH:bs
8/29/69

Case Number: 80709925
(Supercedes Telephone Follow-up of 10/18/68)

Optical Electronics, Incorporated used a NASA Technical Support Package to build a prototype multiplexer, but had to start over because the final product did not have the desired capabilities.

Subject	Technology Source
Optical Electronics, Inc. P.O. Box 11140 Tucson, Arizona 85706 602-624-3605 Contact: Richard Gerdes President	Marshall Space Flight Center Tech Brief: 67-10396, "Multiplexer Uses Insulated Gate-Field Effect Transistors"

Mr. S. S. Gussow of the Boeing Company, under contract to the Marshall Space Flight Center, developed a multiplexer incorporating insulated gate-field effect transistors for all digital logic functions. Basically the multiplexer consists of 30 primary channels, each of which is sampled 120 times per second.

Mr. Richard Gerdes, President, Optical Electronics, Inc., reports that he used the Technical Support Package to construct a prototype multiplexer, but had to abandon the NASA information and begin anew in order to develop a multiplexer that had certain capabilities not available in the NASA design. He has now perfected and is selling the new multiplexer, but it does not incorporate any of the NASA design. The TSP was not deficient in any way, and it provided a general familiarization with the design of multiplexers.

Gerdes' firm expended about one man-month in its attempt to adapt the NASA design to its own specifications. The TSP accounted for about 20 percent of the information input during this period.

Mr. Gerdes is a regular recipient of Tech Briefs, and he now finds about 10-15 percent of them to be of sufficient interest to warrant further study or request for more information.

The Clearinghouse arrangement for ordering TSP's has been agreeable to Mr. Gerdes. His firm had previously ordered a large amount of information through the Clearinghouse, and the change regarding TSP's has enabled him to consolidate his literature acquisition activities.

Case Number: 80709925 (Cont.)

The services of Regional Dissemination Centers are known to Mr. Gerdes, and he stated that he intends to try the literature search service soon.

WH/GEH:ad
9/9/69

Case Number: 80812448
(Supercedes Telephone Follow-up of 11/12/68)

The Westinghouse Electric Corporation investigated the feasibility of introducing commercially a NASA-type cardiotachometer unit. It was hoped that circuitry costs could be reduced sufficiently to place the instrument in a commercially competitive position. It has not been possible to achieve the cost reductions.

Subject	Technology Source
Westinghouse Electric Corporation Research and Development Center Churchill Boro Pittsburgh, Pennsylvania 15235 412-256-7000, Ext. 7765 Contact: Thomas Haas Manager of Engineering	Ames Research Center Tech Brief: 67-10598, "Cardiotachometer with Linear Beat-to-Beat Frequency Response"

J. M. Pope, G. J. Deboo, and D. B. Smith, of Ames Research Center, developed a cardiotachometer with linear beat-to-beat frequency response.

Westinghouse Electric Corporation considered the development of a commercial product on the basis of the NASA cardiotachometer. Technical Support Package review indicated very early in the program that the accuracy of the NASA instrument was too great for commercial needs. Mr. Thomas Haas, Manager of Engineering, thought that there might be a linear relationship of complexity with the accuracy of the device. Reduction of the accuracy requirements would simplify the circuit, and it was hoped that the simplification would yield cost reductions that would make the price of the product competitive with other instruments.

Westinghouse made a preliminary analysis of the cardiotachometer, and a decision was made not to develop it. The analysis indicated that cost reductions would not be forthcoming soon enough or in sufficient magnitude to make the instrument competitively viable. One of several alternative designs was selected for development. However, it was considerably less accurate than the NASA design, and it was not necessary to find ways to reduce accuracy in order to reduce costs.

Case Number: 80812448 (Cont.)

The NASA circuitry is quite specialized, and the firm has not realized any ancillary benefits from the work associated with the Technical Support Package. The only benefit that might eventually accrue from the use of the Technical Support Package would be to develop a product to meet a possible future demand for the extremely accurate instrument described in the Technical Support Package.

WH/GEH:ad
9/10/69

Case Number: 80607728
(Supercedes Telephone Follow-up of 9/24/68)

National Forge Company, Irvine, Pennsylvania, is experimenting with NASA developed circuitry to measure capacitive and inductive reactance.

Subject	Technology Source
National Forge Company Irvine, Pennsylvania 16329 814-563-7522 Contact: D. D. Dalrymple Senior Development Engineer	Marshall Space Flight Center Tech Brief: 67-10513, "Improved Circuit for Measuring Capacitive and Inductive Reactances"

Experiments are being conducted at National Forge Company to improve thermal fatigue testing of various steels and to develop a process for high frequency induction hardening. If the experimental program is successful, the company will utilize the results to improve production efficiency.

A circuit developed jointly by personnel from NASA and the University of Alabama Research Institute improves existing instruments for measuring inductive and capacitive reactance. The circuit design is being incorporated into National Forge's experimental program. Mr. Dalrymple has progressed to the stage of winding a variety of coils which have from one to thirty windings. Coil reactance must be precisely measured to determine the proper sizes and number of capacitors to be used in associated circuitry. The NASA circuit enables him to make the measurements.

This technique will account for over half the information input to the development project. Expected costs associated with the development project are about $5,000.

Because of conflicting work demands, it will be impossible to devote intensive effort to this project until after the first of the year. Mr. Dalrymple thought that a re-interview in six to eight months might yield some useful information about the project results.

WH:ad
9/10/69

Case Number: 80200692
(Supercedes Telephone Follow-up of 8/8/68)

The Colorado Department of Highways considered using an inorganic paint for interior coating of the Straight Creek Tunnel. A decision has been made to use vitreous enamel rather than the inorganic paint.

Subject	Technology Source
State of Colorado Department of Highways Materials Division 4201 E. Arkansas Avenue Denver, Colorado 80222 303-757-9298 Contact: J. J. Gretter Chief Chemist	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

Inorganic paint was among the alternatives considered by the Colorado Highway Department for interior coating for the Straight Creek Tunnel. The tunnel is 1.7 miles long, and the vitreous tile usually used in tunnels is expensive in such a large tunnel. The inorganic paint formulations developed by NASA were attractive because of its fireproof qualities. No fire hazard is allowable in such a tunnel, whether in the form of a tendency to flame, or merely to char and create noxious fumes.

