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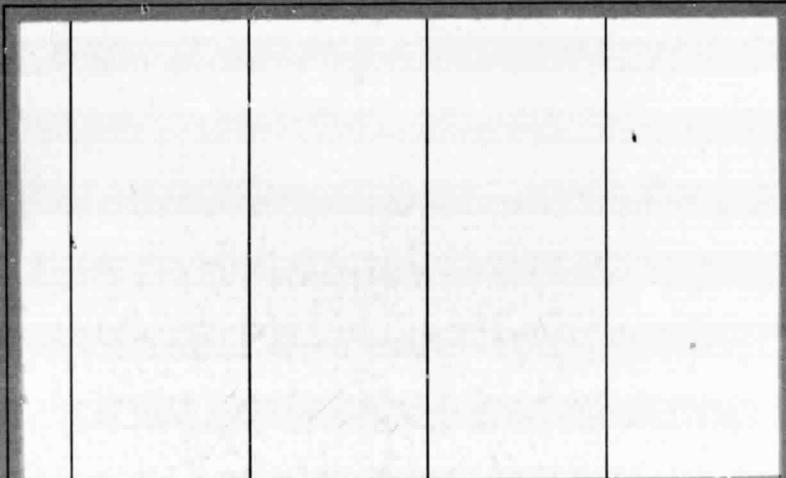
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RESEARCH REPORT



Battelle

Columbus Laboratories



FINAL REPORT

on

PHASE II STS NEW USER DEVELOPMENT PROGRAM:

VOLUME I,
EXECUTIVE SUMMARY

to

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER

CONTRACT NUMBER NAS8-31621

March 26, 1976

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PREFACE

This Battelle report, entitled "Phase II STS New User Development Program", is submitted under NASA Contract No. NAS3-31621 and consists of five volumes as specified below:

- Volume I - Executive Summary
- Volume II - Narrative Report
- Volume III - The Implementation Plan
- Volume IV - Guidance/Instructions for Representatives
- Volume V - Informational Materials.

The five volumes make up the Phase II STS New User Development Program Final Report and summarize the results, conclusions and recommendations from the nine-month study performed by Battelle's Columbus Laboratories (BCL). This contract was administered by the NASA Marshall Space Flight Center, Huntsville, Alabama.

Battelle's Columbus Laboratories would like to acknowledge the efforts of W. Robert Mixon, Jr., of NASA/MSFC as the Contracting Officer Representative for the study program. The following BCL staff should be recognized for their technical contributions to this study:

- P. E. Fisher
- J. A. Madigan
- A. M. White.

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on
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VOLUME I,
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INTRODUCTION

The advanced Space Transportation System (STS) under development by NASA, based upon a reusable Shuttle orbiter vehicle, upper propulsion stages and a reusable Spacelab, will significantly change the worldwide character of spaceflight operations in the 1980's. The introduction of the Space Shuttle will initiate a new era of space use and space users. The planned use of the STS by NASA and the DoD is a continuation and expansion of space research and defense missions. The potential use of the STS by users other than NASA and DoD represents a user community which can be projected as extensive and worldwide but, as yet, not delineated accurately or developed. The planned use of the STS, as reflected in NASA's 1973 Payload Model, shows that only approximately 18% of the total payloads likely to be flown are non-NASA/non-DoD. In general, it is believed that the projections of STS users, other than NASA and DoD, are probably conservative. This is felt to be especially true relative to domestic industry and other U.S. government agencies. In recognition of this, the overall objective of NASA's STS New User Development (NUD) Program is to obtain new users other than NASA and DoD in order to maximize the use of the STS. A major premise of the objective of the STS NUD Program is that a passive user development strategy, which assumes that the new users of the STS will come to NASA, will not be successful. The uniqueness

of the STS, in terms of its broad capabilities, services, and benefits to a wide spectrum of new user communities, requires an active user development approach to stimulate the interest of these users.

NASA, in 1973, initiated Phase I of its STS NUD Program by funding four separate contractor studies* to develop techniques and methodologies for identifying new uses and new users in the educational, industrial, and international sectors, and U.S. Government agencies other than NASA and DoD. Each study, therefore, addressed a separate sector of the total new user community, identifying inherent and historical barriers to marketing and recommending appropriate methods which could be used to develop the users. The conclusions and recommendations of those studies were used as a base for the beginning of the Phase II study.

The purpose of the Phase II study was to define what is required for a NASA user development activity and the tools/aids needed for the user community development. The specific objective of the Phase II STS NUD Program, which has been undertaken by Battelle's Columbus Laboratories (BCL), was to develop an Implementation Plan and attendant informational material which may be used by NASA or its contractors in subsequent phases of the STS NUD Program. The BCL study effort has been carried out over a period of 9 months with a funding level of \$130,000. This final report documents and summarizes the results and recommendations of the Phase II study. This volume provides an Executive Summary of the final report.

It has been recognized that there are striking similarities between the problems of obtaining new users for the STS and those facing industry in marketing its services and products. It should, in fact, be noted that the term "marketing" has been used in conjunction with "user development", throughout the study in presentations and reports, in the test cases conducted, and in the final report. While there are significant similarities between STS user development and industry marketing, it is appreciated that the uniqueness and broadness of the "product" in the STS case dictate key differences in marketing the STS. The study, therefore, has attempted to develop new, innovative market approaches in conjunction with tried and proven techniques. Some of the unique product characteristics of the STS and projected problems associated with the user community development include the following:

* Battelle's Columbus Laboratories (Contract No. NAS8-30529).
Stanford Research Institute (Contract No. NAS8-30533).
University of Alabama at Huntsville (Contract No. NAS8-30737).
A. D. Little (Contract No. NAS8-30739).
Integrated Report, Stanford Research Institute (Contract No. NAS8-30737).

- The product to be marketed is STS services, which will provide routine, easy access to the space environment. The basic service will include broad ground operations, payload delivery, on-orbit service, mission support and post-flight services.
- The STS and its utility are unknown to many potential users. Relevant uses and benefits of the STS will not be readily apparent to these users.
- Effective matching of technically feasible and economically beneficial uses of STS to a user's need will be required. Hard data (flight demonstrated) will be desirable.
- Availability of STS (operational capability) is long term (1980's).
- STS represents a replacement (an elimination of an option) of current space launch vehicles to current space users. Impact on cost and service (business risk) must be shown.
- Projected lower launch costs are based upon the user sharing the mission with other payloads. Multiple payloads and user sharing of STS introduce concern to a user (integration complexities, risk and liabilities, interference/contamination, etc.).
- Some high potential user communities (related to space processing) will be primarily interested as a process level (e.g., crystal growth) and secondarily interested in Spacelab and Shuttle, in that order.

Accordingly, the broad capabilities and services to be offered by the STS will potentially be of interest and benefit to a wide spectrum of users. These users will range from those already involved in space operations to those unaware of space benefits, let alone the applications of the STS. Thus, the introduction of a new era in space transportation must be marketed as a replacement and as an enhancement (lower cost, more frequent and easy access to space, flexibility in mission operations, etc.) to space users already in the space business (communications, Earth observations, weather, etc.) who are

currently using other space launch vehicles. To the "new to space" users, the benefits of space technology (crystal growth, biological processing, etc.) is the primary product to be marketed, with a correlation shown to using the STS as an economical mechanism for implementing an economically viable space operation. Also, the categories of users will include those who directly interface with the orbiter or upper stages as a payload carrier, those interfacing with a space processing furnace or LDEF experiment tray, and those who are interested in space-derived data. User organizations will conceivably include government agencies, regional centers, industry organizations, industrial organizations, consortiums, educational institutions and space brokers. The study conducted by BCL had to consider and address all of the above as a universe of STS use and potential users.

STUDY APPROACH

The study approach that was followed is shown in Figure 1. As can be seen, the approach includes three major, sequential tasks. Volume II of this final report describes the objective, procedure, and results of each task and subtask. A major output of the study was the Implementation Plan, which is described in Volume III. The tools/aids recommended for the NUD representative complete the major outputs of the study and are described in Volume IV - Guidance/Instructions for Representatives, and Volume V - Informational Materials. The approach to user development, reflected in the Implementation Plan, and the attendant informational material to be used were evaluated by conducting a series of test cases with selected user organizations. These test case organizations were, in effect, used as consultants to evaluate the effectiveness, the needs, the completeness and the adequacy of the user development approach and information material. The selection of the test cases provided a variety of potential STS users covering industry, other government agencies, and the educational sector. The test cases covered various use areas and provided a mix of user organization types (consortium, space broker, industrial company, research laboratory, university, government agency, and regional agency research center). A summary of the actual test cases conducted is shown in Table 1. The conduct of the test cases verified the general approach of the Implementation Plan, the validity of the user development strategy prepared for each test case organization, the accuracy of entry point selection in the test case organization and the effectiveness of the STS basic and user customized informational material.

