USER COMMUNITY DEVELOPMENT FOR THE SPACE TRANSPORTATION SYSTEM/SPACELAB

OCTOBER 1974

STANFORD RESEARCH INSTITUTE
AT HUNTSVILLE, ALABAMA

STANFORD RESEARCH INSTITUTE
At Huntsville, Alabama

SRI Project
EGU-3033

October 1974

FINAL INTEGRATED REPORT

USER COMMUNITY DEVELOPMENT FOR THE SPACE TRANSPORTATION SYSTEM/SPACELAB

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INTRODUCTION

With the coming of the new Space Transportation System (STS) and the Spacelab, the space age is evolving from puberty to technological and economic maturity. The most significant feature of this new STS/Spacelab system is that the Shuttle Booster, Orbiter, the Spacelab, and Space Tug are reusable and offer cost benefits to users far exceeding those of previous systems. The lower program costs, versatility, and flexibility of the STS/Spacelab will make practicable services and products never before available to the world at a time when they will be needed most.

NASA has recognized, however, that the existence of the STS/Spacelab capability will not necessarily assure its maximum usage by other organizations to solve problems of national, commercial, and international significance. Such use can be assured only by the explicit identification of the user community and its needs along with the benefits and advantages that the STS/Spacelab offer the user community. In addition, the information must be assimilated into the planning processes of industry and government in order to have utility. Similar conclusions have been reached in other programs designed to disseminate information on NASA capabilities (for example, the Technology Utilization Programs).

Accordingly, NASA has previously funded several studies to develop techniques to identify beneficial uses of space. Among the first of these studies were General Electric's Beneficial Uses of Space (BUS) studies[1*] and the Aerospace Corporation's Business Risk and Value Operations in Space (BRAVO) studies.[2] Both sets of studies provided meaningful information on beneficial uses of space. However, it was clear that they did not furnish a systematic method for identifying new users and uses over the lifetime of the STS; additional information was needed to identify and develop the entire user community for the STS/Spacelab. Therefore, a three phase plan has been proposed to furnish such a systematic method, hereafter called the New User Function (NUF). The

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* Superscript numbers refer to the references listed at the end of this report.

three phases are: (1) the development of methodologies for identifying STS/Spacelab uses and users, (2) the implementation of the methodologies, and (3) the operation of the methodologies to develop the user community. The ultimate goal of the proposed plan is to ensure a high level of meaningful use of STS/Spacelab by the non-NASA user community.

The initial step in this plan was taken by awarding four Phase I (methodology development) contracts to: Stanford Research Institute (SRI) - Contract No. NAS8-30533; University of Alabama in Huntsville (UAH) - Contract No. NAS8-30737; A. D. Little (ADL) - Contract No. NAS8-30739; and Battelle's Columbus Laboratories (BCL) - Contract No. NAS8-30529. The SRI study[3] developed a methodology applicable to the entire user community but stressed the development of the domestic government sector (excluding NASA and the Department of Defense (DoD)). The UAH study[4] treated primarily the educational opportunities offered by the STS. The ADL study[5] considered primarily the nontechnical barriers to user development and the international user community. The BCL[6] study dealt with ways to identify uses and users within the domestic commercial/industrial sector. Each study treated a single, important sector of the total user community.

This report serves as an integrated summary of the four Phase I efforts. Specifically, the following pages contain: an identification and short discussion of each of the main subfunctions of the NUF; an identification of some of the more critical issues that must be addressed prior to operation of the NUF; and a brief discussion of some of the opportunities and barriers which will be faced in future development of the user community. These discussions include those findings that bear out the basic need for the NUF, an activity which all four Phase I contractors found currently unsatisfied.

SUMMARY

The integration of the four Phase I studies has yielded a single basic NUF structure which can be used to develop any sector of the total

user community for the STS/Spacelab. The five subfunctions to this NUF are: user development, strategic planning, user analysis, technical development, and futures analysis. Although all five subfunctions are required for a viable NUF, the most critical subfunction is probably that of user development and its most important component is the liaison activity between NASA (or a NASA representative) and a potential user. This interface must be personal, long-term, and, in part, at the policy-making level.

Several critical issues must be addressed by NASA before the NUF described in this report can become operational. Examples of these critical issues are: the funding and manpower commitment by NASA to the NUF, the protection of user proprietary rights, the STS/Spacelab tariff model (costs and conditions for using the STS/Spacelab), and the organizational structure of the NUF.

These critical issues are directly related to some of the barriers which impede the development of the user community. Many of these barriers were explicitly identified in the Phase I studies and grouped into six different types. Barriers common to all user sectors are listed in Table 1. Although all six types are expected in the development of any one user community sector, the specific barriers will differ from one sector to another. For example, image barriers (a type of people barrier) exist in each user sector, but they take different forms as illustrated by the fact that in the domestic Federal Government sector, a non-NASA user views a NASA representative as a competitor for Federal funds; whereas, a domestic private sector user views a NASA representative as a spokesman from an organization (the U.S. Government) that has restricted the ways in which he can do business. Thus, the strategies to be used within the NUF appropriately differ from one user sector to another, even though the basic subfunctions remain unchanged.

In spite of the existence of these barriers, several opportunities for user community development were coincidentally uncovered in the course of the four Phase I studies. Additional opportunities will be identified during operation of the NUF (Phase III).