Two attributes of vitreous enamel made it more desirable than the inorganic paint. The interior coating of the tunnel must have a high reflectance and washability. A vitreous finish is unexcelled for these qualities. Also, the newness of inorganic paint constituted a negative-rating factor. Considerable information exists about the long-term performance characteristics of vitreous enamel, but almost nothing is known about the inorganic paint's characteristics under a variety of environmental conditions and over a period of time.

At this time, the inorganic paint TSP and related literature are filed. Mr. Gretter stated that he might have opportunities in the future to reevaluate these documents, but he does not foresee any potential applications.

WH:ad
9/5/69

Case Number: 80200925
(Supercedes Telephone Follow-up of 4/30/68)

Chalco Engineering Corporation has temporarily suspended development work concerning adaptation of a NASA-originated solid state recoverable fuse for its electronic products.

Subject	Technology Source
Chalco Engineering Corporation 15126 S. Broadway Gardena, California 90247 213-321-0121 Contact: J. Cox Marketing Manager	Goddard Space Flight Center Tech Brief: 66-10691, "Solid-State Recoverable Fuse Functions as Circuit Breaker"

Chalco Engineering is a small, diversified operation involved in manufacturing electronic products, flight testing support for Edwards Air Force Base, and custom molding of plastics. The marketing manager and the chief engineer of the company receive Tech Briefs on a regular basis. While reviewing these Tech Briefs, Mr. Cox noticed that the solid state fuse developed by Goddard might be potentially useful for protection of the various electronic power supplies and other devices which it manufactures. Experimentation was undertaken in the expectation that a functional fuse could be developed within a year, given the constraint that the development project could only proceed on a part-time basis.

Technical difficulties involving inability to eliminate random thermal effects have been the primary bottleneck in the development program. Work scheduling priorities have caused cessation of the development program. The project was underway for about eight months, with more than 600 man-hours expended, when the personnel had to be reassigned full-time to higher priority peak work requirements. The project will be resumed when personnel are available.

WH/ROM:lj
8/26/69

Case Number: 80201112
(Supercedes Telephone Follow-up of 5/3/68)

American Bosch Arma Corporation, Mississippi Division, evaluated information about a solid state recoverable fuse and is retaining it for future reference.

Subject	Technology Source
American Bosch Arma Corporation Mississippi Division Columbus, Mississippi 601-328-4150 Contact: D. M. Crawford Engineering Supervisor	Goddard Space Flight Center Tech Brief: 66-10691, "Solid-State Recoverable Fuse Functions as Circuit Breaker"

American Bosch Arma, a manufacturer of small electric motors for automotive use, has evaluated information about an epoxy fuse device and decided that it cannot be adapted to immediate use in its motors. The intended application was to replace a bimetal circuit breaker in motors used to open and close automobile windows. The recoverable fuse showed promise of being cheaper, occupying less space, and being easier to mount than the circuit breaker in use. About two man-days were devoted to study of the TSP, and it was concluded that the fuse could not be used. Goddard tests had loaded the device with only 0.6 amp., and the requirements in the intended application involved peak loads as high as 50 amp. Auto manufacturer specifications regarding opening and closing time are rigorous, and there was doubt about the fuse's capabilities in this respect. The doubts were never resolved because the amperage-capacity factor had already precluded a testing program.

The firm is extending its interest in solid-state devices for future applications, and the TSP will be used again when a new potential use appears. Mr. Crawford anticipates that any development program to adapt the concept will involve a "terrific amount" of time. He had earlier estimated that the window-motor adaption would require 200 hours.

WH/ROM:lj
8/28/69

Case Number: 80300801
(Supercedes Telephone Follow-up of 5/10/68)

Columbia Products Corporation is searching for a paint formula that is both electrically resistant and durable. Inorganic paint formulations developed at Goddard Space Flight Center were considered, but no progress has been made in adapting the NASA invention.

Subject	Technology Source
Columbia Products Corporation Route 3 Newberry, South Carolina 29108 803-276-5504 Contact: Sam George Sales Engineer	Goddard Space Flight Center Tech Brief: 65-10156, "Inorganic Paint is Durable, Fireproof, Easy to Apply"

Evaluation of a Technical Support Package about inorganic paint led to a conclusion that it was unsuitable for certain uses by the Columbia Products Corporation. Mr. Sam George reported that the firm wanted to develop the paint for pole line hardware and electrical track system coatings for which the paint must be durable and electrically resistant. A development project has not begun because a chemist in the firm was dubious about the invention. However, no reasons were given for his doubt.

At the moment, there is no plan to further develop the coating. Future progress will depend upon Mr. George's ability to convince several people in the firm that the originally intended application is feasible. If his efforts are successful and a development program is completed, Mr. George estimates that the Technical Support Package may account for 60-75 percent of the information input.

While this firm does not regularly receive Tech Briefs, it uses the services of the Science and Technology Research Center in North Carolina. Mr. George viewed these literature searches as quite helpful.

WH/DRL:ad
9/12/69

Case Number: 80302882
(Supercedes Telephone Follow-up of 6/25/68)

A Senior Research Chemist employed by an Eastern chemicals manufacturer evaluated a Technical Support Package about a new thermosetting plastic. A recent company merger and new product-line emphases may preclude his experimenting to develop new polymers from the TSP.

Subject	Technology Source
An Eastern chemicals manufacturer	Lewis Research Center
Contact: Senior Research Chemist	Tech Brief: 67-10197, "New Class of Thermosetting Plastics has Improved Strength, Thermal and Chemical Stability"

TRW Systems investigators, under contract to Lewis Research Center, developed a new thermosetting plastic with high hydrocarbon content, high stiffness, thermal stability, humidity resistance, and workability in the precured state. TRW has title to the invention, but a NASA Tech Brief describing the plastic and its formulation has been published. A chemicals manufacturer reviewed the TSP, hoping to find ideas for new polymers from which several proprietary products might be made. The senior research chemist devotes almost all of his efforts to development of exterior coatings, but is occasionally called upon to evaluate new polymers for inclusion in the company's product lines. The firm is not a retailer; but it assists its customers in applying new technology.

