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SPACE MARKET MODEL DEVELOPMENT PROJECT

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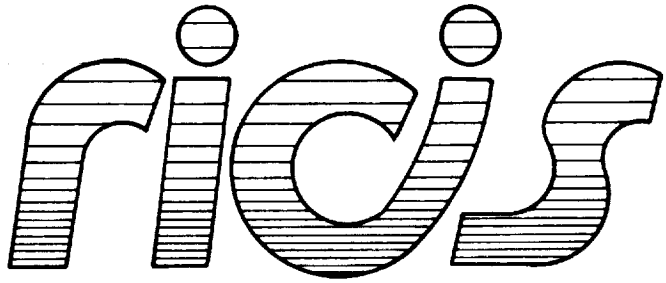

Research Institute for Computing and Information Systems
University of Houston - Clear Lake

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The RICIS Concept

The University of Houston-Clear Lake established the Research Institute for Computing and Information systems in 1986 to encourage NASA Johnson Space Center and local industry to actively support research in the computing and information sciences. As part of this endeavor, UH-Clear Lake proposed a partnership with JSC to jointly define and manage an integrated program of research in advanced data processing technology needed for JSC's main missions, including administrative, engineering and science responsibilities. JSC agreed and entered into a three-year cooperative agreement with UH-Clear Lake beginning in May, 1986, to jointly plan and execute such research through RICIS. Additionally, under Cooperative Agreement NCC 9-16, computing and educational facilities are shared by the two institutions to conduct the research.

The mission of RICIS is to conduct, coordinate and disseminate research on computing and information systems among researchers, sponsors and users from UH-Clear Lake, NASA/JSC, and other research organizations. Within UH-Clear Lake, the mission is being implemented through interdisciplinary involvement of faculty and students from each of the four schools: Business, Education, Human Sciences and Humanities, and Natural and Applied Sciences.

Other research organizations are involved via the "gateway" concept. UH-Clear Lake establishes relationships with other universities and research organizations, having common research interests, to provide additional sources of expertise to conduct needed research.

A major role of RICIS is to find the best match of sponsors, researchers and research objectives to advance knowledge in the computing and information sciences. Working jointly with NASA/JSC, RICIS advises on research needs, recommends principals for conducting the research, provides technical and administrative support to coordinate the research, and integrates technical results into the cooperative goals of UH-Clear Lake and NASA/JSC.

SPACE MARKET MODEL DEVELOPMENT PROJECT

Preface

This research was conducted under the anspices of the Research Institute for Computing and Information Systems by Peter C. Bishop, Director of the Space Business Information Center at the University of Houston-Clear Lake.

Funding has been provided by the NASA Office of Commrcial Programs and the NASA Space Station Customer Utilization Office through Cooperative Agreement NCC 9-16 between NASA Johnson Space Center and the University of Houston-Clear Lake. The NASA Technical Monitor for this activity was Ken Demel, Space Station Projects Office, NASA/ JSC.

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The views and conclusions contained in this report are those of the author and should not be interpreted as representative of the official policies, either express or implied, of the NASA or the United States Government.

SPACE MARKET MODEL DEVELOPMENT PROJECT

Phase I Report

University of Houston-Clear Lake
Research Institute for Computing and Information Systems
NCC 9-16

Research Activity IM.1

prepared by

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Studies of the Future

June 1987

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EXECUTIVE SUMMARY

The Space Market Model Development Project is a research program undertaken by the University of Houston-Clear Lake in cooperation with the NASA Johnson Space Center. The Project has received joint funding from the NASA Office of Commercial Programs and the NASA Space Station Customer Utilization Office. Phase I of the Project began in August 1986 and has concluded with the release of this report.

The objectives of Phase I were

- To study the need for business information in the commercial development of space, and
- To propose a design for an information system to meet the identified needs.

This document reports a summary of the results from Phase I. Some results are also contained in a technical supplement to the final report entitled "Space Market Model Development Project: Economic Analysis." A full description of the research materials and capabilities gathered during Phase I will be contained in a forthcoming report entitled "Space Business Information Center: A Catalog of Resources."

Research Results

The research study proceeded toward its goal using three simultaneous research strategies:

- To describe the space business information which currently exists,
- To survey government and business representatives on the information they would like to have, and
- To investigate the feasibility of generating new economic information about the space industry.

Existing Information --

The first approach was to study the information currently available for space commercialization. The study team focused on four prototype markets for their analysis:

Space Shuttle small accommodation payloads
Remote sensing of land areas from space
Processing biological materials in space
Commercial launch vehicles

The results indicated that some types of information are readily available to participants in these markets. News about government agencies and major aerospace firms is abundant as are the scientific and technical reports collected over 25 years of space exploration. On the other hand, lists of firms in various space markets and standard business statistics about those markets are less easy to come by. In general, the information available reflects the fact that the market to date has been dominated by government R&D performed by a handful of major contractors rather than the more usual pattern of commercial firms working primarily within the private sector.

Desired information --

A second approach to the research question involved interviews with individuals from different segments of space commercialization. Government officials, executives from aerospace firms, entrepreneurs, and business service professionals were asked what information they had and what information they needed to participate in the emerging space industry. All indicated a need for more information and for better access to the available information.

They rated directory information as the highest priority--lists of firms in the market and their businesses' interests. Market statistics such as total product delivered, gross revenue, and market share were also needed for economic and investment analysis. Other respondents wanted to have a better idea of what government agencies had done and what they were planning to do in space. More information about international space programs was also mentioned. The interviews, therefore, complemented what the information analysis had shown--namely, the lack of business information which would be readily available in a mature market.

Economic analysis --

A third approach investigated the likelihood that new business information could be collected and distributed for the benefit of the whole industry. The types of business information selected for study were the economic relationships among various sectors of the space industry and between the space industry and the rest of the U.S. economy.

A team of economists evaluated the feasibility of using an input/output model to describe the flow of products and funds in the industry, and they found that indeed an input/output analysis would provide that information. Two approaches were considered: one which characterized only the market sectors internal to the space industry; another which integrated these sectors into the national I/O model.

The major problems with pursuing either approach were

1) to correctly define the sectors to be described and

2) to gather sufficiently accurate data to calculate the technical coefficients required by the model

Another approach to the question of generating new information was to poll members of the industry on just what information they thought was necessary and what information they would be willing to divulge for aggregate economic analysis.

The remote sensing of land areas was chosen as the test market. A group of experienced advisors assisted the research staff in constructing a draft version of an economic census of the remote sensing business. This draft was then shared with 20 or so industry representatives for their evaluation.

The feedback from the industry representatives was:

1. The goals of the census were quite ambitious at the present time.

2. Most firms would have difficulty providing information on their purchases and sales in any detail.

3. The benefits to the firm for providing that information were difficult to describe, hence the final response rate might be low.

These results point out the problem of generating business information in a new industry. Many firms are small and privately held. They do not keep detailed records of their transactions and are reluctant to share those records when they have them. On the other hand, all respondents agreed that economic information was critical to the mature development of the industry. As a result, the Space Market Model Project will concentrate on developing strategies to overcome the obstacles.

Space Business Information Center

In response to these results, the research team designed an information system to meet the need for business information about space. The goals of the information system are

1. To provide better access to existing information about space commerce, and
2. To generate new information which the business community needs to do business in space.

The first step in implementing this plan is to concentrate on the first goal--assembling and disseminating existing information--before tackling the more difficult problem of generating new information. A prototype of the information system will be constructed and tested at a new research office of the University of Houston-Clear Lake called the Space Business Information Center (SBIC).

The Center's information system will consist of the following components:

- A definition of the type of information to be handled
- Procedures for acquiring and maintaining the information
- Products and services delivered to the space industry

The type of information to be handled --

The research showed that business information was required for the sound development of commercial space. Therefore, the planned information system will concentrate on

- space information rather than the more general category of aerospace information
- business information rather than the more accessible scientific and technical information about space
- information (factual data) rather than the more common set of plans, recommendations, proposals, or policy analyses distributed by space organizations

The other criteria for selecting information for this system is that the information not be readily accessible from other systems. The job of providing sufficient information to the space community is large enough without duplicating the efforts of existing organizations.