Table 1

COMMON BARRIERS

- People Barriers
  - Image Barriers (Credibility, Prejudice, Compatibility)
  - Motivation Differences
  - Objectives Differences
  - Special Interest Problems
- Product or Service Barriers
  - Service Need Barriers
  - Complexity Problems
  - Product and Service Compatibility Barriers
- Financial Barriers
  - Cost Barriers (R&D, Purchase, Maintenance, Operating)
- Organizational Barriers

  (Similar to People Barriers but on an organizational level)
- Information Barriers
  - STS/Spacelab Use and Service Barriers (Relevance, Benefits, Practicalities)
  - Terms and Conditions for Use
- Situation Barriers
  - Fragmentation of User Community
  - NASA Charter and Legal Restrictions
  - Environmental Constraints (Current and Future)

Several NASA activities, currently in existence, are either directly, or almost directly, applicable to the NUF. These include Mission Planning and Payload Integration, Advanced Programs and Future Study functions, and Technology Utilization planning and implementation functions. These existing activities form part of the strategic planning, futures analysis, technical development, and user development subfunctions of the NUF. However, the important, continuing, high-level liaison activity does not formally exist within NASA and even those existing NASA functions appropriate to the NUF are not coordinated appropriately for a viable NUF.

Conclusions and recommendations common to all four studies, are listed below:*

- The New User Function (NUF) is a fundamental requirement for developing all sectors of the STS/Spacelab user community.
- The conditions under which the STS/Spacelab will be made available to the user community should be defined as soon as possible (e.g., user costs, use opportunities, etc.).
- Person to person contact within appropriate peer groups is required to develop all user sectors.
- Personal interaction at the policy-making level is a fundamental requirement.
- Futures considerations must be incorporated in the NUF to assure:
  - Maximum STS/Spacelab use within projected future domestic, foreign, political, and economic environments
  - Consideration of STS/Spacelab uses in users' five- to ten-year planning cycles
  - Formulation and execution of long term creative processes (e.g., technical programs) within NASA and the user community.
- Interaction with the user community should be long term with appropriate continuity.
- Phase II should be implemented as soon as possible.

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* Conclusions and recommendations for specific user sectors are given in the Appendix.

MAJOR NUF SUBFUNCTIONS

Although the specific approach to be used in developing the user community may differ from one segment to another, there is a basic set of operations which must be performed, regardless of the potential user being considered. There is some arbitrariness in grouping these operations into a small set of major NUF subfunctions; however, for the purposes of this report, the following five major subfunctions have been defined:

- User Development
- Strategic Planning
- User Analysis
- Technical Development
- Futures Analysis.

The relationships of these subfunctions are shown in Fig. 1.* Working together, they make up a NUF that supports the identification of relevant, beneficial, and practical uses of STS/Spacelab.

User Development

This is the key subfunction in the NUF. To a major extent, the interaction between NASA and the user community takes place here. This subfunction involves at least three important operations: liaison with the user community; education of the user community; and implementation of the NUF strategy resulting from the strategic planning subfunction. The liaison activity is probably the single most important operation of the NUF.

Phase I studies indicate that the liaison operation must be personal in order to optimize the NUF. The importance of personal contact is illustrated by the fact that a written questionnaire (impersonal approach) submitted as part of one Phase I study[5] elicited a positive response to discuss possible uses of the STS from only 3 of 41 of those

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* Figure 1 is not an organization chart; it is a functional representation of the NUF, and a single man may perform several functions.