A development program involving the TSP was never fully established. Rather, experiments were conducted on a time-available basis and no concrete results were obtained. The Senior Research Chemist remains optimistic about the potential for developing new polymers, and thinks that the TSP could account for as much as 20 percent savings in development time and money. However, he is pessimistic about prospects for further research support. His firm recently merged with another company and the research agenda is quite indeterminate. Until final decisions are made concerning the new entity's product lines, it will be impossible to specify the probability of support for this research. The decisions on product lines will be made in 1970.

WH:ad
9/4/69

Case Number: 80506543
(Supercedes Telephone Follow-up of 9/25/68)

A research team headed by Dr. L. Sherman Watson of the Research Laboratories at Merck, Sharp & Dohme plans to use spray-on electrodes for physiological monitoring of test animals in drug experiments.

Subject	Technology Source
Merck, Sharp & Dohme Research Laboratories West Point, Pennsylvania 215-699-5311 Contact: L. Sherman Watson, Ph.D. Senior Research Physiologist	Flight Research Center Tech Brief: 66-10649, "Spray-on Electrodes Enable EKG Monitoring of Physically Active Subjects"

Because of changes in research project emphasis, Dr. Sherman Watson has been unable to proceed with a research project in which he planned to use spray-on electrodes similar to those described in a NASA Tech Brief. He commented that industrial research is emphasized or de-emphasized according to pressing demands arising from market and production requirements. A given project might be of considerable interest and importance, but nevertheless be delayed in favor of more urgent research needs. The project involving spray-on electrodes has been postponed for about a year, but when it resumes, it will incorporate the NASA invention.

The electrodes will be used to monitor cardiovascular functions in dogs and monkeys to test new anti-hypertension drugs. Present practice entails anesthetizing the animals and inserting wires with a consequent danger of infection. The external electrodes will be much simpler and less dangerous but adaptation problems are anticipated. For example, these animals differ from humans in skin condition and the manner in which their hair grows. Dogs do not perspire, but their skin is more oily than that of humans.

Although Dr. Watson could not forecast the monetary of time-saving potential of the new electrodes, he considers the device to be significant to his work. He will be able to perform tasks not previously possible, especially with respect to working with animals that have not been anesthetized.

Case Number: 80506543 (Cont.)

At least 40 hours have been spent studying the TSP and formulating plans for using the electrodes in the research program.

Dr. Watson expressed great satisfaction with the Tech Briefs and TSP's that he has read. He also stated his interest in gaining access to more NASA documents dealing with physiological monitoring instruments.

WH/DRL:ad
9/11/69

Case Number: 80711259
(Supercedes Telephone Follow-up of 10/3/68)

A casket manufacturing firm reviewed a Technical Support Package about a new thermosetting plastic. No development efforts have been made, and none are planned.

Subject	Technology Source
A casket manufacturer Contact: Production Manager	Lewis Research Center Tech Brief: 67-10197, "New Class of Thermosetting Plastics has Improved Strength, Thermal and Chemical Stability"

The former production manager of a casket manufacturer ordered a Technical Support Package about thermosetting plastic in order to evaluate it as a possible casket material. Container industry innovations prompted consideration of plastic as a casket material. The novelty of a plastic casket is its susceptibility to hermetic sealing by forming an interior vacuum. The unit would be cast with an orifice to exhaust the interior after closing the lid. Some sealers might be necessary, but the vacuum seal is expected to perform the sealing function. The reason for sealing is "to keep things inside the casket," contrary to the popular notion that the purpose is to "keep things out."

There would be a significant impact on the casket market if all manufacturers were to enter a plastic unit in their product lines. Because "tradition" is an important factor in casket marketing, there may be some difficulty with a new type of casket unless its uniqueness can be successfully emphasized.

Mergers and exits from the industry are occurring at high rates, which may either enhance or impede idea diffusion. About 600 casket manufacturers were in business in 1967, as compared with 1800 in 1965.

The potential market for plastic caskets is the "middle" price range units. About 1,800,000 caskets were sold in 1968, and 1,000,000 were in the "middle" price range. However, there is an upward trend in sales of the higher-priced units.

Case Number: 80711259 (Cont.)

Casket industry production economics will probably preclude significant overall savings as a result of using plastic rather than other materials. Labor costs are a large proportion of total costs in all price line. Total costs would remain about the same if plastic were used for middle-price caskets. Some labor displacement might be possible, but higher materials cost would offset the saving. If the plastic casket could be tailored for the higher-price market, there would be a net cost reduction because materials cost increases rapidly as heavier gauge metals are used for the more expensive units. Some savings in all price lines could be achieved with plastic since final finishing would be unnecessary.

Economic problems have resulted in a lack of progress in this firm's efforts to develop a plastic casket. To date, no plastic has been found which meets the firm's specifications. The really crucial factors are susceptibility to casting (rather than injection molding) and a low price. No plastic has been found which satisfies both requirements. A large conglomerate firm with a plastic manufacturing division reviewed the Technical Support Package, but was unable to quote a low enough price to attract this casket manufacturer's business.

The Technical Support Package review was conducted to enlarge the information base about the specific problem of finding a plastic suitable for the firm's needs. The company has no intention or capability to manufacture the plastic. When advised that TRW Systems holds the patent for the thermosetting plastic, the current production manager replied that the firm's judgment was that this plastic would be too expensive.

It is evident that this firm will not achieve the technology transfer originally envisioned.

WH:ad
9/11/69

Case Number: 80200384
(Supercedes Telephone Follow-up of 3/28/68)

Dallons Laboratories of El Segundo, California, evaluated an implantable FM transmitter designed at Ames Research Center. A prototype was built, but the firm decided not to pursue further development.

