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COMMERCE LAB

SCIENCE

COMMERCE LAB:
MISSION ANALYSIS AND
PAYLOAD INTEGRATION STUDY

FINAL REPORT

JULY 1985

CONTRACT NAS8-36109

WYLE LABORATORIES

INDUSTRY

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WYLE LABORATORIES – SPACE PROJECTS
RESEARCH REPORT WR 85-09

COMMERCE LAB: MISSION ANALYSIS AND PAYLOAD INTEGRATION STUDY

July 1985

Final Report
of Work Performed Under Contract NAS8-36109

for

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

Reviewed and Approved by

Tom C. Bannister Space Projects Office	Gary D. Marvin Systems Engineering
Robert A. Hall, Manager Space Projects Office	Jack E. Robertson, Director Research and Engineering Division

PREFACE

The U. S. space program has progressed considerably since the days of Apollo and Skylab in the late sixties and early seventies. At that time, experiments and scientific demonstrations were performed on the usefulness of microgravity in fluid physics and on a range of solidification processes. In those days, sample return to Earth was quite limited. The development and successful flight of the Space Shuttle provides the long-awaited capability to launch and return sizable samples to space for scientific and commercial reasons. The interest of the scientific community and, in particular, the surge of interest being shown toward commercial utilization of space for microgravity processes demands that a vigorous flight program be pursued. In fact, this is one of the strong recommendations of NASA's Space Commercialization Task Force. In addition, the commercial user generates a need for a well-defined infrastructure for operation.

The number of missions currently planned for the next 8 to 10 years is insufficient to support an aggressive commercial microgravity program. Therefore, this program, "Commerce Lab: Mission Analysis Payload Integration Study," has identified needs, defined missions, and to a limited extent, identified and analyzed infrastructural issues.

A commercial laboratory facility which can be used to develop studies in microgravity science and technology as well as to resolve institutional and policy issues related to private sector involvement in the space program is a proposed addition to NASA's mission planning. Commerce Lab is conceived to be one or more of an array of carriers which would fly aboard the Space Shuttle that will accommodate microgravity science experiment payloads. Of equal importance to the task of defining commercial missions is the determination of the status of the experiment development and particularly the state of affairs of the experiment apparatus inventory and its capabilities to support the industrial scientists' requirements.

It is expected that Commerce Lab will provide a logical transition, or bridge, between currently planned Space Shuttle missions and future microgravity missions centered around the Space Station. The current Space Shuttle traffic model envisions a number of flights per year with Microgravity Science and Applications (MSA) experiments scheduled for the middeck, on the Materials Experiment Assembly (MEA) and Materials Science Laboratory (MSL) located in the payload bay and in Spacelab. However, additional emphasis needs to be placed on the current Space Shuttle mission model for MSA studies. The mission model for Commerce Lab should address both scientific interest and commercial applications. Whereas many of these mission requirements may only be resolved by having an operational Space Station, it is important to gain further insight into MSA during the developmental years of Space Station to ensure that the Space Station is not plagued with similar limitations.

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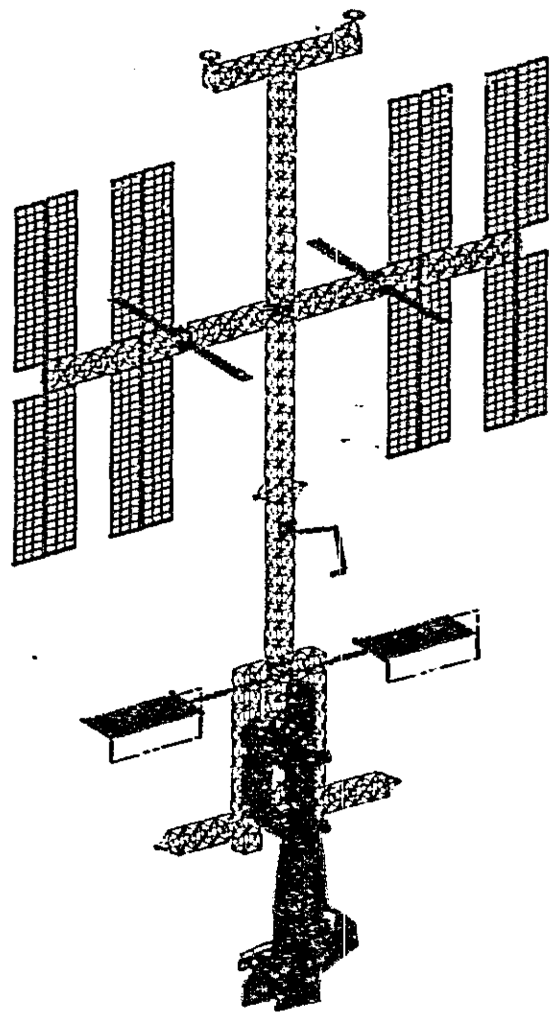
INTRODUCTION

The commercialization of space activities began soon after the first satellite was launched. Communication satellites evolved most quickly, followed later by other disciplines. President Reagan reemphasized the importance of this process in his July 1982 statement of space policy. He called for the United States to obtain economic benefits through the exploitation of space and to expand private sector investment and involvement in civil space and space-related activities.

The long-term development and use of space will require the continuing application of a large array of equipment, facilities, and operational processes. Not only will new opportunities arise for the development and commercialization of new products as a result of the unique environment afforded by space but, likewise, many new service-related opportunities can now be anticipated.

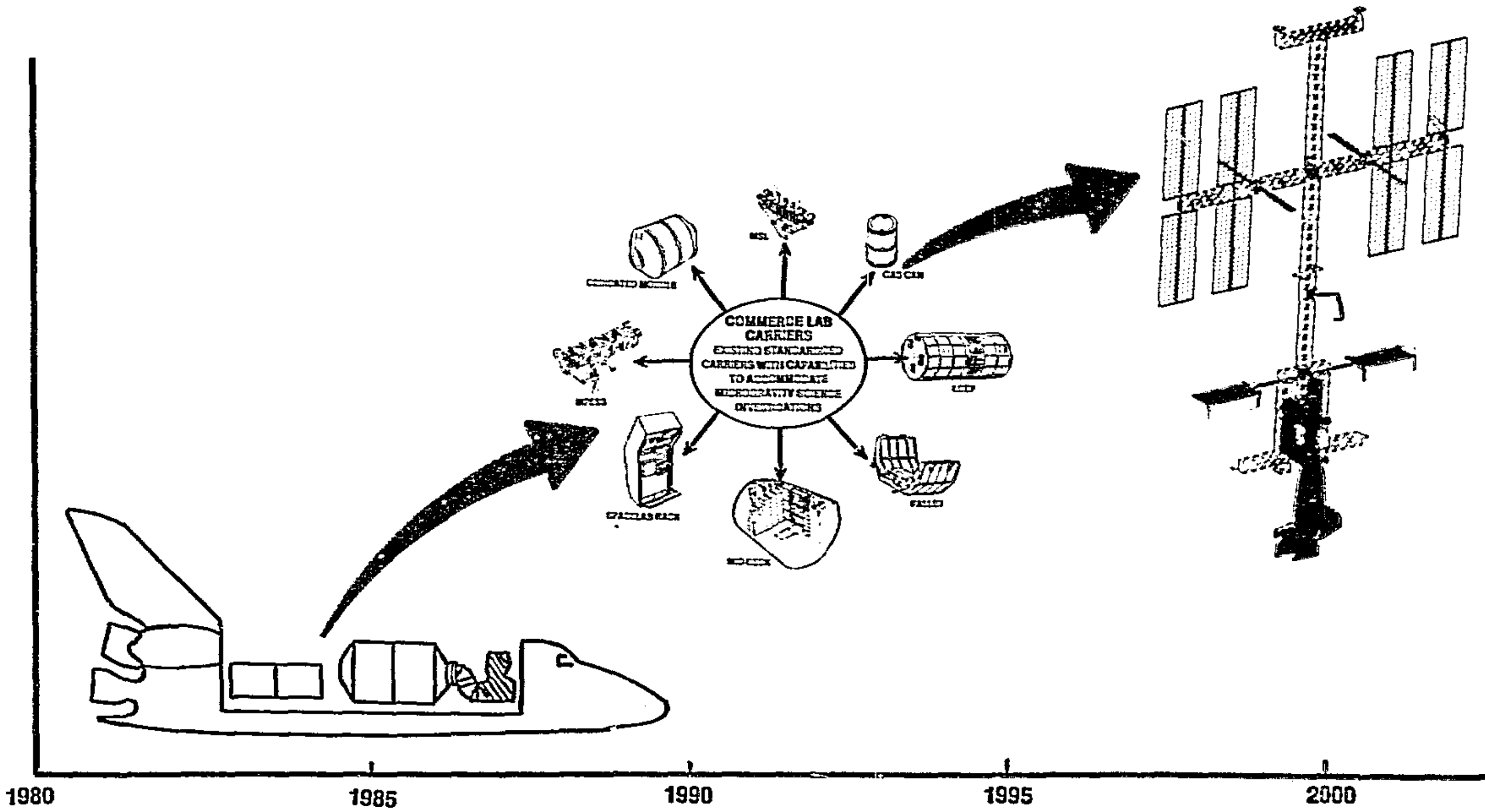
Commercial opportunities in space include the development of products, processes, and services which have potential technical, economic, and institutional viability. To achieve private sector investment in, ownership of, and operation of the activity as a profit-making venture, certain NASA initiatives must be undertaken to stimulate and support private sector involvement. It was under this directive that the "Commerce Lab: Mission Analysis Payload Integration Study" was developed.

AMERICA'S NEW FRONTIER
COMMERCIALIZATION OF SPACE



A NEW COMMERCIAL INITIATIVE

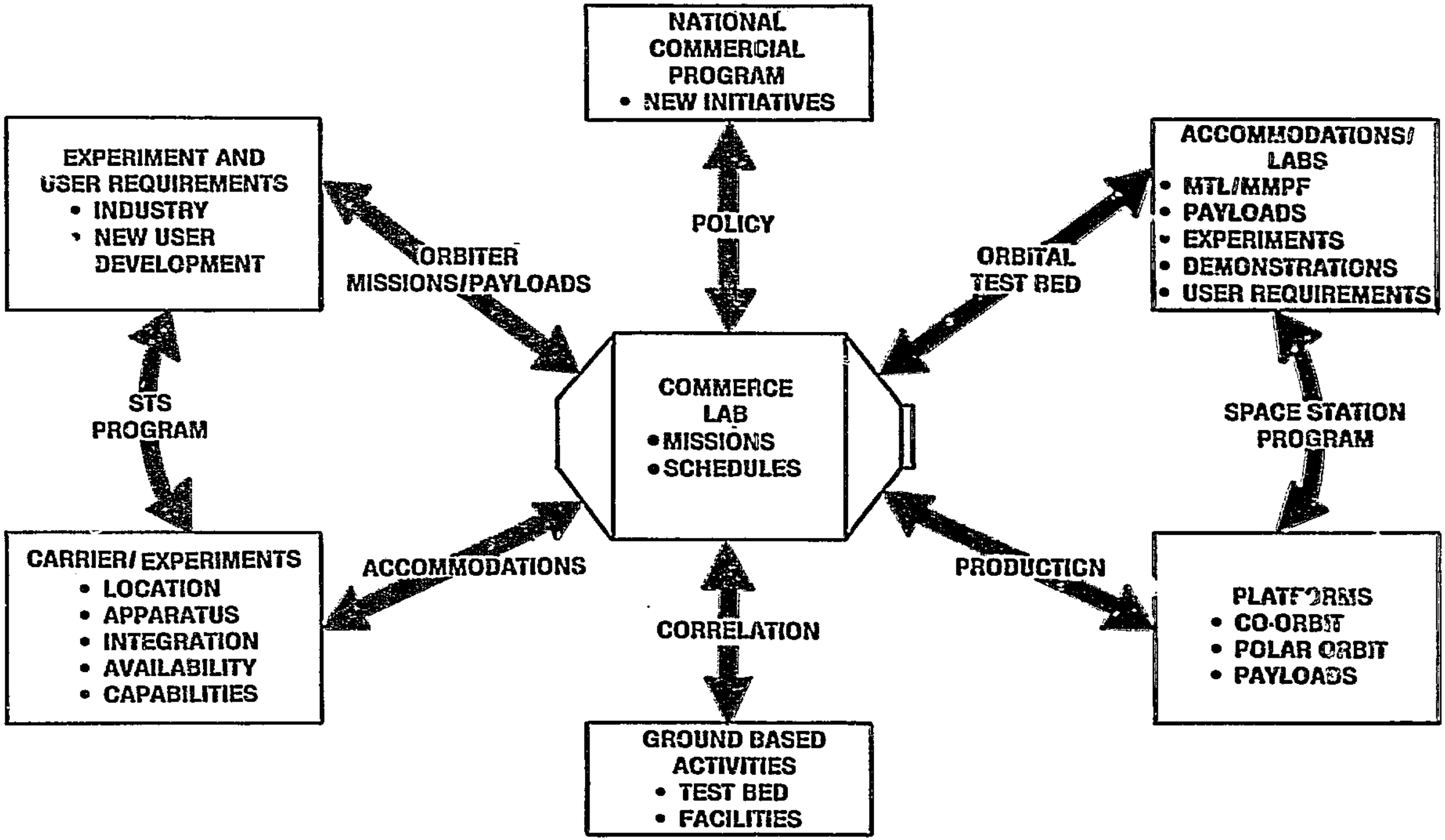
Commerce Lab can serve as a new initiative to industry to actively participate in the commercialization of space. Using existing Spacelab and STS carriers, procedures, and technology, Commerce Lab will allow industry to study and perfect microgravity science and materials processing today without having to wait for the realization of Space Station. Commerce Lab will also serve as a vehicle for the testing and perfecting of hardware and procedures to be used in Space Station so that a full-fledged production facility can be initiated within a year or two of Space Station's insertion into orbit.



WYLE
LABORATORIES

RELATIONSHIP BETWEEN COMMERCE LAB PROGRAM AND OTHER SPACE PROGRAMS

Expanding upon the relationships of Commerce Lab, STS, Space Station, government, and ground-based activities, it can be seen that the interactions are numerous and self sustaining. Commerce Lab will be the facility used to implement national commercialization programs and initiatives while serving to develop and scope a realistic government policy in space. Commerce Lab will augment and correlate current and planned ground-based activities such as test beds, drop towers, and ground-based aircraft testing. Commerce Lab will serve as an adjunct to the STS program by providing a focal point for space commercialization and an easier, faster, and more standardized interface for industry wanting to take advantage of manned microgravity capabilities. STS will provide mission availability, carrier and apparatus capabilities, and integration facilities while Commerce Lab will provide viable commercial payloads and user demand. Finally, Commerce Lab will serve as an orbital test facility for the testing, development, and implementation of hardware and procedures to be used in the Space Station program, providing the ability to enhance Space Station development and, as a result, hasten space platform production capability.



WYLE LABORATORIES

The mission objectives of Commerce Lab are to support the space program in the following major areas:

1. To expedite Space Commercialization

2. To advance Microgravity Science and Applications

3. To serve as a precursor to future missions in the space program

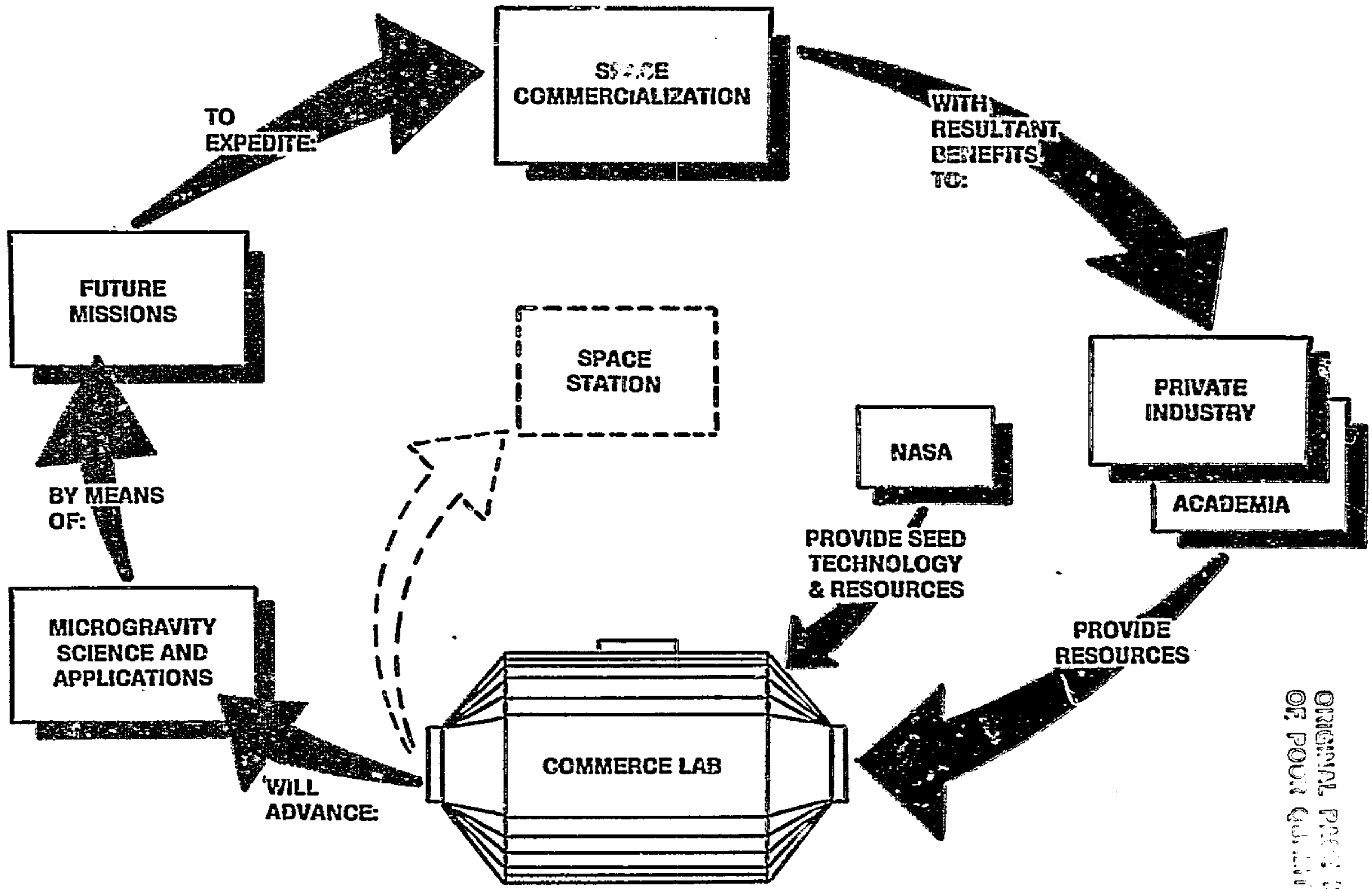
Illustrated are several key points involving the accomplishment of mission objectives. These are as follows:

- NASA, with its vast technological resources and experience in space in general and microgravity science in particular, must be the prime mover in bringing private industry and academia into the arena of space commercialization. This is accomplished by "seeding" its technological base in commercial space ventures. Commerce Lab is the test bed for the seeding process.

- Private industry and academia must recognize that a future commercial bonanza lies in space experimentation and later in space production and must be willing to commit resources toward this endeavor. Commerce Lab provides this opportunity.

- Through Commerce Lab, microgravity science will be advanced by means of future on-orbit missions, which will expedite space commercialization, with the resultant benefits being directly brought back to private industry and academia.

- Commerce Lab will provide an important intermediary step between the Space Shuttle and the Space Station by advancing the state of microgravity science and by cultivating a commercial customer base.



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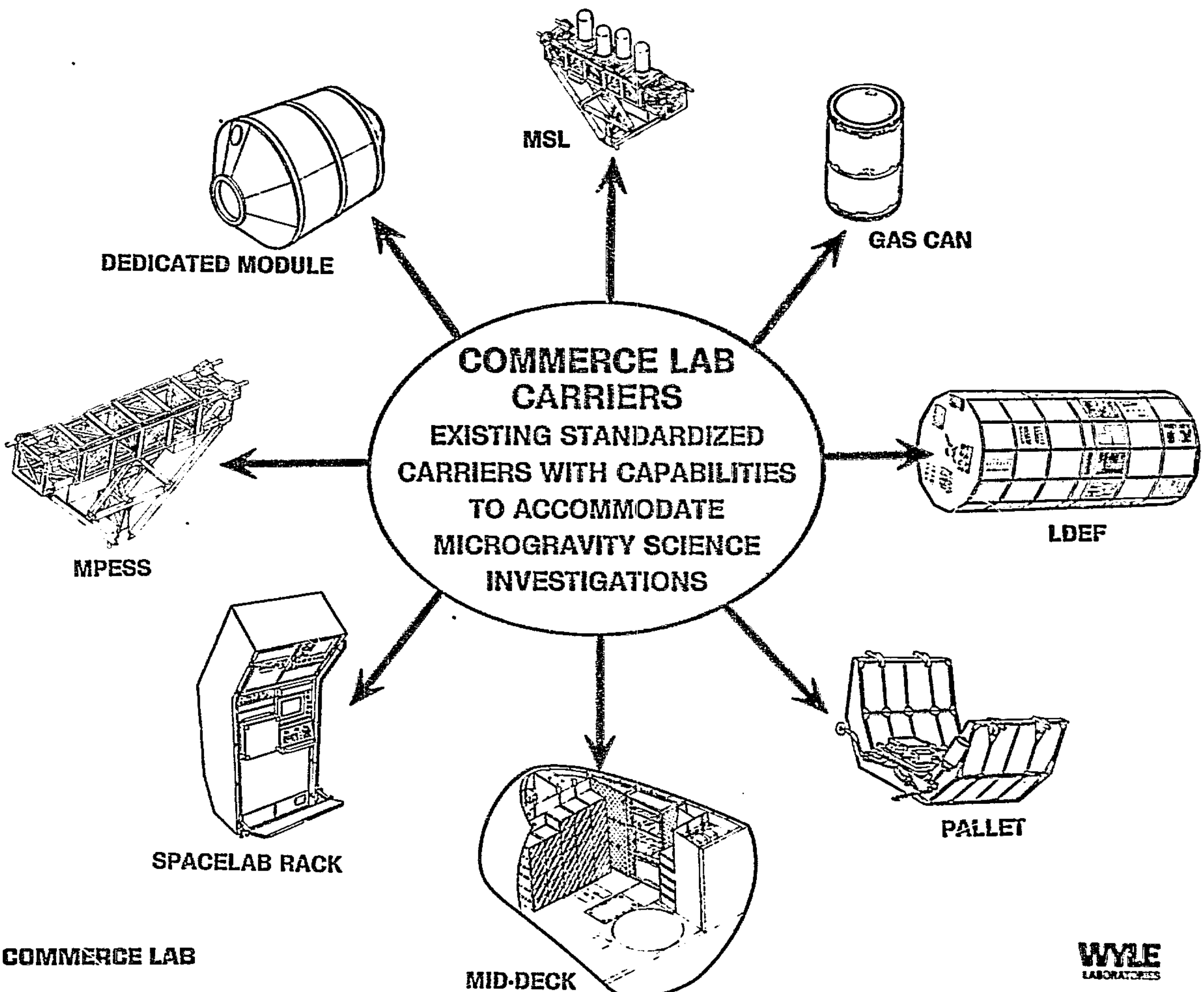
MISSION OBJECTIVES OF COMMERCE LAB
IN THE NATION'S SPACE PROGRAM

COMMERCE LAB CARRIERS

Utilization of existing carriers will enable Commerce Lab to accommodate microgravity science investigations immediately without the time delays and additional expense of developing new carriers. Standardization of interfaces will hold down development costs and maintain integration time at a minimum. It should be noted, however, that the list of carriers is not limited to those illustrated, and the option of modifying existing carriers and/or development of new carriers is held open for possible future needs.



COMMERCE LAB

WYLE LABORATORIES

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PROGRAM PHILOSOPHY

We can say, then, that Commerce Lab will serve as a focal point for the commercialization of space, especially in the microgravity materials processing sciences, and provide a means for NASA and private industry to cosponsor Shuttle flights partially or wholly dedicated to MPS. In addition, Commerce Lab will serve as the developmental stage of Space Station.

Keeping this basic philosophy in mind, Wyle's study has developed capabilities and requirements data bases and taken an initial step toward a mission traffic model for commercial users. Using refined and updated versions of this data, future mission planning can be accomplished.

PROGRAM IMPLEMENTATION

- PROGRAM PHILOSOPHY:
  - TO PROVIDE A POINT OF FOCUS FOR IMPLEMENTING A SERIES OF SHUTTLE FLIGHTS, CO-SPONSORED BY NASA AND U.S. DOMESTIC CONCERNS, FOR THE PURPOSE OF PERFORMING MATERIALS PROCESSING RESEARCH AND PRE-COMMERCIALIZATION INVESTIGATIONS

- WYLE STUDY OBJECTIVE:
  - TO DEVELOP A MISSION TRAFFIC MODEL FOR ACCOMMODATING COMMERCIAL MPS USERS

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PROGRAMMATICS

BACKGROUND

- CONTRACT WAS INITIATED ON JUNE 22, 1984
- KICKOFF MEETING AT MSFC ON JULY 6, 1984
- REVIEWS WITH MSFC ON AUGUST 22 & OCTOBER 17, 1984
- INTERIM REPORT, DECEMBER 6, 1984
- PERIOD OF PERFORMANCE: 12 MONTHS

MAJOR PROGRAM TASKS

The four tasks defined in the contract are given on the facing page. There have been some changes with regard to the emphasis being placed on some areas. Three things are worthy of noting. First, NASA has requested that Wyle take a quick look into integration times and concepts for reducing user integration time. This has led to the development of Fast Track. Second, analysis of infrastructural relationships has been de-emphasized as requested by NASA; and third, it has been necessary to refine and expand the approach logic, taking into account all possible contingencies. (Detailed flowcharts are available.) The status of the tasks are briefly summarized on the following page (see schedule).

CONTRACT STUDY TASKS

TASK I - SYNTHESIS OF USER REQUIREMENTS AND IDENTIFICATION OF COMMON ELEMENTS AND VOIDS

TASK II - DEFINITION OF PERFORMANCE AND INFRA-STRUCTURE REQUIREMENT AND ALTERNATIVE APPROACHES

TASK III - CARRIER AND MISSION TRAFFIC MODEL DEVELOPMENT AND INFRASTRUCTURE DEVELOPMENT

TASK IV - PREPARATION OF FINAL REPORT

SCHEDULE

The schedule on the facing page has been developed commensurate with the tasks which were worked (see preceding page). Task I is complete. Corrections, additions, deletions, and modifications to data bases can and should be made as required by the increasing maturity of the user investigations and development of apparatus or carriers. This is a good subject for follow-on work. Task II is also complete. The approach logic flows for trades and analysis, mission traffic modeling, and mission planning have been refined and expanded in the flowchart forms shown in this report. The trades and analysis has been completed for the initial mission traffic model. As the user requirements, apparatus, and carrier capabilities data bases are updated and modified, mission traffic models will undergo changes and result in iterations to mission planning. Task III, outlining of mission opportunities and delineation of problem areas and possible solutions, is complete for an initial traffic model, which is contained in this report.

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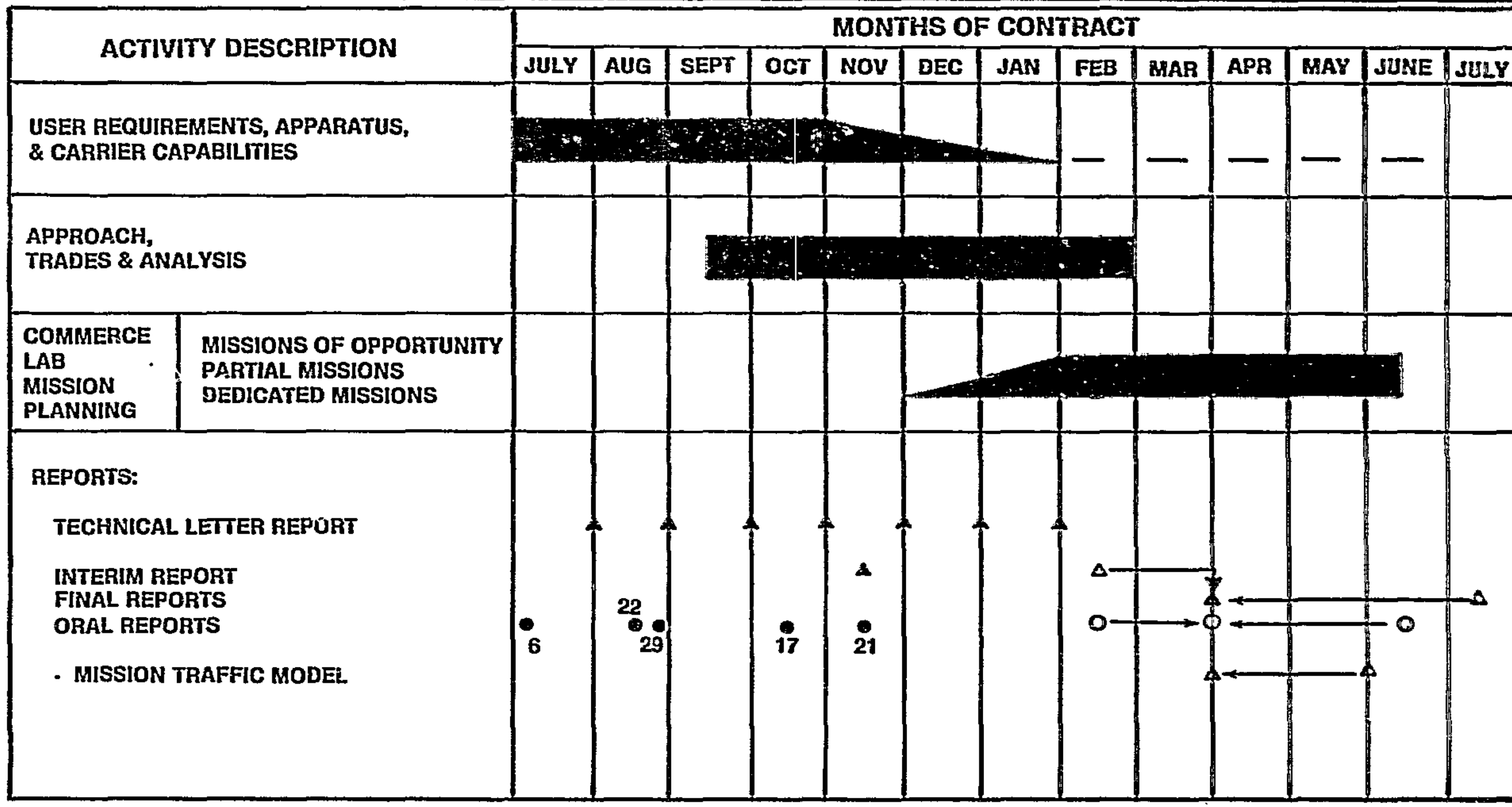
PROGRAM SCHEDULE



METHODOLOGY

CONSIDERATIONS

The Commerce Lab program must take into account a myriad of complex considerations which constitutes the fabric of space commercialization. The technical approach for the Commerce Lab Study recognized these various considerations and provided an analytical framework for structuring the elements and deriving the mission set.

The six microgravity science disciplines must be expanded into their many investigation areas and then screened for potential commercial applications. User interest and requirements are key drivers in the development of a comprehensive set of experiment apparatus requirements.

Experiment apparatus is a fundamental consideration. The apparatus inventory shall include those presently available to industry, those currently under development, and identifiable apparatus needed in the future.

Existing carriers identified for commercial applications represent the foundation for the experiment payload accommodations. Near-term and long-term requirements may dictate modifications or refinements to the existing carrier inventory or new carriers may be recommended.

Integration of the user payloads and methods of providing a more timely access to space and reduced time waiting to be incorporated into missions are paramount to developing the user community.

Trades and analysis are essential in deriving the best mission(s) for both the commercial user and NASA. User requirements, apparatus capabilities, and carrier capabilities are played against missions of opportunities and the STS mission model in the trades and analysis and mission planning elements in an iterative process to define a Commerce Lab mission set.

CONSIDERATIONS

1. MICROGRAVITY SCIENCE DISCIPLINES HAVING POTENTIAL COMMERCIAL APPLICATION

2. USER INTERESTS AND REQUIREMENTS

3. EXPERIMENT APPARATUS
   a. PRESENTLY AVAILABLE
   b. UNDER DEVELOPMENT
   c. FUTURE NEEDS

4. ACCOMMODATIONS
   a. EXISTING CARRIERS
   b. NEAR-TERM REFINEMENTS (MODIFICATIONS TO EXISTING CARRIERS)
   c. LONG-TERM REQUIREMENTS

CONSIDERATIONS
(Concluded)

5. INTEGRATION
   a. EXISTING PROCESS
   b. ALTERNATIVES LEADING TO NEW INTEGRATION CONCEPTS
   c. INTEGRATION/USER INTERFACE TRADES
   d. OPTIMIZATION OF THE USER/NASA INTERFACE

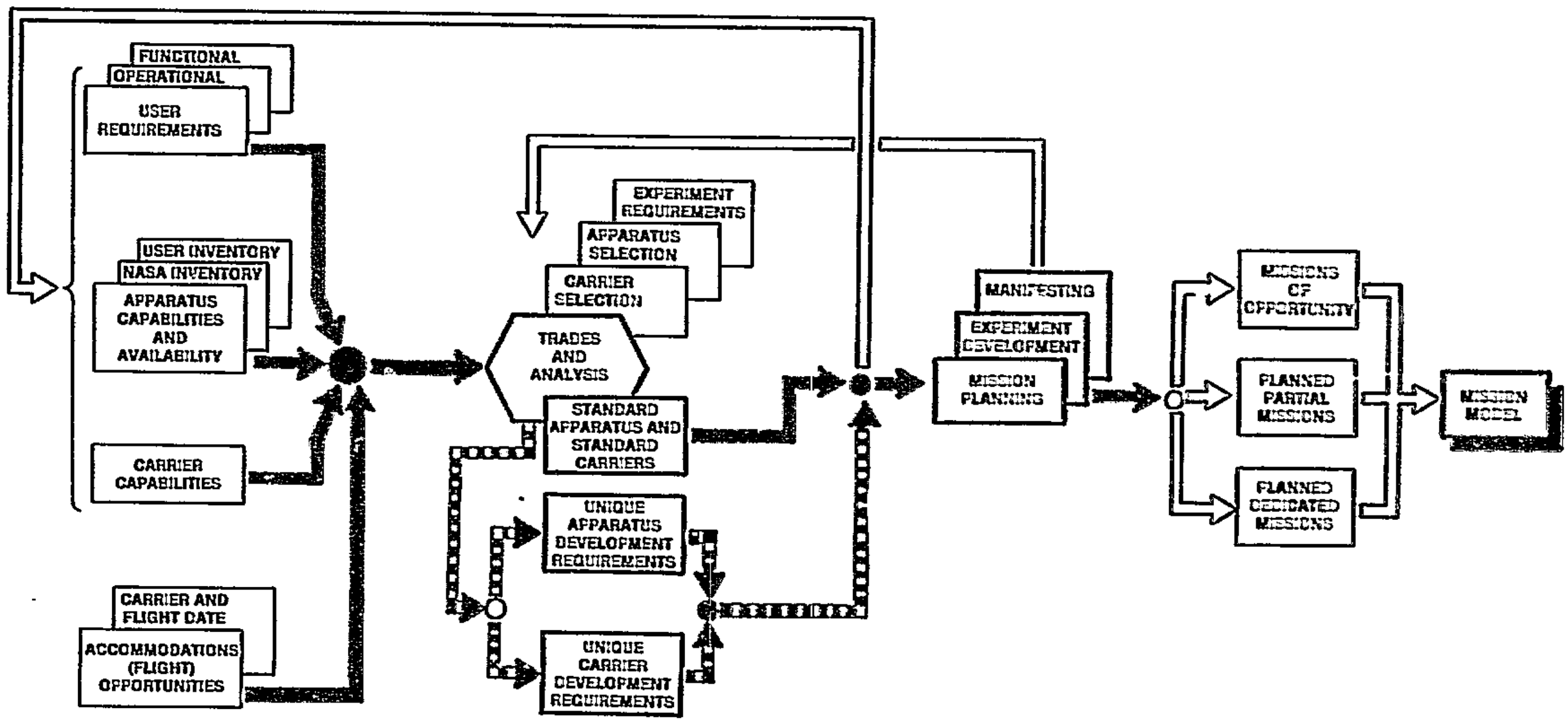
6. TRADES AND ANALYSES NECESSARY TO SUPPORT MISSION PROJECTIONS

7. MISSION MODEL DEVELOPMENT

COMMERCE LAB STUDY FLOW

The study flow presents a simplified block diagram of the elements of the Commerce Lab study with some of the more pronounced interrelationships. The diagram indicates that three elements of the study: (1) user requirements, (2) apparatus capabilities and availability, and (3) carrier capabilities along with missions of opportunity are entered into the trades and analysis element. In the trades and analysis, three discriminator paths are examined: (1) standard apparatus and standard carriers, (2) unique apparatus development requirements, and (3) unique carrier development requirements. Satisfaction of user requirements is initially sought with the standard apparatus and standard carriers, and a mission is identified. Mission trades must be conducted in an interactive mode with the user. A dialog with the user can result in examining alternative missions which will provide varying degrees of user satisfaction. The user may desire to examine other alternative missions based on modification of user requirements or consider a modification of existing apparatus or a new apparatus or possibly a modification of an existing carrier or a new carrier. Each alternative will carry benefits and penalties for the user who must consider these factors in terms of his own goals, objectives, and cost constraints. These decisions cannot be arrived at until the mission planning element has been completed for the various alternatives. It is within the mission planning element that the various development times and the processing and integration times for an alternative are arrived at and a match-up with the STS mission model is identified. There are two feedback loops indicated in the study flow. The first ensues from the trades and analysis back to the three input elements, any of which can be changed at the discretion of the commercial user. The second feedback loop is from the mission planning element to the trades and analysis. The essential feature concerning the approach employed in the study flow is that within the trades and analysis element and the mission planning element an interactivity and a continuing dialog with the commercial user are the key to the program's success.