The collected information will describe the core markets of space business along with the scientific, economic, political, and social contexts of those markets. Market information will include the following types of information:

Products and services
People and organizations
Contracts and agreements
Budgets, expenditures, and revenues
Recent events and future plans

The contextual information will contain the core information about, and monitor the developments in, the aspects of the society which have implications for the future of space business.

Information acquisition and maintenance --

The early information will be collected from available sources: the news media and periodical literature, government reports and publications, searches on electronic databases, and experts in the field. The information will be stored as bulk documents in a library format or as data elements in electronic databases. Information also will be obtained on request from other information systems.

Information products and services --

The prototype information system will be available through the Space Business Information Center to a panel of interested individuals and organizations during the middle of 1987. Members of the prototype panel will be selected according to the following criteria:

1. Knowledge and experience in space commercialization.
2. In-kind or financial contributions to the Center's ongoing research project.
3. Willingness to provide periodic feedback on the Center's products and services.

Panel members will receive information products and request other information and studies from the Center in the normal course of their work in space commerce. They will also provide the Center periodic feedback and guidance on the quality and delivery of the information products and services.

Early information products and services will be developed in the following general categories:

1. Briefing books on various aspects of space business

   The books will include factual data, lists of relevant organizations and individuals, official documents and regulations, and references for further information. The guides will serve as an introduction for business people interested in space business and as a reference handbook for those already involved.

2. Information clearinghouse

   Panel members will request specific information as the need arises. Requests will be received and information will be delivered via telephone, electronic mail, facsimile machine, and hardcopy delivery. The long-term goal is also to provide direct access to the electronic information which the Center maintains.

3. Research reports

   Some information requests will require primary data collection and/or analysis. These requests will be filled through separate contracts with the Center. Research studies will begin with a search for existing information within the Center's collection and move to primary data collection and analysis only where secondary sources are inadequate.

4. Briefings

   The Center also will be able to present its information in a form suitable for face-to-face conferences and seminars. Briefings permit concentrated attention and extended interchange with experts on an aspect of space business. The briefing format is appropriate for clients who wish to become familiar with an area of space business in a short-time, concentrated period.

5. Custom information systems

   Having developed the overall information system for space commercialization, the Center will be in a position to develop subsets of that system for individual clients. The resulting system could be maintained by the Center for the client or by the client organization itself. Custom information systems are cost-effective for clients with large information needs or particular security requirements.

Phase II Plans

Phase II of this research project is scheduled to begin in June 1987. The research objectives of the overall project remain the same:

> To study the information that is available and the information that is required for the conduct of business in space.

The Center will continue to pursue these objectives by collecting examples of space information and by interviewing individuals in the industry.

The new approach for Phase II will be to develop and deliver prototype products and services to knowledgeable members of the space business community for their evaluation and guidance. The focus will be on learning what professionals actually require in the conduct of space business and how to deliver that in a cost-effective manner.

The University of Houston-Clear Lake, through the Research Institute for Computing and Information Services (RICIS), has received Phase II funding from NASA to pursue these objectives. The University is also seeking contributions from other organizations involved in the development of space commerce. In particular, the Center still requires large amounts of information about space business, much of which is in the hands of individuals and private-sector organizations.

Conclusion

Space commercialization is an important long-term goal of the U.S. space program. Achieving that goal requires overcoming numerous obstacles and solving tremendous problems. One of the obstacles to space commercialization is the lack of the types of business information which are taken for granted in all mature sectors of the economy. Business information does not, by itself, overcome obstacles or reduce risk. It does, however, allow individuals, who are prepared to take risk, to calculate the magnitude of the risk they are taking. Without the means to calculate risk, investment is blind and work does not go forward.

SECTION I

BACKGROUND

The major goal for the United States space program in the 1980's has been the commercialization of space. President Reagan has repeatedly stressed the importance of this goal. The President issued the National Space Policy on July 4, 1982 in which he directed that the U.S. government "expand United States private sector investment and involvement in civil space and space related activities." One of the principles of that same policy was that "the United States encourages domestic commercial exploitation of space capabilities, technology, and systems for national economic benefit."

The White House followed up the general policy with a specific directive on May 16, 1983 concerning the U.S. position on the use of commercial expendable launch vehicles. "The U.S. Government fully endorses and will facilitate the commercialization of U.S. Expendable Launch Vehicles." The President also issued a National Policy on the Commercial Use of Space one year later (July 20, 1984) designed to remove some of the economic and legal impediments to space commercialization as well as promote vigorous research and development in the area.

Not to be outdone, the Congress also amended the National Space Act of 1958 to include the commercialization of space as one of the specific objectives of the National Aeronautics and Space Administration.

> The Congress declares that the general welfare of the United States requires that the National Aeronautics and Space Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space. [42 US Code]

NASA itself accepted the direction from the President and the Congress and issued its own policy on the commercial development of space. That policy was implemented by the newly formed Office of Commercial Programs at NASA Headquarters in Washington DC. Other major offices within NASA also took responsibility for implementing the commercialization policy, most notably the Customer Utilization Office within NASA's Space Station program.

One of the initiatives outlined in the NASA Commercial Space Policy was that

> NASA would review its dissemination methods for science and technology data. With advice from industry, NASA will augment publications procedures to provide better support for the domestic private sector.

In response to this initiative, the Office of Commercial Programs and the Space Station Customer Utilization Office jointly funded the Space Market Model Development Project at the University of Houston-Clear Lake. The research project was designed to study the information available about space commercialization and the additional information which the business community needed to fulfill its role in space.

The research was funded as an aspect of a newly formed cooperative agreement between the University of Houston-Clear Lake and the NASA/Johnson Space Center. The cooperative agreement, entitled the Research Institute for Computing and Information System (RICIS), was established to coordinate research into advanced computing and information systems. Continuing research into the development of the Ada programming language for Space Station was the major focus. The Space Market Model represented research into applications-oriented information systems.

The Space Market Model Development Project was funded to investigate techniques for providing relevant business information to firms and agencies involved in the commercial development of space. The project is also intended to study ways of making optimum use of electronic information technology in providing such information.

The Project was officially funded by the Space Station Customer Utilization Office and the NASA Office of Commercial Programs on August 1, 1986. The Johnson Space Center was given the responsibility for managing and supporting the project for these offices.

The schedule for the Project calls for a three-phase development period. Phase I was the definitional phase within which a number of research activities were conducted to answer the following questions:

1. Who requires information about space commerce?
2. What information do they need?
3. How do they want to receive that information?
4. What information can be provided at reasonable cost?
5. What type of computer system is required?

Phase I was also designed to produce some demonstration products which could be used to review the type of products being discussed in these reports.

Phase I concludes with the release of this report. Beginning in June 1987, Phase II will be devoted to designing a major prototype of the information system and establishing base-line information in the target areas. Phase II is scheduled for completion in January 1987. Phase III will then concern itself with evaluating the prototype as a permanent system for use by the space business community.

This document is the report of the activities and accomplishments of Phase I. The report is divided into two major sections: the research results and the design study. The section on research results reports the findings of two different research approaches. One approach gathered and catalogued

existing information relevant to space commercialization. The other approach surveyed knowledgeable people in the industry on what information they found most valuable and what information they still needed to discharge their responsibilities.

The design study reports the preliminary design of an information system to meet the needs discovered in the research section. That design will be implemented in a new research office established at the University of Houston-Clear Lake, entitled the Space Business Information Center. The Center will conduct the Phase II and Phase III research for the Space Market Model Development Project.

The report concludes with an outline of the plans for the Phase II research program.

SECTION II

Research Results

The Space Market Model Development Project had two research objectives. The first was to survey the information available for business applications in space. The second was to discover what information was needed for space commercialization.