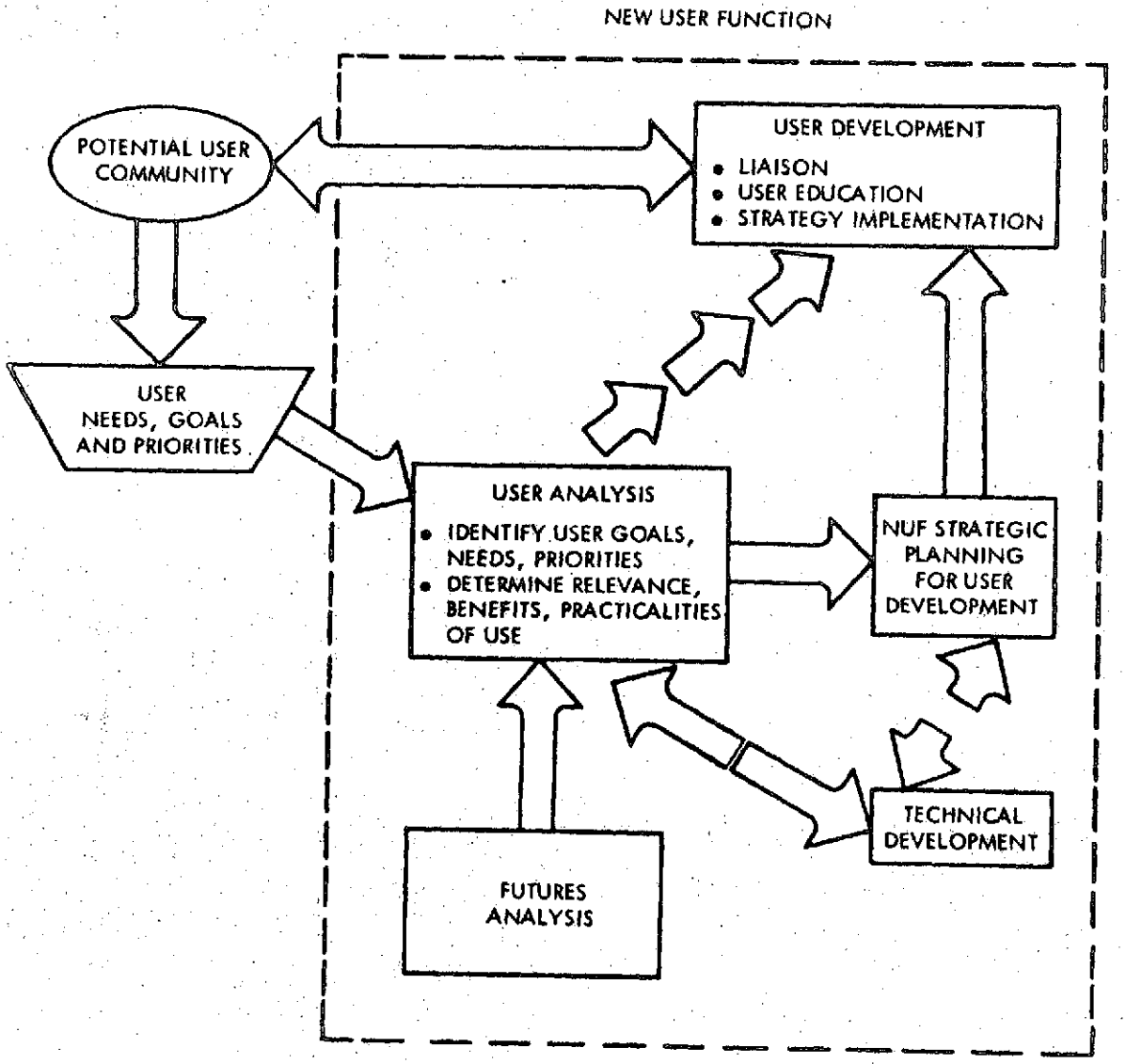

FIG. 1 RELATIONSHIPS OF THE NUF SUBFUNCTIONS

firms contacted;* whereas, another study[3] found that 8 of 9 of those agencies contacted by telephone (personal contact) responded positively in the sense that a subsequent personal conference was scheduled and kept.

In addition, the liaison activities should include interaction with the policy makers in the user community. Only in this way can the commitment of funds and manpower be made to support eventual implementation of a potential use of STS/Spacelab. Politically the NASA, or NASA-affiliated, liaison personnel must have peer status with policy makers in the user community. In part, this requires a high-level rank and a moderate amount of commitment-making authority on the part of the NASA representative. The validity of these observations is borne out by the fact that establishment of several working agreements between NASA and other government agencies has required the personal involvement of the Administrator (for example, the agreement between NASA and the Environmental Protection Agency). SRI, BCL, and ADL have all observed this requirement in their own pursuit of new work.

A third important characteristic of the liaison function is that the interaction between NASA and a specific user should be a long-term one that provides continuity. This is desirable on the part of NASA to reduce the large de-briefing, training, and report-writing activities which would accompany any other approach. More importantly, however, long-term continuity will provide the confidence and trust of the user, and the ability of the NASA, or NASA-affiliated, liaison man to communicate with the user will be greatly enhanced. In the private sector, inherent mistrust of the federal government makes a long-term personal interaction a necessity.[6]

As previously noted, educating the user community is an important operation of the user development subfunction. In this operation, NASA will be attempting to minimize the effects of information barriers within the user community by making known the relevant capabilities of the STS/Spacelab. This activity appropriately involves both impersonal and

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* Barriers, such as information barriers, probably contributed to this low response level; however, personal contact would also minimize the effects of such barriers.

personal techniques which are already being used in NASA's technology transfer activities. These activities form a part of the education operation.

Many techniques (both personal and impersonal) can be used in implementing the NUF strategy identified in the strategic planning subfunction. The selection of the appropriate technique will be made by the personnel of the user development subfunction for each case as they attempt to develop those promising user community sectors within the constraints specified by the NUF strategy. The techniques available have been identified.[6]

Strategic planning, user analysis, technical development, and futures analysis are essentially prime supporting subfunctions to the user development subfunction, providing liaison personnel with appropriate information to interface with user personnel at the policy-making level. Each of these subfunctions is discussed below.

Strategic Planning

The strategic planning subfunction provides prime input to the user development subfunction and provides long-range NUF continuity with long-range forecasting, technology development planning, and resource allocation requirements. The primary inputs to the strategic planning subfunction are the user community needs, goals, and priorities from the user analysis subfunction and the results of analyses to determine the relevance, benefits, and practicality of potential uses of the STS/Spacelab.

The strategic planning subfunction is required within the NUF to provide the ability to identify: 1) the new NASA technical development programs to be undertaken, 2) the most promising user sectors for development, and 3) the way NUF resources are to be allocated among the various subfunctions.