STUDY FLOW



FUNCTIONAL
OPERATIONAL
USER REQUIREMENTS
USER INVENTORY
NASA INVENTORY
APPARATUS CAPABILITIES AND AVAILABILITY
CARRIER CAPABILITIES
CARRIER AND FLIGHT DATE
ACCOMMODATIONS (FLIGHT) OPPORTUNITIES
EXPERIMENT REQUIREMENTS
APPARATUS SELECTION
CARRIER SELECTION
TRADES AND ANALYSIS
STANDARD APPARATUS AND STANDARD CARRIERS
UNIQUE APPARATUS DEVELOPMENT REQUIREMENTS
UNIQUE CARRIER DEVELOPMENT REQUIREMENTS
MANIFESTING
EXPERIMENT DEVELOPMENT
MISSION PLANNING
MISSIONS OF OPPORTUNITY
PLANNED PARTIAL MISSIONS
PLANNED DEDICATED MISSIONS
MISSION MODEL

DEVELOPMENT OF USER REQUIREMENTS DATA BASE

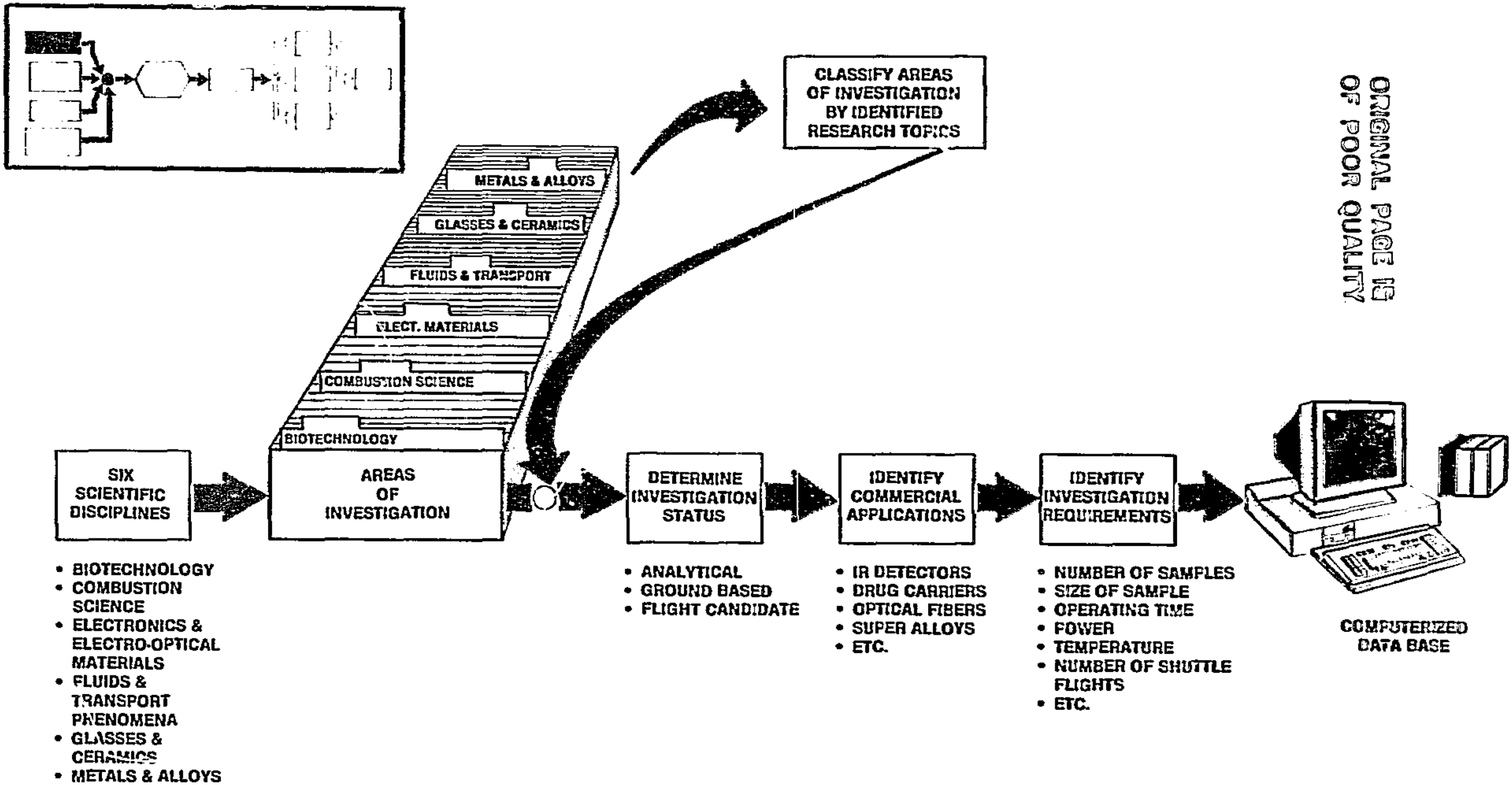
The approach to the development of the user requirements data base was initiated with the six scientific disciplines that NASA uses to categorize microgravity science. These are (1) biotechnology, 2) combustion sciences, (3) electronic and electro-optical materials, (4) fluids and transport phenomena, (5) glasses and ceramics, and (6) metals and alloys. Each of these categories is expanded into areas of investigation of scientific knowledge, process development or product development.

The areas of investigation with collected data, which currently number 85, (see Appendix A, Section 1), were then classified by the research topics identified from the Microgravity Science Requirements Workshop held on December 10-11, 1984. (See page 44.) This was done in an attempt to further refine the user requirements data base. However, it was discovered that some areas of investigation could not be associated with any of the research topics currently identified, and some of the areas of investigation could be classified into several research topics. Each area of investigation is also categorized as to whether it is an analytical exercise, a ground-based exercise, or a flight candidate.

The next screening operation results in focusing on those investigations which have an identified potential commercial application. At this step, interested parties with their institutions or industrial firms are identified.

The identification of investigation requirements is the next step. These requirements are top-level in nature and not specific engineering requirements; however, some knowledge of sample size and number, operating times, power and temperature parameters, and the extent of shuttle use is needed to be able to enter the mission traffic model with realistic requirements. Also, some areas of investigation with potential commercial application have not identified their operational and/or functional requirements as of yet, thus narrowing the field of candidates again. The output of this activity is a computerized data base of user requirements which can be updated as necessary.

DEVELOPMENT OF USER REQUIREMENTS DATA BASE



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APPARATUS CAPABILITIES AND AVAILABILITY DATA BASE

The diagram on the facing page depicts the major elements and activities involved in the process of identifying the capabilities of the apparatus used in the investigations that have an indicated, potential commercial application.

The initial step involves an identification of the apparatus type (i.e. furnace, levitator) and the quantity of each type (quantity helps determine availability).

The next step is a determination of the status. This consists of a determination of whether it is a ground or flight piece of equipment. For each category (ground or flight), it is indicated that it is within one of the four categories as follows:

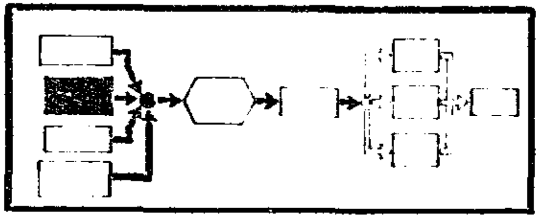
- Existing
- Under development
- Planned
- Needed

The final step provides applications and characteristics which include

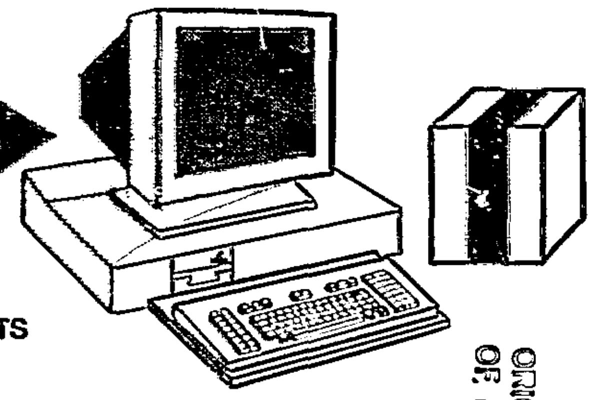
- Functional characteristics
- Operational characteristics
- Resource requirements (i.e. utilities, communications, mechanical, computer and data acquisition)
- Physical characteristics and considerations (i.e. dimensions, mass, access, etc.)

The output of this process is the capabilities and availability data base.

DEVELOPMENT OF APPARATUS CAPABILITIES AND AVAILABILITY DATA BASE



IDENTIFY MICROGRAVITY SCIENCE APPARATUS → DETERMINE STATUS OF GROUND AND/OR FLIGHT UNITS → IDENTIFY APPARATUS CHARACTERISTICS →



COMPUTERIZED DATA BASE

- ADSF
- GPRF
- IEF
- SAAL
- ETC.

- EXISTING
- UNDER DEVELOPMENT
- PLANNED
- NEEDED

- FUNCTIONAL
- OPERATIONAL
- RESOURCE REQUIREMENTS
- PHYSICAL

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CARRIER CAPABILITIES

The development of carrier capabilities involves three fundamental steps culminating in the capabilities matrix as shown in the diagram.

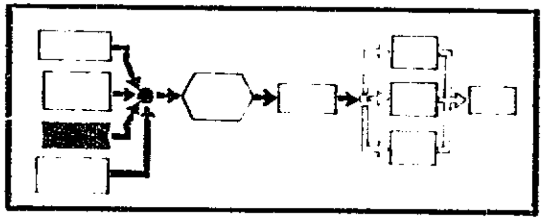
The first step is identification of the carrier set or those existing STS carriers that have the capabilities for accommodating an experiment payload. These consist of Spacelab Modules (long and short), Spacelab Pallets, Orbiter Middeck Lockers, Hitchhiker, MSL, MPESS, GAS Can, etc.

The second step is the development of the carrier set data base. This involves interviews with NASA engineers and other cognizant NASA personnel to identify relevant documentation--such as handbooks, instrument interface agreements, interface control documents, and other sources of information--and to ferret out information and data gained through their personal involvements with carriers.

The third step is the identification of resources and discriminators for the carrier equipment. These include power capabilities, heat rejection capabilities, and discriminators such as physical characteristics for accommodating experiment payloads of given dimensions, volume, mass, etc.

The output of this process consists of the carrier capabilities data base.

DEVELOPMENT OF CARRIER CAPABILITIES DATA BASE



IDENTIFY CARRIER SET

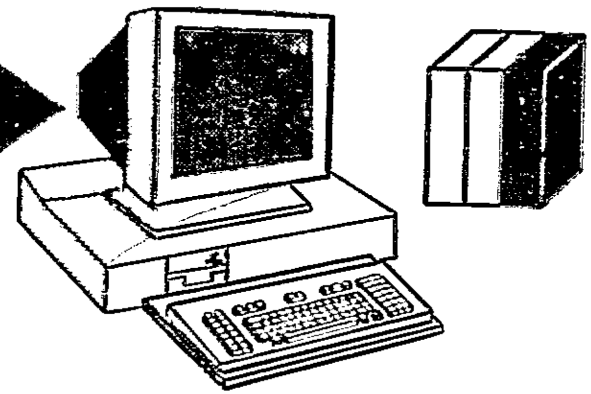
- SPACELAB MODULES
- SPACELAB PALLETS
- MIDDECK LOCKERS
- HITCHHIKER
- MSL
- GAS CAN

DEVELOP CARRIER SET DATA BASE

- HANDBOOKS .
- ICD'S
- INSTRUMENT INTERFACE AGREEMENT
- INTERVIEW NASA ENGINEERS
- OTHERS

IDENTIFY RESOURCES AND DISCRIMINATORS FOR CARRIER EQUIPMENT

- POWER
- HEAT REJECTION
- DIMENSIONS
- VOLUME
- MASS
- ETC.



COMPUTERIZED DATA BASE

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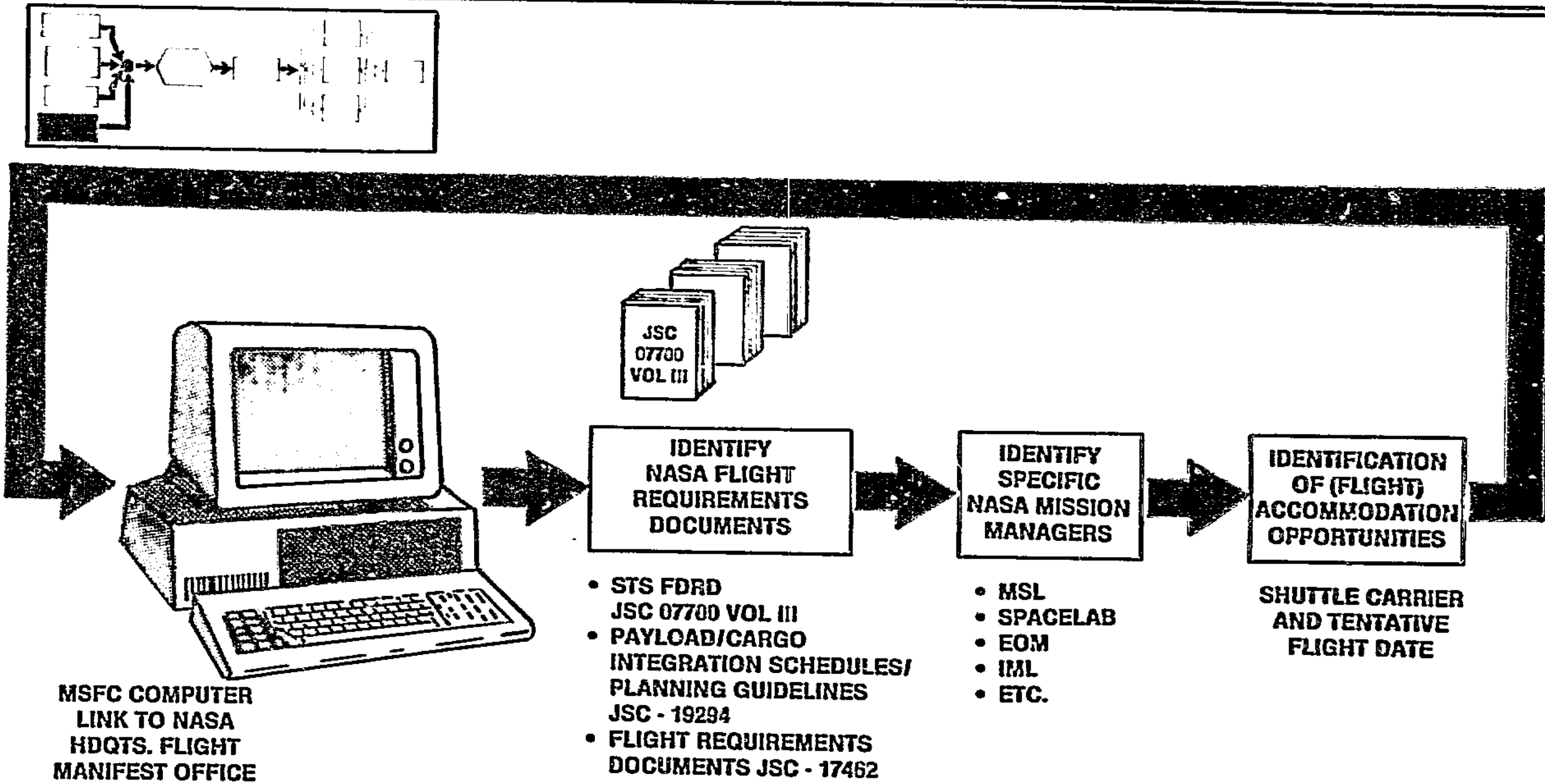
DEVELOPMENT OF ACCOMMODATION (FLIGHT) OPPORTUNITIES

Identification of accommodation opportunities begins with obtaining flight manifest data from NASA Headquarters via the MSFC computer link. Updated printouts of the most current manifest are combined with various NASA flight requirements documents and computerized data bases. These are analyzed to determine possible candidate missions for each investigation.

Discussions with specific NASA mission managers will determine availabilities and applicabilities of candidate missions for investigations. Once flight opportunities have been identified and matched to specific investigations and the user approves the tentative carrier assignment and flight date, the information is fed back to the NASA Headquarters Flight Manifest Office for compatibility checks and approval.

DEVELOPMENT OF ACCOMMODATION (FLIGHT) OPPORTUNITIES



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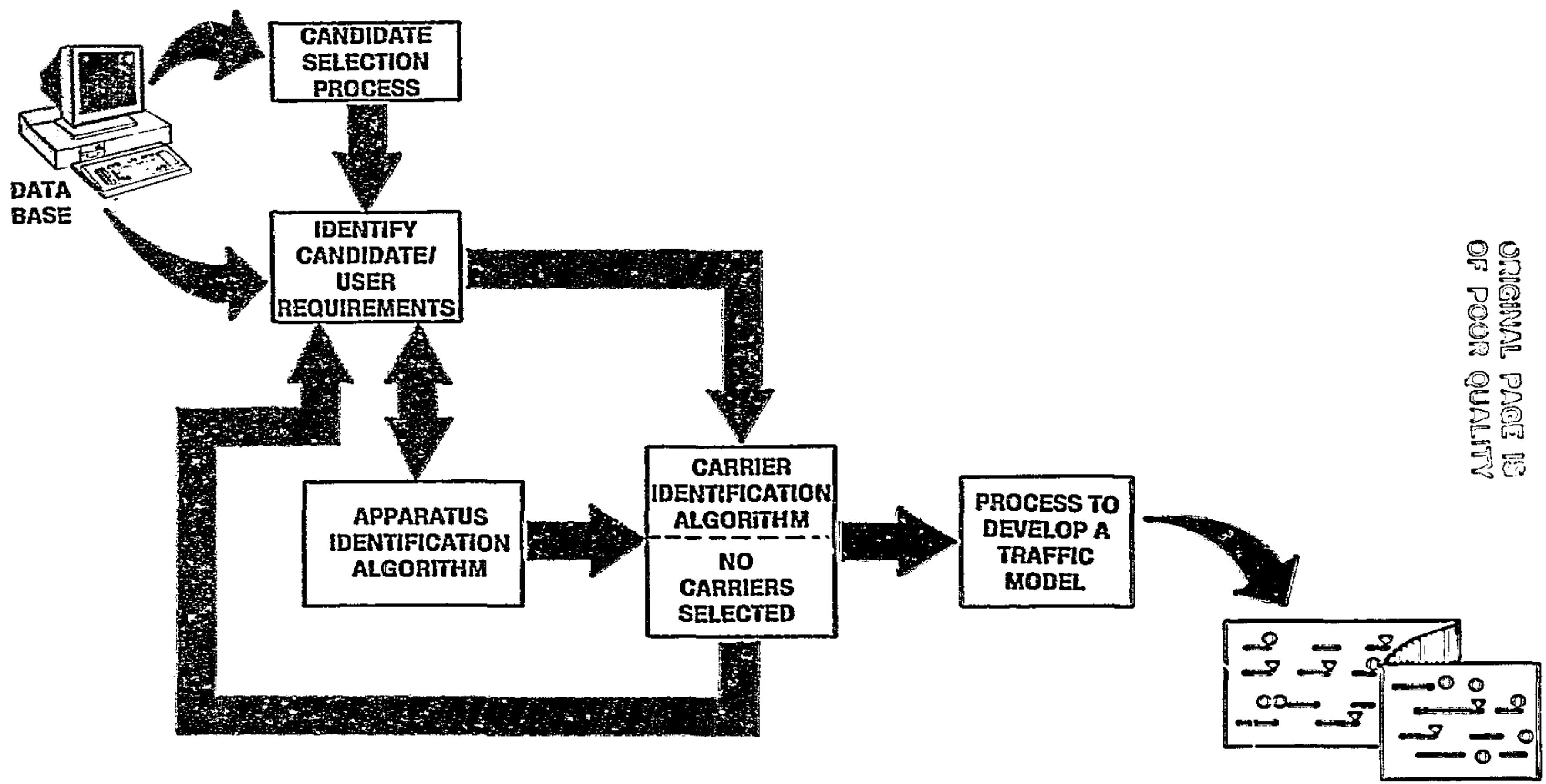
TRADES AND ANALYSIS OVERVIEW

The trades and analysis activity is a user-interactive and iterative process that provides satisfactory user accommodations through a selection of apparatus and carrier and an identified mission. The logic flow shown on the facing page shows a simplified overview of the process. A detailed flow, including the apparatus and carrier identification algorithms, is included in the proposed work section at the back of this report.

Basically, the flight candidate(s) is selected and its needs and requirements determined using the previously developed data bases. An apparatus is then identified using the algorithm and maintaining a constant dialogue with the user. Once a suitable apparatus has been established, a carrier is identified which is compatible with the apparatus and with the user's requirements. If a carrier cannot be identified which will meet all the requirements of the apparatus and user, the process repeats itself starting with the user's requirements and modifying those needs to enable a compatible apparatus and carrier to be identified.

Once a suitable carrier is found for each flight candidate, the traffic model development process is begun. This will identify the type and quantity of carriers and missions which are required to be flown to meet the needs of the commercial community.

TRADES AND ANALYSIS



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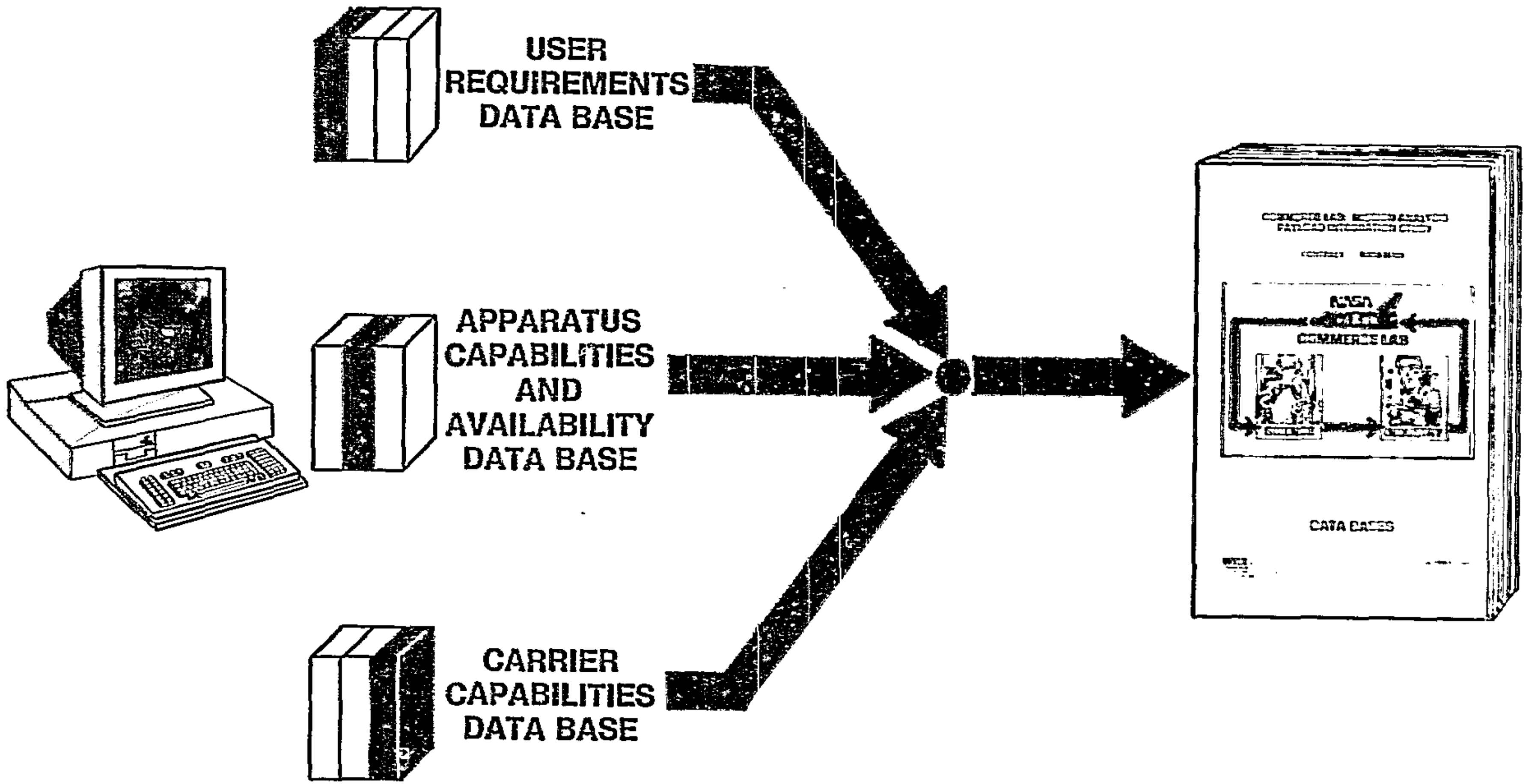
PROGRESS TO DATE

DATA BASES

The three Commerce Lab data bases have been assembled in the appendix.



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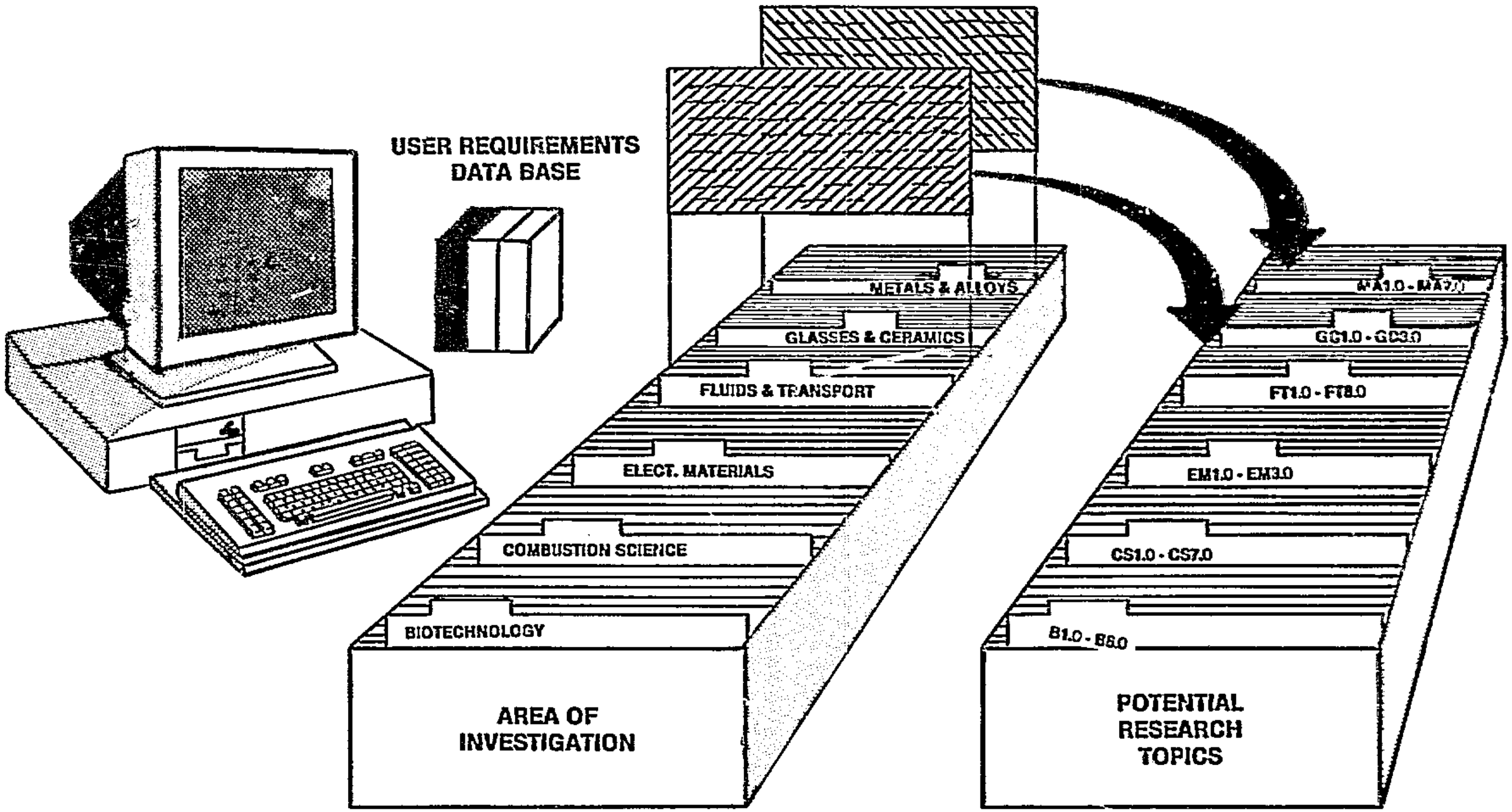
CLASSIFICATION INTO RESEARCH TOPICS

This task is being undertaken to further refine the user requirements data base. The research topics were identified from the microgravity science requirements workhop held on December 10-11, 1984. Further refinement of the research topics must be undertaken to classify all areas of investigation into a research topic. Some areas of investigation have no research topics identified while other investigations have several.

An example of this task is given using the biotechnology section. Table 1 lists the research topics identified for biotechnology and their relationship to the 12 areas of investigation.

Normally one might anticipate that this process would start with research topics, then develop areas of investigation. The flow is shown in the opposite direction because this is what has happened historically.

CLASSIFICATION OF AREAS OF INVESTIGATION INTO POTENTIAL RESEARCH TOPICS



BIOTECHNOLOGY RESEARCH TRACKS

- B1.0 Electrokinetics of Particles and Macromolecules
  - B1.1 Electrophoresis
    - B1.1.1 Continuous Flow Electro-phoresis
    - B1.1.2 Moving Wall Electrophoresis
    - B1.1.3 Containerless
    - B1.1.4 Free Zone Electrophoresis
    - B1.1.5 Immunoelectro-phoresis
  - B1.2 Isoelectric Focusing
    - B1.2.1 Continuous Flow Isoelectric Focusing
    - B1.2.2 Recycling Isoelectric Focusing
    - B1.2.3 Immobilines
    - B1.2.4 Static Column Isoelectric Focusing
  - B1.3 Isotachophoresis
    - B1.3.1 Continuous Flow Isotacho-phoresis
    - B1.3.2 Recycling Isotachophoresis
    - B1.3.3 Static Isotachophoresis
- B2.0 General Kinetics of Particles and Macromolecules
  - B2.1 Thermophoresis
  - B2.2 Photophoresis
  - B2.3 Phase Partitioning
    - B2.3.1 Separation of Phases (±) Electric Field
  - B2.4 Chromatofocusing
  - B2.5 Field Flow Fractionation
- B3.0 Cell Culturing
  - B3.1 Cell Culturing Techniques
    - B3.1.1 Simple Suspension
    - B3.1.2 Monolayers
    - B3.1.3 Microcarrier Beads
    - B3.1.4 Hollow Fibers
  - B3.2 Cell Fusion
  - B3.3 Secretion Science
- B4.0 Macromolecule Crystallization
  - B4.1 Nucleation and Orientation Forces
    - B4.1.1 Seeded Versus Nonseeded Growth
    - B4.1.2 Vapor Phase Transfer
    - B4.1.3 Liquid Diffusion
    - B4.1.4 Dialysis
- B5.0 Biorheology
  - B5.1 Dynamics of Particle Flow in Organs
  - B5.2 Dynamics of Blood Flow in Vessels
  - B5.3 Blood Storage
- B6.0 Development of Analytical Tools for Use at Microgravity
  - B6.1 Laser Doppler Probing
  - B6.2 Two-Dimensional Electrophoresis

CLASSIFICATION OF AREAS OF INVESTIGATION INTO APPROPRIATE RESEARCH TRACKS

Discipline Code	Investigation
B5.2	Aggregation of Red Blood Cells Dintenfass, Dr. Leopold
B3.1	Cell Growth Pharamaceuticals Ley, Dr. Kenneth
B2.3	Cell Partition in Two Polymer Aqueous Phases Harris, Dr. J. Milton, and Brooks, Dr. Donald
B1.2.1	CIEF Bier, Dr. Milan
B2.0	Cyrogenic Equivalence Principal Everitt, Dr. F., and Worden, Dr. P.
B1.1.1	Electrophresis in Space Rose, Mr. James
B1.1.1	Electrophresis Pharmaceuticals Rose, Mr. James
B1.2.4	Hormone Purification by IEF in Space Bier, Dr. Milan
B5.3	Low Gravity Blood Storage
B1.1.2	Moving Wall Electrophoresis Snyder, Dr. Robert S.
B2.3.1	New Instrumentation for Phase Partitioning Harris, Dr. J. Milton
B1.2.2	RIEF Bier, Dr. Milan

SELECTION PROCESS FOR COMMERCE LAB CANDIDATES

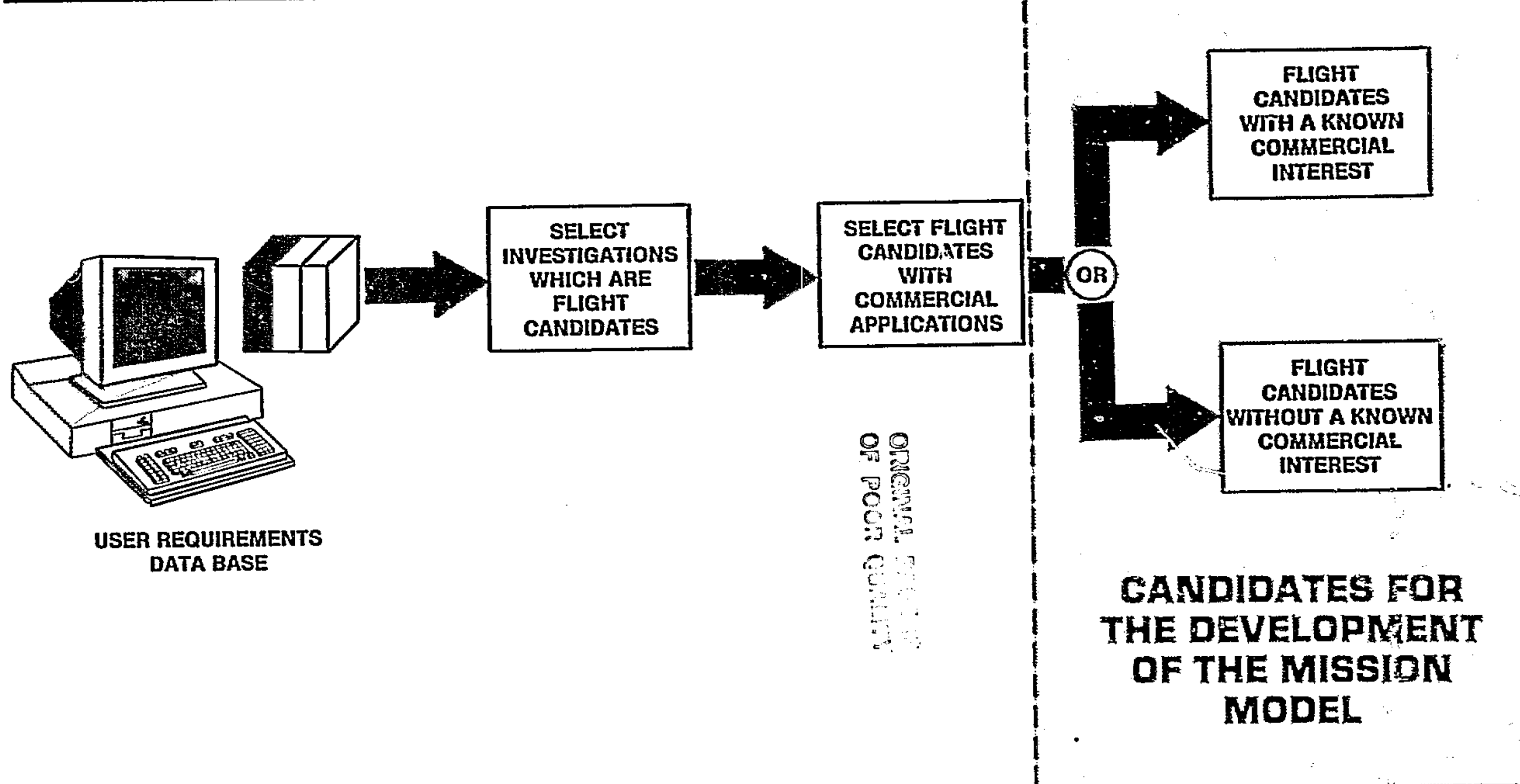
The current User Requirements Data Base identifies 89 studies or areas of investigation, 85 of which have some data collected to date. These are arranged within each process discipline as shown.