II.1 Identification of the Information Available

The approach to the first objective was to acquire examples of all information products and services that would provide information about space business. Samples of information from the following sources were cataloged and evaluated:

Magazines, newsletters, and journals
Books and government reports
Government and industry statistics
Printed and electronic databases
Legal documents
Annual reports and company brochures

Space business information exists in many broad categories and the accessibility of the information varies with the category. The most accessible form is information about current affairs--regarding government agencies and major aerospace companies. Nearly everyone in the industry has easy access to industry magazines and newsletters and possesses essentially the same public information about what happens on a weekly if not a daily basis.

Scientific, technical, and government contracting information represent a second category of information. These public-sector data exist in large quantities. They are not as accesible, however, because relatively few people have the special training and equipment to use the electronic systems for indexing and retrieving the data. Original documents are usually not available in the libraries so that they must be ordered, delaying their use.

Private sector information constitutes the third major category of information. Most items in this category are incomplete. Lists of industry organizations, for instance, are available, but their usefulness for many business purposes is questionable. The criterion for including firms in these lists is not always clear, and the information about each firm is not sufficiently detailed. Furthermore, most of these lists are distributed in printed form, making analysis or manipulation of the information difficult.

Analytical reports on the industry also exist. However, at several thousand dollars or more per copy, they are not within the financial reach of all firms. Finally, publicly available market statistics are non-existent, except about government contracting and satellite communications. The lack of specific Space Information Center codes for space markets means private space expenditures and revenues are merged with larger categories of government aerospace and defense and civil aviation. As a result, data for market estimates and projections for private space business are virtually impossible to locate.

In sum, information availability to the space industry runs from well-reported events and individual statistics in the news media to a complete lack of comprehensive market data for many space applications. The results of this section are summarized in Table 1.

TABLE 1

Information Availability and Accessibility

	AVAILABILITY	ACCESSIBILITY
News media	Excellent	Excellent
Scientific & Technical Literature	Excellent	Good
Government contracts	Excellent	Good
Organizational Directories	Partial (broad > deep)	Good
Business Statistics	Partial (govt > private)	Good
Analytical Reports	Partial (expensive)	Fair

The reason for the disparity in information availability is the traditional structure of the space industry to date. The government has been, and still is the largest consumer of space products and services, and they focus on basic research and the development of advanced technology for the future (Table 2). Therefore, it concentrates on the performance and the potential benefits of space systems rather than on potential revenues that such benefits might bring or the amount of money that could be earned through the most productive application of the technology. As any business person knows, real benefit to a potential customer is no foundation for a business unless that customer is willing to pay for it.

The information that does exist has served the traditional aerospace industry that has evolved from government contracts. What is lacking is the kind of information available in a private-sector market where the business-to-business or business-to-customer relations prevail. There the information is less science-and government-oriented and more commercial.

TABLE 2

Comparison of
Government and Business
Space Information

	SPACE INFORMATION	
	GOVERNMENT	BUSINESS
AVAILABILITY	Available	Unavailable
PURPOSE	R&D	Profit
TIME FRAME	Future	Past, Present
CONTENT	Benefits Performance Expenditures	Revenues Productivity Earnings

II.2 Identification of Information Requirements

The second research objective was to find whether the participants in the space industry <u>needed</u> more information to do their jobs effectively and, if so, what information they need. The approach here was threefold:

1. to interview a cross-section of individuals participating or planning to participate in space business and ask them directly what they need;
2. to survey the information available to the general business community and see what information is currently use;
3. and to survey the information available in an analogous market--in this case, the pharmaceutical industry--to determine what information the industry has.

II.2.1 Interviews

II.2.1.1 Survey Methodology

The research team completed completed 40 interviews with individuals representing the following potential user segments:

Business service companies,

NASA organizations,

major aerospace companies,

and fledgling companies

All interviews with potential clients were relatively unstructured. Most were face-to-face. The first interviews were used in part to formulate a set of questions (Table 3) for use in later interviews. This approach supported the development of a standardized set of questions and at the same time did not preclude valuable observations and ideas that the early respondents might offer.

TABLE 3

INTERVIEW QUESTIONS

1. What is your space market?
2. What information do you need?
3. What information sources do you now use?
4. What makes an information resource useful?
5. What information is usually available?
6. What aspects of the space market are poorly covered by existing information sources?
7. How would you like to see information packaged?
8. Do you have any specific product suggestions?

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II.2.1.2 Results of Interviews

The overwhelming conclusion from the interviews was that respondents felt the available information about the space industry was inadequate for full market development. The lack of business information was identified by almost all of the respondents as a major impediment to space commercialization.

The problem as reported had two parts. First, certain information simply does not exist. Standard business statistics about space markets were the clearest example. The second part of the problem was that, even if information was available, it was difficult to locate and acquire. Respondents indicated extreme frustration at endlessly pursuing leads for information only to come up empty-handed. The respondents' experience is supported by our research staff members, who, after six months of fruitless

investigation into certain information for space commercialization, are only now discovering major new sources of information.

Respondents also indicated the types of information that were most critical for business purposes. Surprisingly, current affairs was not mentioned as one of the necessary items by most respondents. They felt fairly satisfied that each knew as much as anyone else about the latest news in the industry. Of course, they all asked for ways of knowing what was happening before it appeared in the press, but those avenues of information were beyond the scope of this study. If anything, respondents complained there was so much information reported they had difficulty reading and understanding all they received. Some type of service which would alert them to the items relating to their interest and that puts the news into context was mentioned as a need by some.

The most critical need was reported to be directory information. Respondents who have worked in the industry for many years have an informal understanding of who is doing business in space. Inexperienced respondents, however, have not developed that knowledge, and are daunted by the task of acquiring it for themselves. The need for directory information is a curious outcome in the face of the number of large and well advertised directories available. It is clear, however, that existing directories do not meet the total need for organizational information.

Another identified area was the need for consistent and believable market statistics for business planning. Firms in the space industry must base their market estimates upon individual market research reports (which tend to disagree among themselves about the current size of the market) or determine their own estimates (which tend to lack credibility in the eyes of investors or bankers). Since government statistics do not distinguish space activity from aviation or defense, business planners have a difficult time forecasting market growth, particularly when they do not even have a reliable estimate of the size of the current market.

Investors will accept an element of risk in space ventures, but they need to calculate the magnitude of the risk to compare space investments with other opportunities. The space industry is so inadequately understood and business information about it is so spotty, however, that most planners could not estimate risk or return on investment. Lack of business information is one of the reasons entrepreneurs in the space industry find it more difficult than others to raise money in capital markets.

In conclusion, respondents reported that the day-to-day happenings in the aerospace government-contractor market were well reported and, if anything, reported in more detail than desired. The greatest need is for directories -- lists of firms participating in space business and their major business interest. Other respondents expressed a need of market statistics for planning and investment analysis.

II.2.1.3 Results by Sector

Major differences appeared in the quantity and type of information needed by respondents from the five sectors interviewed. The business services sector indicated greatest need for information about the commercial space market. This sector included respondents from the following professional organizations:

Law

Accounting

Marketing/Public Relations

Investment/Finance

Insurance

Architecture

Some respondents in this category had been working in space business for a number of years and built up a network of contacts and information sources that served them well individually. Others want to get into space business, but are stymied by how difficult it is to understand the field and the major government and private organizations involved.

All respondents, even those who have experience in the field, indicate a need for systematic sources of information about the market and its firms. They want to be able to gauge the chances for a specific firm or its product in the marketplace. They indicate that they regularly purchase such information in other market areas and would be willing to purchase that same information in the space market if it existed. Working as they do in a large number of markets, professional

business firms regularly must purchase information about firms and markets rather than develop it themselves.

Respondents from the second companies have completely different needs and capabilities. Having worked in this field for decades, they well understand the structure of the industry and the major firms involved. On the other hand, they do have a need to closely monitor government activity in aerospace very closely, and usually have one or more people assigned to this task full-time. Their monitoring operations typically go beyond monthly news and events, to performing statistical analyses of recent procurements and contracts, and maintaining a network of individuals knowledgeable about government intentions and near-future behavior.