Subject	Technology Source
Dallons Laboratories 120 Kansas Street El Segundo, California 90245 213-678-8171 Contact: J. D. Frasier President	Ames Research Center Tech Brief: 65-10203, "Tiny Biomedical Amplifier Combines High Performance, Low Power Drain"

Dallons Laboratories, a subsidiary of International Rectifier Corporation, is a manufacturer of medical electronics for direct sale to hospitals and physicians. Dallons products include cardiac monitoring equipment such as ECG scopes, heart rate measuring and alarm devices, defibrillators, and external pacemakers.

Dallons also manufactures a transmitter which is used to measure various functions on ambulatory patients and transmit the readings to a central monitoring station. The market for these telemetry systems is limited because of their newness. However, Dallons anticipates a growing market as increasing numbers of physicians and researchers explore the uses of implantable and external telemetering transmitters. At the time of the first follow-up (March 1968) Dallons spokesmen expressed a desire to improve upon the transmitter made by the firm. It was subject to high power drain and was bulky and heavy. The low power drain, light weight, and compactness of an Ames transmitter make it attractive for consideration as a substitute for the currently produced model. A prototype was built from the Technical Support Package, with no modifications of the design.

The Chief Engineer at Dallons was unable to estimate time or money savings associated with the use of the Technical Support Package. However, the sophistication of the circuitry suggested that internal design development would have required a large input of highly talented engineering manpower, with no guarantee that the resulting circuit would perform as well as the Ames design.

Case Number: 80200384 (Cont.)

Dallons' president reported in a second follow-up interview that he was quite pleased with the Technical Support Package and with the excellent cooperation from Ames personnel during the effort to test the transmitter as a potential new product. However, the firm has decided "to go in a different direction" and will not market the Ames implantable transmitter. No technical difficulties pertaining to production were encountered; apparently the constraint exists in the small market for such devices.

WH/ROM:ad
8/29/69

Case Number: 80200602
(Supercedes Telephone Follow-up of 5/27/68)

A California firm hopes to improve its production techniques for computer memory cores, by incorporating a new design.

Subject	Technology Source
A California memory core manufacturer Contact: President	Goddard Space Flight Center Tech Brief: 66-10617, "Improved Memory Word Line Configuration Allows High Storage Density"

A small manufacturer of computer memory cores evaluated a Technical Support Package in order to lay a foundation for automating its production processes for memory core elements. The NASA information, generated by UNIVAC, describes new core designs. If the firm succeeds in implementing the new design and the automatic processes, costs may be reduced as much as 30 percent.

Because of conflicting time requirements, the firm has not actively pursued a program to adapt the idea to its own needs. No problems other than time limitations have been encountered, and the company president is confident that the new techniques can be implemented when time is available for an intensive development effort.

WH:bs
9/2/69

Case Number: 80504372
(Supercedes Telephone Follow-up of 6/7/68)

A small Midwestern manufacturer of electronic and mechanical instruments has decided that "cleanroom" contamination detection techniques are not feasible for a potential commercial quality control system.

Subject	Technology Source
A small manufacturer of electronic and mechanical instruments Contact: President	Marshall Space Flight Center Tech Brief: 67-10076, "Cleanroom Air Sampler Counts, Categorizes, and Records Particle Data"

A NASA technique involving very specialized instruments and test circuitry to detect foreign particles in the air of "cleanrooms" has been evaluated by a small instrument manufacturer. Initial assessments indicated that it might be feasible to adapt the circuitry to a specialized instrumentation system for detecting spots on large sheets of paper as they leave the production line and before they are packaged in large rolls. The instrumentation would have improved the quality control capabilities of paper manufacturers. There is presently very little that can be done in the area because conventional sensing devices cannot perform adequately under conditions in which a stream of paper is moving by at a rate of 1000 feet per second. The spots to be detected are as small as 1/64 inch and constitute such a small proportion of the total area under examination that conventional sensors are ineffective.

An early criticism of the TSP was that it did not clearly elucidate the fundamental principles underlying the technique. External assistance was sought and obtained from another company which is involved in "cleanroom" instrumentation. A day-long conference with an expert from the latter firm producted the conclusion that the intended adaptation was not feasible, and the project was terminated.

Costs associated with this endeavor were small, involving only a few man-days and no cash outlays for materials or prototype construction. The sole benefit is the personal knowledge that one more potential solution to a long-standing problem would not work.

Case Number: 80504372 (Cont.)

The initial TSP inquiry was motivated by a general interest, although the company constantly receives inquiries from its customers in the graphic arts field about possible innovations in quality control instrumentation. Tech Briefs are not regularly received by the firm because there are only three or four staff members qualified to judge the potential of a new idea, and their time is too limited for diversion from immediate production problems. This personnel constraint also inhibits new product development, which usually proceeds on a part-time basis.

WH:lj
8/27/69

Case Number: 80505209
(Supercedes Telephone Follow-up of 10/3/68)

Del Mar Engineering Laboratories has perfected a blood pressure monitoring instrument for which a NASA invention was considered as a component. The NASA invention was not incorporated into the product.

Subject	Technology Source
Del Mar Engineering Laboratories 6901 Imperial Highway Los Angeles, California 90045 213-674-2241 Contact: Ray Cherry Design Engineer	Kennedy Space Center Tech Brief: 67-10239, "A Phonocardiogram Simulator"

Mr. Alan Wong, formerly Product Design Supervisor for Del Mar Engineering Laboratories, reported a year ago that his firm was developing an external automatic blood pressure monitoring system. At that time, he was planning to incorporate a phonocardiogram simulator to verify monitored information. Mr. Wong thought that the NASA designed simulator would require considerable modification to be produced on an economically competitive basis. A prototype had not yet been built, and the significance of the Technical Support Package was undeterminable.

