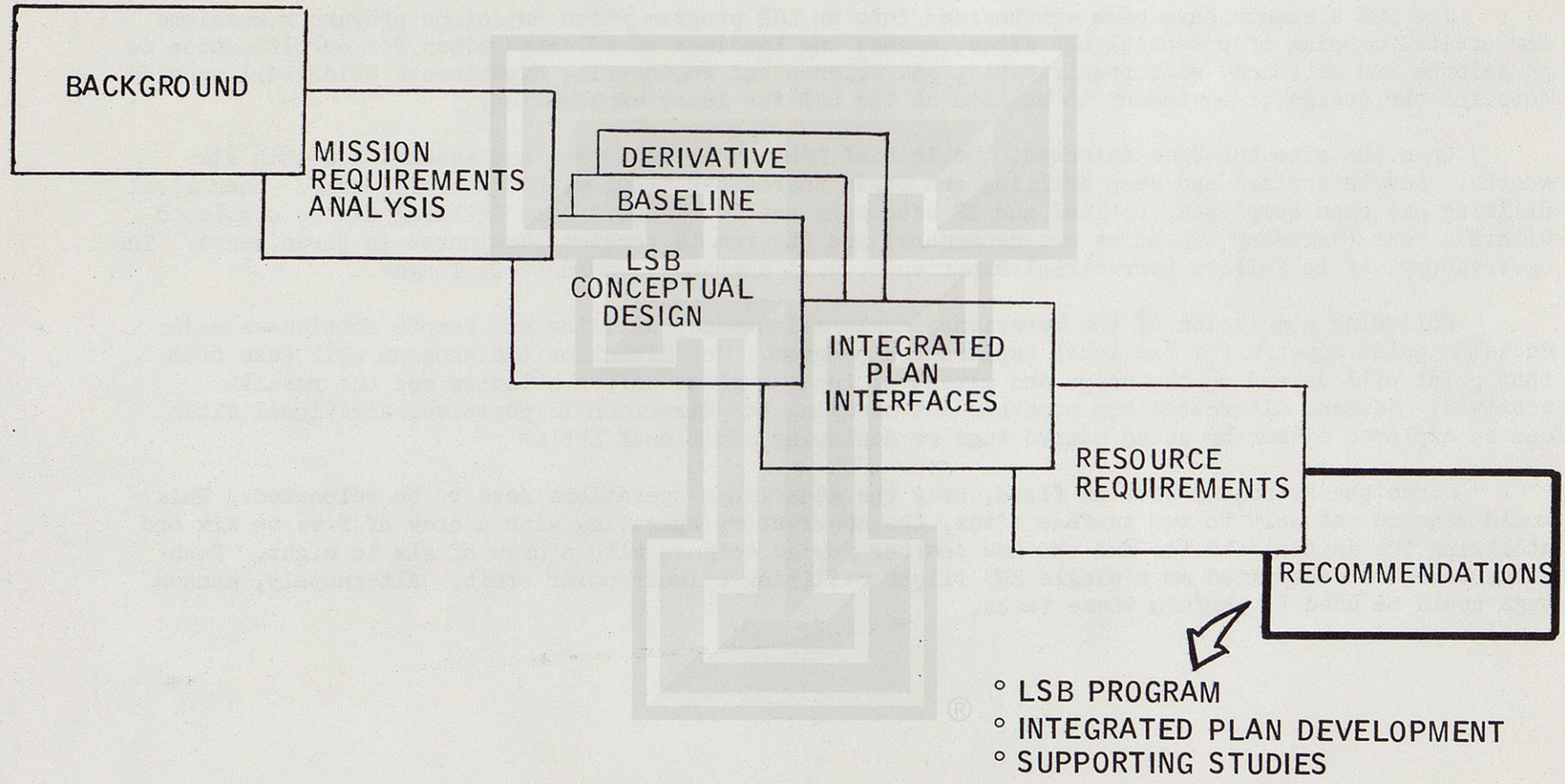
PRESENTATION OUTLINE



BASELINE LSB PROGRAM

The LSB elements have been synthesized into an LSB program which envisions precursor missions for orbital mapping of potential LSB sites, manned tug landings at selected sites for certification to geoscience and astronomy site requirements, and science and engineering experiments which will provide data for the design of equipment to be used at the LSB for lunar exploration.