A third category of respondent is at the other end of the aerospace spectrum, the entrepreneurial start-up company trying to break into the new space commercialization arena. These firms need to know everything--customer lists, business opportunities, and sources of financing. Although they have many contacts who know the traditional aerospace business very well, they also realize they are beginning a new type of business--one they need to understand as well as they did before. The problem with getting that understanding, of course, is that they cannot purchase business services in the same quantity government or established firms can because of lack of funds.

The fourth sector interviewed were was officials. By and large, government personnel does not feel a need for business information about space. As indicated above, government has developed information sources that serve its traditional role very well. Those government officials who are directly committed to facilitate the commercial development of space, however, indicate they have the same needs as entrepreneurs--they want to know a great deal about this new market they are supporting. Unlike the entrepreneurs, however, they also have potential resources to purchase that information for themselves or on behalf of entrepreneurial ventures. Indeed the whole Space Market Model Development Project is an example of the government funding, something which industry needs, but which it can not make sufficiently profitable in the short-run to establish itself.

The results of the sector comparison of information are summarized in Table 4. The table shows that the only group of respondents who did not indicate they need additional information about space commerce is the general government sector. All others could use more information.

TABLE 4

Comparison of
Information Needs by Sector

	NEED	INTERNAL CAPABILITY	RESOURCES
Business Service	High	Low	High
Aerospace	High	High	High
Entrepreneur	High	Low	Low
Government			
-general	Low	High	High
-space commercialization	High	Low	High

Some of the groups that need information, notably the aerospace companies, have sufficient internal ability to generate that information themselves. All others lack that internal capability. Of that group, the business service and government sectors have the resources to purchase information if they found useful sources. Entrepreneurs, however, typically do not have those resources.

TABLE 5

Comparison of
Information Needs by Sector
(High Need Sectors Only)

		ABILITY TO PAY FOR OUTSIDE INFORMATION	
		LOW	HIGH
ABILITY TO GENERATE OWN INFORMATION	HIGH	...	Aerospace
	LOW	Entrepreneurs	Business service Govt (space comm)

The same conclusions are summarized slightly differently in Table 5. The most likely clients for a new information system in space commercialization appear in the lower right of Table 4, business service and government agencies involved in space commercialization. They are the two groups with high need, low internal capability, and resources to purchase what they need (if it exists).

The other high-need sectors (aerospace and entrepreneurs) also are potential customers but only under special circumstances. In the aerospace case, it seems that most firms (and even divisions within firms) are collecting the same publically available information. They might be induced to get that information from an outside supplier if the cost were significantly lower than they are spending now. The problem is that all companies would then have the same or similar information, thereby reducing the competitive advantage of having

the information in the first place. Conversely, it is also possible that the firms have the same information already even though they are collecting and analyzing it individually.

Entrepreneurial firms have the greatest need for space business information but the fewest resources to purchase it. They might be able to avail themselves of such information under some type of government or industry sponsored program--similar to the Small Business Innovation Research (SBIR) program. These arrangements would have to be worked out with some government-or industry-wide group.

The sectorial comparison of information needs reveals two likely target groups for an information service (business service and government-space commercialization) and two less likely but still possible target groups (traditional aerospace and entrepreneurial start-ups). All have information needs of one variety or another, and useful information about space business could conceivably assist them in their enterprises.

II.2.2 Survey of Standard Business Information

In order to further investigate the kind of business information the respondents are requesting, the research staff embarked on another aspect of the study. In this part of the study, they focused on an analysis of selected business information companies that were recognized as authoritative sources. Library resources were used, and individuals from the target companies were interviewed either in person or by telephone.

The companies investigated were:

Dun & Bradstreet,
Standard & Poor's,
Moody's Investor Services,
Frost & Sullivan,
Selling-Areas Marketing,Inc. (SAMI),
and A. C. Neilsen.

The analysis showed that these companies can be grouped into three broad categories depending on the type of information they provide:

- General Financial Information
  (Dun & Bradstreet, Standard & Poor's, Moody's)
- Industry or Market Analysis
  (Frost & Sullivan)
- Tracking Specific Products or Markets
  (SAMI, Neilsen)

The general financial information companies produce a wide array of products which typically focus on the financial status of specific firms or the major trends in an industry. These companies get most of their information and compile their financial data from public documents such as Security Exchange Commission (SEC) reports, corporate annual reports, proxy statements, and others. They also collect general, as well as financial information from the trade and general press. The market for most of these products is the investment community. These companies have a major influence through their ratings of corporate debt, as well as their dissemination of general information about a company's operations.

No example of this type of information for the space industry was discovered in the information survey. One reason for this vacuum is that most space business takes place within

large aerospace firms or small, privately held companies, neither of which report their financial information through the normal channels of the SEC. The lack of such information, however, made it extremely difficult for business service professionals in our interview sample to qualify firms for investments or loans.

Frost & Sullivan is an example of a second type of information company--one that selects an industry or part of an industry to analyze, and issues reports and forecasts. The reports are prepared by outside consultants and sold to a broad market. The annual outlook reports prepared by the Center for Space Policy or the Outside Users Payload Model (of launch demand) by Battelle are examples of such reports for the space industry.

The final category of companies (SAMI and Neilsen) provides timely and accurate tracking data on specific products. The buyers of these services are typically the major competitors in a market who need to monitor product sales for all companies on a weekly or monthly basis. These reports are usually proprietary, with data from competitors disguised. Most of the products tracked are high-volume retail products. No product or service in the space industry is offered in this manner, and no such information is used in space business analysis.

To summarize, business information companies use their own reporting staffs; consultants; public sources such as annual reports, proxy statements, incorporation records, and SEC documents such as 8K and 10K reports; the trade press; the

general press; and company press releases as data sources. Computerization allows them to repackage reports on the same companies in abbreviated or detailed forms. Some companies, such as Frost & Sullivan, specialize in market analysis. Others track sales of specific products and product types as they move from warehouses to consumers.

II.2.3 The Pharmaceutical Industry

The final research strategy produced an analysis of a mature, and in some respects similar industry--the pharmaceutical industry. There are many characteristics about business activity related to space that are common to other, more well-defined industries. High risk, long-term payout, federal regulations and public interest in events and products are some examples of these characteristics. This analysis focuses on information flows and on selected information products in the pharmaceutical industry.

Unlike space commercialization, the pharmaceutical industry has a well-developed information network. Manufacturers, marketers, news media, and advertising publishers rely on the same major sources, plus their own versions of personal networks.

The major drug companies and their representatives rely primarily on the F-D-C Reports' weekly "Pink Sheet." The Pink Sheet tracks:

- hearings with the industry's federal oversight body (the FDA);
- FDA advisory committee meetings and hearings;
- petitions to the FDA;

- applications for approval of new drugs and new uses for marketed drugs;
- personnel changes at pharmaceutical companies;
- financial reviews, mergers, new products;
- congressional and administrative actions.

The "Pink Sheet" sells for $450 annually. F-D-C employs full-time reporters to gather information from various public sources and the companies themselves. The "Pink Sheet" is analogous to Aviation Week and Space Technology, although it appears in newsletter format like Defense Daily and Aerospace Daily.

An annual book called The NDA Pipeline summarizes drugs approved and the status of pre-market drugs in the past year. The Pipeline, which also summarizes FDA advisory committee hearings, sells for $150. The closest analogue to this publication would be AIA's Aerospace Facts and Figures, which reports on government expenditures in aviation, space, and defense over the previous year.

Both the Pipeline book and the Pink Sheet let companies know how close their competitors are to marketing particular drugs, and which drugs are under development. Pink Sheet financial information might also tell them whether a company would be amenable to a joint venture. Industry participants also subscribe to a number of other newsletters that analyze companies, government actions, patient trends, and stock market developments. The space industry, notably, has more attention to news about new technology and less about the financial and stock performance of major companies.

Both industries contain other types of information in roughly comparable amounts as indicated in Table 6.