User Analysis

The user analysis subfunction provides input to the strategic planning and user development subfunctions. Specifically the user analysis operations are to:

(1) Identify the user needs* in current and future environments.[3,4,5,6]

(2) Develop and evaluate new and old techniques, methods, and approaches for developing new ideas and applications for STS/Spacelab in order to meet user needs in current and future environments.[3,6]

(3) Establish the relevancy of STS/Spacelab capabilities to those needs in those environments.[3]

(4) Determine the benefits of solving the user's problems by using the STS/Spacelab capabilities.[3]

(5) Establish the terms and conditions under which STS/Spacelab services will be available to the user.[5]

(6) Determine the practicalities of using the STS in terms of missions, risks to user, costs, confidentiality, etc.[3,5,6]

(7) Evaluate potential barriers in implementing a use of the STS/Spacelab to the user.[5,6]

Such information can then be used to develop preliminary traffic models, mission models, and tariff models, as well as user forecast data.[3] User forecast data are the output of the user analysis subfunction and will be used by liaison personnel (from NASA or middleman organizations) who will contact and develop the user community. User forecast data will be developed by screening ideas and filtering relevant, beneficial, and practical uses of STS/Spacelab to such a point that technology development planning, long-range forecasting, and resource allocation requirements are sufficiently focused to feasibly include use of STS/Spacelab in the potential user's planning cycle.

Technical Development[3,6]

The technical development subfunction consists of R&D and hardware development activities required to meet specific requirements of the user community. This effort is needed to achieve both long term usage of the STS/Spacelab by existing users and the successful development of potential

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* This requires that NASA interact with the user community to gather information on these existing needs, goals, and priorities. The use of personal contact, "a front man", is probably required for this task.

users for whom existing technology is inadequate. This subfunction provides input to both the strategic planning and user analysis subfunctions and receives its primary input from the user analysis subfunction (see Fig. 1).

Futures Analysis

Any segment of the user community using the STS/Spacelab should look ahead and attempt to determine the future environment in which it must operate. This is simply because the time it takes to develop a program (either in private industry or government) is so long* that the environment (economic, political, social) in which it operates will not be the environment in which it is conceived; it is the operational environment, not the environment at conception, that provides the real measure of relevance and benefit of any program. Therefore, considerations of futures must be included in the new user function.

One Phase I study included futures considerations[3] by outlining the techniques which should be used and by illustrating their use. For the limited cases treated, it was concluded that unless NASA's activities were strongly supportive of efforts to improve or maintain the quality of life in the time frame of 1980 to 2000, its programs would be under continual attack and would find only limited support. It is already clear that some of the basic and overriding problems of mankind in the two decades considered will be shortages of energy, raw materials, water and food, and the degradation of the world environment. It was felt these problems will determine what is done in those decades since failure to address them will endanger man's quality of life. Thus, the primary endeavors of NASA should be directed toward these areas. However, some purely scientific endeavors can and should be included. It was recognized, however, that needs and priorities may change drastically during the time period, so the NASA program must be structured to maintain a degree of flexibility and must be reevaluated continually to consider changing needs.

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* Typically at least 5 years.

These observations were considered valid by all four contractors as well as those government agencies contacted[3] during this study. Their validity makes absolutely imperative the existence of a NASA image which is supportive of programs for which other agencies have primary responsibility. In essence, this means that in addition to carrying out internal program responsibilities, NASA must be able to play a supporting role to the user community. The realization of this goal requires the use of an organized, systematic NUF with the subfunctions described above.

CRITICAL ISSUES

The need for an organized NUF is based upon the assertion that NASA must be able to aid in solving other users' problems, many of which are related to improving the quality of life. In order to do this, NASA must be aware of such current and future problems, recognize how they can contribute to their solutions, and interface with those segments of the user community with primary responsibility for their solution. The NUF, as outlined, does just this. The deletion of any major NUF subfunction will negate its utility. There are, however, some critical issues involving policy decisions which NASA must make before the NUF, as described above, can become operational. They are as follow:

(1) NASA must decide what funding and manpower allocations are to be assigned to the NUF.

(2) NASA must decide whether the proprietary rights of the user community are to be protected and, if so, how. Appropriate legislative action would probably have to be initiated.

(3) Decisions must be made concerning the terms and conditions for use of the STS/Spacelab by users in any of the user community sectors.

(4) The organizational structure, as well as the time of implementation, of the NUF must be decided.

In addressing these issues, NASA should consider the relative merits of:

(1) Having the NUF completely internal to NASA

(2) Contracting at least a portion of the NUF to the private sector (as, for example, in the "middleman" concept*[5,6])

(3) Creating a regulated monopoly

(4) Any combination of the above, both with and without start-up assistance from a contractor.

The appropriate action for each critical issue will depend in part on which of these options is selected. Ideally, the option finally selected will depend in part upon the acceptability of those actions needed to resolve the critical issues for that option. These considerations appropriately form part of Phase II of the program outlined on pages 1 and 2 of this report.

OPPORTUNITIES FOR USER DEVELOPMENT

Active identification of STS/Spacelab users and uses within the individual sectors of the total user community was not an explicit task for any of the Phase I contractors. However, in the course of the Phase I efforts, generic opportunities were identified. The following paragraphs summarize some of these.

Domestic Government Sector (Excluding NASA and DoD)[3]

The domestic government sector is ready now to talk to NASA regarding potential STS/Spacelab uses. They have had a chance to do some thinking already on this subject, and most feel they have some idea of what capability NASA can offer. However, the cost of any STS/Spacelab use is an important factor. If an alternate approach exists to provide equivalent service, these users will select the less costly.