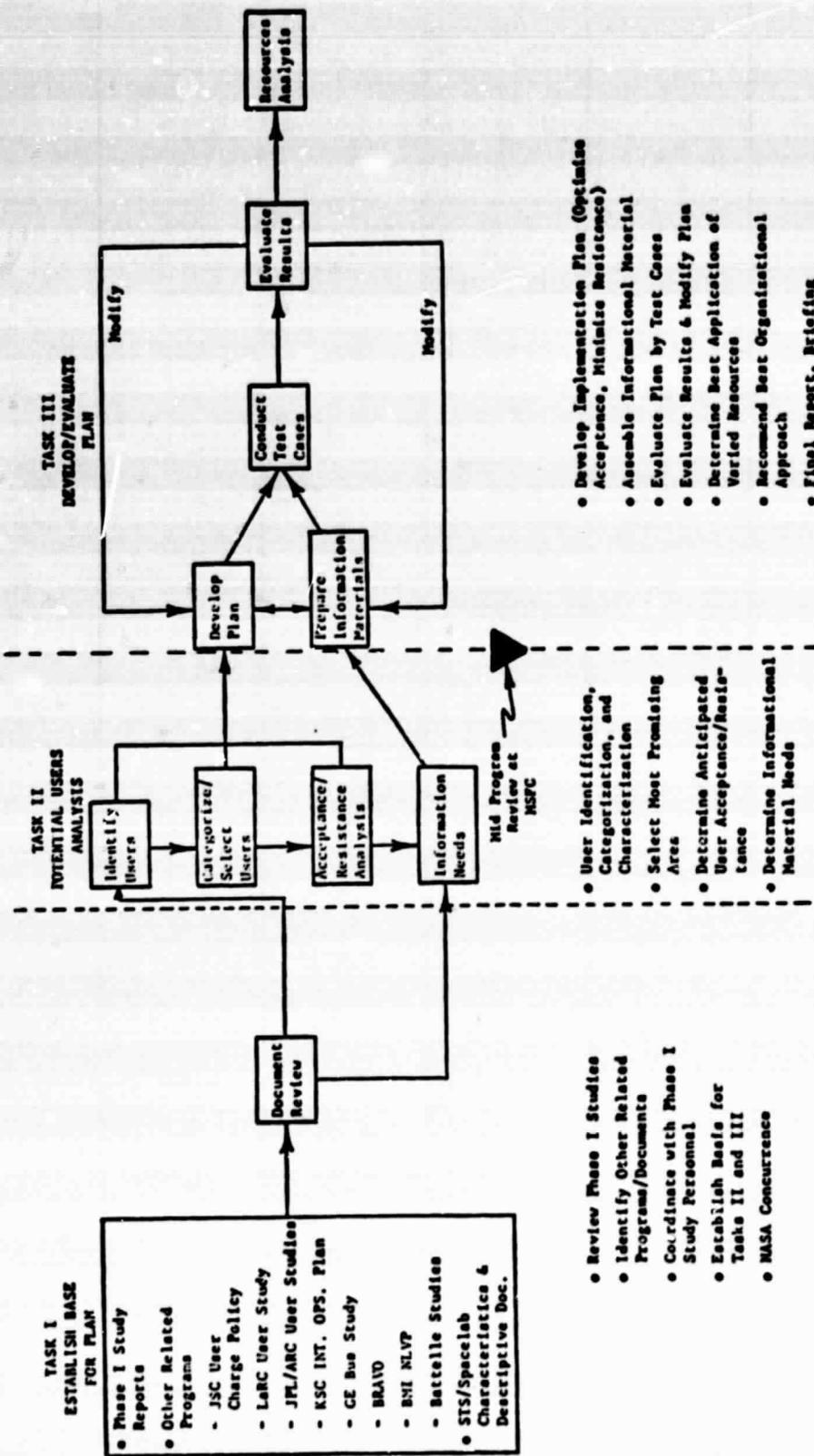


FIGURE 1. NEW USER DEVELOPMENT PROGRAM TECHNICAL APPROACH

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TABLE 1. STS NUD TEST CASE SUMMARY

TEST CASE ORGANIZATION	LOCATION	DATE	BCL-NUD REPORT	USER TYPE	USER COMMUNITY	STS APPLICATION OF INTEREST
Department of Transportation - Systems Development and Technology	Washington, D. C.	1/23/76	NT-76-2	Government Agency - Headquarters	Earth observations, weather, communications, navigation	Multi discipline - satellite/Specalab
Public Service Satellite Consortium	Washington, D. C.	1/30/76	NT-76-3	Consortium	Telecommunications	Educational use of satellite/Specalab
Department of Interior - United States Geological Surveys	Menlo Park, California	2/4/76	NT-76-5	Government Agency Regional Center	Remote Sensing, communications	Research support - satellite/Specalab
Earth/Space	Palo Alto, Calif.	2/5/76	NT-76-4	Space broker	Potentially all	All
Fairchild Camera and Instrument Corporation	Mountain View, California	2/5/76	NT-76-6	Private company	Semiconductor Industry	Space processing - electronic materials
Texas Instruments	Dallas, Texas	2/10/76	NT-76-7	Private company	Semiconductor Industry	Space processing - electronic materials
Merck, Sharp and Dohme	Rahway, New Jersey	2/25/76	NT-76-8	Private company - research labs	Pharmaceutical Industry	Space processing - biological applications
Warner Lambert (Parke-Davis)	Detroit, Michigan	2/27/76	NT-76-9	Private company - research labs	Pharmaceutical Industry	Space processing - biological applications
RUS Corporation	Washington, D. C.	2/19/76	NT-76-11	Private engineering and consultant firm	Utilities	Remote Sensing - environmental impact assessment
RJA Astro/Electronics	Princeton, New Jersey	3/10/76	NT-76-12	Private company	Space communications	Spectral, ana- facturer
Western Union	Upper Saddle River, New Jersey	3/11/76	NT-76-13	Private company	Space communications	System operator
Ohio State University Research Foundation	Columbus, Ohio	3/15/76	NT-76-14	University	Education	Space research, space education, Specalab

* No formal presentation was made. Informal meeting was substituted.

STUDY RESULTS

The Implementation Plan

The Implementation Plan presents a methodology for developing new users for STS other than NASA and DoD, thereby maximizing the use of the STS system. The plan involves a complex market development task, which must promote a unique capability (STS) in an evolving space technology environment to a potentially broad, diverse user community. The status of technological development in potential STS use areas ranges from demonstrated technologies and commercially operated systems to concepts which have not yet been developed. The varying needs, opportunities and constraints of the user community are as diverse as the community itself; ranging from large, sophisticated international consortiums already participating in space, to less sophisticated industrial firms that may eventually benefit from the capabilities offered by STS, to various government agencies and the academic community. Other than broad use areas of space enhanced or newly opened by STS capabilities, specific end uses have generally not been characterized. Similarly, though a good deal of thought has been given to the total spectrum of possible users of STS, and certain obvious end users have already been identified, the total market is still largely undefined; and relatively little planning has been directed at developing the full potential of the non-NASA/non-DoD user community, especially in those areas of technology somewhat removed from current space use (e.g., materials processing).

The new user development process, therefore, is a function of both the state of technology in a given use area and the sophistication of the user in space involvement and is additionally constrained by the various acceptance/resistance criteria in the user market. Because of the broad spectrum of use areas, wide divergence in user space sophistication, and different acceptance/resistance criteria in the different markets, the requirements of the development process are distinct for each individual case, thus dictating a customized strategy for developing each separate user. The development activity will be paced by (1) the potential users' ability to absorb information and generate internal responses leading to concepts for STS use, and (2) the ability of NASA to respond with meaningful information inputs and become aware of the real needs of the user. The importance of NASA's responsiveness cannot be overemphasized.

New User Development Functional Overview

An analogy can be drawn between the function of product marketing and sales in industry and the required function of the new user development activity for the STS. Figure 2 shows that analogy and indicates how product marketing in industry serves as the mechanism for achieving customer interest and sales for products developed within the marketing company. The product marketing function must know the product, know the customer, develop sales strategy, prepare/implement a sales campaign, obtain customer sales and, subsequently, coordinate customer response/new ideas back to the product developers for potential product improvement and new products.

Similarly, as Figure 2 shows, the STS NUD function will serve as NASA's mechanism for actively achieving new user awareness, interest and ultimate commitment to use the STS service for a space use. The achievement of the objective of the STS NUD, analogous to the objective of an industrial firm's product marketing function, cannot be effectively accomplished in a vacuum. The STS NUD operation must coordinate closely with the NASA space use research/development areas and with the STS development/operations areas to achieve a continuing awareness of the current and potential space use and STS capabilities. This will provide the STS NUD function with the needed knowledge of the product.