Once the site has been selected, the initial LSB can be delivered and assembled within six months. Remote sorties and deep drilling can begin thereafter along with radio astronomy. When local drilling has been completed, optical and IR astronomy are initiated. Deep drilling can be completed within a year (assuming two holes are necessary) and the remote sorties terminated in three years. The observatory, if it follows terrestrial experience, will continue considerably longer.

Following completion of the geoscience exploration--deep drilling and remote sorties--a major decision point appears for the lunar exploration program. The direction the program will take from that point will depend on the scope and extent of lunar surface differentiation and the results achieved. Several alternates are possible but assuming the direction is positive, additional sites can be explored either by using manned tugs or deploying additional LSB's.

Since the astronomy site is fixed, only the geoscience operations need to be relocated. This would require resupply to two surface sites, the observatory operating with a crew of five to six and utilizing the initial shelter and the new shelter for geoscience with a crew of six to eight. Both sites could be resupplied on a single RNS flight utilizing a lunar polar orbit. Alternately, manned tugs could be used to perform these tasks.

BASELINE LSB PROGRAM

PRECURSOR MISSIONS

- ORBITAL MAPPING
- MANNED SITE CERTIFICATION LANDINGS

DEPLOY INITIAL LSB

- COMPATIBLE WITH GEOSCIENCE AND ASTRONOMICAL REQUIREMENTS

UNMANNED TRAVERSES

EVALUATE ALTERNATIVES FOR FURTHER EXPLORATION

- LUNAR DIFFERENTIATION DATA
- NUMBER AND GROUPING OF SITES

SUCCESSOR MISSIONS

- LSB: LONG TERM EXPLORATION AT GROUPED SITES
- OLS/TUG: SHORT DURATION EXPERIMENTS AT WIDELY DISPERSED SITES

INFERENCES ON INTEGRATED PLAN

One of the more significant conclusions of the study is that there can be significant cost savings in the development of an LSB by incorporating the subsystems and technology from the EOSS development. Further savings can be achieved if the configuration adopted for the EOSS maintains compatibility with eventual use in a lunar surface environment. Specifically, this includes utilizing small modules, longitudinal floors, and sufficient head room to permit horizontal deployment and occupancy in a one-sixth gravity field. Modules sized to be compatible with the EOS cargo bay; i.e., 15-foot diameter, will be optimal for LSB application.

In general, it was found that the strongest influence on the cislunar shuttle resulting from the LSB program occurred during the initial buildup phase. Further study of concepts which would permit a high rate of cargo transfer for a few months without compromising the subsequent stretched-out resupply appears to be warranted.

The LSB program can be a significant driver on the tug concept if it is determined that a single configuration should be utilized for both earth orbit and lunar landing missions. The delivery of multiple large modules to the lunar surface imposes unique requirements on the tug structure, thermal control, navigation and control as well as potentially affecting the overall configurational arrangement. The expendable tank set concept appears most desirable for the lunar surface applications.

INFERENCES ON INTEGRATED PLAN

EARTH ORBIT SPACE STATION

- PROVIDES DIRECTLY APPLICABLE SUBSYSTEMS AND TECHNOLOGY
- POTENTIAL MODULE USE IF COMPATIBILITY MAINTAINED

  SMALL MODULES ($\leq$ 15-FT DIAMETER)