Research and Development (R&D) funds of the potential user agencies are limited; the majority of the funds at the disposal of these agencies is for day-to-day operations undertaken to perform their individual charters. Thus, the largest potential for the use of NASA's capabilities

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* An independent organization outside of NASA, that performs certain of the user development activities.

lies in the operational phase of activities of a user. It was determined that the term Research and Development has different meanings for NASA and some of the potential governmental users. There is very little work supported by potential users that NASA would call research. What these users call research is more nearly what NASA calls development, and the high-level liaison personnel must learn to make this distinction in order to communicate effectively.

Educational Sector[4]

Basic needs common to all educational levels (i.e., grade schools, higher education, vocational, and industrial) reflect the basic opportunities of STS/Spacelab for educational uses. The basic needs include:

- More flexible dissemination systems, allowing more interaction between instructor and learner
- More effective means for teachers, students, and administrators to observe the innovative practices of their colleagues
- More rapid assimilation of new knowledge into the educational process
- Additional resource allocation to provide learning environments suitable to changing educational purposes and methods.

The projected expenditures for education in the United States for 1982 are:

- Grade schools (public and private) - $70.4 billion
- Higher education - $44.1 billion
- Other (vocational, industrial) - indeterminant but several factors above $20 billion.

Some of these expenditures are used for the following grade school and higher educational activities which could be included as an STS/Spacelab user activity:

- Student experiments
- Educational television
- Teacher curriculum guides
- Education demonstrations
- Symposia and workshops.

The basic opportunities of STS/Spacelab applications arising from these needs and activities of the educational sector can be included in the following three application areas:

- Telecommunications (educational satellites)
- Educational utilization of STS experiments
- Educational dissemination programs.

Although these opportunities have been utilized by the ATS-6, Skylab, and other programs, the STS/Spacelab systems provide a means of maintaining continuity* in each application area in all levels of educational activities.

Domestic Private Sector[5,6]

The opportunities currently recognized for development of the domestic private sector are materials processing, sensing, telecommunications, navigation, energy production support, and research and development. Although much of this user sector is not yet prepared to comment in detail on its probable use of the STS/Spacelab, the potential does exist for significant usage (several flights a year by the late 1980's). This potential can only be realized by vigorous long-term application of the NUF.

Basic R&D uses of the STS/Spacelab will probably have the greatest attraction for the U.S. private sector in the 1980's; however, whatever use is made of the STS/Spacelab by this sector must contribute to corporate objectives (for example, profit, image, long-range plans, etc).

Foreign Sector[5]

Detailed user analysis, including indepth interviews, will be required to provide more than the impressionistic conclusions made thus far in assessing the foreign user opportunities. Generally speaking, stimulation of the foreign sector will present opportunities and difficulties that are similar to those in the domestic sector, with additional

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* Previous criticism of using educational satellites for educational activities has cited the lack of continuity due to the finite lifetime of a program.

difficulties arising from the international nature of legal issues, management structure, and the problem of developing trust and confidence. An international user development program will also need to make appropriate distinctions about the interests and capabilities of the highly industrialized, service-oriented economies (Western Europe, Japan, and the Soviet Union), the rapidly industrializing and/or petroleum-based economies (e.g. Brazil, Iran, Saudi Arabia), and the agriculturally based developing economies.

European participation in the development of Spacelab indicates that the governments of the industrialized countries are interested in STS/Spacelab uses. It seems highly predictable that the private sectors of these countries will, in due course, also become involved.

BARRIERS TO USER DEVELOPMENT

Further identification of specific opportunities for developing STS/Spacelab uses will be made upon implementation of the NUF. This development, however, will be impeded by the presence of barriers such as technical constraints, legal factors, and the events, people, attitudes, and policies which make up the environment in which the user community development is attempted. The NUF must be designed to recognize these barriers and to adapt its strategies to cope with them. The following paragraphs list some of the barriers which were identified in the Phase I studies.

Domestic Private Sector[5,6]

The methods and approaches for obtaining new users for STS parallel those of a marketing function in an industrial organization. Therefore, the barriers to successful marketing in industry would probably be present in the NASA user development effort. Those barriers which reduce the effectiveness of marketing operations in industry have been listed, described, and classified into six major groups. These include: (1) people barriers, (2) product or service barriers, (3) financial barriers, (4) organizational barriers, (5) information barriers, and (6) situation barriers. The relevance of each barrier to the NASA user community development was assessed.

It was observed that people barriers involve trust and confidence of both the seller and buyer and contribute heavily to many of the other barriers. This is significant for interactions between NASA and industry, because, over the years, industry has developed an inherent mistrust of involvement with the U.S. Government. Primarily this mistrust has grown out of fear of increasing governmental control of private industry in such forms as antitrust actions, price controls, punitive taxes, accounting and business practices. While within the established laws of the land, these actions have caused problems in the conduct of business and have contributed to this overall mistrust which has caused some companies to avoid doing direct business with the government. Obviously, if an organization has misgivings about involvement with the government, it is reasonable to assume it will be even more reluctant to directly invest its resources in a government-operated activity. It is primarily for this reason that consideration of a "middleman" organization was recommended[5,6] to provide the NUF interface with the private sector.