Of equal importance, the STS NUD function must know the potential new user communities and be sensitive to the user needs, problems and methods of operation. Appropriate market research and analysis by the STS NUD function will identify high potential STS use areas, user communities and specific user organizations/agencies for STS user development. The STS NUD function, similar to product marketing in industry, will then determine the required strategy for developing the potential new user, prepare appropriate informational material to be used and implement the active development of the user. The full exploitation of the STS capabilities and benefits to these users will be realized by the subsequent NASA response and support of the user as he moves from initial interest to a use consideration, new idea generation, evaluation and, finally, a commitment to use the STS. The new innovative ideas for STS use and potential improvements in STS services will evolve from effective coordination of user ideas, needs and problems by the STS NUD function back to the STS operations and space use development areas in NASA.

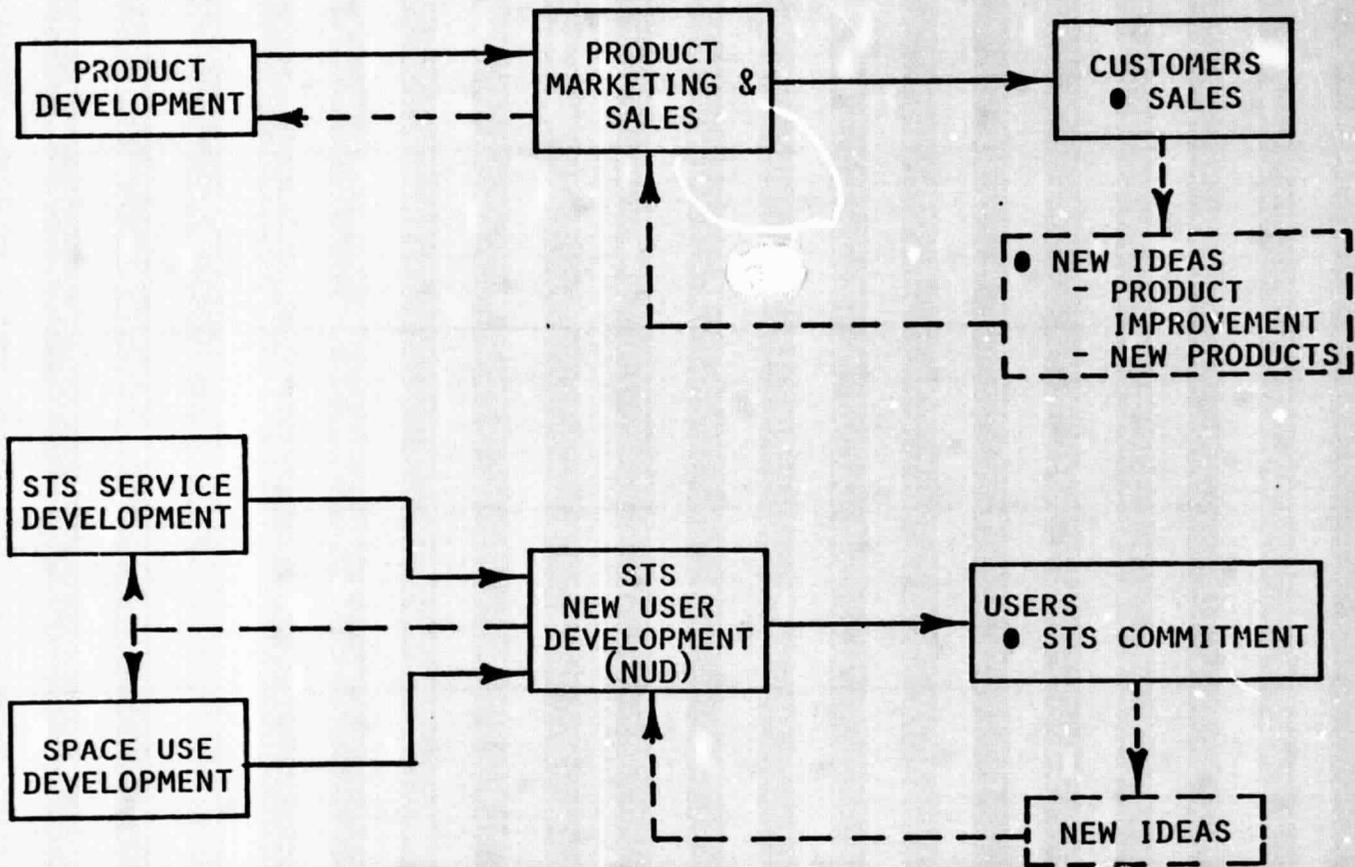


FIGURE 2. INDUSTRY MARKETING/STS NEW USER DEVELOPMENT ANALOGY

The Implementation Plan for the STS NUD Program is based on the establishment of a STS service/space use marketing functional operation as shown in Figure 3. The relationships and interactions between the NUD function and several other supporting activities outside the NUD function are shown. The overall operation of the program can be described as an effort to achieve initial user interest and subsequent idea generation within the potential user organization, leading to a commitment by the user to use the STS. A specific user development plan is generated for each potential user which reflects the user's needs and overcomes major obstacles to utilization of STS. Throughout the user development process, which is necessarily dynamic and iterative, the potential user is supported by the NUD team and other NASA offices. Information is supplied and feedback on barriers/opportunities is channeled into the NUD program. As shown in Figure 3, the NUD program consists of four major functional components: STS/NUD Administration, Technology Management, Market Research, and User Development.

Administration Function. The STS/NUD Administration Function determines and administers STS NUD policy and serves as the focal point for supplying the user community with STS operations data, informational material, legal and contractual arrangements, and policy decisions arising from the development activity. This function is actively involved in review of STS capabilities, availability of the STS to the non/NASA-non/DoD community, and evolving user charge policy and terms and conditions of use. The office not only disseminates these policies within the new user program but also channels key marketing information on the policies back into other responsible elements within NASA. The STS/NUD Administration function is a primary link to the STS Operations Office, and serves to coordinate missions operations data with the new user development effort.

Technology Management Function. The Technology Management function has primary responsibility for coordinating technical information flow to the user development activity, and providing technical support as the potential end user requires. A sensitivity is also maintained to marketing opportunities that can be influenced by technical development so that information flows into the technical components of NASA for use in planning future research and development programs to take advantage of market needs. This function is a major link with NASA ongoing R&D, current programs, use area planning, and support studies.

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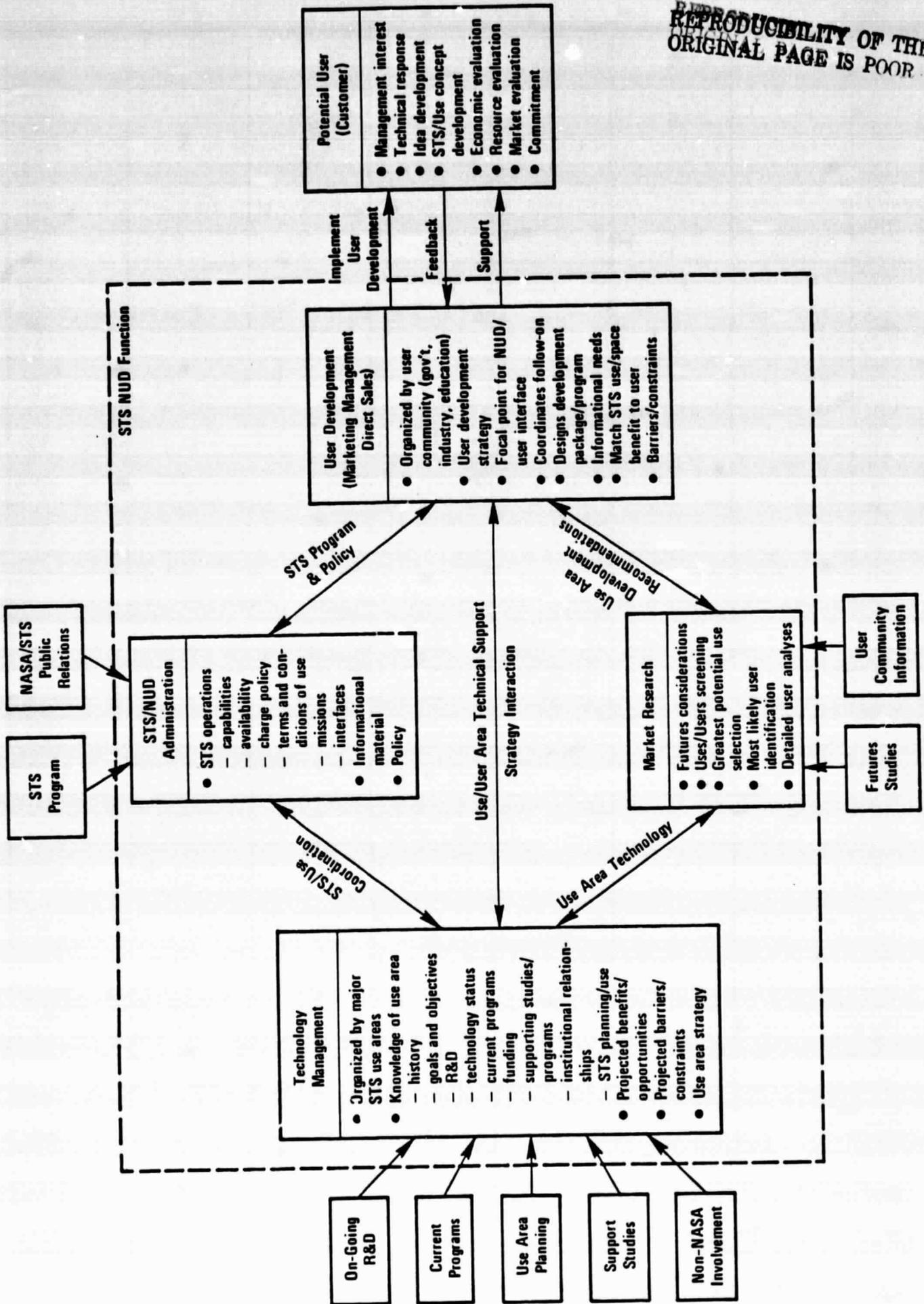