Data base information as well as discussions with the developer were used to determine the current progress and/or status of each investigation. Of the 85 studies in the data base, 68 were found to be flight candidates; that is, they can only be proven in a microgravity environment and are developed enough beyond the conceptual stage to have some requirements identified.

Of the 68 flight candidates, 47 were determined to have a potential commercial application, either by NASA or private industry. These investigations composed the "Nominal" Commerce Lab Traffic Model contained in this report and are considered the candidates for primary consideration for Commerce Lab flight assignment. In addition, 26 of those investigations with a commercial application also have a known commercial interest and represent those companies with a stated interest in investigation results. These compose the "Minimum" Commerce Lab Traffic Model and should be considered for definite shuttle flight assignment.

It should be noted that the 38 studies without a potential commercial application identified at this time are not eliminated from further Commerce Lab consideration. In fact, they represent a potential nucleus of investigations to be included in future traffic model iterations as these studies mature and commercial applications are developed.

IDENTIFICATION PROCESS FOR COMMERCE LAB CANDIDATES



PROCESS DISCIPLINES

The currently identified elements of the microgravity science and applications program fall into three divisions:

1. Material science, including crystal growth, solidification of alloys and composites, and containerless processing.

2. Physics and chemistry, including fluid mechanics, transport phenomena, combustion science, cloud physics, and critical phenomena.

3. Biotechnology, including separation processes, suspension culturing, and blood rheology.

It was from these divisions that the six process disciplines were identified.

PROCESS DISCIPLINES

BIOTECHNOLOGY

COMBUSTION SCIENCES

ELECTRONIC AND ELECTRO-OPTICAL MATERIALS

FLUIDS AND TRANSPORT PHENOMENA

GLASSES.AND CERAMICS

METALS AND ALLOYS

AREA OF INVESTIGATION

The summary of areas of investigation identifies only those areas of significant potential for utilization by Commerce Lab. Since this area is dynamic, both the number of studies identified versus the availability of applicable data will continue to change through the duration of this activity.

AREA OF INVESTIGATION*

NUMERICAL BREAKDOWN OF STUDIES WITHIN EACH PROCESS DISCIPLINE

PROCESS DISCIPLINE	STUDIES WITHIN EACH DISCIPLINE/ STUDIES WITH COLLECTED DATA TO DATE
BIOTECHNOLOGY	12/11
COMBUSTION SCIENCES	7/7
ELECTRONIC AND ELECTRO OPTICAL MATERIALS	18/17
FLUIDS AND TRANSPORT PHENOMENA	24/23
GLASSES AND CERAMICS	14/13
METALS AND ALLOYS	14/14
TOTAL NUMBER OF AREAS OF INVESTIGATION	89/85

*CURRENT NASA MPS PROGRAMS AND PRIVATE COMMERCIAL STUDIES

WYLE LABORATORIES

INVESTIGATION STATUS

The following definitions must be understood to appreciate the divisions/progress involved within the investigation status.

- Analytical identifies those studies which, at this time, exist in a purely conceptual development stage.
- Ground-based addresses those studies whose concept can be proven in a ground-based (Earth) laboratory.
- Flight candidates are those studies which by their nature can only be proven in a microgravity environment.

INVESTIGATION STATUS*

PROCESS DISCIPLINE	ANALYTICAL	GROUND-BASED	FLIGHT CANDIDATE
BIOTECHNOLOGY	0	1	10
COMBUSTION SCIENCES	0	0	7
ELECTRONIC AND ELECTRO OPTICAL MATERIALS	1	1	15
FLUIDS AND TRANSPORT PHENOMENA	11	1	11
GLASSES AND CERAMICS	1	0	12
METALS AND ALLOYS	0	1	12
TOTALS	13	4	68

*CURRENT NASA MPS PROGRAMS AND PRIVATE COMMERCIAL STUDIES

WYLE LABORATORIES

FLIGHT CANDIDATES WITH COMMERCIAL APPLICATIONS

The significance of the chart on the facing page is contained in the column identified as known commercial interest. This column represents those companies with a stated interest in commercially utilizing the results obtained by a study.

FLIGHT CANDIDATES WITH COMMERCIAL APPLICATIONS*

PROCESS DISCIPLINE	POTENTIAL COMMERCIAL APPLICATIONS	KNOWN COMMERCIAL INTEREST
BIOTECHNOLOGY	10	6
COMBUSTION SCIENCES	5	0
ELECTRONIC AND ELECTRO OPTICAL MATERIALS	14	9
FLUIDS AND TRANSPORT PHENOMENA	5	4
GLASSES AND CERAMICS	9	4
METALS AND ALLOYS	4	3
TOTALS	47	26

* CURRENT NASA MPS PROGRAMS AND PRIVATE COMMERCIAL STUDIES

WYLE LABORATORIES

POTENTIAL FLIGHT CANDIDATES WITH KNOWN COMMERCIAL INTEREST

The following pages give a detailed list of the companies with a stated commercial interest in a particular study. These 26 investigations constitute the Commerce Lab Minimum Traffic Model to date.

POTENTIAL FLIGHT CANDIDATES WITH KNOWN COMMERCIAL INTEREST
(Constitute Minimum Traffic Model)

Discipline Code	Study	Investigator	Commercial Interest
B1.2.4	Hormone purification by IEF in space	Dr. Milan Bier	Ionics, Inc.
B1.2.2	RIEF	Dr. Milan Bier	Sherring-Plough
B1.2.1	CIEF	Dr. Milan Bier	Sherring-Plough
B1.1.1	Electrophoresis in space	Dr. James Rose	MDAC Johnson & Johnson
B1.1.1	Electrophoresis Pharmaceuticals	Dr. James Rose	MDAC Johnson & Johnson
B3.1	Cell growth pharmaceuticals	Dr. Kenneth Ley	Lovelace Med. Found.
EM1.2.1, 2.2.8, 3.3	Characterization of terrestrial and Spacelab crystals of HgI_2	Dr. Wayne Schnepple	EG&G
EM1.3.1, 2.2.8, 3.4	Solution growth of crystals in zero gravity	Dr. Ravendra Lal	Nite Vision Labs DOD
EM1.2.2, 2.1.5, 3.3	Vapor growth of alloy-type semiconductor crystals HgCdTe	Dr. Heribert Weidemeier	Honeywell; Boeing; DOD; Hughes
EM1.4, 2.1.3, 2.2.8	GaAs electroepitaxy		MRA
EM1.1, 2.1.3, 3.5	Growth of GaAs crystals		Grumman Aerospace; Alcoa; GTE
EM1.3.1, 3.4	Thin film and solution growth	Dr. Chris Posiadly	3M
EM1.3.1, FT1.6	Organic crystal growth	Dr. Chris Posiadly	3M

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POTENTIAL FLIGHT CANDIDATES WITH KNOWN COMMERCIAL INTEREST (Concluded)
(Constitute Minimum Traffic Model)

Discipline Code	Study	Investigator	Commercial Interest
EM1.3.1, 2.2.8, 3.4	Solution crystal growth		Quantum Technologies
EM1.1.1, 2.1.5, 3.5	Semiconductor materials PbSnTe	Dr. Roger Crouch	DOD
FT1.3	Production of large particle size monodisperse latexes (small, 100 ml)	Dr. John Vanderhoff	NBS Particle Technology
FT1.3	Production of large particle size monodisperse latexes (large, 2 liter)	Dr. John Vanderhoff	NBS Particle Technology
FT1.6	Protein crystal growth	Dr. Charles Bugg	Upjohn Sherring-Plough
FT0.0	Space-produced coatings	Dr. Richard Zito	SAI Wake Shield
GC3.7	Containerless processing of glass-forming melts in space	Dr. Delbert E. Day	DOD
GC3.2	Levitation studies of high temperature materials	Dr. John Margrave	G.E.
GC3.11	Foam stability	Dr. Gary Nishioka	Ownes/Corning Fiberglass
GC3.6	Glass fiber pulling		DARPA Corning Glass
MA1.0	Orbiter processing of aligned magnetic composites	Dr. David A. Larson Dr. James Bethin	Grumman
MA3.0	Graphite formation in cast iron	Dr. Doru Stefanescu	John Deere Bethlehem Steel
MA3.0	Super alloys	Dr. Pete Curreri	Pratt and Whitney

POTENTIAL FLIGHT CANDIDATES WITHOUT KNOWN COMMERCIAL INTEREST

This page is a detailed list of the investigations having a promising commercial application but without a stated commercial interest in that study at this time. These 21 investigations, added to the previous 26, constitute the nominal Commerce Lab Mission Traffic Model to date.

POTENTIAL FLIGHT CANDIDATES WITHOUT KNOWN COMMERCIAL INTEREST
(Constitute Nominal Traffic Model)

Discipline Code	Study	Investigator
B1.1.2	Moving wall electrophoresis	Dr. Robert Snyder
B2.3.1	New instrumentation for phase partitioning	Dr. J. Milton Harris
B5.2	Aggregation of red blood cells	Dr. Leopold Dintenfass
B2.3	Cell partition in two polymer aqueous phases	Dr. J. Milton Harris Dr. Donald Brooks
CS1.0	Droplet Combustion	Dr. William Forman Prof. Fredrick Dryer
CS3.1	Flame spreading in solid materials	Prof. Robert Altenkirch Ms. Sandra Olson Mr. Kurt Sacksteder
CS1.0	Gas-Jet Diffusion Flames	Dr. Tom Harsha Dr. Raymond Edelman
CS1.0	Particle cloud combustion	Prof. Abe Berlad
CS2.1	Premix-gas flame propagation	Dr. Paul Ronney
EM1.1, 2.1.3	Growth of GaAs crystals from the melt in a partially confined configuration	Harry C. Gatos Dr. Jacek Lagowski
EM1.1.3, 2.1.2, 3.5	Microgravity silicon zoning investigation	Mr. Edward Kern
EM1.1.1, 2.1.5, 3.5	Semiconductor materials' growth in low-gravity environment PbSnTe	Dr. Roger K. Crouch Dr. Archie Fripp
EM1.3.1, FT1.6	Protein crystal growth in low gravity	Dr. R. S. Feigelson

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POTENTIAL FLIGHT CANDIDATES WITHOUT KNOWN COMMERCIAL INTEREST - Concluded

Discipline Code	Study	Investigator
EM1.1.1 2.1.5, 3.5	Growth of solid solution single crystals HgCdTe	Dr. S. L. Lehoczky
FT2.3, 2.4	Tests of new thermodynamic model of impurity extraction by droplets	Dr. G. Morrison Dr. J. Kinkaid
GC1.1	Microstructural analysis of Nb-Ge drop tube specimens	Dr. Robert Bayuzick
GC1.1	Influences of containerless undercooling	Mr. E. W. Collings
GC3.7	The upgrading of glass microballoons	Dr. Stanley Dunn
GC1.1	Homogeneous crystallization studies of borderline glass-forming systems	Dr. Ed Ethridge
GC3.4	Ultrapure glass optical waveguide development in microgravity by the sol-gel process	Dr. Shyama Mokherjee
MA3.0	Directional solidification of liquid miscibility gap material	Dr. M. H. Johnston

REQUIRED USER DEVELOPMENT TIME FOR CANDIDATES

Study	Investigator	Developmental Lead Time/Status
Hormone purification by IEF in space	Dr. Milan Bier	Scheduled for reflight, 85-3-30 (51-G). Approximately 1 year required between flights.
RIEF	Dr. Milan Bier	2.0 years. Ground hardware.
CIEF	Dr. Milan Bier	3.0 or more years. Idea stage.
Electrophoresis in space Electrophoresis Pharmaceuticals	Dr. James Rose	Apparatus; CFES has been scheduled for two flights. Less than 1 year required before reflight. First in 85-3-19.
Cell growth pharmaceuticals	Dr. Kenneth Ley	2.0 years. Ground-based hardware.
Characterization of terrestrial and Spacelab crystals of HgI_2	Dr. Wayne Schnepple	Apparatus; VCG scheduled for flight on SL III, 85-4-30 (51-B). Less than a year required for reflight.
Solution growth of crystals in zero gravity	Dr. Ravendra Lal	1.0 to 1.5 years. Ground-based hardware is complex.
Vapor growth of alloy-type semiconductor crystals of HgCdTe	Dr. Heribert Weidemeier	Tentatively scheduled for 4 flights: 85-10-9, MEA-A2; 86-7-17, MSL-4/MEA-A3; 87-1-14, MSL-6/MEA-4; 87-3-18, MSL-7.
GaAs Electroepitaxy		Targeted for Space Station.
Growth of GaAs crystals		2.0 years. Refine existing ground furnace.
Thin film and solution growth	Dr. Chris Posiadly	About 1.0 year. Ground hardware.
Organic crystal growth	Dr. Chris Posiadly	First flight, 85-11-20; reflight within the year. 3M has 72 flights for 3 studies.
Solution crystal growth		3.0 to 4.0 years. No hardware. Idea stage.

REQUIRED USER DEVELOPMENT TIME FOR CANDIDATES (Continued)

Study	Investigator	Developmental Lead Time/Status
Semiconductor materials PbSnTe	Dr. Roger Crouch	Tentatively scheduled for 3 flights: 85-10-9, MEA-A2; 87-4-27, MSL-8; 87-10-21, MSL-10.
Production of large particle size mono-disperse latexes (100 ml)	Dr. John Vanderhoff	Approved for three more flights, first in 85-5-30.
Production of large particle size mono-disperse latexes (2 liter)	Dr. John Vanderhoff	2.0 years. Idea stage.
Protein crystal growth	Dr. Charles Bugg	Flight hardware exists. Less than a year required for reflight.
Space-produced coatings	Dr. Richard Zito	4.0 or more years. Blueprint stage.
Containerless processing of glass-forming melts in space.	Dr. Delbert Day	Scheduled for 2 flights: 85-8-2, MSL-2; 85-2-20, MSL-3.
Levitation studies of high-temperature materials	Dr. John Margrave	Can fly using existing apparatus, EML. No flights scheduled.
Foam stability	Dr. Gary Nishioka	1.5 to 2.0 years. Ground hardware.
Glass fiber pulling		3.0 or more years. Idea stage.
Orbiter processing of aligned magnetic composites	Dr. David Larson Dr. James Bethin	Scheduled for 2 flights: 85-8-2, MSL-2; 85-2-20, MSL-3.
Graphite formation in cast iron	Dr. Dorn Stefanescu	Scheduled for 4 flights: 87-3-18, MSL-7; 87-4-27, MSL-8; 87-9-30, MSL-9; 87-10-21, MSL-10.
Super alloys	Dr. Pete Curreri	Can fly using existing apparatus, ADSF-II. No flights scheduled.
Moving wall electrophoresis	Dr. Robert Snyder	3.0 years. Hardware in design stage.
New instrumentation for phase partitioning	Dr. J. M. Harris	2.0 to 2.5 years. Hardware in design stage.

REQUIRED USER DEVELOPMENT TIME FOR CANDIDATES (Continued)

Study	Investigator	Developmental Lead Time/Status
Aggregation of red blood cells	Dr. Leopold Dintenfass	Scheduled for flight in 85-2-20. No reflight foreseen at this point.
Cell partitioning in two-layer aqueous phases	Dr. J. M. Harris Dr. Donald Brooks	2.0 to 2.5 years. Hardware in design stage.
Droplet combustion	Dr. Wm. Forman Prof. Fredrick Dryer	3.0 years. All hardware is conceptual
Flame spreading in solid materials	Prof. Robert Altenkirch Ms. Sandra Olson Mr. Kurt Sacksteder	
Gas-jet diffusion flames	Dr. Tom Harsha Dr. Raymond Edelman	
Particle cloud combustion	Prof. Abe Berlad	
Premixed-gas flame propagation	Dr. Paul D. Ronney	
Growth of GaAs crystals from the melt in a partially confined configuration	Dr. Harry Gatos Dr. Jacek Lagowski	1.0 year. Selected for flight AADSF.
Microgravity silicon zoning investigation	Dr. Ted Kern	Scheduled for 2 flights: 87-3, MSL-7; 87-9, MSL-9.
Semiconductor material growth in low-gravity environment PbSnTe	Dr. Roger Crouch Dr. Archie Fripp	Tentatively scheduled for 3 flights: 85-10-9, MEA-A2; 87-4-27, MSL-8; 87-10-21, MSL-10.
Protein crystal growth in low gravity	Dr. R. S. Feigelson	1.0 to 1.5 years. Apparatus similar to FES.
Growth of solid solution single crystals HgCdTe	Dr. S. L. Lehoczky	1.5 to 2.0 years. Prototype flight hardware.
Test of new thermodynamic model of impurity extraction by droplet	DR. G. Morrison	3.0 years. All hardware is conceptual

REQUIRED USER DEVELOPMENT TIME FOR CANDIDATES (Concluded)

Study	Investigator	Developmental Lead Time/Status
Microstructural analysis of Nb–Ge drop tube specimens	Dr. Robert Bayuzick	Can fly using existing apparatus.
*Influence of containerless undercooling	Dr. E. W. Collings	Ground-based hardware.
The upgrading of glass microballoons	Dr. Stanley Dunn	3.0 to 5.0 years. Idea stage.
*Homogeneous crystallization studies of borderline glass-forming systems	Dr. Ed Ethridge	Ground-based hardware.
Ultrapure glass optical waveguide development in microgravity by the sol-gel process	Dr. Shyama Mekherjee	1.0 to 1.5 years. Ground-based hardware. JPL.
Directional solidification of liquid miscibility gap materials	Dr. M. H. Johnston	Scheduled for 3 flights: 86-10, MSL-5; 87-4-27, MSL-8; 87-10, MSL-10.

CARRIER MANAGERS AND DATA

The information on the facing page summarizes the data gathered on candidate carriers which are to fly within the next couple of years. This data was obtained from discussions with the particular manager's office. The data on these carriers is also presented in graphic form on page 83.

Candidate Carrier	Manager	Number	Remarks
Astro-1 -2 -3	Leon Allen	3050	Pallet. No commercial payload opportunities on all three missions.
SLS-1	Bill Emanuel	2430	LM. Cargo has been frozen (STS FDRD, Vol. III, pg 13)
EOM-1/2	Gary Wicks	0582	SM + 1P. John Price and J. Moore (materials area). They are identifying equipment and experiments for the module. (Fluids physics experiment has been selected.) Potential for Commerce Lab equipment. Storage in the mid-deck is still available.
EOM-3	Tony O'Neil		Pallet only. Space T.B.D. One or two mid-deck lockers are available. Note: Mr. Tony O'Neil is the contact point for Commerce Lab opportunities on EOM missions.
Spacelab D-1	Earl Harris	3207	LM. German, full 100 percent.
2	Hugh Gangl	3302	Pallet only. Cargo has been frozen (STS FDRD, Vol. III, p. 13)
J	Art White	3303	Full, 100 percent. Note: All hardware must be delivered to the Cape (level 4) 9.5 months prior to launch. Will require at least a year to process "paperwork" on the payload (safety, utilities, etc.) Thus (12 mo + 9.5 mo = 22 mo, or approximately 2 years).
IML-1 June 9, 87	George Wallace	4296	LM Single rack reserved for commercial payloads. Reserved allocation of utilities.
IML-2, Jan. 89 IML-3			Potential Commerce Lab Carrier. No further information. Not assigned flight date yet 1/25/85.
MSL-1, 10	Robert McAnnally	2610	Flight opportunities on MSL-5, -7, -8, -9, -10.
Mid-deck			Mid-deck lockers are manifested 1 year prior to launch. JSC flight manifest office. 713-483-3631

COMMERCE LAB MISSION TRAFFIC MODEL

The Traffic Model graphically portrays the high level of Shuttle accommodations desired by potential commercial users. Selecting those users out of the existing data base which are prime flight candidates due to their current level of development and commercial potential, application, and interest, two mission traffic models were developed. It should be noted that the 38 investigations identified in the Wyle data base but not included in the mission traffic models are not developed enough or lack enough commercial potential to be realistic flight candidates at this time. However, they are possible commercial investigations and could be included in future iterations.

The Minimum Commerce Lab Mission Traffic Model consists of 26 investigations that are prime flight candidates with both commercial potential and commercial interest. Approximately one-third of these investigations have a portion of their desired number of flights currently manifested on Shuttle flights during the next 2½ years (shown in the circles) with three of these having no requests for future flights. The remaining investigations either have a desire to be manifested for additional flights or have not been accommodated to date. Future flight desires are shown with triangles.

Frequency of flights is approximate and based on the best estimate of carrier integration time and experiment developer requests. The traffic model is meant to show an overall number of flights desired and not a specific schedule. While some of the investigations are developed and ready for flight, others are still in a ground development stage and would not be ready for flight for 2 to 3 years. Therefore, the number of flights required is yet to be determined, and flight frequency is shown as being 1 year.

The desired apparatus shown for each investigation is the type currently being used or planned for use. The experiments, in most cases, have been designed for a specific apparatus in mind, and each apparatus has one or two carriers with which it is designed to integrate. This does not rule out the possibility of design modifications or new approaches to experiment accommodation. Particularly in the cases of those investigations which are still 2 to 3 years from flying, an effort could be made to design the experiment around more readily integratable apparatus and carriers. It should be noted that high power input and/or high thermal output requirements of an experiment will tend to drive the placement of that experiment on a cargo bay carrier, such as a pallet or the MPESS, instead of a manned environment. If the experiment is man-intensified, integration will tend to be more complex and usually more time consuming. Also, late access requirements can be accommodated on a limited number of carriers. Because of operational and engineering constraints, access within a few hours of launch can only be accommodated in the mid-deck area.

The Nominal Commerce Lab Mission Traffic Model adds 21 investigations that are also prime flight candidates and have commercial potential but, at this time, lack commercial interest. Four of these have all or part of their desired flights manifested; the remainder have not yet been accommodated. The same parameters have been held concerning the number and frequency of flights desired and the desired apparatus and carriers.

In addition to the 47 investigations discussed above, four other investigations from our bata base are shown as part of the Nominal Model. These investigations have no identified commercial potential or interest but are manifested as shown on future Shuttle flights. They have been included to make the model more complete. Also, they may gain commercial interest if a potential is developed.

In summary, the number of experiment flight requests by the experiment developers is shown in the following table. These numbers reflect a total of experiment flights, and it is possible to accommodate more than one identified investigation on a flight.

	Minimum Model	Nominal Model
Manifested	19	36
Unmanifested	142	221
Total	161	257

ORIGINAL PAGE IS OF POOR QUALITY

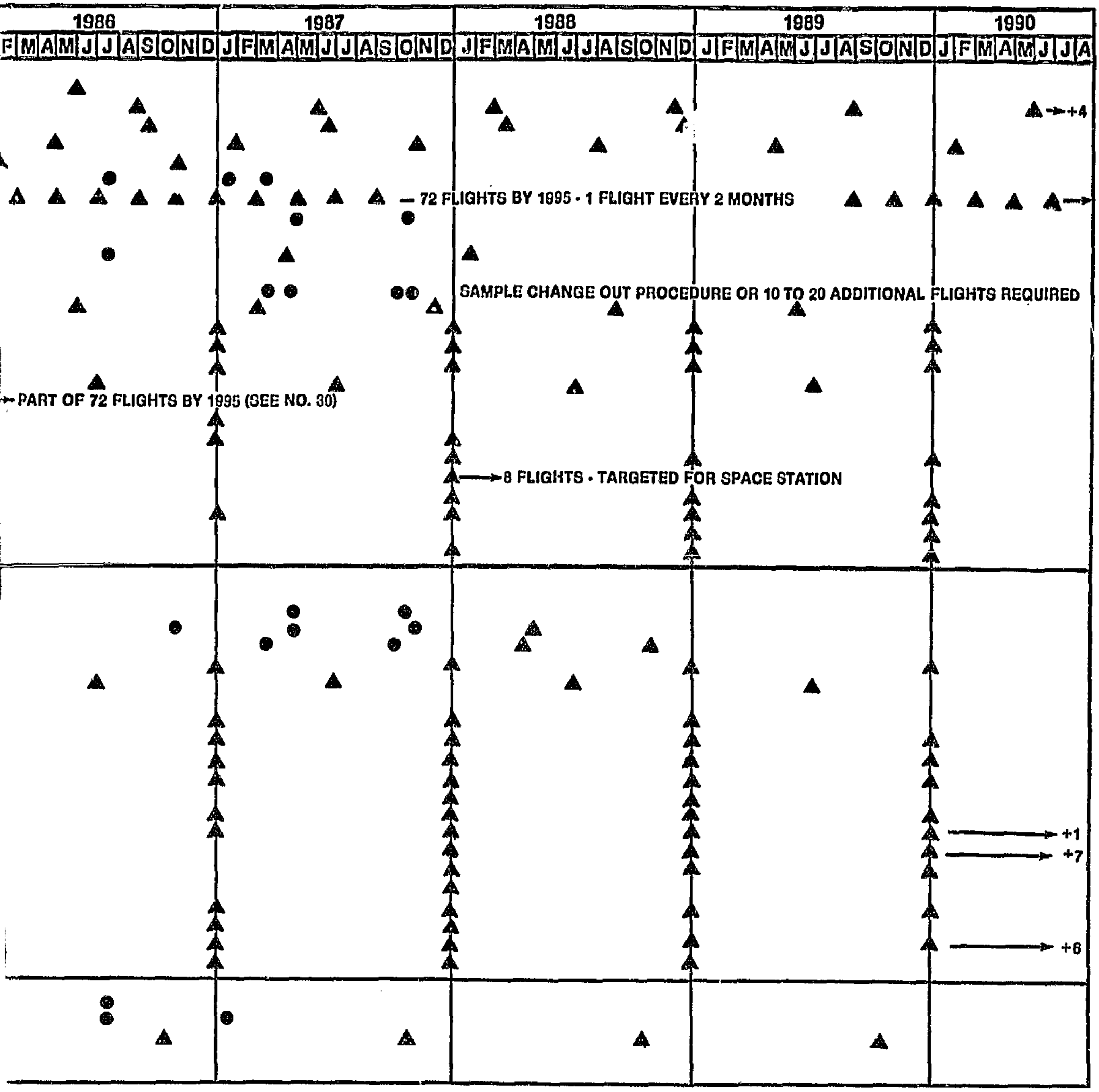
● MANIFESTED
▲ DESIRED

COMMERCE LAB MISSIC

EXPERIMENT NAME	DESIRED APPARATUS	DESIRED CARRIER	1985	1986
NOMINAL COMMERCE LAB MISSION MODEL — MINIMUM COMMERCE LAB MISSION MODEL				
HORMONE PURIFICATION	IEF	MID-DECK, S/L	● M	▲ M
PROTEIN CRYSTAL GROTH	PCG	MID-DECK, S/L		▲ A
ELECTROPHORESIS	CFES	MID-DECK	● M; ▲ D	▲ S
ELECTRO. PHARMACEUT	CFES	MID-DECK		▲ A
CHAR. OF CRYSTALS HgI_2	VCG	S/L	● A	▲ F
VAPOR GROWTH CRYSTALS HgCdTe	GPRF, AADSF	MEA, MSL	● O	● J
ORGANIC CRYSTAL GROWTH	DMOS	MID-DECK, S/L	1ST FLIGHT 84-11-20 ▲ S; ▲ N; ▲ D	▲ F; ▲ A; ▲ J; ▲ A
SEMICONDUCTOR MTL'S PbSnTe	AADSF	MSL, MEA	● O	
MLR (100 ml)	MLR	MID-DECK	● M; ▲ S; ▲ D	
CONTAINERLESS GLASS PROC.	SAAL	MSL, MEA	● O	● J
ALIGN. MAGNETIC COMP.	ADSF II	MSL	● A; ● D	
GRAPHITE FORMATION	ADSF III, MDSF	MSL, S/L		
SUPER ALLOYS	ADSF II	MSL	▲ S	▲ M
LEVITATION STUDIES	EML	MSL	▲ D	
RIEF	RIEF	MID-DECK, S/L		
GaAs CRYSTALS	GRADIENT FURNACE	MSL		
FOAM STABILITY	FOAM GENERATOR	MID-DECK, S/L		▲ J
THIN FILM & SOLUTION GROWTH	3M DEVELOPED	MID-DECK, S/L	▲ D → PART OF 72 FLIGHTS	
CELL GROWTH PHARM.	PROPRIETARY	MID-DECK, S/L		
SOLUTION GROWTH OF CRYSTALS	SOL. CRYSTAL GROWTH	MID-DECK, S/L	▲ D	
C I E F	CIEF	S/L		
GaAs ELECTROEPITAXY	ECG	S/L (S/S)		
SOLUTION CRYSTAL GROWTH	TBD	MID-DECK, S/L		
MLR (200 ml)	MLR	MID-DECK, S/L		
SPACE PRODUCED COATINGS	TBD	CARGO BAY		
GLASS FIBER PULLING	MODIFIED SAAL	MID-DECK, S/L		
NOMINAL COMMERCE LAB MISSION MODEL				
AGG. OF RED BLOOD CELLS	PROPRIETARY	MID-DECK	● A	
SEMICONDUCTOR MTL PbSnTe	GPRF	MEA	● O	
DIR. SOLIDIFICATION	ADSF II	MSL		● O
MICRO G SILICON ZONING	PROPRIETARY	MSL		
MICROSTRUCTURAL ANALYSIS	EXISTING	MSL, MEA	▲ D	
GROWTH OF CRYSTALS HgCdTe	AADSF	MSL		▲ J
PROTEIN CRYSTAL GROWTH	FES	S/L	▲ D	
GROWTH OF GaAs CRYSTALS	AADSF	MSL	▲ D	
CONTAINERLESS UNDERCOOLING	TBD	TBD		
HOMOGENEOUS CRYSTALLIZATION	SAAL	MSL, MEA		
ULTRAPURE GLASS	TBD	TBD	▲ D	
MOVING WALL ELECTROPHORESIS	TBD	MID-DECK, S/L		
PHASE PARTITIONING	TBD	MID-DECK, S/L		
CELL PARTITION	IEF	MID-DECK, S/L		
DROPLET COMBUSTION	TBD	MID-DECK, S/L		
GLASS MICROBALLOONS	SAAL	MSL		
IMPURITY EXTRACTION	TBD	TBD		
GAS-JET DIFFUSION FLAMES	TBD	S/L		
FLAME SPREADING	TBD	MID-DECK, S/L	▲ D	
PARTICAL CLOUD COMBUSTION	TBD	MID-DECK		
PREMIXED GAS FLAME	TBD	S/L		
MANIFESTED BUT NO COMMERCIAL INTEREST AT THIS TIME				
CONTAINERLESS GLASS PROC.	SAAL	MEA	● A; ● O; ● D	● J
ISOTHERMAL SOLIDIFICATION	GPRF	MEA		● J
LIQUID PHASE MISCIBILITY	GPRF	MEA	● O	▲ O
DIFFUSION OF LIQUID ZINC	GPRF	MEA	● O	

FOLDOUT FRAME

AB MISSION TRAFFIC MODEL



SHUTTLE FLIGHT OPPORTUNITIES

The Shuttle Flight Opportunities chart shows the known flight opportunities for commercial payloads through 1989. These have been identified by carrier and whether a potential exists for accommodating a Commerce Lab investigation. Again, it should be noted that a particular flight opportunity may accommodate more than one investigation, particularly in the case of a Spacelab rack or an MSL payload.

The mid-deck opportunities shown are basically all scheduled flights through 1987 with the exception of dedicated DOD missions. This is an optimum repressentation and does not necessarily reflect the true number of mid-deck opportunities available.

For the period beyond 1987, Payloads of Opportunity will exist at the rate of approximately one per month; however, baselined schedules and carriers are not defined and available at this time. Again, this rate is under optimum conditions and assumes best-case Shuttle launch and payload integration schedules.

The flight opportunities are summarized in the following table, which shows the number of Shuttle flights on which payload manifest possibilities exist through 1989.

Type Carrier	Number of Flight Possibilities
Spacelab Rack	3
Pallet	5
MPESS (MSL, other)	9
Mid-deck	32
Total Flight Opportunity, Present-1987	32
Total Flight Opportunity, 1988-1989	33
Total Flight Opportunity, 1989	65

As can be seen, even under optimum conditions, a total of 65 Shuttle flights through 1989 are available for Commerce Lab investigations. Given that over 200 experiment flight requests exist for a limited number of investigations during the same period, it can be quite easily deduced that more opportunities are required to meet the demand. Efforts are needed to accommodate a larger variety of apparatus in manned environments in order to raise the number of samples attainable per flight. This could reduce the number of flights required. Dedicated Commerce Lab flights would accommodate a large number of flight requests and would enable several experiments with similar demands and requirements to be flown, thus utilizing resources more efficiently than can be done with a "mixed" payload. Modification of existing apparatus or carriers or development of new hardware with the idea of more and/or better samples per flight could ease the demand. And, of course, scheduling more Shuttle flights could accommodate more users although the optimum schedule under existing Shuttle availability was already assumed for this study.