In an attempt to update this potential application, Del Mar was again contracted. Mr. Wong is no longer with the firm, and his successor, Don Anderson, has been on the job only two days. He suggested that Ray Cherry, a design engineer, could update the information. Mr. Cherry stated that the firm's automatic blood pressure monitor is on the market and "selling like hotcakes." However, this device is produced under license to a Dr. London who invented it. Mr. Cherry stated that no NASA technology was used during the development of the new instrument and no phonocardiogram simulator was incorporated into it.

Mr. Cherry reads many Tech Briefs, but could not remember this particular one.

WH/DRL:ad
9/4/69

Case Number: 80300535
(Supercedes Telephone Follow-up of 5/16/68)

A major petrochemical processor considered adopting an electroless nickel plating technique for a production unit prototype. The project was never initiated.

Subject	Technology Source
Petrochemical processor New Jersey	Goddard Space Flight Center Tech Brief: 66-10479, "Electroless Nickel Plating on Stainless Steels and Aluminum"

About one day was devoted to study and review of a Technical Support Package describing a technique for electroless nickel plating. The firm was experiencing trouble with leakage and maintaining material balance. It was hoped that the plating technique would eliminate the causes of the leakage by protecting containers and pipes against corrosion from some of the chemicals. However, the initial review was scarcely completed when the leakage problems were removed by a decision to suspend production of the chemicals, which entailed ending the use of the faulty equipment. Had the company continued to produce the chemicals and use the machinery, a development product to test the plating process was planned involving about 30 man-hours. No immediate possibility exists for using the information in another application.

WH/TDB:ad
9/10/69

APPENDIX C

Revised TSP Interview Guide

October 10,1969

TSP INTERVIEW GUIDE

I. COMPLETE BEFORE INTERVIEW

Interviewee _____
(Write name here, and use in Introduction, in Q.12, and after Q.22)

Position _____

Division (if any) _____

Organization _____

Phone Number _____

Location _____

Annual Sales _____

Source of TSP Awareness _____

TSP Request Date _____

TSP Number _____

TSP Title _____
(Write title here, and use in Introduction, Questions 4, 5, 7, 14, and 17)

TSP Subject Area _____

INTRODUCTION

(Dr., Mr., Mrs., Miss)_____, this is _____ with the
(DRI interviewer)

University of Denver Research Institute. I'm calling you with reference to the information on _____ you ordered from _____ some months
(from TSP title) *(NASA or The Federal Clearinghouse)*

ago. As you may recall, you returned a questionnaire to us within the last month indicating how you used the material in the NASA Technical Support Package. If you have a few moments, I'd like to ask you a few additional questions about how you used the material.

II. COMPLETE DURING THE INTERVIEW

Before proceeding with my specific questions, it would be helpful if you could give me a little background information on your (company, department, group). I'm specifically interested in how large a (company, department, group) you work with and what products you make or activities you are engaged in.

1. Number of employees in respondent's

_____
(Specify one: organization, division, department, group)

- ☐ Self-employed
- ☐ 1 to 5 employees
- ☐ 6 to 49 employees
- ☐ 50 to 499 employees
- ☐ 500 to 999 employees
- ☐ 1,000 to 4,999 employees
- ☐ 5,000 to 9,999 employees
- ☐ 10,000 employees

2. Product(s) made in respondent's

_____
(Specify one: organization, division, department, group)

- ☐ None
- ☐ Specify product(s)

3. Respondent's primary work activities

- ☐ Engineering
- ☐ Basic research
- ☐ Management
- ☐ Technical assistance
- ☐ Librarian
- ☐ Other (specify)

4. Would you please describe briefly the problem you were working on when you ordered the Technical Support Package explaining _____ ?
(from TSP title)

_____

_____

_____

_____

_____

5. How did you use the _____
(from Tech Brief title)
technology from NASA to help solve this problem?

_____

_____

_____

_____

6. Considering your attempt to solve this problem, how important was the NASA Technical Support Package?

- ☐ Not important at all (irrelevant, not applicable)
- ☐ Slightly important (less than 5% input to problem solution)
- ☐ Moderately important (about 5% to 14% input to solution)
- ☐ Quite important (15% to 49% input to solution)
- ☐ Crucial (50% or greater input to solution)

7. Can you tell me what specific *technical advances*, if any, resulted from your use of the _____
(from TSP title)
technology? What we have in mind here is the development of new or improved products or processing techniques.

- ☐ No technical advances have resulted. SKIP TO Q. 12
- ☐ Developed a new product
- ☐ Improved an existing product
- ☐ Found new use(s) for an existing product
  } ASK Q.8
- ☐ Developed a new process (or technique)
- ☐ Improved an existing process (or technique)
- ☐ Other _____
  } SKIP TO Q.12

_____

_____

8. Are you marketing the new product you developed?

- ☐ No ASK Q. 9
- ☐ Yes SKIP TO Q. 10

9. Do you have any plans for marketing the new product?

- ☐ No SKIP TO Q. 12
- ☐ Yes (Specify): _____

_____

SKIP TO Q. 11

10. What is your estimate of the dollar sales volume of your new product to date?

- ☐ Respondent *cannot* estimate dollar sales volume to date
- ☐ Respondent *estimates* that sales have totaled $_____ to date
  (number of dollars)

11. How many dollars in sales of the new product do you estimate your company will have during the next twelve months?

- ☐ Respondent not able to estimate future dollar sales volume
- ☐ Respondent estimates that sales volume during the next 12 months will total $_____

12. Considering the next twelve months (Dr., Mr., Mrs., Miss)_____, do you think any (other) technical advances might result from your use of this technology from NASA?

- ☐ None respondent can think of
- ☐ May develop a new product
- ☐ May improve an existing product
- ☐ May find a new use for an existing product
- ☐ May develop a new process (or technique)
- ☐ May improve an existing process (or technique)
- ☐ Other (specify):_____

_____

13. An important part of our research is to determine the *economic* factors associated with your use of NASA-generated technology. Would you please estimate what actual *monetary savings*, if any, have resulted from your use of this technology during the past 12 months?