FIGURE 3. STS/NEW USER DEVELOPMENT PLAN

Primarily, this function is organized by STS use areas; for example by telecommunications, Earth resources, or one of the major divisions of space processing such as biological materials. The activities can be viewed as a program effort to develop the particular use area as it relates to specific market opportunities. The Technology Management component is responsible for supplying the user development activity with historical material on the use area, technological status, R&D programs and objectives, related programs, supporting studies, and institutional relationships.

Market Research Function. The Market Research function is responsible for selection of the highest potential use areas for the STS, analysis of the potential user community, most likely user identification, and detailed analysis of the specific user and STS application. Drawing on the user community for information and familiar with marketing evaluation techniques, this function interacts with the Technology Management component to screen potential use areas for technical and marketing viability. At any point in time, a priority list is generated which indicates the order of importance of STS use areas with respect to technical and marketing considerations. For any particular highly viable use area, the user community directly and indirectly related to the use area is determined and key companies/agencies selected for development. The market research function develops a profile of the user community, which determines interrelationships between the various elements, markets, financial conditions and other significant factors. Level of current involvement in space is determined and recognition is given to key barriers and opportunities. This background is supplied to the Development Function for use in strategy formulation. The specific companies/agencies of importance to the use area are analyzed in detail. A profile of products and markets, financial data, technical and R&D orientation, organization, and specific problems and opportunities is constructed. Specific applications of the use area to known needs and problem areas are outlined. The Market Research function is also responsible for cost/benefit or business analysis of the specific application of STS. The Market Research function also assesses future market conditions with respect to known and developing applications of STS, and highlights areas of market need that warrant technical development. This future analysis activity makes long range projections and performs technological forecasting.

User Development Function. The User Development function is the primary interface between the potential user and the STS New User Development Program. Organized by user community (e.g., specific segments of government, or industry), the User Development function is familiar with the major barriers and opportunities inherent in the market sector relative to interfacing with the NASA/NUD program. Specific marketing strategy is formulated drawing on the detailed user community analysis, detailed customer analysis, and technology summaries generated in the Market Research function and Technology Management function. A specific user development plan is required for each potential user which reflects the user's need, STS benefit and the user organization. The planned approach to the user will reflect a user development strategy dictated by:

- Projected STS use area (e.g., weather and climate, Earth resources, space processing, communications, etc.)
- User involvement in space (COMSAT versus a pharmaceutical company)
- Technology status (space communications versus space processing)
- STS use/service distribution structure
- Specific user organization (company versus consortium)
- User community (government agency, industry, educational sector)
- Preliminary assessment of STS benefit to user's needs.

Informational materials for potential users are assembled with the assistance of the STS/NUD Administration function.

Baseline information will include: (1) an overview of the STS and related information on flight rates, user charge and terms and conditions of use; (2) a film on Shuttle and Spacelab such as was prepared by editing/splicing and combining a Rockwell International film and an ESA film to use in conjunction with the test cases; and (3) a data brochure package of STS material to provide additional overview and detailed data to the potential user. Customized informational material will also be prepared to specifically address the unique information needs of a selected prospective user. This information package will be designed to recognize the user's projected use of space/STS and potential economic benefits. A summary of the applicable technology and research status will be included, as well as material on the element of the STS the user will most likely interface with.

The correct entry level for initial contact with the particular organization will be determined. After the initial meeting with the prospective user, the primary responsibility of the User Development activity will involve continuing coordination of communication between NASA and the potential user in technical and business areas to ensure continued interest and development, ultimately leading to a commitment by the user to use the STS.

Implementing the New User Development Program

Broadly, the implementation plan, operating within the functional framework described, addresses three specific problem areas:

- (1) With all the possible use areas and end users, how can the most viable use areas and users be meaningfully determined, so that detailed attention can be focused on those segments of highest potential?
- (2) What information is needed about a high potential use area and the related companies and agencies in the use area who are likely to be users of STS, and how is this information obtained and organized for inputs to development strategy?
- (3) What is the content of a development strategy for a potential user organization and how is that strategy implemented?

The implementation plan, therefore, defines activities which will be implemented to satisfy the above problem areas: (1) Selection of High Potential Use Areas and Users, (2) Detailed Analysis and Marketing Research, and (3) Strategy Development and Implementation.

Selection of High Potential Use Areas and Users. The screening and ranking procedure developed as part of study Task II and presented in detail in Volume II of this final report, illustrates a methodology for identifying, in a cost-effective and realistic manner, those specific uses and users of Shuttle with high potential for development. The objective of the methodology is not to create a rigorous system for analysis, but to bring together the most current and accurate information on any use area in an organized manner so as to allow some degree of comparison of potential for development among the multitude of possible use areas. The criteria used to "screen" and "rank" use areas are judgmental, that is, dependent on the inputs of technical experts in each use area and individuals familiar with particular markets.

The criteria are also time-dependent variables, so that the ranking of high potential candidates is a dynamic function. The end result of the screening and ranking process, which is shown in Figure 4, is a tabulation of likely use areas for development in approximate order of importance. In addition, an outline of the process to be subsequently followed to identify a listing of the major companies and agencies connected with the use area is shown.

Detailed Analysis and Marketing Research. Market research and detailed analyses will be required to develop detailed information (profiles) on the high potential use areas, user communities and specific companies/agencies. The planned analyses are shown in Table 2.

The high potential use area technical summary is a key input to the marketing analysis and the development effort itself. Stated in a level of detail appropriate for management review (as opposed to scientific rigor), the technical summary presents status of technical development. Detailed scientific information is kept to a minimum, though major points must have scientific credibility with persons active in the field.

With a basic understanding of the use area technology and the opportunities as well as limitations imposed, together with a summary of the technology development effort to date and a planned technological approach, a marketing analysis of the user community is initiated. The companies/agencies related directly and indirectly to the use area are determined, and the interrelationships of the user community outlined. The community is characterized as to their application of high technology, involvement in space, and prior participation in NASA programs. Major trade organizations or technical/scientific organizations are determined and their roles identified. Key problem areas specific to various industry/agency groups are then determined for input to the development process.

Once the user community has been profiled, barriers analyzed, and likely specific companies/agencies determined for actual development, a detailed analysis of each specific company/agency is required to provide the data base for the strategist to use in determining: (1) what firms and agencies to see, and (2) what to discuss so as to maximize the probability of continuing development after the initial contact. Specifically, the following information is developed:

- Company/agency profile - including organizations and products and markets, financial data, technical or R&D orientation, specific problems and opportunities