The basic source of this barrier is that the government and industry have different objectives: the various government agencies are set up to serve the best interests of the general public; whereas, industrial organizations are established primarily to provide maximum return on the stockholders investments. These objectives can be in opposition. One specific example, related to the STS/Spacelab, is the issue of ownership of data or proprietary rights. If industry invests its own money, it generally wants exclusive use of any data/product that might result. However, this may be in conflict with established policies of the government. Unless suitable guidelines can be established at a very early time, industry is likely to avoid any investment of its money.

Another key finding[5] was that there is both a knowledge gap (i.e., information barrier) about what STS can contribute to the profitable functioning of the private sector in the 1980's and 1990's, and a communications gap in making available such knowledge as does exist. In addition, it was observed that appreciation of the potential of the STS for achieving private sector objectives is constrained at this time by the absence of a well-developed, explicit set of terms and conditions on

which STS services will become available. To overcome this barrier a STS "Tariff Model" must be developed which will deal initially with at least the following subjects of crucial interest to prospective users:

- The expected organizational structure of the entity that will form the interface with the user community
- The procedure for mission planning
- The procedure for making and accepting offers to contract for services and resolve competing demands
- Price formulas
- Explicit provisions that will govern the disposition of patentable inventions and utilized or generated capabilities
- Statements of basic policy in at least the following areas: safety and environmental protection requirements, discrimination (or non-discrimination) among different classes of potential users (including foreign organizations), separation between military and non-military missions and payloads, utilization of telecommunications, required availability or dissemination of data acquired by onboard sensors, the extent to which the competitive status of private sector users will be considered, and the extent to which other Federal government policies affecting data generated onboard will be applied.

Domestic Government Sector[3]

As with private industry, barriers play an important role in developing the domestic government sector. For example, many government agencies, like private industry, are concerned with immediate needs and have no formal long-range program plans. In such cases, both situation and information barriers are of significance.

Interviews with various government agencies revealed that the long range plans of most of the potential government users of the STS/Spacelab have not been documented. Moreover, it was found that the agency goals and priorities of interest in the operational time frame of the STS are not well organized outside the minds of people in the policy-making offices of these agencies. Therefore, to overcome such situation and information barriers, complete determination and monitoring of potential

user goals, needs, and priorities must necessarily involve personal interactions with individuals at the policy-making level within the potential user organizations.

Other sources of information, such as newspaper articles of speeches given by members of the government agencies in question, engineering society proceedings, government reports summarizing governmental research activities, and records of congressional committee hearings are all good sources of information for the data base, as are personal contacts between personnel in NASA and the potential user agencies at the technical working level. However, the currentness and completeness of this information cannot be guaranteed without the use of personal contact at the policy-making level.

Educational Sector[4]

Although the educational sector seems to present a large potential for STS/Spacelab use, much of this sector is fragmented, with very few members having the resources required to take advantage of the applications potentially available. Therefore, to overcome this situation barrier it will be necessary to interact with many members of this sector through an office that represents many educational institutions. This may be particularly difficult with those parts of the education sector that provide adult/continuing education, vocational training, and industrial education (Level III institutions) because this group lacks any centralized point of contact.

Foreign Sector[5]

The development of the foreign private sector faces the same barriers identified for the domestic sector as well as others that arise from the international nature of the interaction. As a result, additional complications will arise in resolving legal issues, interacting with an international (if not multinational) management structure, and developing trust and confidence of foreign users in an international environment controlled neither by NASA nor the potential user.

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APPENDIX

PHASE I CONTRACTOR STUDIES

Appendix

PHASE I CONTRACTOR STUDIES

This appendix briefly summarizes the Phase I studies of the four contractors chosen to support NASA in developing methodologies for identifying new users and uses of the Space Transportation System (STS) and Spacelab during the 1980's and 1990's.

1. STANFORD RESEARCH INSTITUTE (SRI)

a. Objective

The objective of the SRI study was to develop methodologies for identifying new uses and users of the STS in the domestic government sector, other than NASA and the DoD. This work was performed for the George C. Marshall Space Flight Center under Contract No. NAS8-30533.

b. Approach

SRI's approach to the development of an efficient methodology for identifying new uses and users of the STS was to develop an organized planning process which could be used to identify STS capabilities that were relevant to user needs, beneficial to the user, and practical to the user. These criteria were assumed to be mandatory for an efficient liaison function which was identified as a critical factor in executing the methodology derived.

c. Definition of Methodology

The methodology developed by SRI has three dimensions: an alternate futures dimension, a data processing dimension, and an analyses dimension. The alternate futures dimension was included to enhance the probability that uses identified for the STS are appropriate for the time frame in which they become realized. This dimension was added because of the long time interval between the design and implementation of NASA capabilities to user needs. Frequently the goals and needs of the user at the time a program is implemented differ from those which existed at

the time the program was designed. The data processing dimension consists of the input data for the methodology and a set of operations which act on this data to identify STS uses and users as a function of time. One of the most important aspects of the data processing dimension is a series of three filtering operations which provide information on the relevance, benefit, and practicality of potential STS uses. The methodology is structured so that the filters can be applied in any order. The analyses dimension allows the use of the information generated into the data processing dimension by determining who will use the information and how it will be used. A key part of the analyses dimension involves taking the output data from the data processing steps and conducting a user forecast analysis to identify a list of credible users of NASA capabilities. This information is used by special liaison personnel who inform potential users, from the policy making level on down, of the relevance, benefit, and practicalities of using NASA's STS capabilities.

d. Conclusions and Recommendations

The following conclusions and recommendations resulted from the SRI study to develop methodologies and procedures for identifying STS users and uses:

(1) Potential governmental users of NASA's capabilities are ready now to initiate talks with NASA on the applications of the STS to the solution of their problems.