- ☐ None
- ☐ Monetary savings resulted, but respondent cannot estimate amount
- ☐ Monetary savings resulted in the amount of $ _____

(specify)

14. Considering the next twelve months, about how many *dollars* do you think will be *saved* because of your use of the_____ technology you received from *(from TSP title)* NASA?

- ☐ None
- ☐ Monetary savings may result, but respondent cannot estimate amount
- ☐ Monetary savings may result in the amount of $ _____

(specify)

15. Would you please estimate how much *working time* you have been able to *save* because you've used this NASA-generated technology?

- ☐ None
- ☐ Time savings occurred, but respondent cannot estimate amount
- ☐ Time savings occurred in the amount of_____

_____

(specify number of hours or weeks or months)

During the next year, how much working *time* do you think might be *saved* because of your use of information in the Technical Support Package?

- ☐ None
- ☐ Time savings may occur, but respondent cannot estimate amount
- ☐ Time savings may occur in the amount of _____

_____

(specify number of hours or weeks or months)

17. In addition to technical and economic results, are there any (other) results that we haven't talked about? For instance, have you been able to use the_____ *(from TSP title)* technology from NASA in teaching, in preparing articles, or in developing new ideas for futher research?

- ☐ No personal results
- ☐ Increased current awareness
- ☐ Used in teaching, lecturing, etc.
- ☐ Used in preparing proposals
- ☐ Used in preparing articles, books, etc.
- ☐ Other (specify): _____

_____

18. What difficulties, if any, have you experienced in your use of this technology from NASA?

- ☐ No difficulties
- ☐ Patent clearance too complicated
- ☐ Technology not well enough developed for respondent's purposes
- ☐ Insufficient information
- ☐ Incorrect information
- ☐ Unusually long delay in obtaining the information
- ☐ Excessive adaptation costs
- ☐ Other (specify):_____

19. I have just a couple of questions concerning contacts your organization may have with NASA. Is your organization a subscriber to the literature review services of a NASA Regional Dissemination Center?

- ☐ Don't know
- ☐ Don't know, but contact _____ *(person, position, phone number)*
- ☐ Yes

20. Does your organization regularly receive NASA Tech Briefs?

- ☐ Don't know
- ☐ No
- ☐ Yes

21. Thinking back over some of the things we've discussed, do you consider any of the information you have given me to be proprietary?

- ☐ No
- ☐ Yes (specify which items): _____

_____

22. Can you think of anything else we should discuss before we conclude?

- ☐ No
- ☐ Yes (specify):_____

_____

Thank you for your help, (Dr., Mr., Mrs., Miss) _____

_____

III. COMPLETE AFTER INTERVIEW

69-70. Interviewer

- ☐ WH
- ☐ DRL
- ☐ DCC
- ☐ ROM
- ☐ TM
- ☐ TDB
- ☐ RJ
- ☐ RH
- ☐ RHO
- ☐ GEH
- ☐ JJR
- ☐ JSG
- ☐ HZ
- ☐ LS
- ☐ RB
- ☐ JF
- ☐ Other (specify):_____

71. Type of interview

- ☐ Telephone
- ☐ Personal

72-74. Interview date:_____

75-79. Case number:_____

80. 3

IV. ANY ADDITIONAL COMMENTS *(Specify relevant questions):*

APPENDIX D

PATT Transfer Data Bank Information Referenced in Section II

TABLE D-1. TEN MOST FREQUENTLY REQUESTED TSP'S" THIRD QUARTER 1969

TSP Number	Title & Originating NASA Center
68-10385	"Electromotive Series Established for Metals Used in Aerospace Technology" (Marshall)
68-10392	"Contamination Control Handbook" (Marshall)
68-10395	"Design of Fluid-Duct Bends With Low Pressure Loss" (Marshall)
68-10069	"Principles of Optical-Data-Processing Techniques" (Goddard)
68-10397	"Charts Designate Probable Future Oceanographic Research Fields" (Marshall)
68-10394	"Nondestructive Testing of Brazed Rocket Engine Components" (Marshall)
68-10097	"Heater Control Circuit Provides Both Fast and Proportional Control" (Marshall)
68-10396	"Evaluation of Superconducting Magnets, A Study" (Marshall)
67-10196	"Technique for Strip Chart Recorder Time Notation" (Goddard)
67-10203	"Automated Microsyringe is Highly Accurate and Reliable" (NASA Pasadena Office)

TABLE D-2. NASA CENTER TSP REQUESTS: JANUARY - JUNE, 1969

TSP Number	Title & Originating NASA Center	Request Frequency	Percent
68-10392	"Contamination Control Handbook" (Marshall)	654	11.9
68-10069	"Principles of Optical-Data Processing Techniques" (Goddard)	279	5.1
69-10391	"Training Manuals for Nondestructive Testing Using Magnetic Particles" (Marshall)	233	4.3
68-10395	"Design of Fluid-Duct Bends with Low Pressure Loss" (Marshall)	138	2.5
68-10385	"Electromotive Series Established for Metals Used in Aerospace Technology" (Marshall)	134	2.4
68-10397	"Charts Designate Probable Future Oceanographic Research Fields" (Marshall)	115	2.1
68-10394	"Nondestructive Testing of Brazed Rocket Engine Components" (Marshall)	94	1.7
67-10266	"Simplified Method Measures Changes in Tensile Yield Strength Using Least Number of Specimens" (SNPO)	90	1.6
67-10005	"Digital Computer Processing of X-Ray Photos" (Jet Propulsion Lab)	87	1.6
67-10097	"Heater Control Circuit Provides Both Fast & Proportional Control" (Marshall)	74	1.3
All Other Tech Briefs		3,590	65.5
	TOTALS	5,488	100.0