Most types of information in the pharmaceutical industry can be found in the space industry as well. One major exception seems to be distribution of scientific and technical literature. In medicine, pharmaceuticals are covered in the standard medical journals. Space technology, however, is more widely dispersed throughout the whole range of physical science and engineering

TABLE 6

Information Sources:
Pharmaceutical vs Space

TYPE	PHARMACEUTICALS	SPACE
Original Directory	Pharmaceutical Marketer's Directory	World Space Dir Satellite Dir
Technical Directory	...	Jane's Dir of Space Encyc of Space Tech
Annual Summary	NDA Pipeline (new product develop-) ment)	Aerospace Facts & Figures (AIA) Space Log (TRW)
Scientific Literature	New England Journal of Medicine Journal of the American Medical Association	NASA Reports AIAA Proceedings AAS Proceedings
Advertising space	PERQ	...
Online databases	Pharmaceutical News International Pharm	NASA/RECON Aerospace Database

reports. The only concentrated set of scientific and technical materials appears in forms which generally are less accessible than bound journals--e.g., NASA documents or conference proceedings. This difference may be one basis for the complaint that available material is difficult to obtain in the space industry.

(A minor difference in Table 6 is that the pharmaceutical industry has a service which tracks the amount of advertising space used for any product while the space industry does not. This difference arises from the different customers in the two industries. Pharmaceutical companies sell to a large number of widely dispersed physicians to whom advertising is appropriate; space companies sell, by and large, to the government, where advertising is less important.)

The comparison between the information available to the pharmaceutical and the space industries has yielded three results:

1. The space industry already possesses well-defined products like the pharmaceutical industry.

2. While news publications in both industries report government activity in their area, pharmaceutical news carries more of the business aspects of the industry than space publications.

3. Pharmaceutical researchers have more identifiable and accessible sources for scientific and technical literature than space researchers.

In general, though, the information sources are more similar than different. That finding is interesting in light of the interviews which indicated almost unanimous desire for more information about space business. The common thread may be,

however, that private sector business in space is still quite undeveloped, and the information sources are still oriented to the traditional aerospace business of government contracting.

Accordingly, new information sources devoted to the business aspects of space will develop when those activities create a market for that information. In typical Catch-22 fashion, however, the lack of space business information is now an impediment to market development in the views of our respondents. The objective of the design aspect of this project is to develop cost-effective information which is appropriate for the space industry in its current state of development.

SECTION III

SPACE BUSINESS INFORMATION CENTER

Design Overview

III.1 Design Objectives

The second major objective of Phase I was to design an information system to address the needs uncovered by the research activity. Specifically those needs are:

1. Types of business information that currently do not exist for the space industry
2. Easy access to information that does exist

To meet these needs, a prototype information system design has been developed. That design is to be embodied in the Space Business Information Center. The Center will be a research organization devoted to providing information for space commercialization. The Center will continue to pursue the research objectives of the Space Market Model Development Project:

1. To catalog and evaluate the information currently available for the space industry
2. To investigate the unmet informational needs of individuals and firms in the industry.

The Center will also assume a new set of operational objectives:

1. To develop new types of information that do not yet exist
2. To provide better access to existing information about space business to the business community.

The operational goals will be pursued in an experimental mode through the duration of research funding. In effect, the Center will serve as a test bed for the research results. At the same time,the prototype operations can be of immediate and future use to many in the development of space.

III.2 Design Components

The Space Business Information Center will consist of three components which, taken together, compose a complete information system. Those components are the space information itself, the organizational structure for acquiring and managing the information, and the electronic data storage and processing systems.

III.2.1 Information

The first and most obvious component is the information itself. The Center will possess all of the essential reference material for understanding space business. Space business will be defined as all portions of the private sector that have necessary links to activities outside the earth's atmosphere. Space business is currently composed of four major market segments.

Satellite communications

Remote sensing

Materials processing

Infrastructure products and services

The library will contain major books, reports, and directories concerning these primary market segments. The databases will also contain information such as lists of shuttle payloads, satellite launches, launch vehicles, and firms involved in each of the markets.

Information important to understanding the context of space business will also be retained. The context for space business is considered in four major categories:

Science and technology

Economics and finance

Law and politics

Information and public opinion

The contextual information will be important for the long-range forecasting of space business. It will contain lists of consultants, investment and insurance firms specializing in space business, laws and regulations that apply business in space, and major publications and information resources. Access will also be available to search databases such as NASA/RECON, Aerospace Database, and Congressional Information Service for additional information.

This material will be maintained in either bulk (hardcopy) form or in electronic form depending on the type of information. Books, reports, directories, and such will be maintained in a reference library that will be accessible at all times. Tabular information will be maintained within electronic databases for easier manipulation and report generation.

The Center will acquire information from many sources. Hardcopy materials will be purchased from standard sources, such as NASA/STIF, NTIS, GPO, and AIAA. Books, directories, and statistical summaries will be purchased directly from the respective publishers. The Center will also subscribe to all major space periodicals and will retain those articles and tables that have lasting reference value.

Electronic information will be obtained via electronic mail and through searches of electronic databases. Current awareness searches will be established to alert the Center of materials pertaining to space business as soon as they enter a key database.

III.2.2 Organization

An information system is more than just information. It is also an organization of people working to acquire, maintain, and disseminate the information in an effective and productive fashion.

The Space Business Information Center will have three major organizational divisions:

Research

Operations

Administration

The research staff will be responsible for continuing to meet the research goals of Phase I, that is, to determine what information the space business community needs to commercialize space. The research staff will interview individuals in the

space industry as before, but they will have two new research techniques available in Phase II:

1. Content analysis of requests for information from clients
2. Follow-up calls to clients who have received information from the Center.

These additional strategies should further refine the conclusions discussed in Section II of this report.

The operations staff will be responsible for collecting, maintaining, and disseminating information in response to client requests. Clients will receive information that is on-hand or readily available within a few days. Requests involving primary data collection or substantial analysis will be treated as custom research projects. The operations staff will also be responsible for maintaining the electronic data, the database, and the database tools.

The administrative staff will support both research and operations activities with standard office services and with relations between the Center and external organizations.

III.2.3. Electronic Data Storage and Processing Systems

The final component of the information system is the set of electronic tools for accessing, storing, and manipulating information. Those tools include a mainframe and PC-based fourth generation database management system (NOMAD2) and a mainframe text retrieval system (TextDBMS). The database environment will be accessed through an information workstation with a complete set of local processing tools such as word processors,

spreadsheets, graphics, and telecommunications. The workstation will also be able to access electronic mail networks and commercial databases through the telephone network.

Each component of the information system is described in detail in the next three sections of the report.

III.3 THE SPACE BUSINESS INFORMATION CENTER

This section describes the overall purpose and organization of the Space Business Information Center. The strategic goals of the Center are outlined, that are necessary for its long-term survival. The research and the operational objectives for Phase II are also discussed. Finally, the section describes the organizational structure and staff assignments that will be created to achieve those goals and objectives.

III.3.1 Description and purpose

The Space Business Information Center is designed to be a clearinghouse for business information about space. The research results described in Section II pointed out that, in contrast to scientific and technological information, less information is available to business people about doing business in space than about most other industries in the economy.

The Center intends to correct this imbalance by pursuing four major strategies for disseminating space business information:

1. Publish factual guides and directories on various aspects of space business. The first guides will describe the market areas chosen as prototype areas in Phase I:

   Small accommodation Shuttle payloads
   Remote sensing of land areas
   Biotechnology
   Launch vehicles

2. Maintain an information center whereby clients can request and receive specific factual information or documents about space business via telephone, electronic mail, post office, or delivery service.

3. Conduct research projects which involve primary data collection or analysis for specific clients.

4. Sponsor educational seminars on the various business aspects of space.

The Center will be established as a research office with the University of Houston-Clear Lake. The University is located next to the NASA/Johnson Space Center and has extensive experience with research projects on space commercialization and information technology through the University's Research Institute for Computing and Information Systems (RICIS). The Center will address the goals outlined above within a research environment where the needs of the space business community will be monitored and productive means of meeting those needs will be continually explored.