(2) Because of this readiness, SRI recommends that NASA immediately initiate the construction of a methodology, such as the one developed, to identify users and uses of the STS (and other NASA capabilities, if possible).

(3) It is strongly recommended that the program to implement the methodology (or new user function) take cognizance of the three following design requirements:

   (a) NASA must present a service or support oriented image to potential or existing users of NASA capabilities

   (b) Alternate futures considerations must be included in the methodology

(c) The identification of potential users and uses must be made in an organized manner and must be supported by NASA as an integral part of its overall planning function.

(4) In order to implement the above recommendation for immediate construction of the new user function, it is recommended that Phase II efforts be initiated as soon as possible.

(5) SRI recommends that the Phase II effort consist of performing four basic tasks: construction of the data base, generation of tools and techniques, training of NASA personnel, and system exercising.

(6) As a necessary adjunct to the above tasks to ensure their meaningfulness, SRI also recommends that the following strictly NASA supported activities be performed:

(a) Operational software personnel and hardware for operating the computer programs must be made available.

(b) Commitments must be made and implemented for hiring new people and/or assigning existing NASA personnel to futures analysis and liaison activities.

(c) The responsibilities for the various subtasks of the new user function within NASA must be assigned to assure proper information flow among NASA people and offices during the operational phase.

2. *THE UNIVERSITY OF ALABAMA IN HUNTSVILLE (UAH)*

a. *Objective*

The objective of the UAH study was to identify and evaluate potential educational uses and users for the STS and to develop methodologies and techniques for improving communication and interface activities between NASA and the education community. The work was performed for the George C. Marshall Space Flight Center under Contract No. NAS8-30737.

b. *Approach*

The UAH approach for identifying new uses and users of the STS in the educational section was to conduct a series of surveys to (1) identify

levels and typical categories of educational programs and the expenditure by level for education (based on 1972 data and projected to 1982 wherever possible), (2) determine basic needs common to all education levels, and (3) determine how the STS might benefit all levels of education based on the common needs of these levels, (4) identify current or historical NASA/Education interfaces, (5) project the impact which Skylab and the ATS-6 education activities might have on STS activities. From these surveys the UAH then suggested methods for encouraging broader use and user awareness of the STS in the educational sector.

c. *Definition of the Methodology*

The methodology derived by UAH is a reiterative process of determining objectives and methods for the educational sector's use of the STS capabilities. This methodology considers constraints, changing objectives, and new methods, all of which are sampled and tested, then modified as needed to improve the methodology.

b. *Conclusions and Recommendations*

The following general conclusions resulted from the UAH study:

(1) The educational community can be a substantial user of the STS/Spacelab capabilities.

(2) A higher priority and an earlier implementation program for education could enlarge user interest in all sectors.

(3) Comprehensive innovations in education require long lead times. The STS program is compatible with this need.

(4) All levels of education need in-depth study, particularly Level III (correspondence schools, vocational/technical education, adult/continuing education, education in industry), as it apparently has the largest potential number of applications and available resources.

(5) The educational community is fragmented, diverse, and complex in nature. More in-depth methodology development is needed to link the potential STS capabilities to educational requirements.

(6) Educational users need a clearer definition of the potential STS capabilities.

The UAH made the following recommendations as a result of their study:

(1) NASA should consider establishing a coordinating function within NASA to serve educational application for STS.

(2) Education should be considered an additional application category for STS missions.

(3) NASA should consider formation of a liaison organization between NASA and potential educational users of STS.

(4) NASA needs to plan early for space education programs to assure long lead times and more effective utilization (diversity and fragmentation of the education market necessitates early user involvement).

(5) NASA needs more indepth analyses (models and methodology) of past NASA programs--for example, Skylab for application to Shuttle/Spacelab programs and the ATS-6 for application to future education satellite systems.

3. ARTHUR D. LITTLE, INC. (ADL)

a. Objective

The objective of the ADL study was to develop market research and market development methodologies for stimulating STS uses by U.S. commercial and foreign users. This work was performed for the George C. Marshall Space Flight Center under Contract No. NAS8-30739.

b. Approach

ADL's approach to this study was to conduct a literature search and analysis of marketing techniques, to interview large technologically oriented manufacturing companies, many with substantial overseas operating experience, and to conduct a mail inquiry about knowledge and interest in STS capabilities in order to determine the probable markets in the private business sector for STS services in the 1980's.

c. *Definition of Methodology*

As the result of Battelle's Columbus Laboratories' (BCL's)* mid-term report on their marketing methodology study (begun three months before the ADL study), ADL's concurrence on its utility and comprehensiveness, and the NASA COR's approval, it was decided that ADL would not develop a detailed marketing methodology, as such, but would, rather, investigate critical elements of the problem not presented in the development of BCL's methodology; that is, the business and public policy issues. This analysis of business and public policy dominated the ADL study and reduced the amount of attention given to a detailed methodology.

d. *Conclusions and Recommendations*

The key conclusions and recommendations of the ADL study, which involved personal or mail contact with 45 leading U.S. organizations--primarily multinational manufacturing companies active in advanced technology fields--are:

(1) There is both a knowledge gap about precisely what STS can contribute to potential commercial users in the 1980's and 1990's, and a communications gap in making available the knowledge which exists.