TABLE D-3. CLEARINGHOUSE TSP REQUESTS: JANUARY - SEPTEMBER, 1969

TSP Number	Title & Originating NASA Center	Request Frequency	Percent
69-10055	"Thermal Expansion Properties of Aerospace Materials" (Marshall)	138	11.5
69-10065	"Materials Data Handbook, Aluminum Alloy 6061" (Marshall)	76	6.4
68-10574	"Training Manual on Optical Alignment Instruments" (Marshall)	64	5.3
68-10392	"Contamination Control Handbook" (Marshall)	46	3.8
69-10098	"Corrosion Protection of Aluminum Alloys in Contact with Other Metals" (Marshall)	39	3.3
68-10522	"Method for Removing Surface-Damaged Layers From Nickel Alloys" (Marshall)	35	2.9
69-10072	"Refractory-Metal Compound Impregnation of Polytetrafluoroethylene" (Lewis)	28	2.3
69-10074	"Adhesive for Cryogenic Temperature Applications" (Lewis)	27	2.3
69-10012	"Microwave Interferometer Controls Cutting Depth of Plastics" (Marshall)	25	2.1
69-10085	"Tube Welding and Brazing" (Marshall)	24	2.0
All Other Tech Briefs		695	58.1
	TOTALS	1,197	100.0

APPENDIX E

PATT Transfer Data Bank Information Referenced in Section III

TABLE E-1. TECHNICAL RESULTS BY SUBJECT AREA OF TECHNOLOGY

Technical Results	Technology Subject Area							
	Electrical	Physical Science	Materials	Life Sciences	Mechanical	Computer	Unclassified	Total
Does not apply	2	--	--	--	--	--	1	3
No major gains	37	2	33	--	15	2	--	89
Increase current awareness	1	--	7	--	--	--	--	8
Stimulate research	11	--	12	1	1	1	--	26
Potential new process or technique	9	1	6	--	5	2	--	23
Potential new product	15	2	16	2	6	--	--	41
Potential improvement of existing product	11	1	7	--	1	--	--	20
Potential new uses for product, process, or technique	2	--	7	2	2	--	--	13
Actual new process or technique	9	6	4	--	5	2	--	26
Actual new product	25	1	7	1	4	--	7	45
Actual improvement of existing product	10	1	3	--	2	--	--	16
Actual new uses for product, process, or technique	18	2	7	1	1	5	--	34
Other	1	--	4	--	1	--	--	6
TOTALS	151	16	114	7	43	12	8	350

TABLE E-2. TECHNICAL RESULTS BY MONETARY SAVINGS

Technical Results	Savings Not Mentioned		None		Amount Not Determinable		Less Than $1,000		$1,000-$10,000		More Than $10,000		Totals	
	A.*	P.**	A.	P.	A.	P.	A.	P.	A.	P.	A.	P.	A.	P.
Does not apply	3	3	--	--	--	--	--	--	--	--	--	--	3	3
No major gains	72	80	11	9	5	--	--	--	1	--	--	--	89	89
Increase current awareness	7	6	--	--	1	2	--	--	--	--	--	--	8	8
Stimulate research	18	25	2	--	5	1	--	--	1	--	--	--	26	26
Potential new process or technique	18	18	--	--	5	3	--	--	--	1	--	1	23	23
Potential new product	33	36	--	1	7	3	--	--	--	--	1	1	41	41
Potential improvement of existing products	18	17	--	--	2	3	--	--	--	--	--	--	20	20
Potential new uses for product, process, or technique	10	9	2	--	1	4	--	--	--	--	--	--	13	13
Actual new process or technique	17	25	1	--	6	1	1	--	1	--	--	--	26	26
Actual new product	27	41	1	--	12	3	2	--	2	1	1	--	45	45
Actual improvement of existing product	13	12	--	--	3	3	--	--	--	--	--	1	16	16
Actual new uses for product, process, or technique	16	28	2	--	9	6	--	--	5	--	2	--	34	34
Other	5	5	--	--	1	1	--	--	--	--	--	--	6	6
TOTALS	257***	305	19	10	57	30	3	--	10	2	4	3	350	350

* Actual monetary savings

** Potential monetary savings

*** Read: "Actual monetary savings were not mentioned in 257 case studies."

TABLE E-3. SPECIFIC MONETARY AND TIME SAVINGS IDENTIFIED IN 350 CASE STUDIES

DRI Case No.	Source of NASA Info.	Company	Description of Technology	Specific Monetary Savings (Dollars)	Specific Time Savings Hours	Specific Time Savings Est. Value (@$10/hr.)	Estimated Percent of NASA Contribution	Expected Value of NASA Info.
	64-10171	Armed Forces Radio-	Telemetry units	$ 450	--	--	100%	$ 450
80200136	66-10057	biology Research Inst.						
	66-10624							
80300466	66-10479	Manufacturing Co.	Electroless nickel plating	150,000	--	--	100%	150,000
80300511	63-10609	Sm. California Electronic Mfg.	Specialized multi-vibrators	3,000	--	--	100%	3,000
80200563	67-10278	TRW Systems	Microelectric application	--	35	$ 350	100%	350
80300606	67-10072	Watervliet Arsenal	X-ray detection device	--	972	9,720	100%	9,720
80200656	65-10156	Sm. Paint Mfg.	Inorganic paint	--	100	1,000	100%	1,000
80200750	65-10156	Bradley-Von Holm Chemical Corp.	Inorganic paint	--	150	1,500	100%	1,500
80201070	66-10691	Major Signal Device Mfg.	Solid state fuse		972	9,720	100%	9,720
80201569	66-10449	Burroughs, Corp.	Arc supression techniques	50,000	--	--	100%	50,000
80402381	66-10291	Large Mfg. of Electronic Components	Large capacitor	--	162	1,620	100%	1,620
80202850	66-10548	Sammuel R. Alvid Private Investigator	Security warning system	--	1,000	10,000	100%	10,000
80403045	66-10490	Argonne Nat'l. Laboratories	Magnetic fields of solenoids	--	80	800	100%	800
80503819	67-10089	Thermophysical Prop. Research Center	Machine coding	--	500	5,000	100%	5,000
80403918	67-10412	Control Data Corp.	Torque meter	10,000	--	--	100%	10,000
80403959	66-10087	Jordan Valve	Solid film lubricant	--	100	1,000	100%	1,000
80504595	66-10113	Helm Instrument Company, Inc.	Special circuitry	--	4	40	100%	40
80504856	66-10537	Anderson, Greenwood & Co.	Quality control of flared tubes	--	16	160	100%	160
80505054	67-10240	Scott Aviation Corp.	Management technique "Vis-a-plan"	200,000	--	--	100%	200,000
80505170	67-10374	Dover Corporation	Eddy current testing	4,000	--	--	100%	4,000
80505689	66-10447	ITT Semiconductor	In-circuit test of semiconductor	2,000	--	--	100%	2,000
80505790	67-10440	Aerojet-General Corporation	Fluid properties handbook	--	1,040	10,400	100%	10,400
80506218	66-10660	Midwestern Electronics Company	Circuit board registry accuracy	--	100	1,000	100%	1,000
80506706	67-10374	Frank D. Weaver & Associates	Eddy current testing handbook	2,000	--	--	100%	2,000
80607213	66-10549	Department of Biology MIT	Miniature electro-meter amplifier	1,200	--	--	100%	1,200
80607373	66-10624	Armed Forces Radio-biology Research Inst.	Pressure measuring of radiation	49,400	--	--	100%	49,400
80607629	67-10438	Creare, Inc.	Fluids logic control system	--	16	160	100%	160
80708011	67-10484	General Electric Company	Polyester resin as metallographic mount	100	--	--	100%	100
80608537	67-10361	Diebold, Inc.	Pocketsize paper tape reader	--	200	2,000	100%	2,000
80710380	65-10156	Fairfax Industries	Inorganic paint	2,500	--	--	100%	2,500
80916218	67-10507	Ball Brothers Research Corp.	Monolithic circuits	6,000	--	--	100%	6,000
81119765	67-10007	Clevite Corp.	High temperature lubricant	87,500	1,944	19,440	100%	106,940
81120055	67-10598	American Optical Corp.	Cardiotachometer	--	320	3,200	100%	3,200
TOTALS				$568,150 (15 cases)	7,711 (18 cases)	$77,110 (18 cases)	. . .	$645,260 (32 cases)