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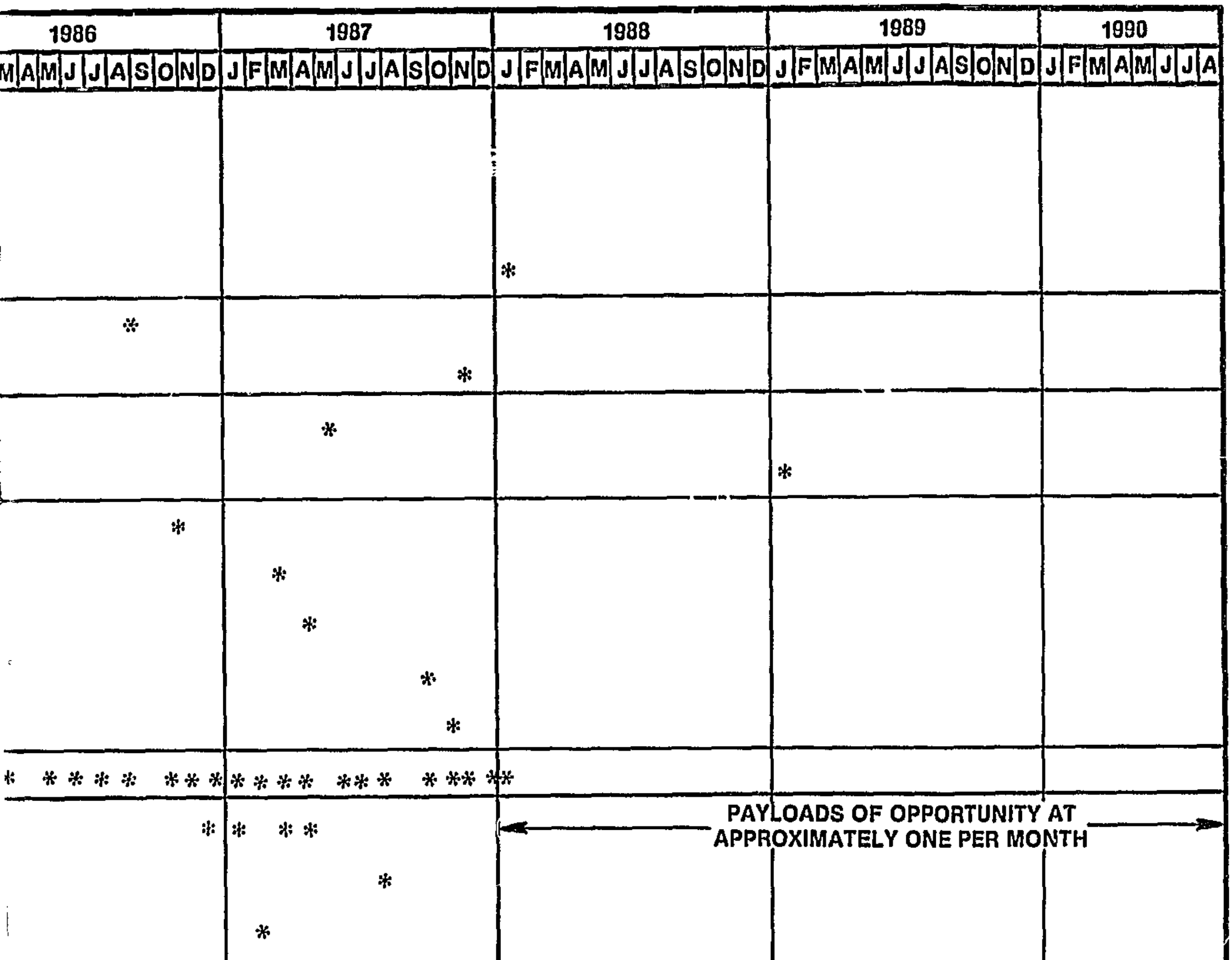
SHUTTLE FLIGHT OPPORTUNI

PAYLOAD	CARRIER	REMARKS	1985												1986												1987								
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
SPACELAB 3	LM + MPESS	CARGO FROZEN				*																													
SPACELAB 2	IG + 3P	CARGO FROZEN							*																										
SPACELAB D - 1	LM	100 FULL										*																							
SPACELAB J	LM + 1P	100 FULL																																	
EOM - 1/2	SM + 1P	POTENTIAL																				*													
EOM - 3	IG + 1P	POTENTIAL																																	
IML - 1	LM + 1P	RES. SINGLE RACK																													*				
IML - 2	LM + 1P	POTENTIAL																																	
MSL - 5	MPESS	POTENTIAL																							*										
MSL - 7	MPESS	POTENTIAL																											*						
MSL - 8	MPESS	POTENTIAL																												*					
MSL - 9	MPESS	POTENTIAL																																	*
MSL - 10	MPESS	POTENTIAL																																	
MID-DECK	EAC, OTHER	POTENTIAL													*		*		*	*	*	*		*	*	*	*	*	*	*	*	*	*		*
PL OPPTY	MPESS	POTENTIAL																								*	*		*	*					
PL OPPTY	PALLET	POTENTIAL																															*		
REFLIGHT OPPTY		POTENTIAL																										*							

FOLDOUT FRAME

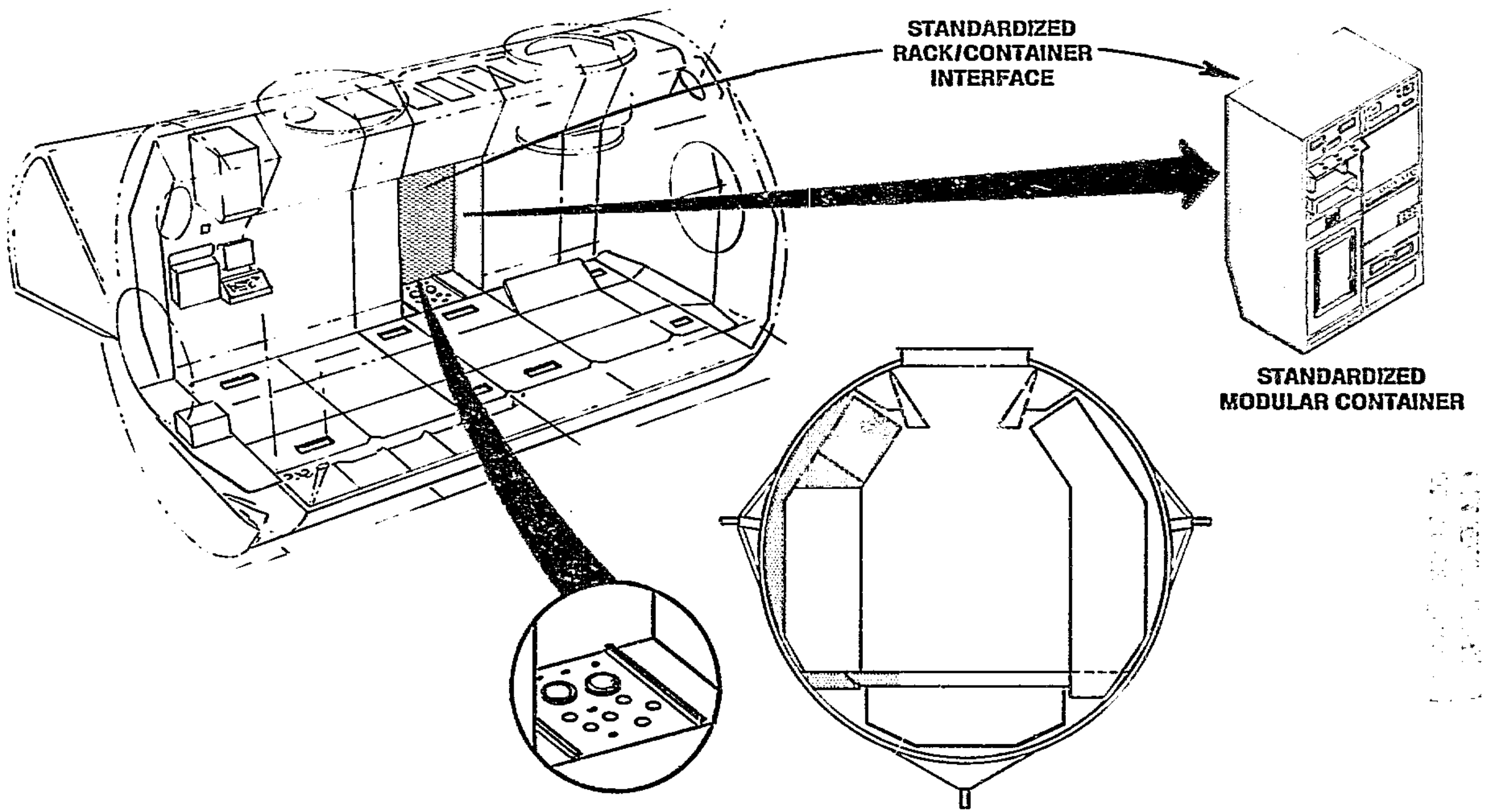
E FLIGHT OPPORTUNITIES



MODULAR RACK CONCEPT

As a by-product of the Commerce Lab study, a concept to reduce the time required by a user for integration is being studied. Reduction in costs and complexity are also primary interests being addressed by this study. Standardization of integration interfaces using a modular rack insert would minimize user constraints while maximizing commonality among the user community. Further detailed designs and results may be obtained under separate cover.

MODULAR RACK INSERT/CONTAINER



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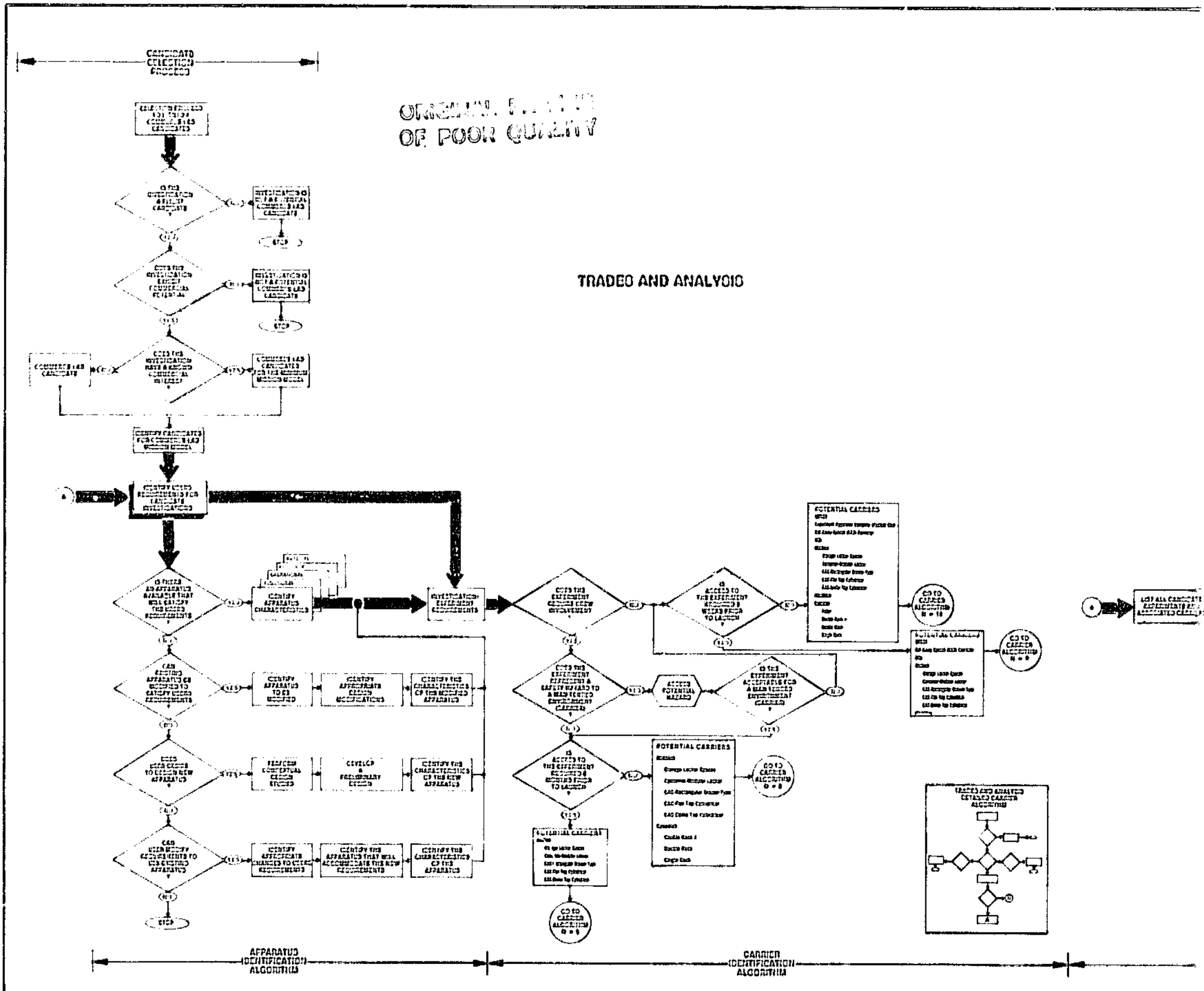
PROPOSED FOLLOW - ON

UPDATE AND REFINE DATA BASES

To maintain a current status of mission traffic requirements and models, the basic data bases of user requirements, apparatus capabilities and availability, and carrier capabilities must be maintained and updated on a continuing basis. As more data is learned from investigation development and/or actual flight, the data base format may be refined to accommodate that information. Because the data has been computerized, updates could be entered on a real-time basis and recalled at any time for analysis. Schedule changes, payload opportunities, or operational requirements could necessitate changes in manifest.

PERFORM DETAILED TRADES AND ANALYSIS

As this study matured, it became evident that the trades and analysis portion of formulating mission traffic models could be developed with more depth and detail than was used in the initial Commerce Lab Traffic Model. A detailed logic flow that could be used for the study of future investigation candidates is shown on the next page. In addition, this detailed flow could be used to restudy the investigations now included in our traffic model to determine whether any changes in their status or requirements are needed.



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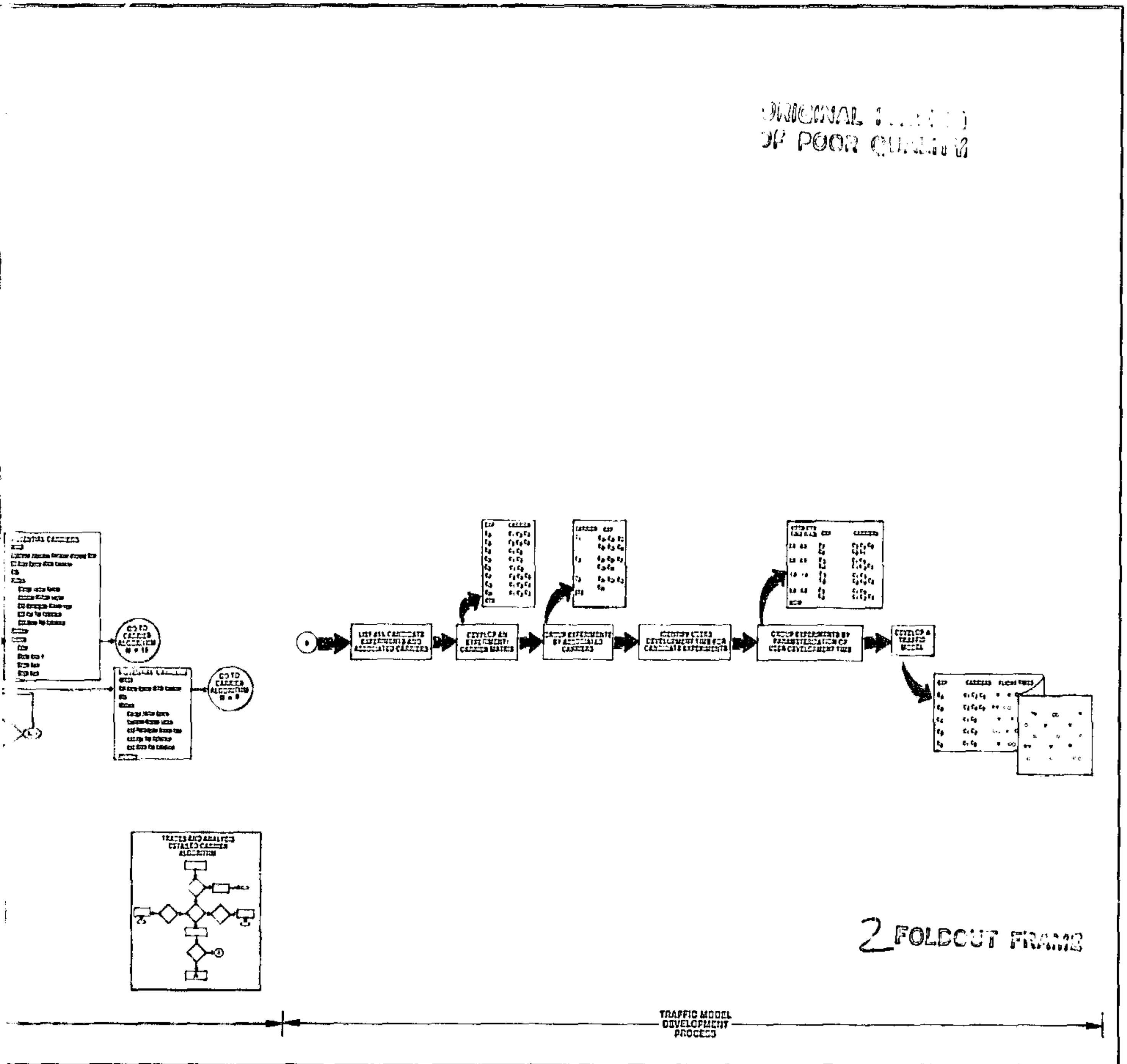
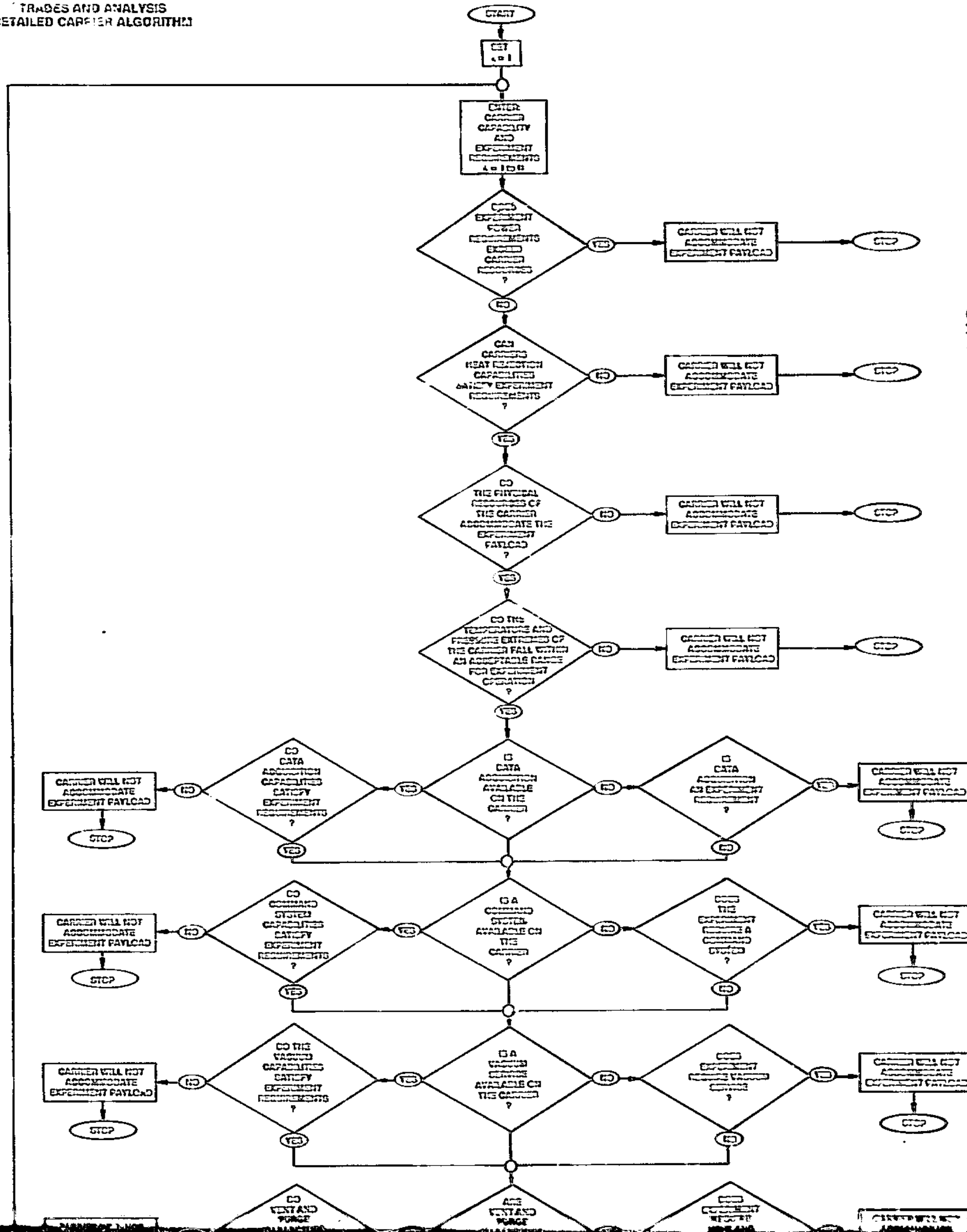
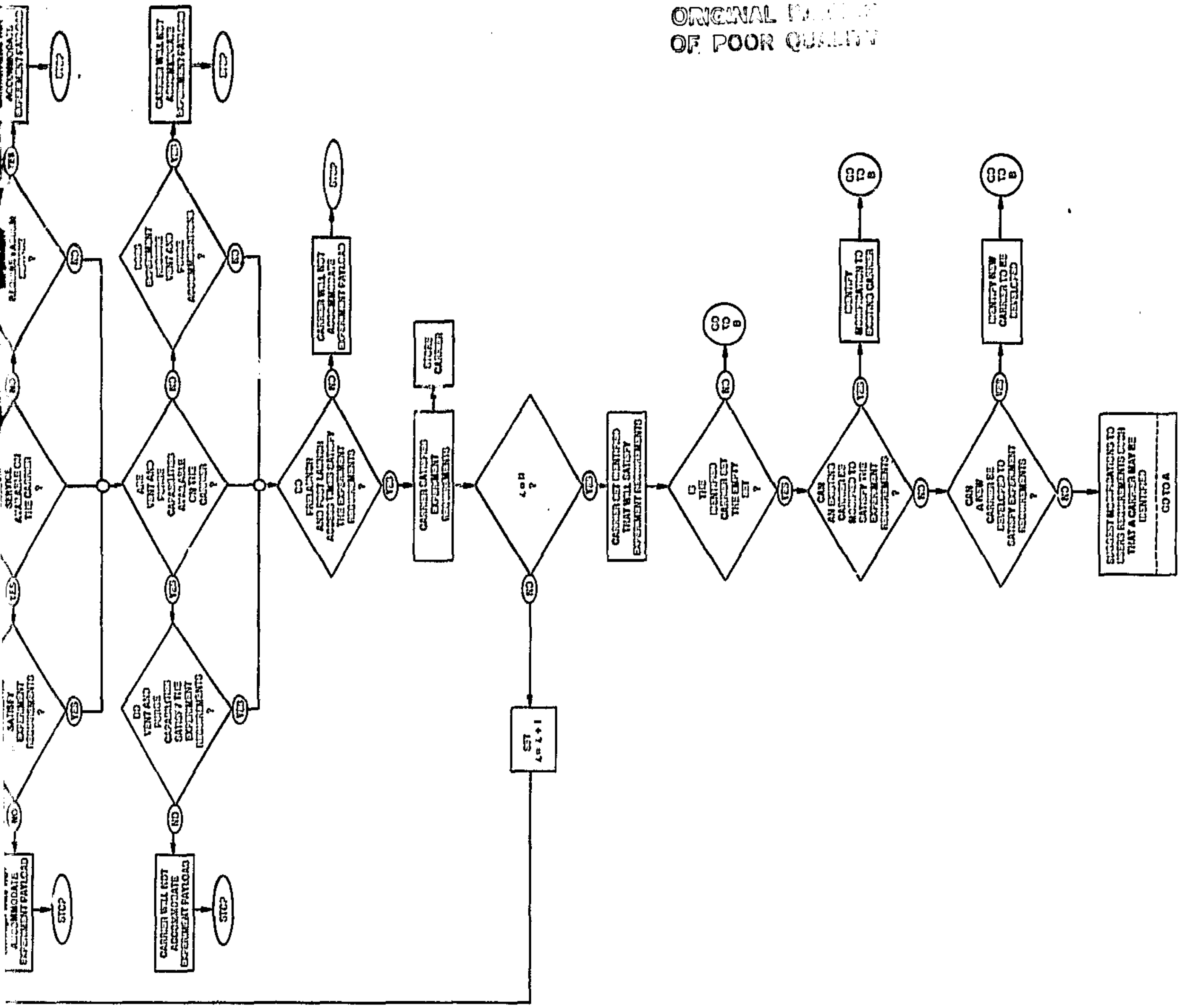

TRAFFIC MODEL DEVELOPMENT PROCESS

TRADES AND ANALYSIS
DETAILED CARRIER ALGORITHM





2 FOLDOUT FRAME

UPDATE AND REFINE TRAFFIC MODEL

As user requirements, apparatus, and carrier capabilities change or are modified, the traffic model will need to be kept current to reflect the most recent data inputs. Changes in shuttle manifest and flight schedules will also have an impact on which payloads can or should be accommodated. Having a Commercial User Traffic Model maintained by a centralized source of data input will allow a current demand picture to be available to the NASA Flight Manifest Office for planning purposes as flight opportunities are opened.

CENTRALIZE DATA BASE SYSTEM

The commercial user community is extremely diverse. Their requirements and data inputs will need to be channeled through a centralized data management system in order to maintain current data files and enable efficient management of the information. Also, by centralizing the system, both the user community and NASA will be able to referred to a single source data file. Traffic modeling and mission planning will be more complete, and a more realistic and current requirements "snapshot" will be available.

PLAN POSSIBLE MISSIONS

The desired product of data base manipulation and traffic model formulation and analysis is the planning of possible mission partial payloads and/or dedicated mission payloads. Once the data bases for specific users, apparatus, and capabilities have been assembled, a detailed trades and analysis operation can be performed and realistic, current traffic models can be formed. Analyzing these against current shuttle manifest schedules, experiments can be manifested on flight opportunities which currently exist, or whole dedicated commercial missions can be planned.

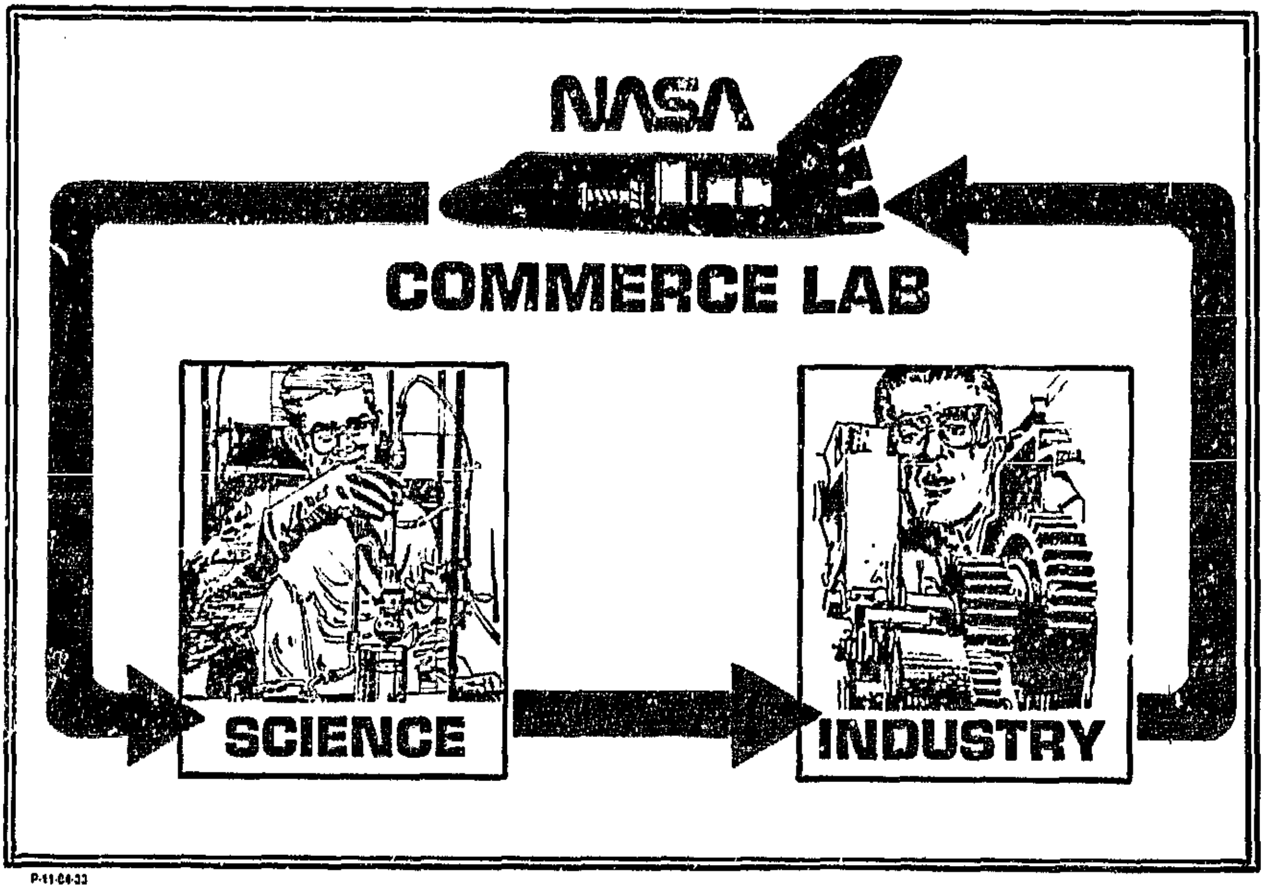
ACRONYMS AND ABBREVIATIONS

AADSF - Advanced Automated Directional Solidification Furnace
ADSF - Automated Directional Solidification Furnace
BIO - Biotechnology
CDMS - Command and Data Management System
CFES - Continuous Flow Electrophoresis System
CIEF - Continuous Isoelectric Focusing
CIR - Cargo Integration Review
CS - Combustion Sciences
EAC - Experiment Apparatus Container
ECG - Electroepiaxial Crystal Growth
EM - Electronic Materials
EML - Electromagnetic Levitator
EOM - Earth Observation Mission
EXP - Experiment
F&T - Fluids and Transports
FES - Fluids Experiment System
FDOR - Final Design and Operations Review
FRR - Flight Readiness Review
G&C - Glasses and Ceramics
GAS-Can - Get-Away-Special cannister
GPRF - General-Purpose Rocket Furnace
GSE - Ground Support Equipment
ICD - Interface Control Document
IDE - Initial Design Evaluation
IEF - Isoelectric Focusing
IG - Igloo
IML - International Microgravity Laboratory
INTEG - Integration
IRR - Integration Readiness Review
LM - Long Module
M&A - Metals and Alloys
MDSF - Manned Directional Solidification Furnace
MEA - Materials Experiment Assembly
MLR - Monodisperse Latex Reactor
MMPF - Microgravity and Materials Processing Facility
MPESS - Mission-Peculiar Experiment Support Structure
MPS - Materials Processing in Space
MSA - Microgravity Science and Applications
MSL - Material Science Laboratory
MTL - Material
PCG - Protein Crystal Growth
POCC - Payload Operations and Control Center
REQ - Requirements
RIEF - Recirculating Isoelectric Focusing
RR - Requirements Review
SAAL - Single-Axis Acoustic Levitator
S/L - Space Lab
SM - Short Module
SMICA - Spacelab Mission Integration Cost Assessment
STS - Shuttle Transportation System
VCG - Vapor Crystal Growth

DAA/ MARSHALL

COMMERCE LAB: MISSION ANALYSIS PAYLOAD INTEGRATION STUDY

CONTRACT NAS8-36109



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FINAL REPORT
APPENDIX A

JULY 1985
DATA BASES

WYLE LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP
P. O. Box 1008, Huntsville, AL 35807
TWX (910) 997-0886, Phone (205) 837-4411

FORWARD

This appendix is an assemblage of the three Commerce Lab data bases. The data bases will be updated during the course of the study as additional or revision information and data become available.

The appendix is organized into three sections to accommodate these elements. Each section is a stand-alone document. For visibility into utilization of these elements, the reader is referred to the Final Report titled "Commerce Lab: Mission Analysis and Payload Integration Study" (NAS8-36109) dated July 1985. That document provides a top-level diagram of the study flow and top-level flow diagrams for the development of the three data bases as well as the approach utilized in performing trades and analysis and mission planning.

Appendix
TABLE OF CONTENTS

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1.0 User Requirements

FOREWORD

Section 1.0 of this appendix provides information on current NASA Materials Processing in Space (MPS) programs and private commercial studies. Since this area is dynamic, it represents the most current information on each study. A glossary of terms which defines the "discriminating factor" for each study has been provided.

An attempt to categorize the areas of investigations into the identified research tracks in each discipline has been undertaken. A breakdown of the research tracks and its associated code is given prior to the start of each discipline section. The research track code is listed next to the area of investigation on the data sheets. Further refinement of the research tracks will be undertaken as it is essential for accurate classification of the areas of investigation.

CONTENTS

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CONTENTS (Continued)

CONTENTS (Continued)

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CONTENTS (Concluded)

C-2

Biotechnology

BIOTECHNOLOGY RESEARCH TRACKS

- B1.0 Electrokinetics of Particles and Macromolecules
  - B1.1 Electrophoresis
    - B1.1.1 Continuous Flow Electrophoresis
    - B1.1.2 Moving Wall Electrophoresis
    - B1.1.3 Containerless
    - B1.1.4 Free Zone Electrophoresis
    - B1.1.5 Immunoelectrophoresis
  - B1.2 Isoelectric Focusing
    - B1.2.1 Continuous Flow Isoelectric Focusing
    - B1.2.2 Recycling Isoelectric Focusing
    - B1.2.3 Immobilines
    - B1.2.4 Static Column Isoelectric Focusing
  - B1.3 Isotachophoresis
    - B1.3.1 Continuous Flow Isotachophoresis
    - B1.3.2 Recycling Isotachophoresis
    - B1.3.3 Static Isotachophoresis

- B2.0 General Kinetics of Particles and Macromolecules
  - B2.1 Thermophoresis
  - B2.2 Photophoresis
  - B2.3 Phase Partitioning
    - B2.3.1 Separation of Phases (±) Electric Field
  - B2.4 Chromatofocusing
  - B2.5 Field Flow Fractionation

- B3.0 Cell Culturing
  - B3.1 Cell Culturing Techniques
    - B3.1.1 Simple Suspension
    - B3.1.2 Monolayers
    - B3.1.3 Microcarrier Beads
    - B3.1.4 Hollow Fibers
  - B3.2 Cell Fusion
  - B3.3 Secretion Science

- B4.0 Macromolecule Crystallization
  - B4.1 Nucleation and Orientation Forces
    - B4.1.1 Seeded Versus Nonseeded Growth
    - B4.1.2 Vapor Phase Transfer
    - B4.1.3 Liquid Diffusion
    - B4.1.4 Dialysis

- B5.0 Biorheology
  - B5.1 Dynamics of Particle Flow in Organs
  - B5.2 Dynamics of Blood Flow in Vessels
  - B5.3 Blood Storage

- B6.0 Development of Analytical Tools for Use at Microgravity
  - B6.1 Laser Doppler Probing
  - B6.2 Two-Dimensional Electrophoresis

PROCESS DISCIPLINE	BIOTECHNOLOGY	
AREA OF INVESTIGATION	AGGREGATION OF RED BLOOD CELLS	B5.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	FLIGHT IN JANUARY '85	
POTENTIAL APPLICATION	DIAGNOSING DISEASES	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	DINTENFASS, DR. LEOPOLD SYDNEY HOSPITAL AUSTRALIA	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS		
NO. FLIGHTS	1	
TENTATIVE FLIGHT DATE	SCHEDULED FOR FLIGHT IN 85-2-20	
REMARKS	ORIGINAL FLIGHT IN DECEMBER OF 84, POSTPONED UNTIL JANUARY OF 85. NO REFLIGHT FORSEEN AT THIS POINT.	

PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	CELL GROWTH PHARMACEUTICALS B3.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	PHARMACEUTICAL APPLICATIONS TO CELL GROWTH
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	LEY, DR. KENNETH LOVELACE MEDICAL FOUNDATION
o COMMERCIAL INTEREST	LOVELACE MEDICAL FOUNDATION
TOP LEVEL INVESTIGATION REQUIREMENTS	OXYGEN ENVIROMENT, SAMPLE CHANGE OUT, MAN INTENSIFIED. 100 SAMPLES, EXPERIMENT RUNS DURATION OF MISSION. ON-BOARD REFRIGERATION. POWER REQUIRED IS SMALL. SELF-CONTAINED.
NO. FLIGHTS	1
TENTATIVE FLIGHT DATE	APPROXIMATELY 2.0 YEARS
REMARKS	A SERIES OF FOLLOW UP STUDIES HAVE BEEN PROPOSED FOLLOWING THE OUTCOME OF THE EXPERIMENT. GROUND BASED HARDWARE.

PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	CELL PARTITION IN TWO POLYMER AQUEOUS PHASES B2.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR A FLIGHT ASSIGNMENT
POTENTIAL APPLICATION	BIOLOGICAL CELL PURIFICATION
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	HARRIS, DR. J. MILTON UNIVERSITY OF ALABAMA IN HUNTSVILLE BROOKS, DR. DONALD UNIVERSITY OF OREGON
o COMMERCIAL INTEREST	PHARMACEUTICAL CO. (NO SPEC.)
TOP LEVEL INVESTIGATION REQUIREMENTS	ONE HOUR RUN TIME. REQUIRES CAMERA AND VIDEO DATA. REQUIRES 3-4 LOCKERS VOLUME. POWER REQUIRED IS NEGLIGIBLE, OPERATIONAL TEMP OF 4.0C. MAN INTENSIFIED.
NO. FLIGHTS	5
TENTATIVE FLIGHT DATE	APPROXIMATELY 2.0-2.5 YEARS
REMARKS	NO FLIGHT ASSIGNMENT. IEF APPARATUS FOR SPECIFIC REQUIREMENTS. HARDWARE IN DESIGN STAGE.