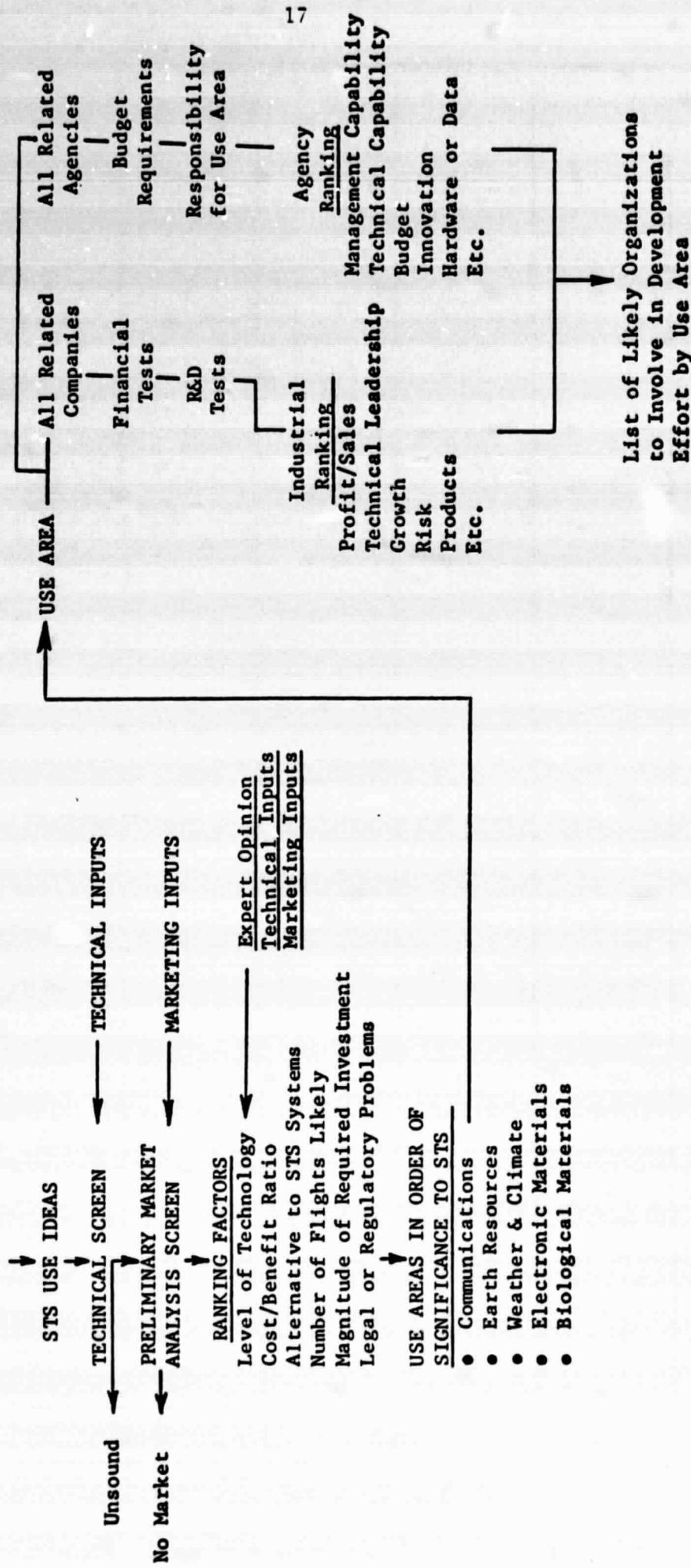


FIGURE 4. SCREENING AND RANKING METHODOLOGY

TABLE 2. DETAILED ANALYSIS

Use Area Summary Technical Assessment	User Community Market Analysis	Specific Companies Market Analysis
<ul style="list-style-type: none"> ● Description of technology <ul style="list-style-type: none"> - Principals of operation - Capabilities of potential application - Limitations ● Relationship to existing methods <ul style="list-style-type: none"> - Results possible in non-space environment - Possibility of non-Shuttle transportation - Why is Shuttle/space cheaper, better, more efficient ● Status of technical development <ul style="list-style-type: none"> - Summary of all related work to date by NASA and others - Outline of planned development effort: <ul style="list-style-type: none"> ● what ● when ● by whom - Anticipated costs - Major obstacles 	<ul style="list-style-type: none"> ● Companies/agencies related to use area <ul style="list-style-type: none"> - Companies, agencies, trade organizations - Structure of community - Markets - Financial - Significant factors ● Level of current involvement <ul style="list-style-type: none"> - In related technology - In space - Prior involvement with NASA in the Shuttle use area ● Recognition of key problem areas <ul style="list-style-type: none"> - General to industry/government - Specific to industry/agency 	<ul style="list-style-type: none"> ● Company/agency profile <ul style="list-style-type: none"> - Products and markets - Financial Data - Technical or R&D orientation - Specific problems and opportunities ● Match of specific application of use area to known needs and problem areas ● Cost/benefit of specific application of STS to specific company/market

- Match of specific application of use area to known needs and problem areas
- Cost/benefit of specific application to specific market.

Strategy Development and Implementation. Strategy development primarily consists of the determination of a strategic user development plan, including an appropriate information package, for a particular user and determination of the key interface within the prospective organization (the proper level of entry). Basically, an approach is determined that will involve all key elements of the user community at the proper time, treating the interests of each element as a separate case. The function, therefore, addresses two major activities:

- (1) Development of a strategic plan and an information package specific to a potential user, and designed to minimize known barriers and maximize opportunity for involvement in STS
- (2) Implementation of the strategy by an initial contact with the potential user and coordination of follow-on activities to minimize barriers and maximize opportunities as the development process is carried out.

The resultant strategic user development plan for each prospective user reflects at least the following elements.

- The projected STS use area in which the prospective user will be interested (Earth resources, space communications, space processing, etc.)
- The specific match of STS benefit to the user needs or product area (use of Spacelab for space satellite development as a commercial venture, use of electrophoretic separator for space separation of isoenzymes, etc.)
- The specific STS payload carrier of interest as an interface to the user (orbiter pressurized compartment, orbiter bay with attachment points or spin table, IUS, Spacelab space processing furnace, LDEF experiment tray, etc.)
- User involvement in space (from no involvement to currently operating a space communication system)

- Status of technology involved in projected user's interest area (from satellites for space communications to silicon ribbon growth or electrophoretic separation in space processing)
- Role of user organization in user community (spacecraft operator, spacecraft manufacturer, data user, product marketer, representative of a collection of users, etc.)
- Type of user organization (government agency, regional center, research laboratory, industrial organization, consortium, broker, trade association, educational institute, etc.).

Barriers which must also be addressed include not only those unique to the specific company or agency, but also (1) those inherent in the level of sophistication of the user regarding space, and (2) those related particularly to industry and government. Once the profile of the user community and the specific company/agency has been assembled, and key barriers addressed, an information package can be assembled.

Key to the STS New User Development Program is actually interfacing with the prospective user once preparation preceding the first call has been completed, and the informational material developed. The dynamic, iterative exchange of information between the developing user and the NUD program is a vital part of the development activity. In developing the non-NASA/non-DoD market for STS, this proactive user development strategy is essential. Initially, interest is gained and enthusiasm generated in management level personnel in an organization, eventually resulting in direct "idea generation" and specific use/mission discussions with research and development personnel. The stimulation of innovative, new ideas from those user individuals who can relate their needs to STS capabilities and services will determine the success of user development. The entry point and path, within a prospective user organization/agency, to get to that creative group must involve a carefully planned contact and cultivation through the appropriate management and financial levels to achieve acceptance, interest, and enthusiasm at those levels. The thrust of the actual user development will be initiated with an initial management level contact accompanied by adequate informational material and background assessment to achieve the interest and a follow-on commitment to a technical working session with the user's technical personnel. The NUD operation will be

responsive to the necessary support of the user's new idea generation working sessions or plans to use a STS service and the feedback resulting from these sessions. A final user commitment to using the STS will be the ultimate objective of the user development strategy.

The success of the prospective user contact and the implementation of the user development strategy falls on the NUD representative and how well he is prepared. Following sections of this volume, therefore, describe the guidance/instructions as to what a representative needs to know about a prospective user and the informational materials he should provide when calling on a potential user.

Guidance/Instructions for Representatives

General Guidance

The burden of actually developing the prospective user falls on the NUD representative, and the success of his user contact will depend upon how well he is prepared to interface with the user. The guidance/instructions for a NUD representative include what he needs to know about the prospective user and the type of data he should provide when calling on a potential user. The informational material which should be provided to a user is described in the next section of this volume.

The guidelines, instructions and data needed by the NUD representative can be identified as those which are generally applicable to the overall objective of developing new users for the STS, supplemented by information uniquely required for developing each specific new user. The understanding and application of the guidance/instructions must be within the total market research and user development strategy functions performed by the NUD organization. In addition, the representative should be aware of the following guidance as it relates to his activities prior to, during, and subsequent to his call on the user organization:

- Do your homework
 - Be aware why the use area being developed has been selected as a high potential to STS
 - Understand the specific match of STS capability or service to the user's need (what part of the STS is being promoted?)
 - Know why the user should be interested (technical and economic benefit)

- - Be familiar with the cost benefit, economic assessment and market projections made for the user's case
- Know the applicable technology history and status
- Know the user, be familiar with the user organization's financial and business profile or agency profile
- Understand the entry point being made at the user's organization (why it was selected and role in authority chain)
- Be familiar with the general acceptance/resistance to be anticipated from the user community (user community profile)
- Assure that informational material is tailored to user
 - Participate in development of the strategy and preparation of the user presentation and informational material
- Make the presentation to the user and listen
 - The user contact must involve an exchange of information and ideas
- Be prepared for follow-up
 - Be responsive to user ideas, questions, need for more data
 - Be capable of providing or coordinating technical backup (research history/results/status)
 - Be able to identify and implement next step.