III.3.2 Strategic goals

One of the strong requirements of this research project is that the proposed information center have a good chance of serving the industry in the future without continuing government support, except for payment for services. Therefore, the Center has been designed to meet five strategic goals for its long-term viability:

Visibility
Accessibility
Timeliness
Quality
Utility

Meeting these goals will also promote the increased use of high-quality business information in space commerce.

Goal 1 -- Visibility

The Space Business Information Center must become known throughout the industry as a credible and reliable source of business information about space. Initially, the word will spread via news channels and the distribution of reports like this one. Ultimately, however, the Center must fulfill its mission if it is to retain a positive image in the community.

Goal 2 -- Accessibility

Once members of the industry have heard about the Center, they must be able to reach the Center and its qualified personnel quickly and easily. Phase II will initiate a trial period of requests for information from the Center via telephone, electronic mail, and postal service. Trained personnel will take requests and discuss information needs with members of the industry.

Goal 3 -- Timeliness

Having requested information, the client must receive some information rapidly, preferably within 24 hours, along with a reasonable estimate of the time needed to secure all information requested. The Center will have on hand, in electronic or document form, a great deal of information about space business. It will also have the means to search other resources and acquire information from them as quickly as possible. The Center hopes to shorten the time span between an information request and its completion.

Goal 4 -- Accuracy

The Center must likewise strive for the very highest standards of accuracy and completeness. Providing a great deal of detailed factual information is a difficult task because of the possibility and consequences of error. The need to commercialize space as fully as possible, however, makes this experiment essential.

Goal 5 -- Utility

The ultimate viability of the Center and its usefulness for the space industry will be determined by the utility of the information provided. The Center will strive to provide clients, with the <u>right</u> information and with the <u>right amount</u> of information required. Too much information can be as detrimental as too little. As a result, requests will be understood in their context so that the information delivered will be as useful as possible.

III.3.3 Phase II Objectives: Research

The strategic goals will be implemented during Phase II through two sets of specific objectives. The first set of objectives deal with the continued research nature of this program. The research goals for Phase II are:

1. Continue the research program begun in Phase I:
   - Monitor and catalogue information sources relevant to space commercialization
   - Investigate the information needs of the space industry
   - Suggest new products and services which the industry needs but presently does not have
2. Test and evaluate the prototype information system initiated for Phase II:
   - Monitor and analyze requests for information from the industry
   - Monitor and evaluate internal procedures to fill requests for information
   - Follow up with clients to measure the appropriateness of the information provided and their evaluation of the Center's services.

In short, the research organization will continue with the same goals as Phase I, but will use a radically different strategy to gather data. With a prototype information system in place, the research staff will use data from the Center's operational records to advance their understanding of the industry's information needs.

III.3.4 Phase II Objectives: Operations

A new set of objectives for Phase II will be to provide information to the space business community on an experimental basis. These specific operational objectives are the following:

1. Complete the collection of information for the four markets previously investigated:

   Small accommodation Shuttle payloads
   Remote sensing of land areas
   Biological processing in space
   Commercial launch vehicles

2. Produce information products and respond to requests for information described above:

   Printed guides
   Clearinghouse services
   Research reports
   Briefings

The staff responsible for meeting these objectives will be divided into three job classes, each with distinct experience and responsibilities:

Information Specialists:

> These staff members will be most familiar with the information sources available at the Center, both internal and external. They will accept and fulfill information requests from clients and other staff members. They also will scan periodicals and databases and update the internal hardcopy and electronic information.

Market Analysts:

> Each market analyst will be responsible for understanding and monitoring the information in each market for which the Center has complete information. On the basis of that understanding, they will recommend additions and adjustments to the information for that market. They also will be available for discussion with clients about information or issues pertinent to that market.

Client Representatives:

These will be the Center's field staff in the industry. They will assist clients in using information to enhance the effectiveness of their business and will help frame their requests for information. They also will assist the Center in understanding the information needs of its clients and the industry as a whole.

III.3.5 Administration

The purpose of the administrative staff is to provide resources and support to the research and operations staff. That support will be available in the following areas:

Computer Systems

The computer staff will be responsible for creating and maintaining all of the Center's electronic tools. The primary set of tools will be the computers, software, and peripherals for storing and manipulating the internal databases. These tools will be available for both research and operations staff members.

Public Affairs

As the Center becomes known within the space industry, it has the responsibility to keep industry leaders informed of its research results and operational procedures. Two particularly important target groups are the government officials charged with the responsibility to assist the development of the commercial space industry and the firms who choose to assist the Center through its Associates program. These groups will be given periodic reports and briefings conducted by the administrative staff.

Financial and Office Management

The basic administrative function is to maintain efficient and effective relations with clients, funding organizations, and the University.

III.4 Information Plan

Another major component of the Center's information system is the information itself. This section first describes how that information differs from the information already available to those interested in space business. Information is acquired and stored in various ways, so the next sections describe the type of information that the Center will contain and the techniques for acquiring it. The ways in which it will be stored and accessed and the security provisions for confidential information will also be described. Finally, the last section will describe how the information will be made available to the public.

III.4.1 Principles of Information Selection

The research reported in the previous section described a wealth of information resources already available to the space industry. The research also reported that some information needs are still unmet. In order to meet the unmet needs without duplicating the information that already exists, information will be collected using four principles. These principles distinguish the Space Business Information Center from most other information services.

Principle #1 -- Space more than aerospace

The Center will attempt to focus exclusively on information about space and include the other elements of aerospace as important but related areas.

Principle #2 -- Business more than science and technology

The Center's information will focus on business matters,particularly those aspects of space that are being developed by the private sector for profit. Scientific and technological information will be held and distributed because it has implications for business, but it will not be the focus of information acquisition.

Principle #3 -- Information more than policy analysis

Most written and spoken materials about space are on the level of policy analysis and recommendation. While basic data and information are a part of policy, most writers prefer to say what should be done rather than describe what is occurring or has been accomplished. The Center will focus on the latter issues, namely, accurate and timely information for use in policy analysis and recommendations. The Center will presumably be more effective in collecting and disseminating data when that is its primary objective.

Principle #4 -- Cooperation more than duplication or competition

Great care has been taken to study the existing information resources for space commercialization to avoid duplication. As a result, the products and services that will be offered by the Center will complement the existing services rather than compete with them. In general, the Center wants to use all existing information about space business in a clearinghouse function, making existing services more accessible to the broader business community. Suitable arrangements will be made with vendors to make sure their interests are not compromised.

III.4.2 Information Categories

The conceptual structure of space commercialization was created as part of the work conducted prior to Phase I. Space business was considered a set of markets, three applications markets, and an infrastructure market (Table 7).

TABLE 7

SPACE BUSINESS

APPLICATION MARKETS	INFRASTRUCTURE MARKET
Communication	Manufacturing
Remote Sensing	Transportation
Materials Processing	Communication

A complete dataset for any of these markets would include the following information:

- Products and services
- People and organizations
- Contracts and agreements
- Budgets, expenditures, and revenues
- Recent events and future plans

Additionally, each of these markets exists in a context that includes the following areas:

Science and technology

Economics and finance

Law and politics

Information and public opinion

A complete description of a space business, therefore, includes information about the market itself as well as the context of the market. The market categories describe the current conditions; the context contains the driving forces that shape the market for the future. The Center plans ultimately to have all this information for all of the identified space markets.

Phase I research concentrated on four prototype markets for study:

Space Shuttle small accommodation payloads

Remote sensing of land areas from space

Processing of biological materials in space

Commercial launch vehicles

The design for the information system was created after in-depth studies of these markets, and the Center will initiate trial products and services in these areas.

III.4.3 Information Acquisition and Maintenance

An information system must be maintained over a period of time if it is to repay its initial investment. A common mistake in building databases is to underestimate the time and materials necessary to adequately maintain the data. Databases begin to deteriorate almost immediately if steps are not taken from the outset to maintain them in a current state.