PROCESS DISCIPLINE	BIOTECHNOLOGY	
AREA OF INVESTIGATION	CIEF	B1.2.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	PURIFICATION TECHNIQUES	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	BIER, DR. MILAN UNIVERSITY OF ARIZONA	
o COMMERCIAL INTEREST	SHERRING-PLOUGH	
TOP LEVEL INVESTIGATION REQUIREMENTS	POWER REQUIRED 400-500 W FOR DURATION OF MISSION.	
NO. FLIGHTS		
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0 YEARS OR MORE. DEPENDS ON PROGRESS OF RIEF DEVELOPMENT.	
REMARKS	DOUBLE RACK. IDEA STAGE	

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PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	CYROGENIC EQUIVALENCE PRINCIPAL B2.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	GROUND BASED RESEARCH
POTENTIAL APPLICATION	NONE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	EVERITT, DR. F. STANFORD UNIVERSITY WORDEN, DR. P. STANFORD UNIVERSITY
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	

PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	ELECTROPHORESIS IN SPACE B1.1.1
INVESTIGATION CATEGORY	PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT APPROVED
POTENTIAL APPLICATION	SEPARATION AND PURIFICATION OF PHARMACEUTICAL PRODUCTS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	ROSE, MR. JAMES MDAC
o COMMERCIAL INTEREST	JEA MDAC/JOHNSON&JOHNSON
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	6
TENTATIVE FLIGHT DATE	CFES HAS BEEN SCHEDULED FOR 2 FLIGHTS, FIRST 85-3-19. LESS THAN A YEAR REQUIRED FOR REFLIGHT
REMARKS	CONTINUOUS FLOW ELECTROPHORESIS SYSTEM

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PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	ELECTROPHORESIS PHARMACEUTICALS B1.1.1
INVESTIGATION CATEGORY	PROCESS DEVELOPMENT
INVESTIGATION STATUS	FLIGHT HARDWARE
POTENTIAL APPLICATION	DEVELOPMENT OF PHARMACEUTICAL PRODUCTS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	ROSE, MR. JAMES MDAC
o COMMERCIAL INTEREST	MDAC/JOHNSON&JOHNSON
TOP LEVEL INVESTIGATION REQUIREMENTS	MAN INTENSIFIED, ONE SAMPLE CONTINUOUS OVER EXPERIMENT DURATION.
NO. FLIGHTS	7
TENTATIVE FLIGHT DATE	CFES HAS BEEN SCHEDULED FOR 2 FLIGHTS, FIRST IN 85-3-19. LESS THAN A YEAR REQUIRED FOR REFLIGHT
REMARKS	JEA APPROVED FOR 7 FLIGHTS. WILL THEN PROCEED TO THE NEXT STAGE. (FREE FLYER)

PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	HORMONE PURIFICATION BY IEF IN SPACE B1.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT
INVESTIGATION STATUS	FLIGHT FLOWN ONCE; SCHEDULED FOR REFLIGHT
POTENTIAL APPLICATION	SUPPORTS RIEF DEVELOPMENT
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	BIER, DR. MILAN UNIVERSITY OF ARIZONA
o COMMERCIAL INTEREST	IONICS, INC.
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	2
TENTATIVE FLIGHT DATE	SCHEDULED FOR REFLIGHT, 85-5-30 (51-G).
REMARKS	NEED FOR MICROGRAVITY IS QUESTIONABLE. FEASIBILITY DEMONSTRATION IN SUPPORT OF RIEF DEVELOPMENT. CENTER OF EXCELLENCE.

PROCESS DISCIPLINE	BIOTECHNOLOGY	
AREA OF INVESTIGATION	LOW GRAVITY BLOOD STORAGE	B5.3
INVESTIGATION CATEGORY		
INVESTIGATION STATUS		
POTENTIAL APPLICATION		
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	ARTHUR D. LITTLE	
o COMMERCIAL INTEREST	CNTR FOR BLOOD RESEARCH/HARVARD MED SCHOOL	
TOP LEVEL INVESTIGATION REQUIREMENTS		
NO. FLIGHTS		
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	BIOTECHNOLOGY	
AREA OF INVESTIGATION	MOVING WALL ELECTROPHORESIS	B1.1.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH APPLICATIONS	
INVESTIGATION STATUS	GROUND BASED TOWARD FLIGHT ASSIGNMENT	
POTENTIAL APPLICATION	BIOLOGICAL CELLS AND PROTEINS	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	SNYDER, DR. ROBERT S. NASA/MSFC	
o COMMERCIAL INTEREST	NONE TO DATE	
TOP LEVEL INVESTIGATION REQUIREMENTS	ONE HOUR RUN TIME. POWER, 300W FOR COOLING AND 100W FOR ELECTRIC FIELD. 3-4 LOCKER VOLUMES REQUIRED. MAN INTENSIFIED.	
NO. FLIGHTS	2	
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0 YEARS	
REMARKS	HARDWARE IN DESIGN STAGE.	

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PROCESS DISCIPLINE	BIOTECHNOLOGY	
AREA OF INVESTIGATION	NEW INSTRUMENTATION FOR PHASE PARTITIONING	B2.3.1
INVESTIGATION CATEGORY	PROCESS DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED TOWARD FLIGHT	
POTENTIAL APPLICATION	BIOLOGICAL CELL PURIFICATION	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	HARRIS, DR. J. MILTON UNIVERSITY OF ALABAMA IN HUNTSVILLE	
o COMMERCIAL INTEREST	NONE TO DATE	
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DEVELOPED	
NO. FLIGHTS	4	
TENTATIVE FLIGHT DATE	APPROXIMATELY 2.0-2.5 YEARS	
REMARKS	MOST LIKELY NOT COMMERCE LAB POTENTIAL INSTRUMENTATION HARDWARE IN DESIGN STAGE.	

PROCESS DISCIPLINE	BIOTECHNOLOGY
AREA OF INVESTIGATION	RIEF B1.2.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	PROTEIN PURIFICATION
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	BIER, DR. MILAN UNIVERSITY OF ARIZONA
o COMMERCIAL INTEREST	SHERRING-PLOUGH
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 3 HRS
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	APPROXIMATELY 2.0 YEARS
REMARKS	EXISTING GROUND BASED SYSTEM. REIF 300 LBS, POWER 275-375 W. 4 LOCKER VOLUMES REQUIRED. CONCEPT STAGE, GROUND BASED HARDWARE.

Combustion Science

COMBUSTION SCIENCE RESEARCH TRACKS

- CS1.0 Combustion of Droplets and Particles
  - CS1.1 Single and Multiple Drops and Particles
  - CS1.2 Flame Structure, Stability, and Sphericity
  - CS1.3 Vaporization
  - CS1.4 Products of Combustion
  - CS1.5 Detonation in Clouds
- CS2.0 Gas Phase Combustion
  - CS2.1 Flame Propagation and Extinction
  - CS2.2 Pressure/Flammability Limits
  - CS2.3 Autoignition/Ignition
  - CS2.4 Cool Flames
  - CS2.5 Flame Structure and Stability
  - CS2.6 Products of Combustion
  - CS2.7 Cellular Flames
  - CS2.8 Combustion of Stratified Mixtures
- CS3.0 Combustion of Large Solids
  - CS3.1 Solid Surface Flame Spreading and Extinction
  - CS3.2 Radiative Ignition
  - CS3.3 Flame Structure and Stability
  - CS3.4 Charring Phenomena
- CS4.0 Smoldering
  - CS4.1 Flame Structure and Stability
  - CS4.2 Radiative Ignition
  - CS4.3 Flame Propagation
- CS5.0 Liquid Pool Burning
  - CS5.1 Flame Structure and Stability
  - CS5.2 Flaming and Extinction Transitions
  - CS5.3 Hetrogeneous Kinetics
- CS6.0 High Pressure Vaporization and Combustion
- CS7.0 Fire Safety
  - CS7.1 Flame Inhibition
  - CS7.2 Extinguishment Techniques
  - CS7.3 Safety Systems

PROCESS DISCIPLINE	COMBUSTION SCIENCES	
AREA OF INVESTIGATION	BUOYANCY EFFECTS UPON VAPOR FLAME PROCESSES	CS1.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH APPLICATIONS TO TERRESTRIAL PROCESSES	
INVESTIGATION STATUS	ANALYTICAL AND GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	HARSHA, DR. TOM AND EDELMAN, DR. RAYMOND SCIENCE APPLICATIONS INC.	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	EXTERNAL VENTING AND SAMPLING OF GASSES IS REQUIRED.	
NO. FLIGHTS	1	
TENTATIVE FLIGHT DATE		
REMARKS	ELABORATE DIAGNOSTIC EQUIPMENT. LASERS TO MEASURE THE FLOW OF GAS SAMPLES.	

PROCESS DISCIPLINE	COMBUSTION SCIENCES
AREA OF INVESTIGATION	DROPLET COMBUSTION (DROPLET BURNING EXPERIMENT) CS1.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH IN-SPACE AND TERRESTRIAL APPLICATIONS
INVESTIGATION STATUS	SHUTTLE FLIGHT HARDWARE DEVELOPMENT
POTENTIAL APPLICATION	COMBUSTION TECHNOLOGY IN STATIONARY POWER PRODUCTION AND VEHICLE PROPULSION
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	WILLIAMS, PROF. FORMAN A. PRINCETON UNIVERSITY DRYER, PROF. FREDRICK PRINCETON UNIVERSITY
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	DROPLET AND FLAME DIAMETERS VS. TIME FOR DROPLET LIFETIME DROPLET SIZE RANGE 0.5-2.0 MM PRESSURE RANGE 0.1-2.0 ATM. SEVERAL PURE HYDROCARBON FUELS AND BINARY FUEL MIXTURES.
NO. FLIGHTS	10
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0 YEARS
REMARKS	DISPENSE DROPLETS IN A VESSEL WITH VISUAL ACCESS. POSITION & DAMP OSCILLATIONS OF DROPLET. IGNITE & RECORD VISUALLY DROPLET & FLAME SIZE. VENTING USEFUL BUT NOT REQUIRED. POWER REQ. DRIVEN BY 2 HIGH-SPEED CAMERAS. MIDDECK EXP. 2-3 LOCKERS REQUIRED. TRW DEVELOPING THE HARDWARE.

PROCESS DISCIPLINE	COMBUSTION SCIENCES
AREA OF INVESTIGATION	FLAME SPREADING IN REDUCED GRAVITY CS3.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH IN SPACE APPLICATIONS AND TERRESTRIAL PROCESSES
INVESTIGATION STATUS	ANALYTICAL AND GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	NONE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	ALTENKIRCH, PROF. ROBERT UNIVERSITY OF KENTUCKY
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	25 SAMPLES. ATMOSPHERIC CHANGE OUT. EXTERNAL VENTING REQUIRED. POWER 28VDC
NO. FLIGHTS	1
TENTATIVE FLIGHT DATE	
REMARKS	SAMPLES IN CLEAR CONTAINER WITH DIAGNOSTICS OUTSIDE. DESIGNED FOR MID-DECK.

PROCESS DISCIPLINE	COMBUSTION SCIENCES
AREA OF INVESTIGATION	FLAME SPREADING IN SOLID MATERIALS (SOLID SURFACE COMBUSTION) CS3.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH IN-SPACE AND TERRESTRIAL APPLICATIONS IN FIRE SAFETY
INVESTIGATION STATUS	SHUTTLE FLIGHT HARDWARE DEVELOPMENT
POTENTIAL APPLICATION	DEVELOPMENT OF IN-SPACE FIRE HAZZARD PREDICTIO AND CONTROL; TERRESTRIAL SOLID FUEL TECHNOLOGY
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	ALTENKIRCH, PROF. ROBERT UNIVERSITY OF KENTUCKY OLSON, SANDRA AND SACKSTEDER, KURT NASA-LeRC
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	CLOSED VESSEL FOR INDIVIDUAL TEST VACUUM VENTING AND SAMPLE CHANGEOUT USEFUL BUT NOT ESSENTIAL. OPERATING PRESSURE 0.5-2.0 ATM. LOCAL TEMP. MEASUREMENTS (THERMOCOUPLES) AND MODERATE SPEED MOVIE RECORDING.
NO. FLIGHTS	3
TENTATIVE FLIGHT DATE	SCHEDULED FOR FLIGHT IN 85. SAFETY REVIEW IN 3-12-85.
REMARKS	POWER REQUIREMENTS DRIVEN BY TWO MOVIE CAMERAS. EXPERIMENT COULD EVOLVE INTO A FIRE-SAFETY TESTING FACILITY WITH POTENTIAL FOR REGULAR REFLIGHT.

PROCESS DISCIPLINE	COMBUSTION SCIENCES
AREA OF INVESTIGATION	GAS-JET DIFFUSION FLAMES CS1.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH IN-SPACE AND TERRESTRIAL APPLICATIONS
INVESTIGATION STATUS	GROUND-BASED LOW-G EXPERIMENTATION (DROP TOWER)
POTENTIAL APPLICATION	STATIONARY POWER AND SENSIBLE HEAT GENERATION; FIRE SAFETY
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	HARSHA, DR. TOM AND EDELMAN, DR. RAYMOND SCIENCE APPLICATIONS, INC.
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	PRECISE GAS METERING APPARATUS, SMALL COMBUSTION TUNNEL WITH CONTINUOUS VENTING TO VACUUM.
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	SPACE-BASED EXPERIMENTS WILL REQUIRE SUB-STANCIAL ADDITIONAL INSTRUMENTATION INCLUDING LASER DIAGNOSTICS OF VELOCITY, TEMPERATURE, AND SPECIES CONCENTRATION FIELDS.

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PROCESS DISCIPLINE	COMBUSTION SCIENCES
AREA OF INVESTIGATION	PARTICLE CLOUD COMBUSTION CS1.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE WITH IN SPACE AND TERRESTRIAL APPLICATIONS
INVESTIGATION STATUS	SHUTTLE HARDWARE DEVELOPMENT
POTENTIAL APPLICATION	COAL COMBUSTION TECHNOLOGY AND FIRE SAFETY
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	BERLAD, PROF. ABE UNIVERSITY OF CALIFORNIA, SAN DIEGO
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	UNIFORM DISTRIBUTION OF SOLID PHASE IN AIR IN A FLAME TUBE. CONSTANT PRESSURE COMBUSTION VISUAL RECORDING OF FLAME PROPAGATION. WIDE RANGE OF FUEL/AIR MIXTURE RATIO.
NO. FLIGHTS	10
TENTATIVE FLIGHT DATE	CONCEPTUAL DESIGN REVIEW IN APRIL 85. WILL FLY IN EARLY 87
REMARKS	SHUTTLE MIDDECK EXPERIMENT, REQUIRING 4 LOCKER FUEL DISPENSED ON-ORBIT AND MIXED WITH AN ACOUSTIC FIELD. MIXTURE IGNITED AND FLAME PROPAGATION RECORDED ON HIGH SPEED MOVIES. POWER REQUIREMENTS DRIVEN BY CAMERAS. 8 EXPERIMENTS PERFORMED ON 1 FLIGHT. HARDWARE TO BE BUILT BY LeRC.

PROCESS DISCIPLINE	COMBUSTION SCIENCES
AREA OF INVESTIGATION	PREMIXED-GAS FLAME PROPAGATION CS2.1
INVESTIGATION CATEGORY	SCIENTIFIC KNPWLEDGE WITH IN-SPACE AND TERRESTRIAL APPLICATIONS
INVESTIGATION STATUS	GROUND BASED LOW-G EXPERIMENTATION (DROP TOWER)
POTENTIAL APPLICATION	FIRE SAFETY, STATIONARY POWER GENERATION, GROUND TRANSPORTATION PROPULSION
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	RONNEY, DR. PAUL D. NASA-LeRC STREHLOW, PROF. ROGER UNIVERSITY OF ILLINOIS
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	PRECISE GAS MIXING APPARATUS, CONSTANT VOLUME COMBUSTION VESSEL COMPATIBLE WITH 0-15 ATM. VACUUM VENTING OF COMBUSTION VESSEL IS ESSENTIAL.
NO. FLIGHTS	3
TENTATIVE FLIGHT DATE	
REMARKS	SPACE-BASED EXPERIMENTS WILL REQUIRE SUB-STANTIAL ADDITIONAL INSTRUMENTATION INCLUDING LASERS FOR VELOCITY, TEMPERATURE, AND SPECIES CONCENTRATION MEASUREMENTS.

Electronic and Electro Optical Materials

ELECTRONIC AND ELECTRO OPTICAL MATERIALS RESEARCH TRACKS

- EM1.0 Processes
  - EM1.1 Directional Solidification
    - EM1.1.1 Bridgman-Stockbarger Growth
    - EM1.1.2 Encapsulated Zone Growth
    - EM1.1.3 Float Zone Growth
    - EM1.1.4 Skull Melting
    - EM1.1.5 Vapor-Liquid-Solid
  - EM1.2 Vapor Growth
    - EM1.2.1 Physical Vapor Transport, Closed Tube
    - EM1.2.2 Chemical Vapor Transport, Closed Tube
    - EM1.2.3 Chemical Vapor Transport, Open Tube
    - EM1.2.4 Low-Temperature, Long-Duration Growth
  - EM1.3 Solvent Growth
    - EM1.3.1 Low Temperature from H_2O or Organic Solvent
    - EM1.3.2 High-Pressure, High-Temperature Hydrothermal
    - EM1.3.3 High-Temperature Flux
  - EM1.4 Epitaxy
    - EM1.4.1 Liquid Phase from Melt
    - EM1.4.2 Liquid Phase from Solvent
    - EM1.4.3 Vapor Phase
    - EM1.4.4 Electroepitaxy

- EM2.0 Materials
  - EM2.1 Semiconductor Crystals
    - EM2.1.1 Superlattices
    - EM2.1.2 Silicon
    - EM2.1.3 Gallium Arsenide
    - EM2.1.4 III-V Alloys
    - EM2.1.5 II-VI Alloys
    - EM2.1.6 IV-VI Alloys
    - EM2.1.7 IV Alloys
  - EM2.2 Non-semiconductor Crystals
    - EM2.2.1 Magnetic Oxides
    - EM2.2.2 Ferroelectrics
    - EM2.2.3 Piezoelectrics
    - EM2.2.4 Phroelectrics, Including TGS
    - EM2.2.5 Sapphire
    - EM2.2.6 Laser Materials
    - EM2.2.7 Nonlinear Frequency Multipliers
    - EM2.2.8 Birefringent and Optically Active Materials
    - EM2.2.9 Model Materials, Including Ice
  - EM2.3 Polycrystalline
  - EM2.4 Amorphous Materials

- EM3.0 Phenomena
  - EM3.1 Mass Transfer
  - EM3.2 Heat Transfer
  - EM3.3 Vapor Behavior
    - EM3.3.1 Diffusion
    - EM3.3.2 Convection
    - EM3.3.3 Composition
  - EM3.4 Liquid Behavior
    - EM3.4.1 Mixing
    - EM3.4.2 Diffusion
    - EM3.4.3 Soret Effect
    - EM3.4.4 Surface Tension-Driven Convection
    - EM3.4.5 Shape
  - EM3.5 Solidification
    - EM3.5.1 Dynamic Interface Behavior
    - EM3.5.2 Undercooling
    - EM3.5.3 Nucleation
    - EM3.5.4. Morphological Stability
    - EM3.5.5 Doping Inhomogeneity and Segregation
    - EM3.5.6 Dislocation Formation

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS	
AREA OF INVESTIGATION	ALUMINUM-SILICON ALLOY AND SPHERICAL SHELL TECHNOLOGY. BINARY MAGNETIC COMPOSITES OF GaAs	EM2.1.2 2.1.3 & 3.5
INVESTIGATION CATEGORY		
INVESTIGATION STATUS		
POTENTIAL APPLICATION		
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS		
o COMMERCIAL INTEREST	ALCOA/GRUMMAN AEROSPACE	
TOP LEVEL INVESTIGATION REQUIREMENTS		
NO. FLIGHTS		
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	CADMIUM TELLURIDE LITHIUM NIOBATE (FLOAT ZONE) FLOAT ZONE OF SILICON — EM1.1.3, 2.1.2, 2.1.5 & 3.5
INVESTIGATION CATEGORY	PROCESS DEVELOPMENT
INVESTIGATION STATUS	ANALYTICAL TO DATE
POTENTIAL APPLICATION	GAMMA RADIATION DETECTORS, SUBSTRATE FOR IR DETECTORS, MEDICAL AND NUCLEAR APPLICATIONS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	KERN, DR. EDWARD MICROGRAVITY TECHNOLOGIES INC.
o COMMERCIAL INTEREST	MICROGRAVITY TECH. INC. AND WESTECH SYSTEMS
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED
NO. FLIGHTS	4-6 FOR DEVELOPMENT
TENTATIVE FLIGHT DATE	
REMARKS	CONCEPTUAL STAGE. SIMILAR TO ZONING OF GaAs FOR TOP LEVEL INVESTIGATION REQUIREMENTS. SEEKING FUNDING, WANTS TO FLY BUT ALL ANALYTICAL TO DATE.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS	
AREA OF INVESTIGATION	CHARACTERIZATION OF TERRESTRIAL AND SPACELAB CRYSTALS OF HgI2	EM1.2.1, 2.2.8 & 3.3
INVESTIGATION CATEGORY	PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT	
INVESTIGATION STATUS	FLIGHT	
POTENTIAL APPLICATION	NUCLEAR AND GAMMA RAY DETECTORS	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	SCHNEPPLE, DR. WAYNE EG&G	
o COMMERCIAL INTEREST	EG&G	
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 6 DAYS. OPERATING TEMP; 100C, POWER REQUIRED 500W, MAN INTENSIFIED.	
NO. FLIGHTS	3	
TENTATIVE FLIGHT DATE	SL III SCHEDULED FOR FLIGHT 85-4-30 (51-B) LESS THAN A YEAR REQUIRED FOR REFLIGHT.	
REMARKS	VCG ON SL III USES PART OF FES POWER. CREWMAN TO ADJUST TEMPERATURE. EXPERIMENT RUNS FOR MONTHS IN LAB.	

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS	
AREA OF INVESTIGATION	FLUID DYNAMICS AND THERMODYNAMICS OF VAPOR PHASE CRYSTAL GROWTH	EM1.2.2 & 3.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	WEIDEMEIER, DR. HERIBERT RENSSELAER POLYTECHNIC INSTITUTE	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	FLUID DYNAMICS OF CRYSTAL MELTS UNDER REDUCED GRAVITY EM3.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	ANALYTICAL
POTENTIAL APPLICATION	NONE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	GREENSPAN, DR. HARVEY MIT
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	NA
NO. FLIGHTS	0
TENTATIVE FLIGHT DATE	
REMARKS	

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	GaAs ELECTROEPITAXY EM1.4,2.1.3 & 2.2.8
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT
POTENTIAL APPLICATION	ELECTRONIC AND ELECTRO OPTICAL DEVICES
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	
o COMMERCIAL INTEREST	MICROGRAVITY RESEARCH ASSOCIATES
TOP LEVEL INVESTIGATION REQUIREMENTS	20 KGM/FLIGHT FOR FIRST PROOF OF CONCEPT FLIGHTS. RUN TIME; 50 HRS, OPERATIONAL TEMP; 900C
NO. FLIGHTS	8
TENTATIVE FLIGHT DATE	TARGETED FOR SPACE STATION
REMARKS	ECG, CONCEPT STAGE. SELF CONTAINED. THREE FURNACES AND AUXILIARY EQUIPMENT MOUNTED IN THE STRUCTURE. 1055 LBS NOMINAL.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	GROWTH OF GaAs CRYSTALS EM1.1,2.1.3 & 3.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED LEADING TO FLIGHT
POTENTIAL APPLICATION	IR SENSORS AND SUBSTRATES
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	LARSON, DR. DAVID GRUMMAN AEROSPACE
o COMMERCIAL INTEREST	GRUMMAN AEROSPACE, ALCOA, GTE
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIMES OF 50 HRS. OPERATING TEMP; 900C VOLUME REQUIRED 4-8 CUBIC METERS. CRYSTAL SIZE 2" DIAMETER
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	APPROXIMATELY 2.0 YEARS
REMARKS	EDG ELECTRONICALLY DRIVEN GRADIENT REFINE EXISTING GROUND HARDWARE

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PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	GROWTH OF GaAs CRYSTALS FROM THE MELT IN A PARTIALLY CONFINED CONFIGURATION — EM1.1 & 2.1.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED TENTATIVELY SELECTED FOR FLIGHT
POTENTIAL APPLICATION	IR DETECTOR
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	GATOS, PROF. HARRY C. MIT LAGOWSKI, DR. JACEK MIT
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	1-3 SAMPLES, MAX TEMP; 1250C, 10-30 C/CM GRADIENT AT S-L INTERFACE. 48 HOUR RUN TIME.
NO. FLIGHTS	4
TENTATIVE FLIGHT DATE	APPROXIMATELY 1.0 YEAR
REMARKS	APPROVED GROUND-BASED INVESTIGATION LEADING TO FLIGHT ASSIGNMENT. AADSF

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS	
AREA OF INVESTIGATION	GROWTH OF SOLID SOLUTION SINGLE CRYSTALS HgCdTe	EM1.1.1,2.1.5 & 3.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED LEADING TO FLIGHT	
POTENTIAL APPLICATION	IR DETECTOR	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	LEHOCZKY, DR. S.L. NASA/MSFC	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	SAMPLE SIZE 1.2 CM DIAMETER TEMP RANGE HOT-1100C, COLD-500C.	
NO. FLIGHTS	4	
TENTATIVE FLIGHT DATE	APPROXIMATELY 1.5-2.0 YEARS	
REMARKS	PROTOTYPE OF AADSF HAS BEEN DEVELOPED. THERE EXIST 2-3 VERSION WILL USE ONE.	

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	MICROGRAVITY SILICON ZONING INVESTIGATION — EM1.1.3,2.1.2 & 3.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED LEADING TO FLIGHT
POTENTIAL APPLICATION	PRODUCTION OF UNIQUE SILICONS FOR INDUSTRY
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	KERN, DR. EDWARD WESTECH SYSTEMS, INC.
o COMMERCIAL INTEREST	NONE TO DATE, KERN TRYING TO START A COMPANY
TOP LEVEL INVESTIGATION REQUIREMENTS	RESISTANCE HEAT FLOAT ZONE. 1 CM MELT ZONE. DIAMETER OF SAMPLE; 6 CM. MELT POINT; 1450C POWER REQUIRED IS LESS THAN 500W.
NO. FLIGHTS	4
TENTATIVE FLIGHT DATE	SCHEDULED FOR TWO FLIGHTS 87-3, MSL-7 AND 87-9, MSL-9
REMARKS	INITIAL EXPERIMENT TO DETERMINE IF CAN AVOID MARANGONI FLOW. DESIGNED FOR MSL.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	ORGANIC CRYSTAL GROWTH EM1.3.1 & FT1.
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	HAS FLOWN, FLIGHT HARDWARE EXISTS
POTENTIAL APPLICATION	LIFE SCIENCES DYES, PIGMENTS AND POLYMERS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	POSIADLY, DR. CHRISTOPHER 3M
o COMMERCIAL INTEREST	3M
TOP LEVEL INVESTIGATION REQUIREMENTS	3 LOCKERS VOLUME REQUIRED. REACTION OCCURS WHILE CREW NOT MOVING AROUND. (I.E. ASLEEP). HEAT DISSIPATION AND POWER MINIMAL.
NO. FLIGHTS	3M HAS 72 FLIGHTS BY 1995
TENTATIVE FLIGHT DATE	FIRST FLIGHT 84-11-20, REFLIGHT WITHIN THE YEAR
REMARKS	DMOS RIG, EAC HOUSES SIX REACTOR UNITS. A GENERIC ELECTRONICS MODULE CONTROLS THE EXPERIMENT. 2 HOUSING SIMILAR TO MLR. FIRST FLIGHT CELLS CONTAINED UREA, CYANINE TOSYLATE TETRAETHYLAMMONIUM OXONOL & PROPRIETARY.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	PROTEIN CRYSTAL GROWTH IN LOW GRAVITY — EM1.3.1 & FT1.6
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED LEADING TO FLIGHT
POTENTIAL APPLICATION	DETECTORS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	FEIGELSON, DR. R. S. STANFORD UNIVERSITY
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	1
TENTATIVE FLIGHT DATE	APPROXIMATELY 1.0-1.5 YEARS
REMARKS	JUST BEGAN GROWING LARGE PROTEIN CRYSTALS. APPARATUS SIMILAR TO FES

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	SEMICONDUCTOR MATERIALS EM1.1.1,2.1.5 PbSnTe & 3.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT
POTENTIAL APPLICATION	IR DETECTOR
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	CROUCH, DR. ROGER K. NASA/LANGLEY RESEARCH CENTER
o COMMERCIAL INTEREST	DOD AND OTHERS
TOP LEVEL INVESTIGATION REQUIREMENTS	TEMP OF 1000C FOR 36 HRS. SAMPLE SIZE 1.5-7.0 CM DIAMETER. THREE SAMPLES A YEAR.
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	SCHEDULED FOR THREE FLIGHTS, 85-10-9, MEA-1 ; 87-4-27, MSL-8; 87-10-21, MSL-10
REMARKS	PbSnTe AADSF IS PLANNED FOR THIS.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	SEMICONDUCTORS MATERIAL GROWTH IN LOW-GRAVITY ENVIRONMENT PbSnTe — EM1.1.1,2.1.5 & 3.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	CONTINUING FLIGHT RESEARCH
POTENTIAL APPLICATION	IR DETECTORS FOR MILITARY USE
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	CROUCH, DR. ROGER K. NASA/LANGLEY RESEARCH CENTER FRIPP, DR. ARCHIE NBS
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	1
TENTATIVE FLIGHT DATE	SCHEDULED FOR THREE FLIGHTS 85-10-9, MEA-A2; 87-4-27, MSL-8; 87-10-21, MSL-10
REMARKS	GPRF ON MEA-A2.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	SOLUTION CRYSTAL GROWTH EM1.3.1,2.2.8 & 3.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	IR DETECTORS AND ELECTRO OPTICAL DEVICES
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	
o COMMERCIAL INTEREST	QUANTUM TECHNOLOGIES
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0-4.0 YEARS
REMARKS	NEW SYSTEM NO HARDWARE AS YET, IDEA STAGE

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PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	SOLUTION GROWTH OF CRYSTALS IN ZERO GRAVITY EM1.3.1,2.2.8 & 3.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT
POTENTIAL APPLICATION	IR DETECTORS AT ROOM TEMPERATURE
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	LAL, DR. RAVENDRA ALABAMA A&M UNIVERSITY
o COMMERCIAL INTEREST	NIGHT VISION LABS AND DOD
TOP LEVEL INVESTIGATION REQUIREMENTS	OPERATING TEMP TO STUDY TGS IS 50C. RUN TIME OF 2 DAYS. MAN INTENSIFIED. LONGER RUN TIMES ARE REQUIRED FOR COMMERCIAL APPLICATIONS.
NO. FLIGHTS	3
TENTATIVE FLIGHT DATE	APPROXIMATELY 1.0-1.5 YEARS
REMARKS	EXPERIMENT RUNS FOR MONTHS IN LAB. CREWMAN TO ADJUST TEMPERATURE AND REMOVE CRYSTALS FOR ANALYSIS. COMPLEX EXPERIMENT, USES HOLOGRAMS.

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	THIN FILM AND SOLUTION GROWTH EM1.3.1 & 3.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	FLIGHT
POTENTIAL APPLICATION	PROPRIETARY
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	POSIADLY, DR. CHRISTOPHER 3M
o COMMERCIAL INTEREST	3M
TOP LEVEL INVESTIGATION REQUIREMENTS	PROPRIETARY
NO. FLIGHTS	3M HAS 72 FLIGHTS BY 1995
TENTATIVE FLIGHT DATE	APPROXIMATELY ONE YEAR
REMARKS	PROPRIETARY GROUND HARDWARE EXISTS

PROCESS DISCIPLINE	ELECTRONIC AND ELECTRO OPTICAL MATERIALS
AREA OF INVESTIGATION	VAPOR GROWTH OF ALLOY TYPE SEMICONDUCTOR CRYSTALS HgCdTe — EM1.2.2,2.1.5 & 3.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASE CONCLUDING, APPROVED FOR FLIGHT
POTENTIAL APPLICATION	IR DETECTOR
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	WEIDEMEIER, DR. HERIBERT RENSSEALAER POLYTECHNIC INSTITUTE
o COMMERCIAL INTEREST	HONEYWELL, BOEING, DOD AND HUGHES
TOP LEVEL INVESTIGATION REQUIREMENTS	PROCESSING TIMES OF 18 AND 33 HRS, MELT POINT RANGE FOR HgCdTe IS 535-595C.
NO. FLIGHTS	4
TENTATIVE FLIGHT DATE	SCHEDULED FOR FOUR FLIGHTS 85-10-9, MEA-A2 86-7-17, MSL-4/MEA-A3; 87-1-14, MSL-6/MEA-4 AND 87-3-18, MSL-7
REMARKS	3 FLIGHTS ASSIGNED. FLYING GeSe ON MEA-A1 AND A2 IN GRADIENT GPRF. MEA-A3, SEEDED AND UNSEEDED, END ZONE HEATER MODIFICATION. TWO FURNACES SUGGESTED ARE THE VAPOR CRYSTAL GROWTH GRADIENT FURNACE AND THE AADSF.

Fluids and Transport Phenomena

FLUIDS AND TRANSPORT PHENOMENA RESEARCH TRACKS

- FT1.0 Convection and Diffusion Transfer
  - FT1.1 Heat Transfer
  - FT1.2 Phase Change Processes
  - FT1.3 Chemical Reaction Processes
  - FT1.4 Surface Tension
  - FT1.5 Hydrodynamic Instability
  - FT1.6 Organic Crystal Growth
- FT2.0 Multiphase Mixtures
  - FT2.1 Equilibrium Properties
  - FT2.2 Critical Wetting
  - FT2.3 Surface Dynamics
  - FT2.4 Single-Phase Multicomponent Mixing and Separation
- FT3.0 Critical Point Phenomena
  - FT3.1 Phase Transition
  - FT3.2 Transport Properties
- FT4.0 Droplet Physics and Chemistry
  - FT4.1 Nucleation and Growth of Droplets and Crystals
  - FT4.2 Collision Coalescence
  - FT4.3 Riming
  - FT4.4 Aerosol Scavenging
- FT5.0 Thermophysical Properties of Corrosive and Reactive Fluids
  - FT5.1 Compressibility
  - FT5.2 Heat Capacity
  - FT5.3 Thermal Conductivity
  - FT5.4 Viscosity
- FT6.0 Synthetic Chemistry
- FT7.0 Superfluid Helium Behavior
- FT8.0 Capillary Processes

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	AN EXPERIMENTAL STUDY OF ICE CRYSTAL GROWTH AND SCAVENGING BY ICE IN A CLOUD SIMULATION FACILITY	FT4.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	HAGEN, DR. DONALD E. UNIVERSITY OF MISSOURI-ROLLA	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS	EXPERIMENT CLOUD DISPERSION CHAMBER.	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	CLOUD MICROPHYSICS AND SCAVENGING	FT4.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	ANDERSON, DR. JEFFREY NASA/MSFC	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	CLOUD PHYSICS EXPERIMENT SIMULATION	FT4.C
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	PLOOSTER, DR. MYRON N. UNIVERSITY OF DENVER	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	COLLAGEN FIBERS FTO.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	ANALYTICAL, BUT WANT TO FLY
POTENTIAL APPLICATION	REPAIR AND REPLACEMENT OF CONNECTIVE TISSUE
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	HUGHES, DR. KENNETH BATTELLE LABS
o COMMERCIAL INTEREST	
TOP LEVEL INVESTIGATION REQUIREMENTS	POWER REQUIRED IS SMALL (FEW AMPS), RUN TIME LESS THAN ONE HOUR. SEVERAL SMALL SAMPLES, 100 ml TOTAL. COOLING REQUIRED BY AVIONICS AIR OR WATER. REFRIGERATION TO STORE SAMPLE NEEDED.
NO. FLIGHTS	3-5 TO DETERMINE FEASIBILITY
TENTATIVE FLIGHT DATE	
REMARKS	TO DATE NO AEROSPACE COMPANY HAS SPONSORED THE PROGRAM. BATTELLE COULD NOT AFFORD THEIR PART OF JEA WITH NASA. DESIGN IS FOR MIDDECK WOULD START SMALL AND BUILD UP.