Information a Representative Needs About a Prospective User

A profile of a potential new user can be prepared to summarize the information needed by the representative. This information will be directly related to understanding why and how the STS can benefit the user's needs, why the user organization qualifies as a potential STS user and the factors which will tend to influence acceptance or resistance to the representative's call.

The information needed about a user organization should first of all include a general, broad understanding of the user community in which the prospective user is. This information will include the following:

- Structure of the community - major industry groups or government agencies which are considered a part of the community
- Markets served or local/national needs served

- Research and development history, status and trends
- Applied, fundamental, operations research breakdown
- Involvement in space or related technology programs
- A summarization of status, concerns and potential role of the community as to the future use or impact of the STS.

An example of this last mentioned category of information could be applied to the space communication operations community. First it would be recognized that the community is made up of both systems operations organizations (INTELSAT, COMSAT, American Satellite Corporation, Global Satellite, Inc., Western Union, Satellite Business Services, etc.) and spacecraft manufacturers (RCA Astro/Electronics, Hughes, TRW, GE, Aeronutronic-Ford, etc.). The profile of the community, as a whole, would clearly point out that they, collectively, are very much concerned over the substitution of a new space launch system over which they have little control, little input to and limited options. The overall relative competitiveness (cost, availability, ease of access, etc.) of the STS to the current expendable launch vehicle (ELV) and assurance of smooth transitioning (both design and operations) from the ELVs to STS are issues. The past, present and future influence and regulatory controls of government agencies (such as the FCC) should be identified. Primarily then, the community is concerned about the business risk of committing to the STS and the projected effect upon their present service and cost.

The user community information will provide a background for the information needed about a specific prospective user. Again, as an example, within the space communication community a specific profile could be made up on Western Union or a spacecraft manufacturer (Hughes). The WESTAR involvement of Western Union, the type of service they provide by FCC regulation, their business operations policy of "procuring everything" and their past experience with and views of NASA should be described. In the case of a specific manufacturer of spacecraft, information relating to their past designs, expertise, and actual satellites sold and operational should be specified. It should be recognized by the NUD representative that, at the present time, the major burden of what to do about STS lies with the spacecraft manufacturers. The business decisions of what redesigns or new designs to undertake and the timing of such actions have to be made in terms of what costs can be passed on to the space system operators and how much of a market can be captured.

The above described user community/user organizational general profiles can be applied to any potential user community and organization or government agency. The makeup of an agency, such as the Department of Interior and the specific user (United States Geological Survey) can be treated similarly. The areas of research covered, problems being addressed, regional center responsibilities, all are included in needed information.

A major part of the information needed about a prospective user is of a business/financial nature. Budget allocations, how and when dispersed, approval of new projects chain, etc., can be delineated for a government agency. A simplified, but adequate, business profile of an industrial organization should be provided.

In addition to the resistance/acceptance associated with users who are involved to various degrees in space programs, unique factors of resistance can be associated with the industry sector and with non-NASA/non-DoD domestic government agencies and with the user's views regarding the competitiveness of the STS.

Industry. One of the major areas of resistance to a NUD representative interacting with industry can be associated with the basic difference in objectives between industry and government (NASA in this case). While NASA strives to serve the best interests of the public, industry must serve the best interests of its stockholders. This represents an emphasis on technical as opposed to economic considerations. Industry will, therefore, be very sensitive to the economics of space involvement and the STS application, and to terms and conditions of use. STS policy on proprietary rights, confidentiality of research/information, allocation of risks/liability, and assurance of access to STS services will have a significant influence on resistance/acceptance.

Also, industry over the years has developed an inherent mistrust and resistance to business involvement with the government. Some of the mistrust is unfair and not based on real situations, but on the other hand the image of government red tape, control policies, budget constraints, etc., contribute to industry resistance. Regulations and anti-trust policies on the pharmaceutical industry have alienated that industry relative to working with another government agency (even NASA). Additionally, just the complexity of dealing with a complex operation, such as STS, will be a deterrent to industry involvement.

Domestic Government Agencies. Most of the resistance anticipated with industry, which is based upon dealing with any government agency, will not be experienced in NUD contacts with non-NASA/non-DoD government agencies. Other government agencies are appreciative of governmental control and business policies, objectives, etc. Other government agencies may resist a NASA approach that doesn't identify NASA as only a partner in the STS application to the problem facing the potential user agency, which leaves the direction and responsibility for the overall problem-solving program with the potential user. Interagency feelings on charter responsibilities, budget allocations, prestige and Congressional backing, etc., represent barriers to developing the STS user in other government agencies. Resistance to dealing with NASA may be influenced (more or less) by agencies which have had previous program involvement with NASA. Sensitivities to STS launch costs and charge policy will be just as real (considering budget constraints) as commercial user's concerns considering profit incentives.

Competitiveness of the STS. A significant factor in the resistance/acceptance of the potential user to a NUD representative will be his awareness and assessment of the competitiveness of the STS. This competitiveness assessment will be of primary concern to the sophisticated space user who must compare STS to current expendable space transportation systems, and will ultimately be of concern to the "yet to use space" user. The STS is being developed as a new capability in space transportation to provide routine, low-cost space operations. With its versatility and reusability features, it is intended as a replacement for the existing expendable launch vehicles at an anticipated equal or lower cost per launch. The STS will have operational benefits, such as on-orbit payload checkout and servicing and payload recovery and return to Earth. Additionally, payload design benefits are anticipated through a relaxation of constraints on payload mass and volume and the ability to service and update payloads in orbit. While all of these cost and operational advantages of the STS may evolve as the STS develops into a mature, routine space transportation system, it can be assumed that the benefits will not fully exist in the early years of operation. This will impact the competitiveness of the STS from the potential user's viewpoint and will affect the user's acceptance of the NUD representative.

Informational Materials (Provided to User)

The effectiveness of the user development function in directly dealing with a prospective user is dependent upon the strategy derived for that specific user and the informational material provided to the user as the strategy is implemented. The informational material to be provided to a user should be considered in three categories. A set of standard or basic information, maintained to reflect current programmatic/operations/mission data, is needed to provide any or all users with the overview of the STS. This information is referred to as the "Basic Information Package". A second category of informational material is needed to specifically address the unique information needs of a selected user. This information is referred to as the "Customized User Information Package". In general, the major marketing call to a new user is made using the Basic and Customized packages. A third category of informational material may be required as a follow-up or response to the feedback from the initial user contact. The program approach to deriving and using the three categories of informational material is shown in Figure 5. The relationship to and influence from other NASA activities and information is also shown.

Basic Information Package

A set of basic information, maintained to reflect current data, is needed to provide an overview of the STS, policy related to its use and charge, mission availabilities, uses and space facilities provided, etc. This basic package will include film, brochures, and presentation material and will be continuously coordinated with NASA public relations activities, use area development programs, and the STS operations. The preparation of the material should have the user needs and interests in mind, primarily. If an analogy can be made, the material should tend to be of a Consumer's Report nature, as compared to hardware specifications. The STS Users Handbook, being developed by NASA/JSC, will be a key part of the basic information package and, by structure, will lead a user to the element of the STS he will interface with