III.4.3.1 Establishing the information

Having defined the generic dataset for a market, the next task is to acquire the information that is readily available to meet those specifications. The Center will be considered established in a space market area when it holds the following information:

1. Major books and reports, particularly overviews and forecasts, on that market

2. Official documents related to doing business there

   Laws
   Regulations
   Policies
   Treaties

3. Factual data on that market

   Products and services
   People and organizations
   Space technology and programs
   Contracts and agreements
   Budgets, expenditures, and revenues
   Events and plans

III.4.3.2 Maintaining the information

Once established, the Center will monitor activity in the particular field and update its information accordingly. The goal is that the Center would establish itself only in those markets where there exists sufficient demand for the information and where the Center had sufficient resources to maintain the information once established.

The monitoring process for maintaining up-to-date information in any market will be conducted in the following manner:

1. Scan periodicals for documents and data to be added to the library and databases
2. Search external databases for new material added since the last update
3. Discuss recent events and plans with experts in the market

III.4.3.3 Acquiring new information

Establishing and maintaining the information in a market is the first goal of the Center. A longer-term goal, however, is to act as a focal point for the development of new information about space business. The primary area of missing data for space commercialization is economic statistics about space markets. Either these statistics are included in larger markets, like aerospace or defense, or they have never been collected.

A case in point is the remote sensing industry. Numerous studies of the market potential for space-based remote sensing have been conducted over the last twenty years. Most of these studies showed enormous unrealized potential for private ventures

in remote sensing. Not one study, however, has collected the actual dollar value of goods and services exchanged in that industry. Without such statistics, the calculation of market share, growth, or future revenues is difficult, if not impossible.

The Space Business Information Center will attempt to resolve this problem by gathering statistics that are not now being collected. These statistics will aid construction of an economic model of the industry measuring descriptive and analytical relationships between various elements of the market. These statistics will also contribute to more meaningful projections and business plans enabling entrepreneurs to raise capital for new ventures.

The model under study is an input-output model of the space industry. The model would be constructed on two levels, showing the interactions among the various segments within the space industry, and the interactions between the aggregate space industry and the rest of the U.S. economy. Such a model would be particularly useful for showing the effects that changes in final demand for certain products would have on the demand for space business and, conversely, the effect of a vigorous space industry on the rest of the economy.

The major obstacle to implementing such a model of the space industry is data collection. A perfectly accurate model would measure the purchases and the sales of every firm in a given segment of the economy under study, a formidable task under ideal

circumstances. A further problem in the space industry is that most firms, particularly those in the prototype markets studied, are small and privately held. Since they do not report their balance sheet to any government agency, these firms are particularly sensitive about releasing information on their financial status.

One of the goals of Phase II will be to measure how much firms are willing to contribute their financial data on a confidential basis in order to characterize the economics of the marketplace.

III.4.4 Forms of Information

Information will be kept at the Center in two forms: documents and electronic databases. Initially, textual information and large tables and lists will be kept in document form. Most lists and tables, however, will be kept in electronic form for easier manipulation and dissemination.

Information will be kept at the Center when:

1. It is central to understanding space business and its future
2. It is frequently requested by clients.

The Center currently plans to retain bulk information in the following forms:

Books

Reports

Official documents (bills, laws, regulations, treaties)

Selected articles and chapters of books

Selected lists, tables, and charts

Electronic data will be kept in a relational database for ad hoc query and report generation. Current plans are to use the D&B Computing Services' NOMAD2 database management system running on an IBM mainframe at the NASA/Johnson Space Center. The information workstation in the Information Center (described below) will be used to enter, maintain, and query these databases. The current major areas for database development include the following:

Products and services

People and organizations

Space technology and programs

Budgets and expenditures

Events and plans

Much of the information does not even need to be held at the Center because it already exists in accessible form through other information services. When this is the case, the Center will attempt to use that service instead of maintaining its own information in that area.

Some of the information sources presently under consideration are the following:

NASA/RECON (NASA/STIF)
National Technical Information Service (NTIS)
Congressional Information Service (CIS)
Commerce Business Daily (CBD)
Federal Regulations Abstracts (Capitol Services)
Aerospace Database (AIAA)
Aerospace/Defense Markets & Technologies (Predicasts)
Aerospace On-line (Murdoch)
Newsnet
DMS Contract Awards
Federal Research in Progress (NTIS)
Monthly Catalog (GPO)

Other more general business and bibliographic databases will be included as they are found to be relevant to the space industry and its markets.

III.4.5 Information Confidentiality and Security

The Center will be concerned primarily with public information that will be obtained and disseminated in the open market. Occasionally, however, the Center will request or receive information on a confidential basis. It is imperative, therefore, that the Center handle this data in a responsible manner to prevent its misuse and consequent harm to innocent parties.

The Center's security procedures are designed around three different security levels: public, sensitive, and confidential. Each level has its own rules and procedures for storing information, accessing it, and using it. In general, public information is obtained from published sources or government reports marked "unclassified and unlimited." It can be stored and manipulated according to its best use.

Sensitive and confidential information requires special rules for storage, access, and use. Sensitive information is collected for statistical purposes, and it is not to be reported as individual items with or without identification. Confidential information is one-of-a-kind information, regarding new products or research areas, and is not to be reported at all. Both types of information will be stored in secured areas or in separate computer accounts. Access will be limited to selected management personnel or to other staff members under special conditions.

The Center takes very seriously the responsibility for handling confidential information in a professional manner. Accordingly, the Center would welcome any assistance or advice to perfect its security procedures.

III.4.6 Information Products and Services

The Center will concentrate on four product and service areas during Phase II. These services will be offered on a trial basis. They will initially provide information from the four prototype markets listed above and be extended to other markets as the Center becomes established in a wider range of markets.

III.4.6.1 Printed Products

The Center will produce two types of printed publications during Phase II. The first type will be a set of introductory guides to the prototype markets studied in Phase I: Shuttle payloads, remote sensing, biotechnology, and launch vehicles. These guides will introduce business people to the structure and

characteristics of each of these markets. The guides also would be a handy reference for factual data that already exists about these markets.

The guide for small accommodation Shuttle payloads, for example, would include the following sections:

1. A brief description of the Orbiter and its capability for small payloads.
2. A list of small payloads that have flown including a brief description, the flight date, the principal investigator, and a current contact.
3. An aggregate analysis of payloads by application area, type of payload, physical characteristics, and sponsors.
4. A brief description of payload integration--the process by which a customer flies a payload on the Space Shuttle.
5. Text and citations of relevant laws, regulations, and policies.
6. A list of the principal NASA offices that deal with payloads, and their responsibilities and contacts.
7. A list of the engineering firms that offer assistance in payload integration.
8. A glossary of technical terms and acronyms
9. Citations of other information for further investigation.

Existing information compiled by NASA and other organizations would be used where possible. The Center would generate its own information when existing information is not publicly unavailable. One notable example of that is the inventory of small accommodation Shuttle payloads being compiled as part of a separate NASA grant in conjunction with this research.

Publication of this guide is scheduled for summer 1988. Guides to the other markets will be produced as the information is developed. All guides should be published by the end of Phase II. If these guides prove useful in the marketplace, they could be updated annually.

The second type of printed product will be background papers on current issues in space commercialization. These papers will provide relevant historical and statistical background for issues being discussed in the industry. The topics for these papers are unknown at this time because sufficient data has not yet been collected on topical issues. When that data is collected and stored, the Center will seek opportunities to produce high quality, data-intensive pieces on issues currently under investigation.

III.4.6.2 Information Clearinghouse

A completely different type of information service will be the clearinghouse function, providing information on demand. Even if the Center's printed products from the Center contain the most useful information for the industry, they will still contain only a small fraction of all the useful information. The clearinghouse, therefore, is the companion service to the printed products.

The clearinghouse will respond to client's inquiries received by telephone, electronic mail, or postal service. Clients will receive a preliminary response to the inquiries within 24 hours, an estimate of the time and cost to fill the

complete request. Ultimately, clients will be charged through some combination of subscription charge and payment for time and materials. Since Phase II is still a research program, however, selected clients will be allowed to use the service on a trial basis just for the cost of materials.