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	CONTINUOUS FLOW ELECTROPHORESIS MATH MODEL	FT2.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	SAVILLE, DR. DUDLEY A. PRINCETON UNIVERSITY	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS	MODELING	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	CRITICAL TRANSPORT PHENOMENA IN FLUID HELIUM UNDER LOW GRAVITY	FT7.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT WORK	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	MEYER, DR. H. DUKE UNIVERSITY BEHRINGER, DR. R. AND BROOKS, DR. WALTER AMES RESEARCH CENTER	
o COMMERCIAL INTEREST		
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 4 HRS. WILL REQUIRE 10 SEPERATE RUNS. POWER OF 100W. He MUST BE IN A DEWER AT AMBIENT TEMPERATURE.	
NO. FLIGHTS	2	
TENTATIVE FLIGHT DATE		
REMARKS	SPACELAB II SSEG DEWER IS APPROPRIATE.	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	ELECTROHYDRODYNAMICS	FT1.5
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	SAVILLE, DR. DUDLEY PRINCETON UNIVERSITY	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	FREE SURFACE PHENOMENA UNDER LOW AND ZERO GRAVITY CONDITIONS	FT1.4 & 2.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	CONCUS, DR. PAUL CASE WESTERN RESERVE UNIVERSITY FINN, DR. R. BERKELY COLES, DR. D. CALIFORNIA TECH.	
o COMMERCIAL INTEREST		
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED	
NO. FLIGHTS	MORE THAN ONE	
TENTATIVE FLIGHT DATE		
REMARKS	DESIGN DOCUMENT NOT COMPLETED. CLOSING OUT FEASIBILITY STAGE OF EXPERIMENT.	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	INFLUENCE OF LOW CONVECTIVE VELOCITIES ON THE GROWTH OF CRYSTALS FT1.
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	ANALYTICAL
POTENTIAL APPLICATION	NONE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	HALLET, DR. JOHN UNIVERSITY OF NEVADA
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	NA
NO. FLIGHTS	0
TENTATIVE FLIGHT DATE	
REMARKS	INSTRUMENTATION IS ELABORATE. DATA RECORDING ASSESSMENT IS COMPLEX. DEAD-ENDED STUDY.

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	LIGHT SCATTERING TESTS OF FUNDAMENTAL THEORIES OF TRANSPORT PROPERITIES IN THE CRITICAL REGION	FT3.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	MOLDOVER, DR. MICHAEL NBS	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED	
NO. FLIGHTS	MORE THAN ONE FLIGHT	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	MASS TRANSPORT PHENOMENA BETWEEN BUBBLES AND DISSOLVED GASES IN LIQUIDS UNDER LOW GRAVITY CONDITIONS	FTO.O
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	DEWITT, DR. K. UNIVERSITY OF TOLEDO	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED	
NO. FLIGHTS	MORE THAN ONE	
TENTATIVE FLIGHT DATE		
REMARKS	DESIGN STUDY FOR EXPERIMENT NOT COMPLETED.	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	POLYMER PROCESSING AND CRYSTALLIZATION	FT6.0

INVESTIGATION CATEGORY

INVESTIGATION STATUS

POTENTIAL APPLICATION

COMMERCIAL POTENTIAL YES

INTERESTED PARTIES

- o INVESTIGATORS

- o COMMERCIAL INTEREST CLEANESE

TOP LEVEL INVESTIGATION REQUIREMENTS

NO. FLIGHTS

TENTATIVE FLIGHT DATE

REMARKS

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	PRECISE VISCOSITY MEASUREMENTS VERY CLOSE TO THE CRITICAL REGION FT3.0 & 5.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	NONE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	MOLDOVER, DR. MICHAEL NBS
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED
NO. FLIGHTS	MORE THAN ONE FLIGHT
TENTATIVE FLIGHT DATE	
REMARKS	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	PRODUCTION OF LARGE PARTICLE SIZE MONODISPERSE LATEXES (100 ml) FT1.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT HARDWARE
POTENTIAL APPLICATION	CALIBRATE EQUIPMENT, BIOMEDICAL RESEARCH, BODY TRACERS, DRUG CARRIERS AND MEMBRANE SIZING
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	VANDERHOFF, DR. JOHN W. LEHIGH UNIVERSITY KORNFELD, DALE NASA/MSFC
o COMMERCIAL INTEREST	NBS AND PARTICLE TECHNOLOGY
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 20 HRS PER REACTOR. 3 LOCKERS VOLUMES REQUIRED. MANUAL INITIATION.
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	SCHEDULED FOR FLIGHT IN 85-5-30
REMARKS	ALL APPARATUS EXISTS HAS FLOWN 5 TIMES, SCHEDULED FOR 3 MORE FLIGHTS. MASS 155 lbs, POWER 340W FOR FIRST HOUR, THEN 50W FOR THE NEXT 19 HRS.

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	PRODUCTION OF LARGER PARTICLE SIZE MONODISPERSE LATEXES (2 1) FT1.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT HARDWARE
POTENTIAL APPLICATION	CALIBRATE EQUIPMENT, BIOMEDICAL RESEARCH, BODY TRACERS, DRUG CARRIERS AND MEMBRANE SIZING
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	VANDERHOFF, DR. JOHN W. LEHIGH UNIVERSITY KORNFELD, DALE NASA/MSFC
o COMMERCIAL INTEREST	NBS AND PARTICLE TECHNOLOGY
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME 20 HRS PER REACTOR. VOLUME TO BE DETERMINED. MANUAL MIXING ON-ORBIT.
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	APPROXIMATELY 2.0 YEARS
REMARKS	1) MISSION SPECIALIST-AUTOMATED LARGE CONSOLE WITH 6 REACTORS AUTOMATICALLY INJECT SAMPLE INTO NEXT REACTOR. 2) DEVELOPER-MANUAL • SERIES OF AS MANY AS 12 REACTORS. MANUAL REMOVAL OF SEED AND INJECTION INTO REACTOR. IDEA STAGE

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	PROTEIN CRYSTAL GROWTH FT1.6
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT, HARDWARE EXISTS
POTENTIAL APPLICATION	PROBLEM DRUG DESIGN. PROTEIN BIOTECHNOLOGY
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	BUGG, DR. CHARLES UNIVERSITY OF ALABAMA IN BIRMINGHAM
o COMMERCIAL INTEREST	UPJOHN, SHERRING-PLOUGH
TOP LEVEL INVESTIGATION REQUIREMENTS	FIRST FLIGHT UNIT (FFT) ONE LOCKER VOLUME REQUIRED, RUN TIME OF 1 WEEK. SECOND FLIGHT UNIT (SFF) ONE LOCKER VOLUME REQUIRED, RUN OF 1 WEEK, OPERATING TEMP 4.0C, REFRIGERATION REQUIRED.
NO. FLIGHTS	10
TENTATIVE FLIGHT DATE	
REMARKS	TEMP IS CRITICAL. BOTH UNITS ENCAPSULATED EXPERIMENTS. SFF REQUIRES POWER FOR REFRIGERATION. LESS THAN A YEAR REQUIRED FOR REFLIGHT.

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	SPACE INFRARED TELESCOPE FACILITY (STICKERS) FT2.4
INVESTIGATION CATEGORY	PROCESS DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT.
POTENTIAL APPLICATION	PROCESS TO REFILL DEWERS IN SPACE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	BROOKS, DR. WALTER AMES RESEARCH CENTER
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 5 HRS, WILL REQUIRE 2 RUNS. TOTAL OPERATIONAL TIME 10 HRS. 200W POWER REQUIRED. OPEN PALLET IS DESIRED CARRIER WITH EVA.
NO. FLIGHTS	4-5
TENTATIVE FLIGHT DATE	
REMARKS	MOVE FLUIDS FROM ONE DEWER TO ANOTHER AND VARY THE TRANSFER RATE TO OBSERVE THERMO-DYNAMIC EFFICIENCY. FLIGHT DESIGNS ARE IN 6/85.

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	SPACE PRODUCED COATINGS	FTO.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION		
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	ZITO, DR. RICHARD R. SCIENCE APPLICATIONS, INC.	
o COMMERCIAL INTEREST	SAI, WAKE SHIELD	
TOP LEVEL INVESTIGATION REQUIREMENTS	REQUIRES POWER	
NO. FLIGHTS		
TENTATIVE FLIGHT DATE	APPROXIMATELY 4.0 YEARS OR MORE	
REMARKS	DESIGN IN BLUEPRINT STAGE. LENGTH 41", RADIUS 8.4". WEIGHT 76 LBS. POWER 120V, 60 HZ, 15 A PLUS HEAT FOR ELECTRONICS PACKAGE. DEPLOYED AT THE END OF A REMOTE MECHANICAL ARM.	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA
AREA OF INVESTIGATION	SPECTIFIC HEAT OF HELIUM THROUGH THE LAMBDA POINT FT5.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	APPLICATIONS IN MATERIAL SCIENCES
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	FAIRBANK, DR. W. STANFORD UNIVERSITY LIPA, DR. JOHN STANFORD UNIVERSITY
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	EXPERIMENT TO RUN DURATION OF FLIGHT. 10 TO THE NEGATIVE 5 ENVIRONMENT REQUIRED. CAN NOT RUN EXPERIMENT DURING SOLAR MAX PERIOD. He GAS VENTING REQUIRED. POWER OF 100-200 W, PASSIVE COOLING REQUIRED.
NO. FLIGHTS	2-3
TENTATIVE FLIGHT DATE	
REMARKS	COOPERATIVE PHASE TRANSITION PROTOTYPE FLIGHT HARDWARE HAS BEEN DEVELOPED.

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	SURFACE TENSION INDUCED INSTABILITY IN REDUCED GRAVITY; THE BENARD PROBLEM	FT1.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	KOSCHMIEDER, DR. A. CHAI UNIVERSITY OF TEXAS	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED	
NO. FLIGHTS	MORE THAN ONE FLIGHT	
TENTATIVE FLIGHT DATE		
REMARKS	DESIGN STUDY FOR EXPERIMENT HAS NOT BEEN COMPLETED.	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	SURFACE-TENSION DRIVEN CONVECTION UNDER REDUCED GRAVITY CONDITIONS	FT1.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	OSTRACH, DR. S. CASE WESTERN RESERVE UNIVERSITY KAMOTANI, DR. Y. CASE WESTERN RESERVE UNIVERSITY	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	TEST OF NEW THERMODYNAMIC MODEL OF IMPURITY EXTRACTIONS BY DROPLETS	FT2.3 & 2.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	INDUSTRIAL EXTRACTION TECHNIQUES	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	MORRISON, DR. G. NBS KINKAID, DR. J. NBS	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED	
NO. FLIGHTS	1	
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0 YEARS	
REMARKS	DOCUMENT ON THIS STUDY IS WITH NASA. RESULTS OF FIRST FLIGHT MAY OPEN UP AVENUES FOR FURTHER FLIGHTS. ALL HARDWARE IS CONCEPTUAL	

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	THEORETICAL STUDIES OF THE SURFACE TENSION OF LIQUID METAL SYSTEMS	FT1.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	STROUD, DR. DAVID G. OHIO STATE UNIVERSITY	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS		

Glasses and Ceramics

GLASSES AND CERAMICS RESEARCH TRACKS

GC1.0 Phenomena
- GC1.1 Nucleation/Crystallization (Extension of Glass Formation)
- GC1.2 Phase Transformation and Separation (Immiscible Systems)
- GC1.3 Mass Transport (Diffusion, Marangoni Flow, Bubble Motion)
- GC1.4 Chemical Corrosion
- GC1.5 Weak Forces

GC2.0 Products
- GC2.1 Surface and Interfacial (Tension/Energy/Enrichment)
- GC2.2 Viscosity
- GC2.3 Electrical Conduction/Loss
- GC2.4 Optical
  - GC2.4.1 Emissivity
  - GC2.4.2 Transmissivity
- GC2.5 Diffusion Coefficient
- GC2.6 Thermodynamic - Cp Heats of Reaction
- GC2.7 Structural and Microstructural Characteristics

GC3.0 Processes
- GC3.1 Optical Devices
  - GC3.1.1 Gradient Lasers
  - GC3.1.2 High-Power Lasers
  - GC3.1.3 Mirrors
- GC3.2 Ultrapure Materials -Single and Polycrystalline (Standards with Intrinsic Properties)
- GC3.3 Low-Gravity Processing (Positioning, Shaping, Etc., Precursor Preparation, Sol-Gel)
- GC3.4 Fining and Homogenization
  - GC3.4.1 Bubble Motion, Coalescence and Dissolution
  - GC3.4.2 Sol-Gel Processing
- GC3.5 Composites
  - GC3.5.1 Directionally Solidified
  - GC3.5.2 Dispersion Strengthened
- GC3.6 Fibers
  - GC3.6.1 Optical Waveguides
  - GC3.6.2 Ceramic Reinforcement
- GC3.7 Macroballoons
- GC3.8 Containerless High-Temperature Gas Phase Reaction (Solid or Liquid Synthesis, CVD, Plasma Decomposition)
- GC3.9 Exotic Glasses or Ceramics with Unique Properties
- GC3.10 Slip Cast Materials
- GC3.11 Foams
- GC3.12 Space Structures

PROCESS DISCIPLINE	FLUIDS AND TRANSPORT PHENOMENA	
AREA OF INVESTIGATION	THERMOPHYS[illegible] PROPERTIES MEASUREMENTS	FT5.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED	
POTENTIAL APPLICATION	SCIENTIFIC KNOWLEDGE TO SUPPORT OTHER PI'S	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	TAYLOR, DR. RAY PURDUE UNIVERSITY	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS	SUPPORTS FLIGHT INVESTIGATORS	

PROCESS DISCIPLINE	GLASSES AND CERAMICS
AREA OF INVESTIGATION	CONTAINERLESS HIGH TEMPERATURE PROPERTY MEASUREMENTS BY AUTOMATIC FLUORESCENCE GC2.6
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT WORK
POTENTIAL APPLICATION	LASER INDUCED FLOURESCENCE TO MEASURE HIGH TEMPERATURE PROPERITIES IN CONTAINERLESS EXPERIMENTS
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	NORDINE, PAUL C. YALE UNIVERSITY
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	AERODYNAMIC LEVITATOR

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	CONTAINERLESS PROCESSING OF GLASS FORMING MELTS IN SPACE	GC3.7
INVESTIGATION CATEGORY	PROCESS DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED AND FLIGHT WORK	
POTENTIAL APPLICATION	HOLLOW GLASS SPHERES FOR FUSION WORK	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	DAY, DR. DELBERT E. UNIVERSITY OF MISSOURI-ROLLA	
o COMMERCIAL INTEREST	DOD	
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 30 MINUTES, POWER REQUIRED	
NO. FLIGHTS	4	
TENTATIVE FLIGHT DATE	SCHEDULED FOR TWO FLIGHTS 85-10-9, MEA-A2; 86-7-17, MSL-4/MEA-A3	
REMARKS	SAAL, REQUIRES 15 MINUTES TO HEAT-UP. RUN TIME OF 30 MINUTES. WILL FLY IN NOVEMBER OF 85.	

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	EFFECTS OF UNDERCOOLING & MODIFIED MICRO-STRUCTURE ON THE PHYSICAL PROPERITIES OF MATERIALS SYNTHESIZED IN DROP TOWER	GC. 1.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	ANALYTICAL (SKYLAB FLOWN)	
POTENTIAL APPLICATION	SUPER CONDUCTING ALLOYS	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	CHU, DR. CHING WU UNIVERSITY OF HOUSTON	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	NA	
NO. FLIGHTS	0	
TENTATIVE FLIGHT DATE		
REMARKS	USING DROP TOWER AT MSFC.	

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	FOAM STABILITY	GC3.11
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT	
INVESTIGATION STATUS	FLIGHT	
POTENTIAL APPLICATION	FOAM PROCESS SCIENCE	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	NISHIOKY, DR. GARY OWENS CORNING FIBERGLAS	
o COMMERCIAL INTEREST	OWENS CORNING FIBERGLAS	
TOP LEVEL INVESTIGATION REQUIREMENTS	POWER REQUIRED FOR 2 HRS. VOLUME OF 3 LOCKERS	
NO. FLIGHTS		
TENTATIVE FLIGHT DATE	APPROXIMATELY 1.5-2.0 YEARS	
REMARKS	FOAM GENERATOR. 3 LOCKER VOLUMES, POWER OF 250W FOR 5 MINUTES AND 50W FOR 2 HOURS FOR ELECTRONICS. GROUND HARDWARE EXISTS	

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	GLASS FIBER PULLING	GC3.6
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT	
INVESTIGATION STATUS	FLIGHT	
POTENTIAL APPLICATION	OPTICAL FIBERS FOR COMMUNICATION	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS		
o COMMERCIAL INTEREST	DARPA, CORNING GLASS	
TOP LEVEL INVESTIGATION REQUIREMENTS		
NO. FLIGHTS		
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0 YEARS OR MORE	
REMARKS	MODIFICATION TO SAAL PROTOTYPE FURNACE, LEVITATOR. IDEA STAGE. SAAL, POWER 28 VDC 840W FOR 30 MINUTE HEAT-UP. H 20", W 6", D 6" ELECTRONICS REQUIRE FOUR LOCKER VOLUMES.	

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	HOMOGENOUS CRYSTALLIZATION STUDIES OF BORDERLINE GLASS FORMING MELTS	GC1.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT, FLEW ON KC-135	
POTENTIAL APPLICATION	SPECIAL OPTICS FOR LASER APPLICATIONS	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	ETHRIDGE, DR. EDWIN NASA/MSFC	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	LEVITATOR WITH AIR-JETS	
NO. FLIGHTS	1 A YEAR	
TENTATIVE FLIGHT DATE		
REMARKS	SAAL WITH AIR-JETS. COLLOBRATES WITH DR. DUNN COMMERCIAL POTENTIAL WAY DOWN THE LINE. GROUND BASED HARDWARE	

PROCESS DISCIPLINE	GLASSES AND CERAMICS
AREA OF INVESTIGATION	INFLUENCES OF CONTAINERLESS UNDERCOOLING GC1.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	ALTER SUPERCONDUCTIVE AND MAGNETIC PROPERITIES
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	COLLINGS, DR. E. W. BATTELLE LABS
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	HAS ONLY USED DROP TUBE TO DATE TO STUDY FERROMAGNETISM. GROUND BASED HARDWARE

PROCESS DISCIPLINE	GLASSES AND CERAMICS
AREA OF INVESTIGATION	LEVITATION STUDIES OF HIGH TEMPERATURE MATERIALS — GC3.2
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT WORK
POTENTIAL APPLICATION	ELECTRICAL AND LIQUID CONDUCTORS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	MARGRAVE, DR. JOHN RICE UNIVERSITY
o COMMERCIAL INTEREST	GENERAL ELECTRIC
TOP LEVEL INVESTIGATION REQUIREMENTS	
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	ELECTROMAGNETIC LEVITATOR. HAS DEVELOPED SPECIAL INSTRUMENTATION FOR LEVITATOR. 1) AUTOMATIC RECORDING MULTICOLOR PYROMETER 2) GULP CALORIMETER. CAN FLY USING EXISTING HARDWARE. NO FLIGHTS SCHEDULED

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	METALLIC GLASSES	GC1.1

INVESTIGATION CATEGORY

INVESTIGATION STATUS

POTENTIAL APPLICATION

COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	
o COMMERCIAL INTEREST	OWENS CORNING FIBERGLAS

TOP LEVEL INVESTIGATION
REQUIREMENTS

NO. FLIGHTS

TENTATIVE FLIGHT
DATE

REMARKS

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PROCESS DISCIPLINE	GLASSES AND CERAMICS
AREA OF INVESTIGATION	MICROSTRUCTURAL ANALYSIS OF Ng-Ge DROP TUBE SPECIMENS GC1.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	SUPER CONDUCTING ALLOY AND HIGH QUALITY ULTRASONIC WORK
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	BAYUZICK, DR. ROBERT S. VANDERBILT UNIVERSITY
o COMMERCIAL INTEREST	NONE TO DATE
TOP LEVEL INVESTIGATION REQUIREMENTS	SAMPLE TEMPERATURE MUST NOT EXCEED 1000C
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	HAS ONLY USED MSFC DROP TOWER TO DATE. CAN FLY USING EXISTING APPARATUS

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	PHYSICAL PHENOMENA IN CONTAINERLESS GLASS PROCESSING	GC1.C
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT	
INVESTIGATION STATUS	FLIGHT (HAS FLOWN)	
POTENTIAL APPLICATION		
COMMERCIAL POTENTIAL	UNKNOWN	
INTERESTED PARTIES		
o INVESTIGATORS	SUBRAMANIAN, DR. SHANKAR CLARKSON COLLEGE OF TECHNOLOGY	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME OF 30 MINUTES REQUIRED.	
NO. FLIGHTS	4	
TENTATIVE FLIGHT DATE		
REMARKS	USES THE SAAL ON THE MEA WITH DR. DAY.	

PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	SPHERICAL SHELLS	GC3.7
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT	
INVESTIGATION STATUS	ANALYTICAL TO DATE	
POTENTIAL APPLICATION	CONTAINERLESS PROCESSING IN LOW GRAVITY	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	KMS INDUSTRIES	
o COMMERCIAL INTEREST	KMS INDUSTRIES	
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED	
NO. FLIGHTS	UNDETERMINED	
TENTATIVE FLIGHT DATE		
REMARKS	ACOUSTIC LEVITATOR	

PROCESS DISCIPLINE	GLASSES AND CERAMICS
AREA OF INVESTIGATION	THE UPGRADING OF GLASS MICROBALLOONS GC3.
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT, HAS FLOWN ON KC-135
POTENTIAL APPLICATION	LASER FUSION TARGETS
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	DUNN, DR. STANLEY BJORKSTEN RESEARCH LABS
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	LEVITATOR WITH AIR-JETS
NO. FLIGHTS	ONE A YEAR
TENTATIVE FLIGHT DATE	APPROXIMATELY 3.0-5.0 YEARS
REMARKS	SAAL WITH AIR JETS. COLLOBRATES WITH DR. ETHRIDGE. NO FLIGHTS ASSIGNED. COMMERCIAL POTENTIAL WAY DOWN THE LINE.

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PROCESS DISCIPLINE	GLASSES AND CERAMICS	
AREA OF INVESTIGATION	ULTRAPURE GLASS OPTICAL WAVE GUIDE DEVELPOMENT IN MICROGRAVITY BY THE SOL GEL PROCESS	GC3.4
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PROCESS DEVELOPMENT	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	OPTICAL WAVE GUIDES	
COMMERCIAL POTENTIAL	YES	
INTERESTED PARTIES		
o INVESTIGATORS	MUKHERJEE, DR. SHYAMA JET PROPULSION LAB	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	PRESSURIZED MEDIUM, LARGER SAMPLES REQUIRED	
NO. FLIGHTS	ONE A YEAR	
TENTATIVE FLIGHT DATE	APPROXIMATELY 1.0-1.5 YEARS	
REMARKS	EVALUATION OF CONTAINERLESS PROCESSING IN PRESSURIZED MEDIUM. COMPRESSED AIR MEDIUM, DENSER SAMPLES. COMMERCIAL POTENTIAL WAY DOWN THE LINE. GROUND BASED HARDWARE JPL	

Metals and Alloys

METALS AND ALLOYS RESEARCH TRACKS

MA1.0 Coarsening and Stability of Two-Phase Mixtures
- MA1.1 Liquid Phase Sintering
- MA1.2 Dendrite Coarsening
- MA1.3 Gravitational Settling
- MA1.4 Coalescence and Ripening
- MA1.5 Critical Wetting
- MA1.6 Stoichiometry

MA2.0 Solidification of Two-Phase Melts
- MA2.1 Dendritic Growth/Diffusion Control
- MA2.2 Interfacial Control
- MA2.3 Control of Supercooling
- MA2.4 Containerless Processing
- MA2.5 Nucleation/Formation of Metastable Phases
- MA2.6 Rapid Solidification
- MA2.7 Thermodynamic Activity Control

MA3.0 Alloy Segregation
- MA3.1 Directional Solidification
- MA3.2 Particle "Pushing"
- MA3.3 Bubble Formation/Porosity Control
- MA3.4 Microsegregation
- MA3.5 Thermal Migration

MA4.0 Scaling Laws
- MA4.1 Microstructure Prediction/Design
- MA4.2 Anisotropic Surface Energy Effects
- MA4.3 Anisotropic Kinetics
- MA4.4 Discontinuous Grain-Size Effects
- MA4.5 Solidification Velocity-Dependent Coefficients

MA5.0 Thermophysical Properties
- MA5.1 Heat Capacity
- MA5.2 Thermal/Electrical Conductivity
- MA5.3 Diffusion Coefficients
- MA5.4 Interfacial Energy
- MA5.5 Latent Heat
- MA5.6 Viscosity
- MA5.7 Expansion Coefficients
- MA5.8 Emissivity
- MA5.9 Soret Diffusion Coefficients

MA6.0 Deposition of Metals from Ionic Solutions
- MA6.1 Electroplated Coatings
- MA6.2 Electropolishing
- MA6.3 Corrosion
- MA6.4 Whisker Growth
- MA6.5 Electroless Deposition

MA7.0 Convective Interactions
- MA7.1 Columnar Equiaxed Transitions
- MA7.2 Coupled Convection Effects
- MA7.3 Macrosegregation
- MA7.4 Modifications via External Fields
- MA7.5 Surface Tension-Driven Flows
- MA7.6 Interface Shapes

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	DIRECTIONAL SOLIDIFICATION OF LIQUID MISCIBILITY GAP MATERIAL MA3.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	SUPER CONDUCTING WIRE
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	JOHNSTON, DR. M. H. NASA/MSFC
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	30 SAMPLES OF Cu AND Al ALLOYS. MELTING POINTS OF 1080C AND 550C. RUN TIMES OF 4-5 HOURS
NO. FLIGHTS	4
TENTATIVE FLIGHT DATE	SCHEDULED FOR THREE FLIGHTS 86-10, MSL-5; 87-4-27, MSL-8; 87-10-21, MSL-10
REMARKS	ADSF II BEING USED. WILL REQUIRE 4 FLIGHTS FOR RESEARCH, ADDITIONAL FLIGHTS FOR PRODUCTION. CAN USE EXISTING FLIGHT HARDWARE.

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	GRAPHITE FORMATION IN CAST IRON MA3.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED LEADING TO FLIGHT
POTENTIAL APPLICATION	DEVELOPMENT OF DESIRED MECHANICAL PROPERITIES IN CAST IRON. HIGH STRENGTH ALLOY SCIENCE.
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	STEFANESCU, DR. DORU UNIVERSITY OF ALABAMA BIRMINGHAM
o COMMERCIAL INTEREST	JOHN DEERE, BETHLEHEM STEEL
TOP LEVEL INVESTIGATION REQUIREMENTS	PHASE I MICROSTRUCTURAL 6-12 SAMPLES ARE REQUIRED, SAMPLE SIZE 4-5 MM. PHASE II 45-135 SAMPLES ARE REQUIRED, SAMPLE SIZE 5-10 MM.
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	SCHEDULED FOR FOUR FLIGHTS 87-3-18, MSL-7; 87-4-27, MSL-8; 87-10-21, MSL-10
REMARKS	ADSF III OR MDSF (MANNED DIRECTIONAL SOLIDIFICATION FURNACE)

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	INTERFACIAL DESTABILIZATION IN METALS AND ALLOYS MA1.0 & 3.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	MODEL ALLOY
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	MALMEJAC, DR. YVES NUCLEAR RESEARCH CENTER OF GRENOBLE FAVIER, DR. JEAN-JACQUES NUCLEAR RESEARCH CENTER OF GRENOBLE
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	PROCESSING TEMP OF 600C
NO. FLIGHTS	3
TENTATIVE FLIGHT DATE	
REMARKS	MEPHISTO FURNACE FOR LOW MELTING ALLOYS RUNS 3 SAMPLES SIMULTANEOUSLY. WANTS TO FLY ON A MSL THEREFORE ADAPTING POWER TO LESS THAN 450W. WORKS WITH DR. SAMUEL CORIELL AT NBS.

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PROCESS DISCIPLINE	METALS AND ALLOYS	
AREA OF INVESTIGATION	ISOTHERMAL SOLIDIFICATION IN A BINARY ALLOY	MA3.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT. 1ST FLIGHT APPROVED	
POTENTIAL APPLICATION	MODEL ALLOY	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	LAXMANAN, DR. V. LEWIS RESEARCH CENTER WINSA, DR. EDWARD A. LEWIS RESEARCH CENTER	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	ONE SAMPLE OF PbSn AT 350C	
NO. FLIGHTS	1	
TENTATIVE FLIGHT DATE		
REMARKS	GPRF ON MEA-A3. MORE SAMPLES FOR 2ND AND 3RD EXPERIMENT.	

PROCESS DISCIPLINE	METALS AND ALLOYS	
AREA OF INVESTIGATION	LIQUID PHASE MISCIBILITY GAP MATERIALS	MA3.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	FLIGHTS ON MEA-A1 AND MEA-A2	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	GELLES, DR. STANLEY S. H. GELLES ASSOCIATES, INC.	
o COMMERCIAL INTEREST		
TOP LEVEL INVESTIGATION REQUIREMENTS	4 SAMPLES. Al 90% In MELT POINT OF 970C, RUN TIME OF 8 HRS. Al 40% In MELT POINT OF 920C, RUN TIME OF 12 HRS.	
NO. FLIGHTS	ONE A YEAR	
TENTATIVE FLIGHT DATE		
REMARKS	2 SHUTTLE FLIGHTS ASSIGNED FOR Al-In SYSTEM. HE HAS PROPOSED ADDITIONAL FLIGHTS FOR THE COMPARISON OF THE 90% PLUNGER CARTRIDGE TO THE 40% FREE SURFACE.	

PROCESS DISCIPLINE	METALS AND ALLOYS	
AREA OF INVESTIGATION	MECHANICS OF GRANULAR MATERIALS AT LOW INTER-GRANULAR STRESSES	MAO.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	PHASE A-B STUDY COMPLETED	
POTENTIAL APPLICATION	NONE	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	COSTE, DR. NICHOLAS NASA/MSFC STURE, DR. STEIN UNIVERSITY OF COLORADO	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	THREE SAMPLES PER FLIGHT. SAMPLE SIZE OF; 4" HIGH AND 6" DIAMETER. MAN INTENSIFIED. RUN TIME OF 2.5 HRS PER SAMPLE. 4 HRS TO REMOVE AND REPLACE SAMPLE. TOTAL OPERATIONAL TIME PER SAMPLE IS 6.5 HRS.	
NO. FLIGHTS	3	
TENTATIVE FLIGHT DATE		
REMARKS		

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	MODELING DIRECTIONAL SOLIDIFICATION MA3.
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE
INVESTIGATION STATUS	ANALYTICAL WITH FLIGHT TO VERIFY APPROACH
POTENTIAL APPLICATION	MODELING TO SUPPORT DR. LARSON AND DR. PIRICH AT GRUMMAN AEROSPACE
COMMERCIAL POTENTIAL	NO
INTERESTED PARTIES	
o INVESTIGATORS	WILCOX, DR. WILLIAM CLARKSON COLLEGE
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	TO BE DETERMINED
NO. FLIGHTS	1
TENTATIVE FLIGHT DATE	
REMARKS	APPROACH TO BE DETERMINED WITHIN THE NEXT 18-24 MONTHS. CONCERNED WITH THE FLOW OF CONSTITUTIENTS IN THE MELT. ALL MATHEMATICAL IN CONCEPT.

PROCESS DISCIPLINE	METALS AND ALLOYS	
AREA OF INVESTIGATION	NUCLEATION AND GROWTH OF IMMISCIBLE PHASES	MA4.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED, FLEW ON KC-135	
POTENTIAL APPLICATION	MODELING TRANSPARENT MATERIALS FOR MONOTECTIC ALLOYS	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	FRAZIER, DR. DONALD NASA/MSFC	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	SAMPLE SIZE LESS THAN 1 CM	
NO. FLIGHTS		
TENTATIVE FLIGHT DATE		
REMARKS	TUBE AND PHOTOGRAPHY EQUIPMENT. NEGLIGIBLE HEAT PRODUCED. DR. ROBERT OWENS APPARATUS.	

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	ORBITER PROCESSING OF ALIGNED MAGNETIC COMPOSITES MA1.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	FLIGHT
POTENTIAL APPLICATION	MAGNETIC MATERIAL
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	LARSON, DR. DAVID A. GRUMMAN AEROSPACE CORPORATION BETHIN, DR. JAMES GRUMMAN AEROSPACE CORPORATION
o COMMERCIAL INTEREST	GRUMMAN HAS A DEVELOPER IN MIND
TOP LEVEL INVESTIGATION REQUIREMENTS	MAX TEMP 1570C, SAMPLE TEMP 1400C. PROCESSING TIME 20 HR & UP. SAMPLE SIZE 6 MM BY 35 CM. SAMPLE AMPULE 8 CM LONG.
NO. FLIGHTS	2
TENTATIVE FLIGHT DATE	SCHEDULED FOR TWO FLIGHTS 85-8-2, MSL-2; 85-12-20, MSL-3
REMARKS	ADSF II ON MSL 2. WILL KNOW BY FEBRUARY IF FURNACE WORKS. SAMPLE ENCAPUSLATED IN A BORON NITRILE TUBE.

PROCESS DISCIPLINE	METALS AND ALLOYS	
AREA OF INVESTIGATION	ORBITER PROCESSING OF ALIGNED MAGNETIC COMPOSITES	MA1.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	FLIGHT	
POTENTIAL APPLICATION	MODEL MATERIAL	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	LARSON, DR. DAVID A. GRUMMAN AEROSPACE CORPORATION BETHIN, DR. JAMES GRUMMAN AEROSPACE CORPORATION	
o COMMERCIAL INTEREST	GRUMMAN HAS A DEVELOPER IN MIND	
TOP LEVEL INVESTIGATION REQUIREMENTS	MAX TEMP 600C AVERAGE TEMP OF 300C. PROCESS TIMES OF 8 HRS/SAMPLE. 4 SAMPLES, DIMENSIONS OF 1 CM BY 35 CM.	
NO. FLIGHTS	2	
TENTATIVE FLIGHT DATE		
REMARKS	RECORDS IN FLIGHT TEMPERATURE DATA FROM THERMOCOUPLES WITHIN THE SAMPLE. ENCAP-SULATED IN A QUARTZ AMPULE. VARIES THE COMPOSITION TO DUPLICATE SPAR RESULTS.	

C-3

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	SUPER ALLOYS MA3.0
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE, PROCESS DEVELOPMENT AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	SUPER ALLOYS FOR JET ENGINES
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	CURRERI, DR. PETER NASA/MSFC
o COMMERCIAL INTEREST	PRATT AND WHITNEY
TOP LEVEL INVESTIGATION REQUIREMENTS	SUPER ALLOYS REQUIRE HIGHER PROCESSING TEMP AND DRAW MUCH MORE POWER. 126 VDC TEMP @ 1600C.
NO. FLIGHTS	6
TENTATIVE FLIGHT DATE	
REMARKS	ADSF II WILL BE USED UNTIL A SAMPLE CHANGE OUT PROCEDURE HAS BEEN DEVELOPED. SIX FLIGHTS ARE REQUIRED FOR RESEARCH NOT PRODUCTION. CAN USE EXISTING FLIGHT HARDWARE. NO FLIGHTS SCHEDULED

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	THE DIFFUSION OF LIQUID ZINC IN LEAD MA7.3
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT
POTENTIAL APPLICATION	SCIENTIFIC APPLICATIONS FOR DIFFUSION COUPLES
COMMERCIAL POTENTIAL	UNKNOWN, FLIGHT MAY HAVE COMMERCIAL APPEAL
INTERESTED PARTIES	
o INVESTIGATORS	POND, DR. ROBERT B. MARVALAUD, INC.
o COMMERCIAL INTEREST	NONE
TOP LEVEL INVESTIGATION REQUIREMENTS	2 SAMPLES, OPERATING TEMP OF 440-820C. PROCESSING TIME ESTIMATED AT 2 HRS.
NO. FLIGHTS	
TENTATIVE FLIGHT DATE	
REMARKS	ISOTHERMAL GPRF NOW ON MEA-A2

PROCESS DISCIPLINE	METALS AND ALLOYS
AREA OF INVESTIGATION	THERMAL AND SOLUTAL CONVECTION DAMPING USING AN APPLIED MAGNETIC FIELD MA7
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE AND PRODUCT DEVELOPMENT
INVESTIGATION STATUS	GROUND BASED LAB ANALYSIS
POTENTIAL APPLICATION	MAGNETIC MATERIALS IN ELECTRICAL MOTOR CORES
COMMERCIAL POTENTIAL	YES
INTERESTED PARTIES	
o INVESTIGATORS	PIRICH, DR. RON G. GRUMMAN AEROSPACE CORPORATION
o COMMERCIAL INTEREST	PROPRIETARY
TOP LEVEL INVESTIGATION REQUIREMENTS	OPERATIONAL TEMP RANGE FOR Bi-Mg ALLOY: MAX 600C AVG 300C
NO. FLIGHTS	0
TENTATIVE FLIGHT DATE	
REMARKS	GE ADSF LOW TEMPERATURE. ADSF CONVERTED INTO A CANISTER AND PLACED IN A MAGNETIC FIELD. SOLIDIFICATION IN A MAGNETIC FIELD. USING MAGNETIC AS ALTERNATE TO SPACE. IF IT WORKS NO NEED FOR FLIGHT.