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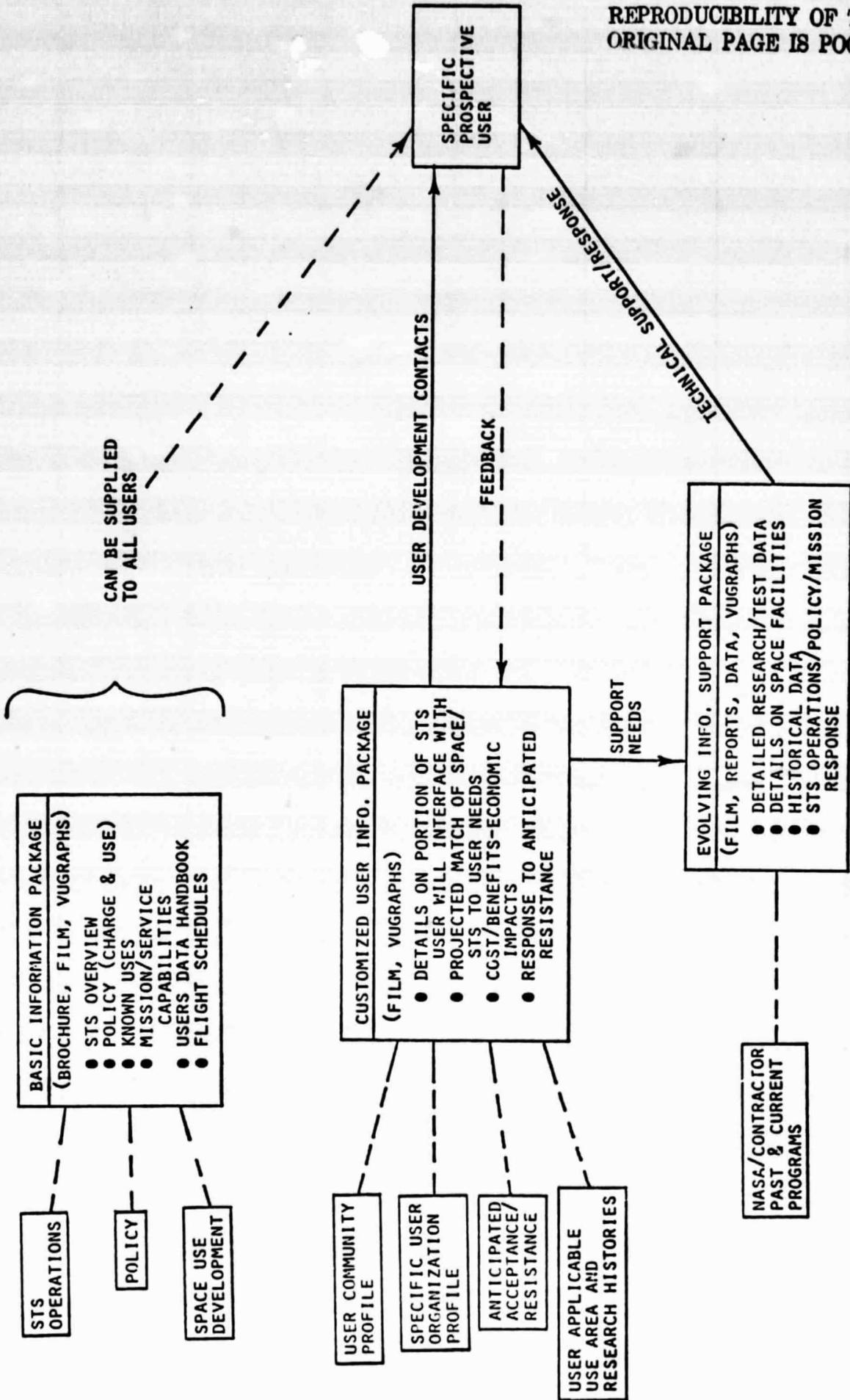


FIGURE 5. STS NUD INFORMATIONAL MATERIALS PROGRAM

and to more detailed design oriented data. In general, the types of information to be covered should include:

- Overview of STS concept/program/missions/physical components
- Summary of planned STS use areas/identified space applications
- Cost per flight
- User charge/sharing policy
- Methods of determining charge/design tradeoffs related to charge
- Terms and conditions of use
- STS planned availability/accessibility
- Method of interfacing with STS (applicable technology and operations)
- STS benefits/constraints
- ELV to STS transition plan
- Means of potential early involvement for user
- Specific follow-on steps
- Informational contacts within NASA.
- Long-range, future space planning (e.g., space station)

It is realized that the basic package may be overdesigned for certain users who are currently involved in space operations. The user development strategy will consider the role of a user and the need for what information and how much should be presented.

The preparation of the Basic Information Package should capitalize on existing material currently used to promote the STS and its elements. Consideration should be given to information from sources such as STS contractors, the European Space Agency, National Space Institute, and all NASA centers. The assembly of the material should be flexible enough to allow for ease in updating and duplicating specific elements of the package.

The Basic Information Package should be designed to be utilized by all STS program areas, NASA's public information office and/or NASA's designated promotional agency for STS. The objective of this information package is to provide an overview of the STS program to as many potential users as possible. This package would be utilized in many different ways and is analogous to a "sales brochure". It should be designed to stimulate the potential user of STS into conceptualizing possible program applications.

Customized User Information Package

The second category of informational material to be provided a user is the "customized data" prepared specifically for a user. A presentation would be designed for a user which recognizes his specific space market role, the projected use of space/STS beneficial to his needs, which element (orbiter, Spacelab, IUS, LDEF, etc.) of the STS he most likely will interface with, some form of economic benefit projections, and a summarization of the applicable technology and research status. This information package can only be developed as a result of significant homework matching a STS service, a space application, and a beneficial economic projection of the user's need. The information must reflect what is known about the user and must coordinate the current research and use area developments within NASA as they apply to the user.

In developing the second major information package, it is important to note that, for any particular potential user of STS, the level of development of the "Customized User Information Package" is directly related to the background and history of the organization's space-related activities. Acceptance of the information presented will depend on the particular barriers and opportunities surrounding the use and the user. The development of this information package will be the responsibility of a team or task force effort involving NUD personnel familiar with the applicable use area, related technology and research programs. They will work together in developing briefing materials and information needs which are pertinent to the specific applications of STS/space that the prospective user is associated with. The objective of this information package is to provide specific answers to anticipated questions and known issues concerning the targeted organization. Demonstrated examples and details of applicable on-going programs will be reported. A review of cost-effective programs similar to the interest of the potential user's use concept will be documented and presented. Special consideration will be given to the uniqueness of the potential user organization and organizational strengths in the industry as outlined in various business profiles. Special attention will be given to providing specialized information on the user's anticipated payload carrier or interface point with STS.

Evolving Information Support Package

Once there has been a general interest demonstrated by the potential user, it will be necessary for the NUD team to prepare and maintain an "Evolving

Information Support Package". The majority of the content of this package will be generated during the development of the second package, "Customized User Information Package". The objective of this information package is to provide continuous technical information, in more detail, in support of the various technical sessions now needed to implement the continuing development of the new user. This information package, then, will provide the follow-up in direct response to problems identified, new ideas, and desire for more detailed data as the user development process evolves.

Informational Material Evaluation by Test Cases

A major part of the Phase II study involved conducting test cases to evaluate informational material, in conjunction with the NUD Implementation Plan. The purpose was to prepare and assemble the material which could be generally supplied to prospective users in the future and, in particular, would be supplied to user organizations contacted as test cases. The general approach to this subtask was to assemble available material from NASA and several contractors to provide the overview of the STS, and to supplement that material by specially prepared presentation material tailored to each test case.

Several brochures and promotional documents were obtained directly from contractors. A Basic Information Package was put together primarily from a Rockwell International Space Division STS promotional package enclosed in a folded jacket. Several documents were added so that the total package included the following:

- "Space Shuttle Transportation System", July 1975, Rockwell International, Public Relations Department
- "Space Shuttle - For Down to Earth Benefits", Rockwell International Space Division
- "Space Shuttle - Model Information", Rockwell International Space Division
- "Space Shuttle - What It Will Do", Rockwell International Space Division
- "Space Shuttle", February 1975, NASA/JSC, U.S. Government Printing Office: 1975 - 671-199/1608

- "Data Guide for Space Processing Applications Payloads - Space Shuttle/Spacelab", TRW Systems Group
- "ESA Spacelab", European Space Agency
- Five 8-1/2" x 11" color photos of Shuttle, Spacelab.

A film on Shuttle and Spacelab was prepared by editing/splicing and combining a Rockwell International film (Film Report No. 5108, "The Space Division") and a European Space Agency (ESA) film. The resultant 12-minute film provided a very informative, effective overview of the STS and the Spacelab and provided credibility by showing orbiter hardware design and manufacture status. Kept current, such a film can be continuously effective. The film should be prepared with minimum contractor promotional material, be informative on current hardware status, and emphasize a theme telling the user what STS can do for them.

A presentation was prepared for each test case. VuGraphs were used for the presentation and copies of the VuGraphs were bound and provided as a handout. The presentation material attempted to present the basic material, standard for each test case, and supplementary material tailored for the specific user. In general, the basic information presented included the following:

- Introductory material on the program background, the Phase II study objectives and methods of approach, and the strategy of the test cases.
- STS - this information (used in conjunction with the film) provided an overview of the STS (and its elements). Mission descriptions, flight rates, terms and conditions of use, charge policy, the STS operations organization, STS uses, and benefits to a user, were included.

Therefore, for the purpose of conducting the test cases, the Basic Information Package consisted of the information brochure, the film, and the STS portion of the presentation.

The remaining portion of the presentation to each test case organization provided the Customized User Information Package. This customized material included an outline of the recommended STS new user development approach and information making the approach applicable to the test case user.

In the case of the semiconductor and pharmaceutical test cases, summary information was provided on the space processing program, process areas being researched, history of flight-demonstrated results, space facilities under design and benefits of the Spacelab. Additionally, information on a specific beneficial space product idea (silicon ribbon growth in space, high specificity separation of isoenzymes) was provided to describe the idea, the flight hardware (free flyer or electrophoretic separator), the market analysis and the economic assessment conducted. Finally, specific opportunities for early involvement of a user were described by summarizing programs such as the space processing sounding rocket program. Where appropriate, copies of the recent Announcement of Opportunity for the sounding rockets were reviewed and left with the user. Copies of a set of typical presentation VuGraphs have been included in Volume II, Appendix C, to provide an example of the test case presentation material.