The clearinghouse depends on successful arrangements with other information vendors to distribute their information through licensing arrangements or for royalty fees. The Center's clients will benefit from being able to discuss their request with experienced individuals who know the information sources in the industry. The value to the primary vendor, in addition to income, will be being cited by the Center as the original source of the information. Clients with a substantial information need in any one area can then deal directly with that vendor.

The clearinghouse is a direct response to research results that indicated significant frustration in companies' attempts to locate particular information. It is not yet known if a clearinghouse will reduce that frustration and thereby become a sustainable part of the industry. The Phase II research program is designed to answer that question.

III.4.6.3 Research Reports

When information requested by a client is not available, the Center will offer to collect that information under a separate agreement with the client. Fees for this service will be negotiated on a case-by-case basis during Phase II to gain experience for pricing information services. Information that

will be collected and stored for re-use by the Center will be priced lower than proprietary work conducted solely for one client.

III.4.6.4 Briefings

Some information is best communicated personally. The Center will respond to requests for briefings or seminars on various aspects of space business. Briefings will be conducted by individuals experienced in the requested field. The attendees also will have the full resources of the Center available during and after the briefing through online or telephone contact.

III.5 Computer System

The third major area of the information system is the design of a cost-effective computer system to manage the information and support products and services. Work on planning the computer system has not proceeded as rapidly as the other two research areas because the computer system is more a support function than an independent research activity. Nevertheless, some planning has taken place and construction for the computer system is a priority for Phase II.

The computer system for this information has three main objectives:

1. To allow information specialists to gather, manipulate, store, and transmit information using electronic tools and media

2. To generate informational products and support information services useful for the space industry

3. To monitor the activities of information specialists and staff for research and accounting purposes

III.5.1 Information Workstation

The core of the computer system needed to meet these objectives will be a system called the information workstation. The workstation is a central node of an extensive computer network. It is also the location of the electronic tools for handling the information. Figure 1 illustrates the capabilities of the Workstation and its links to other information systems and tools.

The major capabilities from this workstation are:

Workstation equipment

- IBM PC-AT (enhanced)
- Fixed disk drive
- Laser printer
- Dot matrix printer
- 2400 Baud modem

Workstation software tools

- Word processor
- Database
- Graphics
- Utilities
- Spreadsheet
- Communications
- Publisher

Local computer resources via local area networks

- JSC/CIN via IBM/SNA
- UHCL/VAX via ETHERNET
- RICIS/HCX-9 via IBM/Token Ring

Electronic mail

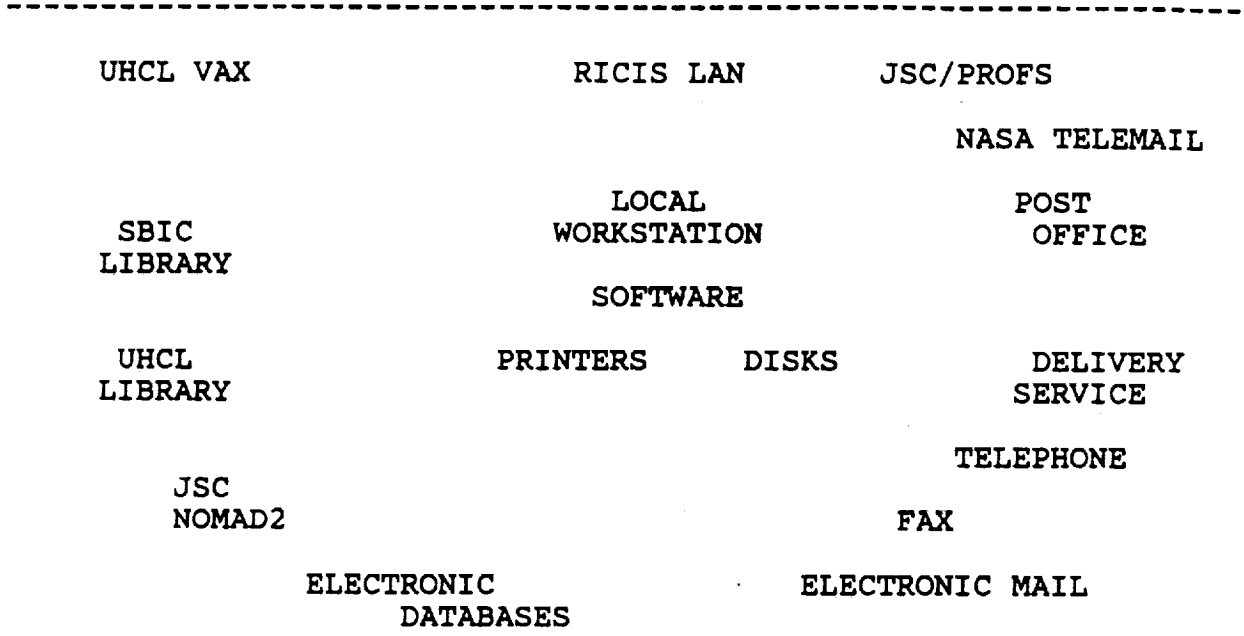
- JSC/PROFS via JSC/CIN
- UHCL/DECMAIL via ETHERNET
- NASA/TELEMAIL via NASA/NPSS
- Commercial electronic mail networks

Electronic databases

- NOMAD2 via JSC/CIN
- DIALOG Information Services
- Newsnet
- Aerospace On-Line

FIGURE 1

INFORMATION WORKSTATION



III.5.2 Database Environment

Information stored locally will be retained, for the most part, in electronic databases. For that reason, plans for the database environment are crucial to the success of this information system.

The preliminary decision has been made to develop the demonstration databases in the NOMAD2 database management system from D&B Computing Services. This decision was made because of the flexible and powerful nature of NOMAD2 and the availability of strong local support in that system. The system also is used extensively on the JSC IBM network.

The actual databases to be created are listed in Table 8.

TABLE 8

DEMONSTRATION DATABASES

Space Shuttle payloads (SSPIS)
Products/Services
People/Organizations
Events/Plans
Budgets
Infrastructure facilities
Documents
Administration

The database environment consists of much more than actual databases. A strong requirement for this research project is to develop a set of database tools that support the maintenance and use of databases in a cost-effective manner. So far, this toolset includes four standard database functions for which specific tools and procedures will be developed (Table 9). The tools will be written in the NOMAD2 fourth generation language and stored as callable NOMAD2 procedures. The procedures will be embedded into the operations of the research office and become part of the policy and training for the operation of the electronic system.

TABLE 9

DATABASE TOOLS AND PROCEDURES

DOCUMENTATION for	DATA INPUT via
Structure	Key
Data	Bulk Load
MAINTENANCE of	**OUTPUT**
Structure	On-line
Data	Off-line
	Print

The principles guiding the development of this workstation and its tools are:

Productivity -- the ability for operators to perform all standard functions quickly and easily

Technology -- the use of well-established technology whenever possible

Integration -- the ability for software programs, database tools, and communication networks to work together

Flexibility -- the ability to adapt the database structure to changes in the information without changing the tool

Growth -- the ability to expand the database rapidly in response to market demand

Given these principles, the computer system with the Center will become a testbed for the integration of existing hardware and software into a highly productive information work environment.

III.6 Conclusions

The design for the Space Business Information Center is a carefully worked out set of interrelated functions. Despite the apparent complexity of the plan, the overriding goals were specified above--

Visibility

Accessibility

Timeliness

Quality

Utility

Each aspect of the information system is designed to serve one or more of these strategic goals. Whether or not they do, of course, is the first question of the Phase II research program. The second question is whether or not they also serve the needs of the space business community. Only experimental operation and feedback will answer that question. Then the only remaining question is whether this information system is a useful, and indeed a necessary, component to a successful space industry. That question can only be answered in the long-run.

This research effort has contributed to an important long-term goal, making space a well-known and attractive enough place for business. Information in its own right does not solve the problems of doing business in space. Indeed, in the short-run, it may even reveal problems which are currently poorly understood or ignored. In the long-run, however, business has to go into space with as much information as it can for the enterprise to succeed.