PROCESS DISCIPLINE	METALS AND ALLOYS	
AREA OF INVESTIGATION	UNIDIRECTIONAL SOLIDIFICATION OF MONOTECTIC AND HYPERMONOTECTIC Al-In ALLOY	MA3.1
INVESTIGATION CATEGORY	SCIENTIFIC KNOWLEDGE	
INVESTIGATION STATUS	GROUND BASED FOR FLIGHT	
POTENTIAL APPLICATION	MODEL MATERIAL	
COMMERCIAL POTENTIAL	NO	
INTERESTED PARTIES		
o INVESTIGATORS	POTARD, DR. CLAUDE NUCLEAR RESEARCH CENTER OF GRENOBLE	
o COMMERCIAL INTEREST	NONE	
TOP LEVEL INVESTIGATION REQUIREMENTS	RUN TIME; 2-3 HRS. Al-In ALLOY MELT POINT 900C.	
NO. FLIGHTS	2	
TENTATIVE FLIGHT DATE		
REMARKS	MUST MODIFY GPRF TO FLY. USES A SPACER TO REDUCE POWER. BACKFILLS He FOR ADSORPTION. NO HEAT LOSS. MEETS MSL CONSTRAINTS.	

AUTHOR INDEX

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AUTHOR INDEX

GLOSSARY

GLOSSARY OF TERMS

PROCESS DISCIPLINES

The currently identified elements of the microgravity science and applications program fall into three divisions:

1. **Material science**, including crystal growth, solidification of alloys and composites, and containerless processing.
2. **Physics and chemistry**, including fluid mechanics, transport phenomena, combustion science, cloud physics, and critical phenomena.
3. **Biotechnology**, including separation processes, suspension culturing, and blood rheology.

It was from these divisions that the six process disciplines were identified:

1. Biotechnology
2. Combustion science
3. Electronic and electro-optical materials
4. Fluids and transport phenomena
5. Glasses and ceramics
6. Metals and alloys

AREA OF INVESTIGATION

Identifies the tital of the study or program.

RESEARCH TRACK

Area of potential investigation in each process discipline.

INVESTIGATION CATEGORY

The divisions within the investigation category are

- **Scientific knowledge**, which identifies those activities intended to prove the validity of theories or concepts.
- **Process development**, which addresses the potential for improving or advancing current processing technology.
- **Product development**, which identifies those activities that would yield a useable commercial product.

Due to the complex nature of the studies, an activity may encompass one or more divisions within the investigation category.

INVESTIGATION STATUS

The divisions/progress involved within the investigation status are

- **Analytical**, which identifies those studies for which an analytical solution is sufficient.
- **Ground-based**, which addresses those studies whose concept can be proven in a ground-based (Earth) laboratory.
- **Flight candidates**, which are studies that, by their nature, can only be proven in a microgravity environment.

POTENTIAL APPLICATIONS

States known applications of the study.

COMMERCIAL POTENTIAL

Identifies whether or not the applications of the study presently have any recognized commercial value.

INTERESTED PARTIES

Identifies the principal investigator(s) and an industrial developer who has stated an interest in promoting the study for commercial applications.

TOP-LEVEL INVESTIGATION REQUIREMENTS

Identifies characteristics and requirements (physical) of the experiment (i.e. processing time and temperatures, size and number of samples, power and volume requirements, etc.)

NUMBER OF FLIGHTS

Gives an estimate of the number of flights needed to complete the study.

TENTATIVE FLIGHT DATE

Identifies scheduled flight date for the investigation or an estimate of the user's required experimental development time prior to a flight assignment.

2.0 Apparatus Capabilities and Availability

FOREWORD

This section of the appendix contains current information on equipment used for microgravity research and materials processing in space. The apparatus described was either developed by NASA, by a contractor for NASA, or, in some cases, by a private entity under a joint agreement with NASA.

CONTENTS

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NAME	ACOUSTIC CONTAINERLESS EXPERIMENT SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	JPL
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MELTING, ROTATION, AND OSCILLATION OF MATERIALS IN A CONTROLLED ENVIRONMENT
CHARACTERISTICS	
o FUNCTIONAL	ONE ACOUSTIC FURNACE CHAMBER WITH THREE ADVANCED VARIABLE ACOUSTIC DRIVERS
o OPERATIONAL	160 WATTS POWER 900C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	28 VDC HEAT DISSIPATION EXTERNAL VENTING
o PHYSICAL PARAMETERS	45 KG (APPROXIMATELY) HOUSED IN TWO EAC'S
COMMENTS	ONE UNIT AVAILABLE

NAME	ADVANCED AUTOMATED DIRECTIONAL SOLIDIFICATION FURNACE
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MELTING AND DIRECTIONAL SOLIDIFICATION OF MATERIALS AT HIGH THERMAL GRADIENTS (UP TO 900C)
CHARACTERISTICS	
o FUNCTIONAL	TWO FURNACE CAVITIES, EACH WITH TRANSLATING QUENCH BLOCK
o OPERATIONAL	500 WATTS POWER 1400C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	28 VDC HEAT DISSIPATION
o PHYSICAL PARAMETERS	68 KG (APPROXIMATELY) HOUSED IN A EAC
COMMENTS	DEVELOPER UNIDENTIFIED USERS IDENTIFIED

NAME	ADVANCED ISOTHERMAL FURNACE
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MELTING AND RAPID RESOLIDIFICATION OF MATERIALS IN A ISOTHERMAL MODE AT INCREASED SAMPLE SIZE
CHARACTERISTICS	
o FUNCTIONAL	FURNACE CAVITY EXCHANGE CAPABILITY WITH ADVANCED ELECTRONICS
o OPERATIONAL	3000 WATTS POWER 2100C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	TO BE DETERMINED
o PHYSICAL PARAMETERS	TO BE DETERMINED
COMMENTS	DEVELOPER UNIDENTIFIED USERS IDENTIFIED

NAME	AIRJET LEVITATOR
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MELTING AND RESOLIDIFICATION OF MATERIALS IN A CONTAINERLESS PROCESS
CHARACTERISTICS	
o FUNCTIONAL	COMPRESSED AIRSTREAM WITH CO2 LASER HEATING
o OPERATIONAL	700 WATTS POWER (LASER) 2700C (SAMPLE DEPENDANT)
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	LABORATORY SCALE
COMMENTS	PREVIOUSLY USED FOR STUDIES IN UNDERCOOLING AND GLASS FORMATION IN OXIDE SYSTEMS

NAME	AUTOMATED DIRECTIONAL SOLIDIFICATION FURNACE
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	G.E.
APPLICATIONS	MELTING AND DIRECTIONAL SOLIDIFICATION OF MATERIALS AT LOW THERMAL GRADIENTS
CHARACTERISTICS	
o FUNCTIONAL	FOUR FURNACE CAVITIES, EACH WITH A TRANSLATING QUENCH BLOCK
o OPERATIONAL	1175 WATTS POWER 1500C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	28 VDC HEAT DISSIPATION
o PHYSICAL PARAMETERS	77.1 KG HOUSED IN A EAC
COMMENTS	HIGH AND LOW TEMPERATURE VERSIONS ARE AVAILABLE.

NAME	AUTOMATIC DIRECTIONAL SOLIDIFICATION UNIT III (ADSF-III)
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	JOHN DEERE AND BETHLEHEM STEELE
APPLICATIONS	HIGH STRENGTH ALLOY SCIENCE. DEVELOPMENT OF DESIRED MECHANICAL PROPERITIES IN CAST IRON.
CHARACTERISTICS	
o FUNCTIONAL	PROTOTYPE BASED ON ADSF-II
o OPERATIONAL	1175 WATTS MAXIMUM POWER CAPABILITY 200-1500C OPERATING TEMPERATURE
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION 28 VDC POWER EXTERNAL VENT
o PHYSICAL PARAMETERS	40 INCHES HIGH, 17 INCHES DIAMETER 77 KG (INCLUDES FURNACE AND TWO EAC'S)
COMMENTS	ADSF-III WILL FACILITATE LARGER SAMPLES UP TO 1.0 TO 1.25 CM DIAMETER. IT WILL EXHIBIT SAMPLE CHANGE OUT CAPABILITY (MULTIPLE)

NAME	AUTOMATIC SCG FACILITY	
STATUS		
o GROUND UNIT	PLANNED	
o FLIGHT UNIT	NEEDED	
DEVELOPER		
o NASA	MSFC	
o ACADEMIA		
o INDUSTRY		
APPLICATIONS	GROWTH OF SINGLE CRYSTALS FOR SEMICONDUCTORS ELECTRO-OPTICAL DEVICES, IR DETECTORS	
CHARACTERISTICS		
o FUNCTIONAL	MICROPROCESSOR APPARATUS DEPENDANT ON MATERIAL	
o OPERATIONAL	1 KW POWER PEAK FOR 2-3 HRS THEN MINIMAL POWER TO SUSTAIN TEMPERATURE	
o RESOURCE REQUIREMENTS	1 KW POWER HEAT EXCHANGER VACUUM	AVIONICS AIR COOLING LOOP
o PHYSICAL PARAMETERS	IDEAL SYSTEM NEEDS HALF A DOUDLE RACK	
COMMENTS	ALL CONCEPTUAL DATA FORM EXISTING SYSTEMS AND REQUIREMENTS.	

NAME	AUTOMATIC VCG FACILITY

STATUS

o GROUND UNIT	PLANNED
o FLIGHT UNIT	NEEDED

DEVELOPER

o NASA	MSFC
o ACADEMIA	
o INDUSTRY	

APPLICATIONS	GROWTH OF SINGLE CRYSTALS FOR SEMICONDUCTORS, ELECTRO-OPTICS FOR COMMUNICATIONS, IR DETECTORS

CHARACTERISTICS

o FUNCTIONAL	MICROPROCESSOR APPARATUS DEPENDANT ON MATERIAL	
o OPERATIONAL	1 KW POWER PEAK FOR 2-3 HRS, THEN MINIMAL POWER TO SUSTAIN TEMPERATURE	
o RESOURCE REQUIREMENTS	1 KW POWER HEATING REQUIRED VACUUM	COOLING LOOP AVIONICS AIR
o PHYSICAL PARAMETERS	IDEAL SYSTEM NEEDS HALF A DOUBLE RACK	

COMMENTS	ALL CONCEPTUAL DATA FROM EXISTING SYSTEMS AND REQUIREMENTS.

NAME	CELL CULTURING SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	UNDER DEVELOPMENT
DEVELOPER	
o NASA	JSC
o ACADEMIA	
o INDUSTRY	MDAC
APPLICATIONS	FUNDAMENTAL RESEARCH IN CELL GROWTH UNDER MICROGRAVITY CONDITIONS
CHARACTERISTICS	
o FUNCTIONAL	CFES WITH VARIABLE CHAMBER DIMENSIONS, ELECTRODE SHAPES, AND VOLTAGE CAPACITY.
o OPERATIONAL	300-400 WATTS POWER RUN TEMPERATURE 0 TO -4.0C
o RESOURCE REQUIREMENTS	REFRIGERATION VENTING OF OXYGEN 110 VDC POWER
o PHYSICAL PARAMETERS	EST. 3 LOCKERS OR HALF A SINGLE RACK EST. 136 TO 181 KG
COMMENTS	REQUIRES DEDICATED INSTRUMENTATION. HANDS-ON CAPABILITY BY SCIENTIST.

NAME	COMBUSTION RESEARCH CHAMBER
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	LeRC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	FUNDAMENTAL RESEARCH IN PHYSICAL AND CHEMICAL COMBUSTION SCIENCE
CHARACTERISTICS	
o FUNCTIONAL	TO BE DETERMINED
o OPERATIONAL	200 WATTS POWER
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION EXTERNAL VENT POWER
o PHYSICAL PARAMETERS	EST. 1.0 BY 0.[illegible] BY 0.5 METERS EST. 60 KG
COMMENTS	

NAME	CONTINUOUS FLOW ELECTROPHORESIS SYSTEM (CFES)
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	MDAC AND JOHNSON & JOHNSON
APPLICATIONS	CONTINUOUS FLOW ELECTROPHORESIS OF PARTICLES AND MACROMOLECULES
CHARACTERISTICS	
o FUNCTIONAL	ONE SEPERATION CHAMBER
o OPERATIONAL	80 WATTS POWER FROM LAUNCH TILL OPERATIONAL 480 WATTS FOR 100 HRS 1 KW COOLING POWER
o RESOURCE REQUIREMENTS	POWER HEAT EXCHANGER LOOP COOLING POWER REFRIGERATION AT 4.0C
o PHYSICAL PARAMETERS	80 BY 26 BY 23 INCHES 18 BY 22 BY 14 INCHES (ELECTRONICS) 346 KG
COMMENTS	INDUSTRY OWNED UNDER JEA TWO TYPES OF COOLING REQUIRED.

NAME	DROPLET COMBUSTION EXPERIMENT
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	UNDER DEVELOPMENT
DEVELOPER	
o NASA	LeRC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	INVESTIGATE THE MECHANISMS AND RATES OF DROPLET BURNING AND EXTENSION UNDER CONDITIONS OF NEGLIGIBLE HEAT
CHARACTERISTICS	
o FUNCTIONAL	FURNACE CHAMBER WITH ELECTROSTATIC LEVITATION
o OPERATIONAL	TO BE DETERMINED
o RESOURCE REQUIREMENTS	TO BE DETERMINED (POWER REQUIRED)
o PHYSICAL PARAMETERS	TO BE DETERMINED
COMMENTS	CONCEPTUAL DESIGN STAGE

NAME	EDG PROGRAMMABLE MULTIZONE FURNACE
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	GRUMMAN AEROSPACE AND MELLON
APPLICATIONS	MULTIZONE FURNACE AS SUBSTITUTE FOR SES. SEMICONDUCTORS, IR DETECTORS, AND ELECTRO OPTICAL DEVICES
CHARACTERISTICS	
o FUNCTIONAL	FURNACE WITH TWO HEATING ELEMENTS PER ZONE. 16 ZONES
o OPERATIONAL	RUN TIME 100 HRS MAX (10 DAYS IN SOME LABS) POWER 4.0 KW 132 WATTS PER HEATING ELEMENT 1300-1350C MAXIMUM TEMPERATURE RANGE
o RESOURCE REQUIREMENTS	COOLING LOOP EXTERNAL VENT POWER WATER FLOW
o PHYSICAL PARAMETERS	EST. 500 KG 2.9 BY 1.0 BY 1.5 METERS
COMMENTS	MASS IS OVER ESTIMATED

NAME	ELECTROEPIAXIAL CRYSTAL GROWTH SYSTEM
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	MICROGRAVITY RESEARCH ASSOCIATES
APPLICATIONS	SEMICONDUCTORS
CHARACTERISTICS	
o FUNCTIONAL	CONCEPTUAL DESIGNED CRYSTAL GROWTH FURNACE
o OPERATIONAL	POWER IS FUNCTION OF CRYSTAL DIAMETER, RUN TIME, AND SIZE OF ECGS. 10 KW POWER AND 170 DAY OPERATING TIME EST. FOR 1993.
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION POWER VENT AND PURGE
o PHYSICAL PARAMETERS	4536 KG 4 FT LONG, 4 FT WIDE, 10 FT HIGH VOLUME 160 CUBIC FEET
COMMENTS	CONCEPTUAL DESIGN. PLANNED FOR SPACE STATION

NAME	ELECTROMAGNETIC CONTAINERLESS EXPERIMENT SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MANIPULATION OF CONDUCTIVE MATERIALS WITHIN AN ELECTROMAGNETIC FIELD IN A CONTAINERLESS PROCESS
CHARACTERISTICS	
o FUNCTIONAL	INTERCHANGABLE COILS
o OPERATIONAL	1200C TEMPERATURE CAPABILITY 2500 WATTS POWER
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION EXTERNAL VENT POWER
o PHYSICAL PARAMETERS	EST. 1.0 BY 0.6 BY 0.6 METERS EST. 45 KG
COMMENTS	MANNED INTERFACE WILL ALLOW SIMPLIFIED HARDWARE. DESIGNED FOR SPACE STATION

NAME	ELECTROMAGNETIC LEVITATOR
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	G.E
APPLICATIONS	MELTING AND RESOLIDIFICATION OF CONDUCTIVE MATERIALS IN A CONTAINERLESS PROCESS
CHARACTERISTICS	
o FUNCTIONAL	ELECTROMAGNETIC COIL WITH AUXILIARY ELECTRON BOMBARDMENT HEATING
o OPERATIONAL	25,000 WATTS POWER
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	LABORATORY SCALE
COMMENTS	PREVIOUSLY USED FOR EXPERIMENTS WITH TUNGSTEN AND REFRACTORY MATERIALS

NAME	ELECTROMAGNETIC LEVITATOR FURNACE
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	G. E.
APPLICATIONS	MELTING AND RESOLIDIFICATION OF CONDUCTIVE MATERIALS IN A CONTAINERLESS PROCESS IN A CONTROLLED ENVIRONMENT
CHARACTERISTICS	
o FUNCTIONAL	ONE CUSP COIL, GENERATING A ELECTROMAGNETIC FIELD FOR INDUCTION MELTING
o OPERATIONAL	1200 WATTS POWER 1300C DEMONSTRATED
o RESOURCE REQUIREMENTS	28 VDC HEAT DISSIPATION
o PHYSICAL PARAMETERS	42 KG HOUSED IN AN EAC
COMMENTS	ONE UNIT AVAILABLE

NAME	ELECTROSTATIC CONTAINERLESS EXPERIMENT SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	JPL
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MANIPULATION OF DIELECTRIC MATERIALS WITHIN AN ELECTROSTATIC FIELD IN A CONTAINERLESS PROCESS
CHARACTERISTICS	
o FUNCTIONAL	TO BE DETERMINED
o OPERATIONAL	1700C TEMPERATURE CAPABILITY 3000 WATTS POWER
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION EXTERNAL VENT POWER
o PHYSICAL PARAMETERS	EST. 1.0 BY 0.6 BY 0.6 METERS
COMMENTS	MANNED INTERFACE WILL ALLOW SIMPLIFIED HARDWARE. DESIGNED FOR SPACE STATION

NAME	ELECTROSTATIC LEVITATORS
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	
DEVELOPER	
o NASA	JPL
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	CONTAINERLESS PROCESSING OF ELECTRICALLY CHARGED MATERIALS
CHARACTERISTICS	
o FUNCTIONAL	ELECTRODE FIELD GENERATION WITH FEEDBACK SYSTEM FOR SAMPLE POSITIONING
o OPERATIONAL	DISH, RING, AND TETRAHEDRAL CONFIGURATIONS
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	LABORATORY SCALE
COMMENTS	TETRAHEDRAL CONFIGURATION CAPABLE OF THREE DIMENSIONAL POSITIONING AND DAMPING

NAME	FLOAT ZONE EXPERIMENT SYSTEM
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	WESTECH SYSTEMS
APPLICATIONS	FLOAT ZONING OF HIGH TEMPERATURE MATERIALS IN A CONTROLLED ENVIRONMENT
CHARACTERISTICS	
o FUNCTIONAL	TEST CHAMBER WITH RADIO FREQUENCY HEATING
o OPERATIONAL	50,000 WATTS POWER MAXIMUM
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	LABORATORY SCALE
COMMENTS	CONSTRUCTED TO ASSIST IN CHACTERIZING FLOAT ZONE PROCESS

NAME	FLOAT ZONE EXPERIMENT SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	RESEARCH IN FLOATING ZONE CRYSTAL GROWTH IN MICROGRAVITY ENVIRONMENT
CHARACTERISTICS	
o FUNCTIONAL	TO BE DETERMINED
o OPERATIONAL	TO BE DETERMINED
o RESOURCE REQUIREMENTS	VERY LOW MOMENTARY ACCELERATION ENVIRONMENT
o PHYSICAL PARAMETERS	TO BE DETERMINED
COMMENTS	REQUIRED TO ADVANCE SCIENCE IN FLOATING ZONE CRYSTAL GROWTH

NAME	FLUID EXPERIMENT APPARATUS
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	ROCKWELL
APPLICATIONS	FUNDAMENTAL SPACE PROCESSING RESEARCH EXPERIMENTS IN GENERAL LIQUID CHEMISTRY
CHARACTERISTICS	
o FUNCTIONAL	MODULES ARE CONFIGURED TO MEET SPECIFIC REQUIREMENTS
o OPERATIONAL	TO BE DETERMINED
o RESOURCE REQUIREMENTS	TO BE DETERMINED
o PHYSICAL PARAMETERS	HOUSED IN A MIDDECK LOCKER
COMMENTS	FEA-1 CONFIGURED FOR FLOAT ZONE CRYSTAL GROWTH EXPERIMENTS

NAME	FLUIDS EXPERIMENT SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	TRW
APPLICATIONS	MULTIPURPOSE RESEARCH IN FLUID CONVECTION, PHASE TRANSITION, SURFACE PHYSICS, AND CRYSTAL GROWTH
CHARACTERISTICS	
o FUNCTIONAL	ACCOMMODATES A VARIETY OF TEST CELLS WITH BOTH VIDEO AND HOLOGRAPHIC CAPABILITIES
o OPERATIONAL	1000 WATTS POWER MAXIMUM AVERAGE
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	HOUSED IN SPACELAB DOUBLE RACK
COMMENTS	DESIGNED FOR USE IN COMBINATION WITH VAPOR CRYSTAL GROWTH SYSTEM

NAME	FOAM GENERATOR
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	OWENS-CORNING FIBERGLAS
APPLICATIONS	FOAM PROCESS SCIENCE
CHARACTERISTICS	
o FUNCTIONAL	FOAM GENERATOR IN CIRCULAR CANNISTER, INCLUDES PISTON, LIQUID STORAGE, AND DRIVE MOTOR.
o OPERATIONAL	250 WATTS POWER FOR 5 MINUTES 50 WATTS FOR 2 HRS FOR ELECTRONICS
o RESOURCE REQUIREMENTS	POWER MIDDECK ELECTRONICS MODULE
o PHYSICAL PARAMETERS	16 INCHES DIAMETER, 16 INCHES HIGH 53 KG VOLUME OF 3 LOCKERS
COMMENTS	SELF-CONTAINED APPARATUS MAY BE DESIGNED FOR LOCKER OR RACK.

NAME	GENERAL PURPOSE ROCKET FURNACE
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	MELTING AND RESOLIDIFICATION OF MATERIALS IN ISOTHERMAL AND GRADIENT MODES
CHARACTERISTICS	
o FUNCTIONAL	THREE FURNACE CAVITIES, EACH WITH TRIZONE HEATING
o OPERATIONAL	1600 WATTS POWER 900C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	28 VDC HEAT DISSIPATION
o PHYSICAL PARAMETERS	63.65 KG HOUSED IN EAC
COMMENTS	FOUR UNITS AVAILABLE

NAME	GLASS FIBER PULLER
STATUS	
o GROUND UNIT	UNDER DEVELOPMENT
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	DARPA, CORNING GLASS AND INTERSONICS
APPLICATIONS	OPTICAL FIBERS FOR COMMUNICATIONS
CHARACTERISTICS	
o FUNCTIONAL	PROTOTYPE FURNACE AND LEVITATOR
o OPERATIONAL	POWER, 1175 W (FURNACE) 126 W (LEVITATOR) 1600C TEMPERATURE CAPABILITY SAMPLE SIZE 2.5 CM DIAMETER
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION 28 VDC POWER
o PHYSICAL PARAMETERS	HARDWARE AND ELECTRONICS 4 LOCKERS EST. 20 BY 6.0 BY 6.0 INCHES EST. 139 KG (FURNACE AND LEVITATOR)
COMMENTS	TRIPLY CONTAINED DUE TO DANGEROUS GASES

NAME	HIGH GRADIENT NONPROGRAMMABLE FURNACE
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	PLANNED
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	GRUMMAN AEROSPACE
APPLICATIONS	SEMICONDUCTORS, IR DETECTORS, AND ELECTRO OPTICAL DEVICES
CHARACTERISTICS	
o FUNCTIONAL	HIGH GRADIENT FURNACE
o OPERATIONAL	4 KW POWER 100 HR RUN TIME SAMPLE SIZE 1-3 INCH DIAMETER
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION VENTING POWER
o PHYSICAL PARAMETERS	250 KG VOLUME 5.5 CUBIC METERS
COMMENTS	

NAME	HIGH TEMPERATURE GENERAL PURPOSE FURNACE
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	ALLOY SOLIDIFICATION TO FURTHER MODEL ALLOY SCIENCE
CHARACTERISTICS	
o FUNCTIONAL	3 INDEPENDENTLY CONTROLLED CAVITIES CONSISTING OF A 3-ZONE FURNACE WITH HEAT EXTRACTION. MAY OPERATE IN ISOTHERMAL OR GRADIENT MODE.
o OPERATIONAL	1600 WATTS MAXIMUM POWER 100-900C OPERATING TEMPERATURE RANGE
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION POWER EXTERNAL VENT
o PHYSICAL PARAMETERS	20 INCHES HIGH, 17 INCHES DIAMETER 63.56 KG HOUSED IN A EAC
COMMENTS	NASA PLANS TO MODIFY GPRF TO INCREASE OPERATION TIME AND TEMPERATURE CAPABILITIES; AFTER D-1 MISSION IN 1985.

NAME	ISOELECTRIC FOCUSING EXPERIMENT
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	UNIVERSITY OF ARIZONA
o INDUSTRY	
APPLICATIONS	ISOELECTRIC FOCUSING OF MACROMOLECULES IN A STATIC FREE FLUID
CHARACTERISTICS	
o FUNCTIONAL	EIGHT COLUMN ASSEMBLIES
o OPERATIONAL	
o RESOURCE REQUIREMENTS	NOMINALLY 15 VDC FROM 10 D CELLS
o PHYSICAL PARAMETERS	HOUSED IN MIDDECK LOCKER
COMMENTS	PRECURSOR TO RECYCLING APPARATUS

NAME	ISOTHERMAL FURNACE
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	UNDER DEVELOPMENT
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	GRUMMAN AEROSPACE AND MELLON
APPLICATIONS	ISOTHERMAL FURNACE FOR ELECTROEPITAXIAL GROWTH, IR DETECTORS AND SEMICONDUCTORS
CHARACTERISTICS	
o FUNCTIONAL	ISOTHERMAL FURNACE
o OPERATIONAL	6.4 KW POWER 100 HRS RUN TIME 1-3 INCH DIAMETER SAMPLE SIZE
o RESOURCE REQUIREMENTS	POWER THERMAL DISSIPATION VENTING
o PHYSICAL PARAMETERS	100 KG VOLUME 6.0 CUBIC CM
COMMENTS	CHARACTERISTICS OF FLIGHT UNIT ARE OVER ESTIMATED

NAME	MONODISPERSE LATEX REACTOR (100 ml)
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	G.E. AND ROCKWELL
APPLICATIONS	CHEMICAL REACTION OF LIQUID MATERIALS WHILE MIXED AND HEATED
CHARACTERISTICS	
o FUNCTIONAL	FOUR REACTOR VESSELS OF 100 ml VOLUME
o OPERATIONAL	216 WATTS MAXIMUM POWER
o RESOURCE REQUIREMENTS	36 VDC
o PHYSICAL PARAMETERS	6.8 KG HOUSED IN EAC IN MIDDECK
COMMENTS	5 MISSIONS COMPLETED, 3 MORE SCHEDULED MONODISPERSE LATEX REACTOR 21 BEING DEVELOPED

NAME	MONODISPERSE LATEX REACTOR (21)
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	LEHIGH UNIVERSITY
o INDUSTRY	NBS AND PARTICLE TECHNOLOGY
APPLICATIONS	CALIBRATE EQUIPMENT, BIOMEDICAL RESEARCH, DRUG CARRIERS, BODY TRACERS, MEMBRANE SIZING
CHARACTERISTICS	
o FUNCTIONAL	6 TO 12 TWO LITER REACTOR VESSELS
o OPERATIONAL	20 HR RUN TIME PER REACTOR
o RESOURCE REQUIREMENTS	28 VDC POWER
o PHYSICAL PARAMETERS	TO BE DETERMINED
COMMENTS	PHYSICAL PARAMETERS ARE DEPENDANT UPON MANUAL OR AUTOMATED OPERATION, WHICH HAS NOT BEEN DECIDED.

NAME	MOVING WALL ELECTROKINETIC SEPERATOR SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	UNIVERSITY OF ARIZONA
o INDUSTRY	
APPLICATIONS	SEPERATION OF BIOLOGICAL PARTICLES AND MACROMOLECULES
CHARACTERISTICS	
o FUNCTIONAL	TO BE DETERMINED
o OPERATIONAL	EST. 150 WATTS FOR 8 HRS
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION POWER
o PHYSICAL PARAMETERS	EST. HALF A SINGLE RACK EST. 68 KG
COMMENTS	DESIGN UNDER WAY.

NAME	ORGANIC CRYSTAL GROWTH

STATUS

o GROUND UNIT	EXISTING
o FLIGHT UNIT	EXISTING

DEVELOPER

o NASA	
o ACADEMIA	
o INDUSTRY	3M

APPLICATIONS	PROPRIETARY

CHARACTERISTICS

o FUNCTIONAL	DMOS RIG IN EAC WHICH HOUSES SIX REACTOR UNITS	
o OPERATIONAL	POWER SMALL RUN TIME, 10 HRS AFTER FLIGHT FOR DURATION SIX SAMPLES HEATED TO 90C	
o RESOURCE REQUIREMENTS	THERMAL DISSIPATION (SMALL) POWER (SMALL)	
o PHYSICAL PARAMETERS	DMOS RIG; 3 FT HIGH 2.5 FT DIAMETER 98 KG HOUSED IN EAC	3M'S GEM 40.8 KG 2 LOCKERS

COMMENTS	TWO HOUSINGS SIMILAR TO MLR

NAME	PARTICLE CLOUD COMBUSTION EXPERIMENT
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	UNDER DEVELOPMENT
DEVELOPER	
o NASA	LeRC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	TO STUDY FLAME PROPOGATION AND EXTINCTION CONDITIONS IN A QUIESCENT MIXTURE OF AIR AND FUEL PARTICLE CLOUDS UNDER LOW GRAVITY CONDITIONS
CHARACTERISTICS	
o FUNCTIONAL	SEALED CONTAINER WITH EIGHT FLAME TUBES AN ACOUSTIC MIXER AND MICROPROCESSOR
o OPERATIONAL	150 WATTS POWER
o RESOURCE REQUIREMENTS	PAYLOAD MOUNTING PANEL 28 VDC
o PHYSICAL PARAMETERS	VOLUME OF ONE LOCKER
COMMENTS	EXISTING CONFIGURATION WILL BE CHANGED FOR FLIGHT. MIDDECK EXPERIMENT. LITTLE INSTRUMENTATION.

NAME	PROTEIN CRYSTAL GROWTH FACILITY	
STATUS		
o GROUND UNIT	EXISTING	
o FLIGHT UNIT	EXISTING	
DEVELOPER		
o NASA	MSFC	
o ACADEMIA	UNIVERSITY OF ALABAMA IN BIRMINGHAM	
o INDUSTRY	UPJOHN AND SHERRING-PLOUGH	
APPLICATIONS	PROBLEM DRUG DESIGN PROTEIN BIOTECHNOLOGY	
CHARACTERISTICS		
o FUNCTIONAL	EACH PROTEIN CRYSTAL GROWTH DRAWER CONTAINS 36-48 CRYSTAL GROWTH TUBES.	
o OPERATIONAL	FIRST FLIGHT UNIT ENCAPSULATED EXPERIMENT	* SECOND FLIGHT UNIT * ENCAPSULATED * EXPERIMENT
o RESOURCE REQUIREMENTS	NONE	* POWER * REFRIGERATION AT 4.0C *
o PHYSICAL PARAMETERS	TWO PCG DRAWERS IN A MIDDECK LOCKER	* TWO PCG DRAWERS * IN A MIDDECK * LOCKER
COMMENTS		

NAME	RECYCLING ISOELECTRIC FOCUSING FACILITY
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	LARGE SCALE PURIFICATION OF PEPTIDE HORMONES PROTEINS AND BIOLOGICAL MACROMOLECULES.
CHARACTERISTICS	
o FUNCTIONAL	MULTICHANNEL PERISTALIC PUMP
o OPERATIONAL	POWER 275-375 WATTS RUN TIME 2-3 HRS RUN TEMPERATURE 4.0C
o RESOURCE REQUIREMENTS	REFRIGERATION AT 4.0C 28 VDC POWER
o PHYSICAL PARAMETERS	EST. 20.5 BY 36 BY 20.4 INCHES 4 LOCKERS 134 KG (INCLUDES RIEF ELECTRONICS AND SUPPORT EQUIPMENT)
COMMENTS	LATE ACCESS REQUIRED (24 HRS MAX) MUST BE KEEP COOL FROM THE TIME IT IS LOADED UNTIL IT IS UNLOADED.

NAME	SINGLE AXIS ACOUSTIC LEVITATOR
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	INTERSONICS
APPLICATIONS	CONTAINERLESS PROCESSING OF MOLTEN MATERIALS IN A CONTROLLED ENVIRONMENT
CHARACTERISTICS	
o FUNCTIONAL	ONE ACOUSTIC FURNACE CHAMBER WITH SINGLE ACOUSTIC DRIVER
o OPERATIONAL	3100 WATTS POWER 1600C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	32 VDC HEAT DISSIPATION
o PHYSICAL PARAMETERS	61.3 KG HOUSED IN AN EAC
COMMENTS	ONE UNIT AVAILABLE

NAME	SINGLE-AXIS ACOUSTIC LEVITATION SYSTEM
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	INTERSONICS
APPLICATIONS	MELTING AND RESOLIDIFICATION OF MATERIALS IN A CONTAINERLESS PROCESS
CHARACTERISTICS	
o FUNCTIONAL	FURNACE CHAMBER WITH SINGLE ACOUSTIC DRIVER
o OPERATIONAL	1400C MAXIMUM TEMPERATURE
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	LABORATORY SCALE
COMMENTS	SAMPLES AS LARGE AS 3 MM SUCCESSFULLY LEVITATED TO >1000C

NAME	SOLID SURFACE COMBUSTION
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	UNDER DEVELOPMENT
DEVELOPER	
o NASA	LeRC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	FUNDAMENTAL RESEARCH IN SOLID SURFACE COMBUSTION
CHARACTERISTICS	
o FUNCTIONAL	REPLACEABLE CHAMBER WITH VIEWING PORTS AND CAMERA AND ELECTRICAL ASSEMBLY
o OPERATIONAL	2 MINUTE MAXIMUM RUN TIME 146 WATTS POWER TWO SAMPLES: PAPER AND PMMA
o RESOURCE REQUIREMENTS	FOUR PAYLOAD MOUNTING PANELS 28 VDC POWER
o PHYSICAL PARAMETERS	25 KG (CHAMBER WEIGHT) 32 KG (ELECTRICAL ASSEMBLY) VOLUME OF FOUR LOCKERS
COMMENTS	EXISTING CONFIGURATION WILL BE CHANGED FOR FLIGHT. LITTLE INSTRUMENTATION.