The test cases, therefore, confirmed the validity and effectiveness of the conceptual approach to the STS NUD information material. Both basic and customized materials were used and were found to be informative, effective and interest-stimulating.

STUDY CONCLUSIONS

This study was successful in developing an overall STS New User Development Implementation Plan and a set of informational material to be used in conjunction with the plan. The Implementation Plan reflects a dynamic, iterative approach to selecting the most promising STS use areas, conducting detailed market research within those use areas, creating a specific strategy for developing a prospective user organization, generating informational material to support that strategy and actively developing the user. The plan and informational materials were evaluated through the use of test cases in which selected test case organizations were used as consultants to establish the effectiveness, the adequacy and the need for the user development strategy and attendant informational material. The test cases were conducted over a broad variety of STS use areas, user communities, and types of user organizations.

Conduct of the test cases was found to be a valid, effective technique for verifying the implementation plan and attendant informational material. The results of the test cases verified the general approach of the implementation plan, the validity of strategy developed for each test case organization, the accuracy of entry point selection in the test case organization and the effectiveness of using STS overview and user customized informational material. Interest in STS and space applications was definitely stimulated in all test cases. The existence of a wide spectrum of potential user categories, with which the NUD function must deal, was established. Additional, more specific, findings included the following:

- User development to a government agency most likely should be initiated at a Headquarters level, compared to a regional center, although prior contacts at a regional center can provide valuable insight into technical research needs.
- Correct entry level for user development in industry is Vice President of R&D and/or the Vice President of Corporate Planning. Middle management contact may be valuable for obtaining information. The ideal contact in government agencies is the senior scientist or similar individual whose recommendations influence the direction of R&D. The chief administrator is not likely to be the correct individual to contact.

- Prior homework (market analysis, user analysis, user development strategy) will have significant payoff in productive user development.
- Use of consortiums such as the Public Service Satellite Consortium (PSSC) and trade associations such as the Pharmaceutical Manufacturers Association (PMA) can be and should be made, as they are effective/accepted coordinating organizations for their respective members.
- The "educational community" will be difficult to delineate as a prospective user community. A feasible role for a university as a purchaser of STS services can be defined and is of potential interest.
- Properly prepared informational material can be very effective in stimulating interest. The use of a short, current information film was well accepted.
- User development for STS must recognize that, in some cases, the interest is at a space process or results level, with Spacelab as a future interest and STS of remote interest. This was especially true of the pharmaceutical companies. Minimum informational material is needed on STS policy, operations, and availability. Most material is needed on space processing.
- Informational needs for existing space users are primarily related to impacts on their costs and services currently being provided. Cost per flight, charge policy, terms and conditions of use, availabilities, etc., are required.
- Knowledge of the Spacelab was found to be lacking with most users. The Spacelab capability and applications as a commercial venture had not been given much thought, but discussions regarding that concept did stimulate thinking of the industrial test case organizations.

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- Cost/effectiveness information presented to a user can, in some situations, be useful. Varying degrees of acceptance was experienced. In general, it is recommended that such projections not be made to potential users in other government agencies, but that it be included in industry user development with some discretion. Where a space application (new to a user) is being presented (e.g., separation of isoenzymes to a pharmaceutical company), then the associated economics analysis and projections will likely be effective in selling the idea or gaining the interest of the user. However, in the case where a product improvement idea (e.g., improvements in integrated circuit "chip" processing by using silicon ribbon growth in space) was presented to the semiconductor companies, the credibility and appropriateness of the economic analysis compromised its effectiveness and acceptance.
- The concept of a space broker must be considered as a potential user type in the future.
- Awareness was lacking of the space processing sounding rocket program as a means (even with NASA funding) of early involvement in research leading to STS applications.
- The concept of NASA/STS new user development must consider:
 - (1) The industry/agency and the environment in which it functions
 - (2) The operating problems, needs, and objectives of the company or agency
 - (3) How the needs can be satisfied, cheaper, better, or whatever, or how a new business in similar markets can come about.

- Development of a particular user of the STS may be a lengthy process requiring significant transfer of information, both to the potential user from NASA and from the potential user to NASA. The interactions must take place in a climate of total sensitivity to the needs of the potential user, and the environment in which the user functions. The development activity will actually be paced by the potential users' ability to absorb information and generate internal responses leading to concepts for STS use. (The development activity also depends on the ability of NASA to respond with meaningful information inputs and become aware of the real needs of the user.)
- Proprietary rights and confidentiality of research are major factors to industrial firms in considering any user development program. In some firms (notably pharmaceutical) the very methodology of research is as proprietary as the end result. High technology, rapidly advancing industries are characterized by high proprietariness (biological, electronic), and these are the very industries most likely to find STS of high value. Within the pharmaceutical industry, there is a significant anti-government sentiment resulting from their relationship with FDA and other regulatory bodies, in addition to the fear of losing control of trade secrets on products and methodology. These organizations may be reluctant to work directly with NASA. The present policy on invention rights and funding options, applicable to the space processing sounding rocket program*, was very germane to the presentations to the pharmaceuticals.
- Beyond a general overview of Shuttle and Spacelab operations which can be provided in a short film to orient a potential user, what is really needed to interest an industrial firm in the STS is actual experimental results that the firm sees as having commercial potential. To a glass manufacturer this could be more pure material. To a pharmaceutical company, it could be a separated component of a complex biological material. To an electronics firm, it could be a new semiconductor. Generally,

* Announcement of Opportunity, Space Processing Rocket Experiment Project, A.O. No. OA-76-02, February 6, 1976.

the firm will need hard technical and cost data from NASA, but will only trust its own internal market and financial analysis before committing funds. The important point is that an industrial firm won't commit funds on experimental concepts, and it will commit only on demonstrated results. The cost of such basic research to demonstrate feasibility will likely have to be borne by NASA as part of the marketing effort.

- It is possible that content and direction of basic research can be guided by working with the academic community and industry groups such as the PMA. It is important, however, that NASA also work with industrial companies who can provide significant inputs to the content and direction of further research in this manner. The problem of immediacy is overcome. Although the STS will not be available for several years, the individual company can become involved now in basic research inputs. If some degree of control does not reside in the end user, the results may not fit the needs of the company and may not be commercialized. These firms will not, in general, fund the research effort until demonstrated results can be shown; but they will very likely work with NASA in outlining research programs, funded by NASA, which will have significant commercial potential if feasibility and practicality can be demonstrated.

The several test cases conducted provided adequate background information to permit formulation of preliminary profiles on some user communities and user organizations. These profiles provide an insight into the issues and concerns of STS potential use as the user views it. The profiles have been included in Volume IV of this final report as typical of information a STS NUD representative should know about users.

RECOMMENDATIONS

The resources of both government and industry can be applied in appropriate degrees of magnitude, timeliness, and effectiveness to achieve the objectives of the STS NUD program.

The obvious approaches to implementing the NUD function would, at one end of the spectrum, have NASA undertake the entire functional/organization responsibility and, at the other end of the spectrum, have NASA utilize an outside organization to undertake the entire functional/organization responsibility. There could be many variations of this latter approach, ranging from a subcontractor arrangement to the creation, probably by legislation, of an independent, regulated monopoly (similar to COMSAT) to conduct the user development task as a commercial venture. Another variation could comprise an initial subcontractor arrangement evolving over time to the COMSAT-like organization. There is no clear-cut, outstanding advantage to any of these approaches and it is obvious that many major, complex issues would have to be addressed prior to a final decision as to which way to go.

It is felt that none of the above approaches should be recommended, at least in the immediate future. First of all, this study has confirmed that the development of non-NASA/non-DoD users of the STS will be a very large, complex undertaking for any agency or organization. Such a development program must be initiated soon if other government agency and industrial interest and use is to be achieved in the 1980's, concurrently with the maturing STS. This dictates an approach which blends the capabilities and experience of both NASA and industry. The Implementation Plan developed in this study stresses the use of industrial marketing techniques and know-how. It is very apparent, however, that marketing of the product (STS) must be directly supported by STS knowledgeable personnel and space use development activities, clearly a function and responsibility NASA must retain in the NUD function. It is also believed that it would be more cost-effective for NASA to obtain the experienced, qualified personnel who will be required to do the market research and user development functions from outside NASA. Referring to Figure 3, it is recommended that NASA establish the overall NUD function as shown, and employ industry resources to accomplish the "Market Research" and "User Development" functions. It is, however, recognized that, where lines of communication already exist between NASA and an agency (i.e., NOAA) or an organization (i.e., COMSAT), it may

prove to be more practical for NASA to be responsible for those specific user developments. The key determining factor would be demonstrated experience in a particular user community and knowledge of a specific agency or organization.