TABLE E-4. SPECIFIC SALES INCREASES IDENTIFIED IN 350 CASE STUDIES

DRI Case Number	Source of NASA Info.	Company	Description of Technology	Specific Sales Increases	% NASA Contribution	Expected Value
80300429	NASA Contractor	Space Craft, Inc.	Magnetic tape	$ 37,500	100%	$ 37,500
80100430	NASA Contractor	Garrett Corporation	Aircraft galley refrigeration	370,000	50%	185,000
80100431	NASA Contractor	Electro-Mechanical Research, Inc.	Photo receiver	136,000	100%	136,000
90300441	NASA Employee	Jarrell Ash	Gordon arc spectrometer accuracy	5,000	100%	5,000
80302988	66-10664	Midwest Refractory Metals Mfg.	Packaging electronic products	1,000,000	10%	100,000
80403178	NASA Contractor	Electronics Mfg.	Physiological monitoring devices	110,000	50%	55,000
80404535	65-10156	Paint Company	Inorganic paint	370,000	5%	18,500
80204793	NASA Contractor	Space Craft, Inc.	Industrial monitoring system	1,400,000	50%	700,000
80505202	67-10289	Mfg. of electro-optical products	Light modulator	7,200	5%	150
TOTALS				$ 3,435,700 (9 cases)	. . .	$ 1,237,150 (9 cases)

TABLE E-5. TECHNICAL RESULTS BY SOURCE OF AWARENESS

Technical Results	Tech Brief	Other NASA Publications	Trade Press Professional Journals	Personal Contact	SBA	Other	Not Specified	Total
Does not apply	1	--	--	1	--	--	1	3
No major technical results	42	9	28	6	2	2	--	89
Increase current awareness	5	1	1	--	--	1	--	8
Stimulate research	11	1	9	3	--	2	--	26
Potential new process or technique	12	1	8	--	--	2	--	23
Potential new product	17	3	11	2	4	4	--	41
Potential improvement of existing product	7	1	10	--	--	1	1	20
Potential new uses for product, process, or technique	4	--	6	1	--	2	--	13
Actual new process or technique	6	3	12	2	2	1	--	26
Actual new product	13	3	11	4	2	5	7	45
Actual improvement of existing product	6	--	8	1	--	1	--	16
Actual new uses for product, process, or technique	12	4	13	1	1	1	2	34
Other	5	--	1	--	--	--	--	6
TOTALS	141	26	118	21	11	22	11	350

TABLE E-6. TECHNICAL RESULTS BY NASA CENTERS

Technical Results	Ames	Argonne	ERC	FRC	Goddard	Kennedy	Langley	Lewis	MSC	Marshall	SNPO	Wallops	JPL	Not Specified	Totals
Does not apply	--	--	2	--	--	--	--	--	--	--	--	--	--	1	3
No major gains	7	3	--	2	25	5	1	11	3	22	4	1	5	--	89
Increase current awareness	1	--	--	--	--	1	--	--	--	6	--	--	--	--	8
Stimulate research	7	--	--	--	4	--	--	4	1	9	--	--	1	--	26
Potential new process or technique	2	1	--	--	3	1	--	8	--	5	3	--	--	--	23
Potential new product	6	1	--	1	16	--	1	6	3	5	--	--	2	--	41
Potential improvment of existing product	3	--	1	--	10	--	--	1	--	4	--	--	1	--	20
Potential new uses for product, process or technique	--	--	--	1	1	--	1	4	1	4	--	--	1	--	13
Actual new process, or technique	1	1	--	--	3	2	3	6	1	5	2	--	2	--	26
Potential new product	16	4	--	--	7	2	--	1	2	5	--	--	1	7	45
Actual improvement of existing product	2	1	--	--	2	--	--	3	1	6	--	--	1	--	16
Actual new uses for product, process, or technique	6	1	--	--	5	3	2	2	2	7	3	--	3	--	34
Other	--	--	--	--	--	--	--	1	--	4	1	--	--	--	6
TOTALS	51	12	3	4	76	14	8	47	14	82	13	1	17	8	350