NAME	SOLUTE DIFFUSION APPARATUS
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	LeRC
o ACADEMIA	
o INDUSTRY	ROCKWELL
APPLICATIONS	SLOW DIFFUSION OF LIQUID SOLUTIONS, ALLOWING CHEMICAL REACTION AND CRYSTAL GROWTH
CHARACTERISTICS	
o FUNCTIONAL	FOUR REACTORS EACH HAVING THREE COMPARTMENTS
o OPERATIONAL	37.5 WATTS MAXIMUM POWER 260-320K OPERATING TEMPERATURE
o RESOURCE REQUIREMENTS	BATTERY POWERED
o PHYSICAL PARAMETERS	57.1 KG 30 BY 82 CM (REACTOR) 21 BY 28 CM (MICROCOMPUTER)
COMMENTS	IN FLIGHT ON THE LDEF, 1984 OR EARLY 1985

NAME	SOLUTION CRYSTAL GROWTH
STATUS	
o GROUND UNIT	EXISTING
o FLIGHT UNIT	NEEDED
DEVELOPER	
o NASA	
o ACADEMIA	
o INDUSTRY	QUANTUM DETECTOR TECHNOLOGY
APPLICATIONS	IR DETECTORS AND ELECTRO OPTICAL DEVICES
CHARACTERISTICS	
o FUNCTIONAL	
o OPERATIONAL	
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	
COMMENTS	

NAME	STATIC COLUMN ELECTROPHORETIC SEPERATOR
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	ZONE ELECTROPHORESIS OF PARTICLES IN A STATIC FREE FLUID
CHARACTERISTICS	
o FUNCTIONAL	EIGHT COLUMN ASSEMBLIES
o OPERATIONAL	32 WATTS POWER
o RESOURCE REQUIREMENTS	115 VAC
o PHYSICAL PARAMETERS	3.4 KG 17.5 BY 12.5 BY 34.0 CM
COMMENTS	REQUIRES REFURBISHMENT TO SUIT SPECIFIC EXPERIMENTS

NAME	THIN FILMS

STATUS

o GROUND UNIT	EXISTING
o FLIGHT UNIT	PLANNED

DEVELOPER

o NASA	
o ACADEMIA	
o INDUSTRY	3M

APPLICATIONS	PROPRIETERY

CHARACTERISTICS

o FUNCTIONAL

o OPERATIONAL

o RESOURCE REQUIREMENTS

o PHYSICAL PARAMETERS

COMMENTS	PROPRIETARY

NAME	THREE AXIS ACOUSTIC LEVITATOR
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	JPL
o ACADEMIA	
o INDUSTRY	
APPLICATIONS	INVESTIGATION OF FLUID DYNAMIC PROPERITIES AND PARTICLE INTERACTIONS IN A CONTROLLED ENVIRONMENTS
CHARACTERISTICS	
o FUNCTIONAL	ONE ACOUSTIC CHAMBER WITH THREE VARIABLE ACOUSTIC DRIVERS
o OPERATIONAL	126 WATT POWER 150 DB MAXIMUM ACOUSTIC PRESSURE
o RESOURCE REQUIREMENTS	28 VDC
o PHYSICAL PARAMETERS	70.8 KG HOUSED IN AN EAC
COMMENTS	ONE UNIT AVAILABLE

NAME	VAPOR CRYSTAL GROWTH SYSTEM
STATUS	
o GROUND UNIT	
o FLIGHT UNIT	EXISTING
DEVELOPER	
o NASA	MSFC
o ACADEMIA	
o INDUSTRY	TRW
APPLICATIONS	GROWTH OF SINGLE CRYSTALS BY VAPOR TRANSPORT WITH INHIBITING OF POLYCRYSTALLINE NUCLEATION
CHARACTERISTICS	
o FUNCTIONAL	FURNACE WITH THREE HEATING ELEMENTS AND TEMPERATURE CONTROLLED GROWTH AMPULE
o OPERATIONAL	HEATER RANGES: SOURCE, 100-128C RING, 120-180C STING, 40-80C
o RESOURCE REQUIREMENTS	
o PHYSICAL PARAMETERS	HOUSED IN A SPACELAB SINGLE RACK
COMMENTS	DESIGNED FOR USE IN COMBINATION WITH FLUIDS EXPERIMENT SYSTEM

NAME	VAPOR GROWTH

STATUS

o GROUND UNIT	EXISTING
o FLIGHT UNIT	PLANNED

DEVELOPER

o NASA	
o ACADEMIA	
o INDUSTRY	3M

APPLICATIONS	PROPRIETARY

CHARACTERISTICS

o FUNCTIONAL

o OPERATIONAL

o RESOURCE REQUIREMENTS

o PHYSICAL PARAMETERS

PROPRIETARY

COMMENTS

3.0 Carrier Capabilities

FOREWORD

Section 3.0 of this appendix contains the 14 individual data sheets for each Commerce Lab carrier configuration. A carrier capabilities summary table that presents a quick look at the key resources and discriminators is also included. References and sources of additional information/data are listed on the individual carrier data sheets for traceability where more depth may be required.

CONTENTS

F1

CARRIER: MISSION PECULIAR EXPERIMENT SUPPORT STRUCTURE (MPESS)

DATE: 11-19-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE	-		
	KVA	-		
DC	VOLTAGE	-		
	KW	-		
TOTAL	KWHr	-		
THERMAL	PASSIVE (KW)	-		
	ACTIVE (KW)	-		
DIMENSIONS (HxWxD, IN)		TOP: 150X27 SIDES: 150X27		
VOLUME (CU FT)		VARIABLE		
MASS (LB)		5000		
TEMP EXTREMES (DEGREES F)		-250 TO 200		
PRESSURE EXTREMES (PSIA)		0 TO 14.7		
CG MAX DIST FROM MOUNT (IN)		32 IN Z AND X		VARIABLE AS A FUNCTION OF Y & MASS
ACCESS	PRE LAUNCH (LATEST HR)	336 (2 WEEKS)		
	POST LANDING (EARLIEST HR)	6-12 HRS		
DATA ACQUISITION AVAIL (Y/N)		N		
COMMAND SYSTEM AVAIL (Y/N)		N		
VACUUM SERVICE AVAIL (Y/N)		N		
PURGE AVAIL (Y/N)		N		
VENT AVAIL (Y/N)		N		

COMMENTS:

F2
CARRIER: EXPERIMENT APPARATUS CONTAINER (PAYLOAD BAY)

DATE: 11/14/84

RESOURCE AND DISCRIMINATOR	VALUE OR RESPONSE	REFERENCE	REMARKS
POWER			
AC VOLTAGE			
KVA			
DC VOLTAGE			
KW			
TOTAL KWHr			
THERMAL PASSIVE (KW)			
ACTIVE (KW)			
DIMENSIONS (HxWxD, IN)	40X16.32		
VOLUME (CU FT)			
MASS (LB)	275	MSL USERS HANDBOOK, P.2-7	
TEMP EXTREMES (DEGREES F)			
PRESSURE EXTREMES (PSIA)	14.7-20.5	MSL USERS HANDBOOK, P 2-7	
CG MAX DIST FROM MOUNT (IN)			
ACCESS PRE LAUNCH (LATEST HR)			
POST LANDING (EARLIEST HR)			
DATA ACQUISITION AVAIL (Y/N)	N		
COMMAND SYSTEM AVAIL (Y/N)	N		
VACUUM SERVICE AVAIL (Y/N)	N		
PURGE AVAIL (Y/N)	N		
VENT AVAIL (Y/N)	N		

COMMENTS:

F3

CARRIER: GET AWAY SPECIAL (GAS) CANISTER

DATE: 11-16-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE	NONE		
	KVA	-		
DC	VOLTAGE	NONE		EXPERIMENT PROVIDED
	KW	-		
TOTAL	KWHr	-		
THERMAL	PASSIVE (KW)	-		BLANKETS/HEATERS
	ACTIVE (KW)	NONE		
DIMENSIONS (HxWxD, IN)		LG: 19.75 DIA. X 28.25 SM: 19.75 DIA X 14.13	GAS EXPERIMENTER HDBK,7/84 P.17	
VOLUME (CU FT)		LG: 5 SM: 2.5	GAS EXPERIMENTER HDBK,7/84 P.17	
MASS (LB)		LG: 200 SM: 100 OR 60	GAS EXPERIMENTER HDBK,7/84 P.17	
TEMP EXTREMES (DEGREES F)		-148 TO + 176	GAS EXPERIMENTER HDBK,7/84 P.69	DEPENDENT ON PAYLOAD PWR
PRESSURE EXTREMES (PSIA)		0 TO 14.7	GAS EXPERIMENTER HDBK,7/84 P.14	PRE-DETERMINED CONTROL
CG MAX DIST FROM MOUNT (IN)		WITHIN GAS CANISTER		
ACCESS	PRE LAUNCH (LATEST HR)	3 WEEKS		
	POST LANDING (EARLIEST HR)	3 DAYS		
DATA ACQUISITION AVAIL (Y/N)		N		
COMMAND SYSTEM AVAIL (Y/N)		Y	GAS EXPERIMENTER HDBK,7/84 P.29	ON-OFF/FAST-SLOW/HI-LOW
VACUUM SERVICE AVAIL (Y/N)		N		
PURGE AVAIL (Y/N)		Y	GAS EXPERIMENTER HDBK,7/84 P.18	
VENT AVAIL (Y/N)		Y	GAS EXPERIMENTER HDBK,7/84 P.14	BATTERY AND PRE-SET PRESSURE

COMMENTS:

ORIGINAL PAGE IS
OF POOR QUALITY

F4
CARRIER: MATERIALS SCIENCE LABORATORY

DATE: '11/16/84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE			
	KVA			
DC	VOLTAGE	28 +/- 4	MSL USER HANDBOOK	
	KW	.47	MSL USER HANDBOOK, P.2-21	1.410 TOTAL NET CAPACITY
TOTAL	KWHr	34	MSL USER HANDBOOK, P.2-22	102 TOTAL NET CAPACITY
THERMAL	PASSIVE (KW)	-		
	ACTIVE (KW)	0.8	MSL USER HANDBOOK, P.1-3	2.5 TOTAL NET CAPACITY
DIMENSIONS (HxWxD, IN)		TOP: (3) 33.6x40 SIDE: (3) 29x40	MSL USER HANDBOOK	LIMITS LOAD TO 350 LB. WITH C.G. 21" ABOVE COLD PLAT MAX 74 HGT AT CENTER (DYN. ENVELOPE)
VOLUME (CU FT)				
MASS (LB)		680	MSL USER HANDBOOK, P.2-12	2040 TOTAL NET CAPACITY
TEMP EXTREMES (DEGREES F)		PASSIVE: -250 TO +200 ACTIVE: 36 TO 120	MSL USER HANDBOOK	
PRESSURE EXTREMES (PSIA)		14.7-20.5 (EAC)	MSL USER HANDBOOK	UNCONTROLLED OUTSIDE EAC
CG MAX DIST FROM MOUNT (IN)		32 IN Z AND X	MSL USER HANDBOOK	VARIABLE AS A FUNCTION OF MASS & Y
ACCESS	PRE LAUNCH (LATEST HR)	2 WEEKS	MSL USER HANDBOOK	
	POST LANDING (EARLIEST HR)	6-12	MSL USER HANDBOOK	
DATA ACQUISITION AVAIL (Y/N)		Y	MSL USER HANDBOOK	
COMMAND SYSTEM AVAIL (Y/N)		Y	MSL USER HANDBOOK	
VACUUM SERVICE AVAIL (Y/N)		N	MSL USER HANDBOOK	
PURGE AVAIL (Y/N)		N	MSL USER HANDBOOK	
VENT AVAIL (Y/N)		N	MSL USER HANDBOOK	

COMMENTS:

F5

CARRIER: MIDDECK STORAGE LOCKER SPACES (33 LOOKING FWD, 9 LOOKING AFT)

PREPARED BY:

DATE: 9/17/84

RESOURCE AND DISCRIMINATOR	VALUE OR RESPONSE	REFERENCE	REMARKS
POWER			
AC VOLTAGE	115	P.10, TBE SP84-MSFC-2725	400 HZ, 3-PHASE, 3A/PHASE
KVA	.597	CALCULATED	
DC VOLTAGE	23-32	PARA 6.2.1.1, I-2-1M001-1	28 NOMINAL
KW	.165-.224	PARA 6.2.1.1, I-2-1M001-1	MINIMAL VALUE DEPENDING ON BUSS
TOTAL KWHr	CONTINUOUS	-	
THERMAL PASSIVE (KW)	.2	PARA 5.2.1.1, I-2-1M001-1	.3 PEAK FOR < 30 MINUTES
ACTIVE (KW)	-	-	
DIMENSIONS (HxWxD, IN)	10.757X18.125X21	PARA 3.5.1, I-2-1M001-1	21 DIM. - EXTENSION FROM BULK-HEAD INTO MIDDECK
VOLUME (CU FT)	2.4	CALCULATED	
MASS (LB)	60		AVERAGE = 40 - INCLUDES CON-TAINER/ADAPTER
TEMP EXTREMES (DEGREES F)	65-95	PARA 5.1, I-2-1M001-1	65-80 NORMAL OPERATION, 120 MAX (STRUCTURE)
PRESSURE EXTREMES (PSIA)	7.8-18.1	PARA 5.1, I-1-1M001-1	14.7 +/- 2 NORMAL OPERATION
CG MAX DIST FROM MOUNT (IN)	14	P.8, TBE SP84-MSFC-2725	IDEAL =10. DEPENDS ON LOCATION. INCLUDES ADAPTER PLATE
ACCESS PRE LAUNCH (LATEST HR)	9	ED VALENTINE MSFC (9/10/84)	
POST LANDING (EARLIEST HR)	18	ED VALENTINE MSFC (9/10/84)	POSSIBLE COULD BE EARLIER
DATA ACQUISITION AVAIL (Y/N)	N	ED VALENTINE MSFC (9/10/84)	
COMMAND SYSTEM AVAIL (Y/N)	N	ED VALENTINE MSFC (9/10/84)	
VACUUM SERVICE AVAIL (Y/N)	N	ED VALENTINE MSFC (9/10/84)	POSSIBLY COULD RUN LINE FROM FLIGHT DECK
PURGE AVAIL (Y/N)	N	ED VALENTINE MSFC (9/10/84)	
VENT AVAIL (Y/N)	N	ED VALENTINE MSFC (9/10/84)	

COMMENTS: QUANTITY OF LOCKER SPACES AVAILABLE DEPENDSON REQUIREMENTS OF THE FLIGHT CREW FOR STORAGE, OTHER MIDDECK LOCATIONS AVAILABLE FOR PAYLOAD STORAGE. NO MORE THAN TWO ADJOINING LOCKER SPACES CAN BE USED AS AN ATTACHMENT FACE. POWER MUST BE SHARED WITH OTHER EXPERIMENTS/PAYLOADS IN MIDDECK AREA. PAYLOAD EXTERAN TEMPERATURES: ACCESSABLE - 113 DEGREES F, INACCESSABLE 120 DEGREES F. STANDARD ADAPTER PLATES AND PAYLOAD MOUNTING PANELS AVAILABLE.

F6

CARRIER: MIDDECK CONTAINERS - MODULAR LOCKER

DATE: 9-17-84

RESOURCE AND DISCRIMINATOR	VALUE OR RESPONSE	REFERENCE	REMARKS
POWER			
AC VOLTAGE			NOT AVAILABLE
KVA			NOT AVAILABLE
DC VOLTAGE			NOT AVAILABLE
KW			NOT AVAILABLE
TOTAL KWHr			NOT AVAILABLE
THERMAL PASSIVE (KW)			NOT AVAILABLE
ACTIVE (KW)			NOT AVAILABLE
DIMENSIONS (HxWxD, IN)	9.950X17.312X20.320	FIG. 3.4.1-1, I-2-1M001-1	+/-0.015
VOLUME (CU FT)	2.0	PARA 3.4.1, I-2-5M001-1	
MASS (LB)	50	PARA 3.4-1, I-2-1M001-1	BASED ON STOWAGE PROVISIONS WT OF 10 LB MAX
TEMP EXTREMES (DEGREES F)	65-95	PARA 5.1, I-2-1M001-1	
PRESSURE EXTREMES (PSIA)	7.8-18.1	PARA 5.1, I-2-1M001-1	14.7 +/- 2 NORMAL OPERATION
CG MAX DIST FROM MOUNT (IN)	NO CONSTRAINT	-	MAX DENSITY · 30 LB/CU FT
ACCESS PRE LAUNCH (LATEST HR)	120	P. 60, TBE SP84-MSFC-2725	
POST LANDING (EARLIEST HR)			
DATA ACQUISITION AVAIL (Y/N)	N		
COMMAND SYSTEM AVAIL (Y/N)	N		
VACUUM SERVICE AVAIL (Y/N)	N		
PURGE AVAIL (Y/N)	N		
VENT AVAIL (Y/N)	N		

COMMENTS: USED FOR STORAGE ONLY

F7

CARRIER: MIDDECK EXPERIMENT APPARATUS CONTAINER (EAC)
RECTANGULAR DRAWER-TYPE

9-18-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE	115	P.10,TBE SP84-MSFC-2725	400 HZ, 3-PHASE, 5A/PHASE
	KVA	.597	CALCULATED	
DC	VOLTAGE	23-32	PARA 6.2.1.1,I-2-1M001	28 NOMINAL
	KW	.165-.224	PARA 6.2.1.1, I-2-1M001-1	MINIMAL VALUE DEPENDING ON BUSS
TOTAL	KWHr	CONTINUOUS	-	
THERMAL	PASSIVE (KW)	.090	P. 10,TBE SP84-MSFC-2725	
	ACTIVE (KW)	-	P.4,TBE SP84-MSFC-2725	
DIMENSIONS (HxWxD, IN)		10.31X17.5X17.66	P.4,TBE SP84-MSFC-2725	
VOLUME (CU FT)		1.7	P.4 TBE SP84-MSFC-2725	
MASS (LB)		43	P.35 TBE SP84-MSFC-2725	
TEMP EXTREMES (DEGREES F)		65-95	PARA 5.1,I-2-1M001-1	65-80 NORMAL OPERATION, 120 MAX (STRUCTURE)
PRESSURE EXTREMES (PSIA)		7.8-18.1	PARA 5.1,I-2-1M001-1	NOT PRESSURIZED - 14.7 +/- 2 NORMAL OPERATION
CG MAX DIST FROM MOUNT (IN)		14	P.8, TBE SP84-MSFC-2725	INCLUDES COMBINATION OF PAY-LOAD, ADAPTER & CONTAINER
ACCESS	PRE LAUNCH (LATEST HR)	9	ED VALENTINE (9/10/84)	
	POST LANDING (EARLIEST HR)	18	ED VALENTINE (9/10/84)	
DATA ACQUISITION AVAIL (Y/N)		N		
COMMAND SYSTEM AVAIL (Y/N)		N		
VACUUM SERVICE AVAIL (Y/N)		N		
PURGE AVAIL (Y/N)		N		
VENT AVAIL (Y/N)		N		

COMMENTS:

F8

CARRIER: MIDDECK EXPERIMENT APPARATUS CONTAINER (EAC)
FLAT TOP CYLINDRICAL

DATE: 9-18-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE	115	P.10,TBE SP84-MSFC-2725	400 HZ, 3-PHASE, 3A/PHASE
	KVA	.597	CALCULATED	
DC	VOLTAGE	23-32	PARA 6.2.1.1, I-2-1-1M001-128 NOMINAL	
	KW	.165-.224	PARA 6.2.1.1, I-2-1M001-1	MINIMAL VALUE DEPENDING ON BUSS
TOTAL	KWHr	CONTINUOUS	-	
THERMAL	PASSIVE (KW)	.090	P. 10,TBE SP84-MSFC-2725	
	ACTIVE (KW)	-	P.4,TBE SP84-MSFC-2725	
DIMENSIONS (HxWxD, IN)		18.35X16.22(DIA.)	P.4,TBE SP84-MSFC-2725	
VOLUME (CU FT)		2.3	P.4 TBE SP84-MSFC-2725	
MASS (LB)		93.1	P.4 TBE SP84-MSFC-2725	
TEMP EXTREMES (DEGREES F)		65-95	PARA 5.1,I-2-1M001-1	65-80 NORMAL OPERATION, 120 MAX (STRUCTURE)
PRESSURE EXTREMES (PSIA)		-	P.25, TBE SP84-MSFC-2725	DEPENDS ON PAYLOAD REQUIREMENT. CONTAINER SEALED
CG MAX DIST FROM MOUNT (IN)		14	P.8, TBE SP84-MSFC-2725	INCLUDES COMBINATION OF PAY-LOAD, ADAPTER & CONTAINER
ACCESS	PRE LAUNCH (LATEST HR)	9	ED VALENTINE (9/10/84)	
	POST LANDING (EARLIEST HR)	18	ED VALENTINE (9/10/84)	
DATA ACQUISITION AVAIL (Y/N)		N		
COMMAND SYSTEM AVAIL (Y/N)		N		
VACUUM SERVICE AVAIL (Y/N)		N		
PURGE AVAIL (Y/N)		N		
VENT AVAIL (Y/N)		N		

COMMENTS: USED FOR MONODISPERSE LATEX REACTOR. REQUIRES TWO LOCKER SPACES AND TWO SINGLE ADAPTER PLATES.

F9

CARRIER: MIDDECK EXPERIMENT APPARATUS CONTAINER (EAC)
DOME TOP CYLINDRICAL

DATE: 9-18-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER AC	VOLTAGE KVA	115 .597	P.10 TBE SP84-MSFC-2725 CALCULATED	400 HZ, 3 PHASE, 3A/PHASE
DC	VOLTAGE KW	23-32 .165-.224	PARA 6.2.1.1,I-2-1M001-1 PARA 6.2.1.1,I-2-1M001-1	28 NOMINAL MINIMAL VALUE DEPENDING ON BUSS
TOTAL	KWHr	CONTINUOUS	-	
THERMAL	PASSIVE (KW) ACTIVE (KW)	.090 -	P.10, TBE SP84-MSFC-2725 P.4 TBE SP84-MSFC-2725	
DIMENSIONS (HxWxD, IN)		31.97X16.86 (DIA)	P.4 TBE SP84-MSFC-2725	
VOLUME (CU FT)		3.7	P.4 TBE SP84-MSFC-2725	
MASS (LB)		90.0	P.4 TBE SP84-MSFC-2725	
TEMP EXTREMES (DEGREES F)		65-95	PARA 5.1,I-2-1M001-1	65-80 NORMAL OPERATION, 120 MAX (STRUCTURE)
PRESSURE EXTREMES (PSIA)		7.8-18.1	PARA 5.1,I-2-1M001-1	NOT PRESSURIZED .14.7 +/- 2 NORMAL OPERATION
CG MAX DIST FROM MOUNT (IN)		14	P.8, TBE SP84-MSFC-2725	INCLUDES COMBINATION OF PAYLOAD, ADAPTER & CONTAINER
ACCESS	PRE LAUNCH (LATEST HR)	9	ED VALENTINE MSFC (9/10/84)	
	POST LANDING (EARLIEST HR)	18	ED VALENTINE MSFC (9/10/84)	
DATA ACQUISITION AVAIL (Y/N)		N		
COMMAND SYSTEM AVAIL (Y/N)		N		
VACUUM SERVICE AVAIL (Y/N)		N		
PURGE AVAIL (Y/N)		N		
VENT AVAIL (Y/N)		N		

COMMENTS:

ORIGINAL PAGE IS
OF POOR QUALITY

F10
CARRIER: HITCHHIKER

DATE: 11-12-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE	-	-	NOT AVAILABLE
	KVA	-	-	-
DC	VOLTAGE	28	HITCHHIKER HDBK VOL I,P.35	
	KW	.450	HITCHHIKER HDBK VOL I,P.11	.750 WATTS PEAK
TOTAL	KWHr	34	HITCHHIKER HDBK VOL I,P.11	
THERMAL	PASSIVE (KW)	-		
	ACTIVE (KW)	1.6	HITCHHIKER HDBK VOL I,P.11	MOUNT TO COLD PLATE OR FREON LOOP FOR INTERNAL
DIMENSIONS (HxWxD, IN)		TBD	HITCHHIKER HDBK VOL I,P.21	
VOLUME (CU FT)		TBD	HITCHHIKER HDBK VOL I,P.21	
MASS (LB)		1000	HITCHHIKER HDBK VOL I,P.11	
TEMP EXTREMES (DEGREES F)		-250 TO 200	HITCHHIKER HDBK VOL I,P.49	ENVELOPS PRE-LAUNCH THROUGH POST LANDING
PRESSURE EXTREMES (PSIA)		14.7	HITCHHIKER HDBK VOL I,P.69	
CG MAX DIST FROM MOUNT (IN)		TBD	HITCHHIKER HDBK VOL I,P.21	
ACCESS	PRE LAUNCH (LATEST HR)	TBD		
	POST LANDING (EARLIEST HR)	TBD		
DATA ACQUISITION AVAIL (Y/N)		Y	HITCHHIKER HDBK VOL I,P.11	TAPE RECORDER, DOWNLINK AND 48 HEALTH CHANNELS
COMMAND SYSTEM AVAIL (Y/N)		Y	HITCHHIKER HDBK VOL I,P.11	28 CHANNELS OR 3 MANUAL SWITCHES
VACUUM SERVICE AVAIL (Y/N)		N	-	
PURGE AVAIL (Y/N)		N	-	
VENT AVAIL (Y/N)		N	-	

COMMENTS: ABOVE CAPABILITIES BASED ON THREE EXPERIMENTS PER MISSION

F11
CARRIER: SPACELAB PALLET

DATE: 11-14-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE	115/200	SPAH 3.6.3.1	
	KVA	.6[illegible]	SPAH 3.6.3.1	
DC	VOLTAGE	28	SPAH 3.6.3.1	
	KW	7	SPAH 3.6.3.1	
TOTAL	KWHr	890	SPAH 3.6.3.1	
THERMAL	PASSIVE (KW)	-	-	
	ACTIVE (KW)	6.1	TBE PI79-MSFC-2316,P.63	
DIMENSIONS (HxWxD, IN)		70.0X118X113	SPAH 4.1.2	ACCORDING TO MTG LOCATION
VOLUME (CU FT)		1165	SPAH 4.1.2.3	
MASS (LB)		6856	SPAH 3.6.2.1	INCLUDES MDE
TEMP EXTREMES (DEGREES F)		-238 TO + 248	SPAH 5.2.1.4.2.4	PALLET SURFACE TEMPERATURE
PRESSURE EXTREMES (PSIA)		0-15		NO PRESSURE CONTROL
CG MAX DIST FROM MOUNT (IN)		2=400	SPAH 4.1.2.3	
ACCESS	PRE LAUNCH (LATEST HR)	PRIOR TO PAD	SPAH 6.4.2	
	POST LANDING (EARLIEST HR)	AT OPF	SPAH 6.4.2	
DATA ACQUISITION AVAIL (Y/N)		Y		
COMMAND SYSTEM AVAIL (Y/N)		Y		
VACUUM SERVICE AVAIL (Y/N)		N		
PURGE AVAIL (Y/N)		N		
VENT AVAIL (Y/N)		N		

COMMENTS:

F12
CARRIER: SPACELAB RACK 4 (DOUBLE)

DATE: 11-14-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER				
AC	VOLTAGE KVA	115/200, 400HZ 2.7	SPAH 4.3.3.2 SPAH 4.3.2.1	3A PER PHASE - 2 OUTLETS DEDUCT FROM DC POWER AVAILABLE
DC	VOLTAGE KW	28 2.1	SPAH 4.3.2.1 TABLE 3-11 SPAH 3.6.3.2.1	? OUTLETS, 60A MIN CONTINUOUS, ON-ORBIT
TOTAL	KWHr	86-226	TABLE 3-11 SPAH 3.6.3.2.1	
THERMAL	PASSIVE (KW) ACTIVE (KW)	- COLD PLATE: 1 HEAT EXCHANGER: 4	SPAH 3.6.4.1 & TBE PI79-MSFC-2316,P.56	HEAT REJECTION MATCHES POWER & OTHER HEAT LOADS
DIMENSIONS (HxWxD, IN)		UL 27.1X17.7X20.1 UR 27.1X17.7X20.1 LL 43.8X17.7X24.0 LR 41.3X17.7X24.0	TBE PI79-MSFC-2316,P.23	
VOLUME (CU FT)		28.2	TBE PI79-MSFC-2316,P.25	
MASS (LB)		1175	TBE PI79-MSFC-2316,P.25	
TEMP EXTREMES (DEGREES F)		62 to 65	TBE PI79-MSFC-2316,P.51	
PRESSURE EXTREMES (PSIA)		14.5-14.9	TBE PI79-MSFC-2316,P.51	
CG MAX DIST FROM MOUNT (IN)				
ACCESS	PRE LAUNCH (LATEST HR)	HORIZ. INTEG.		LEAVE III LAUNCH - 6 TO 9 MOS
	POST LANDING (EARLIEST HR)			
DATA ACQUISITION AVAIL (Y/N)		Y		
COMMAND SYSTEM AVAIL (Y/N)		Y		
VACUUM SERVICE AVAIL (Y/N)		Y		
PURGE AVAIL (Y/N)				
VENT AVAIL (Y/N)		Y		

COMMENTS:

F13
CARRIER: SPACELAB RACK (DOUBLE)

DATE: 11-13-84

RESOURCE AND DISCRIMINATOR		VALUE OR RESPONSE	REFERENCE	REMARKS
POWER AC	VOLTAGE	115/200, 400HZ	SPAH 4.3.3.2	3A PER PHASE 2 OUTLETS
	KVA	2.7	SPAH 4.3.2.1	DEDUCTS FROM DC POWER AVAILABLE
DC	VOLTAGE	28	SPAH 4.3.2.1	7 OUTLET, 6W
	KW	2.1	TABLE 3-11 SPAH 3.6.3.2.1	MIN CONTINUOUS, ON-ORBIT
TOTAL	KWHr	86-226	TABLE 3-11 SPAH 3.6.3.2.1	
THERMAL	PASSIVE (KW)	-		
	ACTIVE (KW)	8.5	SPAH 3.6.4.1	MATCHES THE POWER & OTHER HEAT LOADS
DIMENSIONS (HxWxD, IN)		UL 27.1X17.7X15.8 UR 27.1X17.7X15.8 LL 58.6X17.7X24.0 LR 41.3X17.7X24.0	TBE PI79-MSFC-2316,P.22	
VOLUME (CU FT)		33.0-34.2	TBE PI79-MSFC-2316,P.25	WITH AND WITHOUT CENTER POST
MASS (LB)		1058-1278	SPAH 4.1.1.3.4	WITH AND WITHOUT CENTER POST
TEMP EXTREMES (DEGREES F)		62 TO 65	TBE PI79-MSFC-2316,P.25	
PRESSURE EXTREMES (PSIA)		14.5-14.9	TBE PI79-MSFC-2316,P.25	
CG MAX DIST FROM MOUNT (IN)		-		
ACCESS	PRE LAUNCH (LATEST HR)	HORIZ. INTEG.		LEVEL III LAUNCH - 6 TO 9 MOS.
	POST LANDING (EARLIEST HR)			
DATA ACQUISITION AVAIL (Y/N)		Y		
COMMAND SYSTEM AVAIL (Y/N)		Y		
VACUUM SERVICE AVAIL (Y/N)		Y		
PURGE AVAIL (Y/N)				
VENT AVAIL (Y/N)		Y		

COMMENTS:

F14
CARRIER: SPACELAB RACK (SINGLE)

DATE: 11/13/84

RESOURCE AND DISCRIMINATOR	VALUE OR RESPONSE	REFERENCE	REMARKS
POWER AC VOLTAGE	115/200 400 HZ	SPAH 4.3.3.2	3A PER PHASE - 2 OUTLETS
KVA	2.7	SPAH 4.3.2.1	DEDUCTS FROM DC POWER AVAILABLE
DC VOLTAGE	28	SPAH 4.3.2.1	7 OUTLETS, 60A
KW	2.1	TABLE 3-11 SPAH 3.6.3.2.1	MIN CONTINUOUS, ON-ORBIT
TOTAL KWHr	86-226	TABLE 3-11 SPAH 3.6.3.2.1	
THERMAL PASSIVE (KW)	-	-	
ACTIVE (KW)	8.5	SPAH 3.6.4.1	MATCHES THE POWER & OTHER HEAT LOADS
DIMENSIONS (HxWxD, IN)	UPPER:27.1X17.7X15.8 LOWER:41.3X17.7X24.0	TBE PI79-MSFC-2316,P.22	PAYLOAD ENVELOPE
VOLUME (CU FT)	14.5	TBE PI79-MSFC-2316,P.25	
MASS (LB)	639	SPAH 4.11.3.4	
TEMP EXTREMES (DEGREES F)	62 TO 65	TBE PI79-MSFC-2316,P.51	
PRESSURE EXTREMES (PSIA)	14.5-14.9	TBE PI79-MSFC-2316,P.51	
CG MAX DIST FROM MOUNT (IN)	-		
ACCESS PRE LAUNCH (LATEST HR)	HORIZ. INTEG.		LEVEL III LAUNCH - 6 TO 9 MOS.
POST LANDING (EARLIEST HR)			
DATA ACQUISITION AVAIL (Y/N)	Y		
COMMAND SYSTEM AVAIL (Y/N)	Y		
VACUUM SERVICE AVAIL (Y/N)	Y		
PURGE AVAIL (Y/N)			
VENT AVAIL (Y/N)	Y		

COMMENTS:

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OF POOR QUALITY

CARRIER CAPABIL

CARRIER	ELECYRICAL POWER: AC VOLTAGE	AC KVA	DC VOLTAGE	DC KW	TOTAL (KWH)	HEAT REJECTION: PASSIVE (KW)	ACTIVE (KW)	MAXIMUM PAYLOAD: DIMENSIONS (HxWxD, in.)	VOLUME (CU.FT.)
SPACELAB									
SINGLE RACK	115/200	2.7	28	2.1	86-226	-	MATCHES LOAD	UPPER: 27.1X17.7X15.8 LOWER: 41.3X17.7X24.0	14.8
DOUBLE RACK	115/200	2.7		2.1	86-226	-	MATCHES LOAD	UP. LEFT: 27.1X17.7X15.8 LOW.LEFT: 58.6X17.7X24 UP.RIGHT: 27.1X17.7X15.8 LOW. RIGHT: 41.3X17.7X24	33.3-34.2
DOUBLE RACK 4	115/200	2.7	28	2.1	86-226	-	MATCHES LOAD COLD PLATE -1 HEAT EXCH -4	UP. LEFT: 27.1X17.7X20.1 LOW. LEFT: 43.8X17.7X24 UP. RIGHT: 27.1X17.7X20.1 LOW. RIGHT: 41.3X17.7X24	28.2
PALLET	115/200	0.69	28	7.0	890	-	6.1	70.0X118.0X115.0	1168
HITCHHIKER	-	-	28	0.48	34	-	1.6	TBD	TBD
MIDDECK									
EAC-DOME TOP CYLINDRICAL	115	0.6	23-32	.17-.22	CONTINUOUS	90	-	31.97X16.86 (DIA.)	3.7
EAC-FLAT TOP CYLINDRICAL	115	0.6	23-32	.17-.22	CONTINUOUS	90	-	18.38X16.22 (DIA.)	2.3
EAC-RECTANGULAR DRAWER TYPE	115	0.6	23-32	.17-.22	CONTINUOUS	90	-	10.31X17.5X17.66	1.7
CONTAINER-MODULAR LOCKER	-	-	-	-	-	-	-	9.960X17.312X20.320	2.0
STORAGE LOCKER SPACES	115	0.6	23-32	.17-.22	CONTINUOUS	200	-	10.757X18.125X21	2.4
MSL	-	-	28	0.47	34	-	0.8	TOP (3): 33.6X40 SIDE (3): 28X40	-
GET AWAY SPECIAL (GAS) CANISTER	-	-	-	-	-	-	-	-	2.5-5
EXPERIMENT APPARATUS CONTAINER (PAYLOAD BAY)	-	-	-	-	-	-	-	40X16.32	-
MPESS	-	-	-	-	-	-	-	TOP: 150X27 SIDE (2): 150X27	-

FOLDOUT FRAME

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OF POOR QUALITY

RIER CAPABILITIES

MAXIMUM PAYLOAD DIMENSIONS (LXWXD, in.)	MAXIMUM PAYLOAD VOLUME (CU.FT.)	MAXIMUM PAYLOAD MASS (LBS.)	AMBIENT EXTREMES TEMP. (DEG. F)	AMBIENT EXTREMES PRESSURE (PSIA)	OTHER CAPABILITIES Y/N DATA ACQ.	COMMAND	VACUUM	PURGE	VENT	LATEST ACCESS (HRS) PRE LAUNCH	POST LAUNCH
1X17.7X15.0 3X17.7X24.0	14.5	659	62 TO 68	14.8-14.9	Y	Y	Y		Y	HORIZ INTRES	
27.1X17.7X15.0 .6X17.7X24 27.1X17.7X15.0 41.3X17.7X24	33.3-34.2	1060-1270	62 TO 68	14.8-14.9	Y	Y	Y		Y	HORIZ INTRES	
27.1X17.7X20.1 43.0X17.7X24 27.1X17.7X20.1 41.3X17.7X24	28.2	1175	62 TO 68	14.8-14.9	Y	Y	Y		Y	HORIZ INTRES	
10.0X113.0	1165	6806	-230 TO +240	0-15	Y	Y	N	N	N	PRIOR TO PAD	
TBD	TBD	1000	-250 TO +200	0-15	Y	Y	N	N	N		
16.06 (DIA.)	3.7	90	65 TO 95	7.0-10.1	N	N	N	N	N	9	10
16.22 (DIA.)	2.5	93.1	65 TO 95	-	N	N	N	N	N	9	10
X17.5X17.66	1.7	43	65 TO 95	7.0-10.1	N	N	N	N	N	9	10
17.312X20.320	2.0	50	65 TO 95	7.0-10.1	N	N	N	N	N	120	-
7X18.125X21	2.4	60	65 TO 95	7.0-10.1	N	N	N	N	N	9	10
): 33.6X40 3): 29X40	-	680	PASSIVE: -250 TO +200 ACTIVE: 56 TO 120	EAC:14.7-20.5 OTHER: 0-15	Y	Y	N	N	N	336	6-12
-	2.5-5	60-200	-140 TO +176	0-14.7	N	Y	N	Y	Y	4504	72
0X16.32	-	275	-	14.7-20.5	N	STET	N	STET	STET		
50X27 2): 150X27	-	5000	-250 TO 200	0 TO 14.7	N	N	N	N	N	336	6-12

FOLDOUT [illegible]