(2) These gaps can probably be closed by well-planned, well-organized and energetic research and market development efforts; and closing them is crucial to securing widespread utilization of the STS by the private sector.

(3) R&D uses of the STS, of a fairly basic kind, will probably have the greatest attraction for the U.S. private sector in the early 1980's; but the scale of such uses, in the light of the size of the whole private sector industrial R&D budget at that time, may be somewhat less than that presently projected for STS. However, by later in the 1980's, demand may exceed capacity considering potential uses of the STS for processing, sensing, telecommunications and navigation, and energy production support.

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* BCL was one of four contractors, including ADL, chosen to support NASA in developing methodologies for identifying users and uses of the STS.

(4) The potential of the STS to achieve private sector objectives is severely constrained at this time by the absence of a well-developed, explicit set of terms and conditions on which STS services will become available.

(5) To overcome this barrier ADL recommends development of an STS "Tariff Model" which will deal initially with at least the following subjects of crucial interest to prospective users:

(a) The expected organizational structure of the entity that will form the interface with the user community

(b) The procedure for mission planning

(c) The procedure for making and accepting offers to contract for services and resolution of competing demands

(d) Price formulas

(e) Explicit provisions that will govern the disposition of patentable inventions and utilized or generated knowhow

(f) Statements of basic policy in at least the following areas: safety requirements, environmental protection requirements, discrimination (or non-discrimination) among different classes of potential users, separation among military and non-military missions/payloads, utilization of telecommunications, required availability or dissemination of data acquired by on-board sensors, the extent to which the competitive status of private sector users will be considered, and the extent to which other Federal government policies affecting data generated on-board will be applied.

(6) ADL also endorses the concept of the development of an independent "middleman" organization distinct from NASA itself to carry out the market development and, later, the marketing function.

(7) The marketing organization should become completely independent of NASA, generating its revenues from fees paid by users of STS and, in turn, purchasing facilities and services from NASA.

(8) An international marketing program will need to distinguish among the distinctive interests and capabilities, with respect to STS, of the highly-industrialized, service-oriented economies (the U.S., Western Europe,

Japan, and the Soviet Union), the rapidly industrializing and/or petroleum-based economies (e.g. Brazil, Iran, Saudi Arabia), and the agricultural-based developing economies.

(9) NASA must develop and extend an atmosphere of trust and confidence in NASA for all potential foreign markets for STS.

(10) NASA must resolve a large number of complex legal issues, and establish a specialized management structure for the international market development effort.

ADL also recommends that the following elements be included in Phase II program:

(1) Further identification and analysis of the interests of foreign users, necessarily involving field interviews abroad

(2) A careful study of the terms and conditions on which STS services will become available and their embodiment in an evolving STS Tariff Model

(3) Detailed development of the structure and program of a new, independent marketing entity which would ultimately make STS services, supplied by NASA, available to the user community, including careful consideration of the transitional stages through which such a development must move, over a 5 to 20 year period

(4) Continuing elaboration of presently fragmentary knowledge about both uses and users in the private sector, drawing on other studies and contractors as appropriate.

4. *BATTELLE COLUMBUS LABORATORIES (BCL)*

a. *Objective*

The objective of the BCL study was to determine techniques for developing the industrial user community for the STS. This work was performed under Contract No. NAS8-30529 for the George C. Marshall Space Flight Center.

b. *Approach*

BCL's approach to this study was to treat the marketing of the STS in the same way that an industrial marketing problem is handled. The techniques used by industry to obtain new ideas/uses and new users/customers

were evaluated and analyzed for their relevance to the STS, its potential uses and capabilities. Marketing barriers to the STS user community were identified and examined. Using these analyzed data, a recommended strategy was developed.

c. *Description of Methodology*

The methodology recommended by BCL is to take a classical industrial marketing approach to the development of uses and users of the STS. Because of the barriers imposed on NASA in the marketing area as a result of a lack of marketing experience, general mistrust of government participation in industry, and conflicts of proprietary rights between government agencies and private industry, BCL has suggested that a middleman approach be used to implement the development of the industrial user community. Specifically, NASA should handle the program management, basic research, system development, public relations, and systems operations, and the "middleman" organization should handle the marketing operations.

d. *Conclusions and Recommendations*

The following conclusions result from BCL's study:

(1) There is a need for an active effort aimed at developing the industrial user community for STS.

(2) The effort required is very large and should be implemented immediately if industrial support is to be forthcoming by 1980.

(3) NASA does not possess the necessary experience in dealing with industrial market development.

(4) Real barriers exist which will make it very difficult for NASA to directly develop the industrial user community.

(5) The use of a middleman organization represents the best strategy for developing the industrial user community.

(6) The middleman approach allows NASA to concentrate on what it does best and provides an opportunity to leverage its resources in the future.

(7) Successful development of the industrial user community can be achieved by employing marketing methods commonly used by industry.

The following recommendations are made as a result of BCL's study:

(1) NASA should immediately initiate an industrial user development operation.

(2) The industrial user development activity should be centrally operated in NASA and not be divided among the various Centers.

(3) NASA should utilize a middleman organization in developing the industrial user community.

(4) NASA should implement fully the approach recommended in this study at the earliest possible time.