  LONGITUDINAL FLOORS FOR HORIZONTAL DEPLOYMENT

  HEADROOM FOR 1/6-G OCCUPANCY

CISLUNAR SHUTTLE

- HIGH CARGO RATE DURING BUILD-UP REQUIRES ALTERNATE MODE

REUSABLE SPACE TUG

- LUNAR LANDINGS W/FOUR LARGE MODULES IS MAJOR CONFIGURATION DRIVER
- EXPENDABLE TANK SET CONCEPT APPEARS DESIRABLE

POTENTIAL SUPPORTING STUDIES

No outstanding advancements in the state of the art were found to be required to implement the LSB concepts described. As indicated, the LSB will benefit from the development accomplished on the other elements of the integrated space program, particularly the EOSS. Some areas which appear to be unique to lunar missions (and perhaps planetary) and which could benefit from supporting research and technology/advanced research and technology were identified in Volume I of the final report.

The planning effort on this study indicated that the LSB project Phase B effort would not need to be initiated until GFY 1977 to support a January 1985 initial launch. However, there appear to be areas which are associated with the LSB definition that could be studied in somewhat more depth than the scope of this study permitted. Typical examples of these studies include:

1. Additional site analyses to narrow the choices and to determine what supporting sites might be required.
2. Further definition of the mobility equipment concepts identified to bring them to the same definition level as the shelter.
3. Further definition of the major science elements; i.e., the telescopes and drills with the same purpose as above.
4. Definition of a data relay satellite for deployment in a Halo orbit around the L_2 libration point.
5. Evaluation of the hardware and program impacts of potential concepts for oxygen recovery from lunar rocks.
6. Development of a concept for a simulated LSB to be deployed in a selected earth location for investigation of operational and hardware concepts.

It should be emphasized that none of the above are considered to be constraints to the initiation of the LSB project Phase B, but will provide conceptual and parametric data on additional "building blocks" on the integrated plan for utilization in programmatic decisions in the same way the Lunar Base Synthesis Study has.

POTENTIAL SUPPORTING STUDIES

NO PACING TECHNOLOGY OR SYSTEMS STUDIES IDENTIFIED FOR LUNAR SURFACE BASE PHASE B

POTENTIAL ASSOCIATED DEFINITION STUDY AREAS

- LUNAR BASE SITE ANALYSES
- MOBILITY CONCEPT PHASE A
- MAJOR SCIENCE ELEMENT PHASE A's
- HALO ORBIT DATA RELAY SATELLITE PHASE A
- HARDWARE AND PROGRAM IMPACT OF OXYGEN MINING
- CONCEPT DEFINITION OF SIMULATED LSB

WOULD PROVIDE ADDITIONAL "BUILDING BLOCKS" OF INTEGRATED PLAN

STUDY SIGNIFICANCE

It is felt that conducting the study of the Lunar Surface Base at this time has resulted in several significant accomplishments. First, it is believed that the science program which has been described is sufficiently complete and definitive to be utilized as a planning tool until the acquisition of higher resolution data permits a more detailed examination of the distribution of surface features.

Similarly, the close inter-relationship between the mobility, power source, and shelter subsystem concepts which has been disclosed infer programmatic guidelines for the eventual implementation approach. It is felt that the specific concepts described can form a baseline for planning for any approach to extended lunar surface operations.

Finally, it has been shown that the LSB can be implemented utilizing the subsystems and technology developed in other elements of an integrated plan and can support a significant scientific exploration and exploitation of the moon with relatively higher safety and lower risk than any other approach.

STUDY SIGNIFICANCE

- SCIENCE PROGRAM DEFINITION

  RELATED TO LUNAR CHARACTERISTICS

  NEXT STEP REQUIRES HIGHER RESOLUTION

- INTEGRATED MOBILITY / POWER / SHELTER CONCEPTS

  PROVIDES FEASIBLE BASELINE FOR EXTENDED LUNAR SURFACE OPERATIONS

- LSB IS A REASONABLE EXTENSION OF CAPABILITIES INHERENT IN INTEGRATED PLAN

  EFFECTIVE SCIENCE PROGRAM

  HIGH SAFETY

  LOW RISK