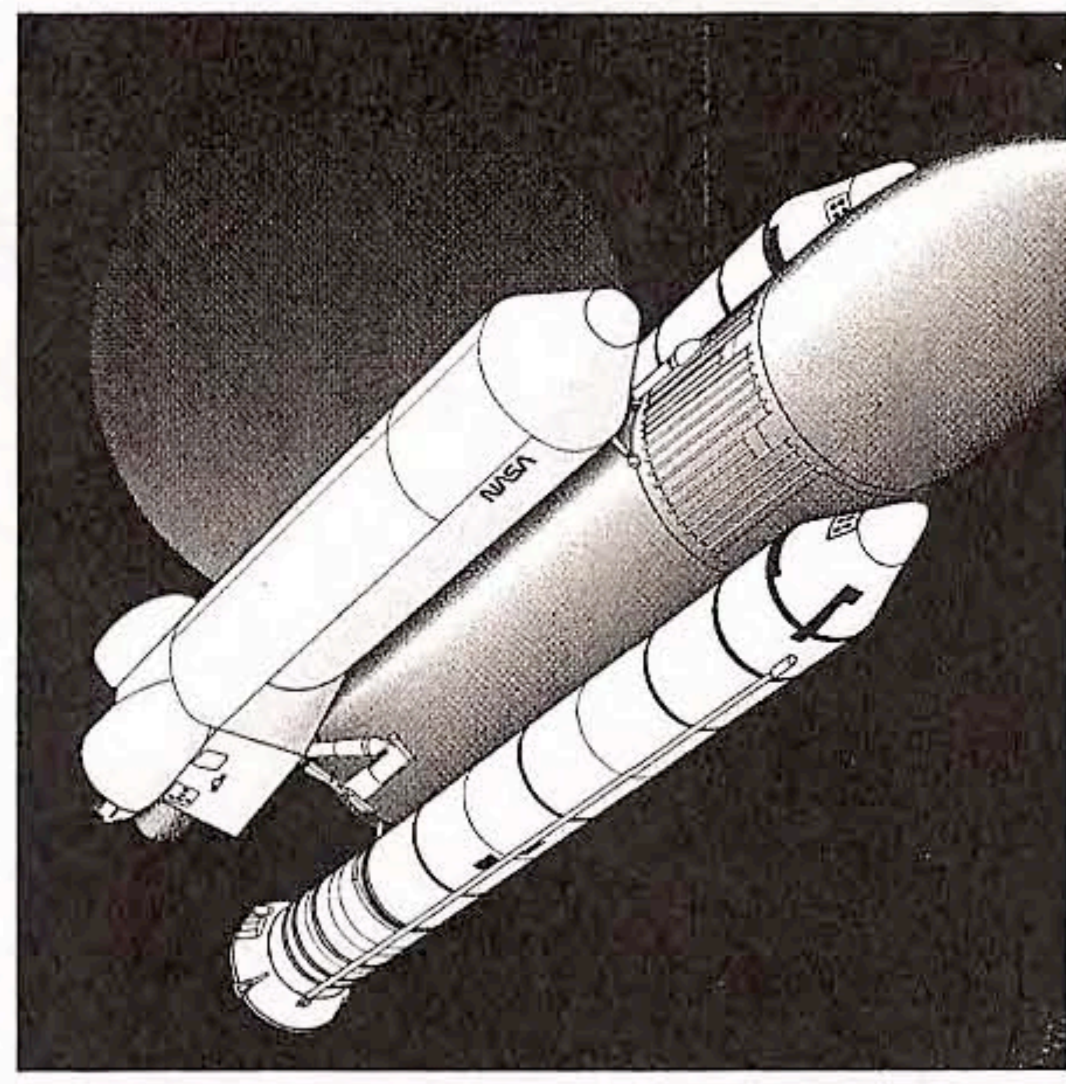
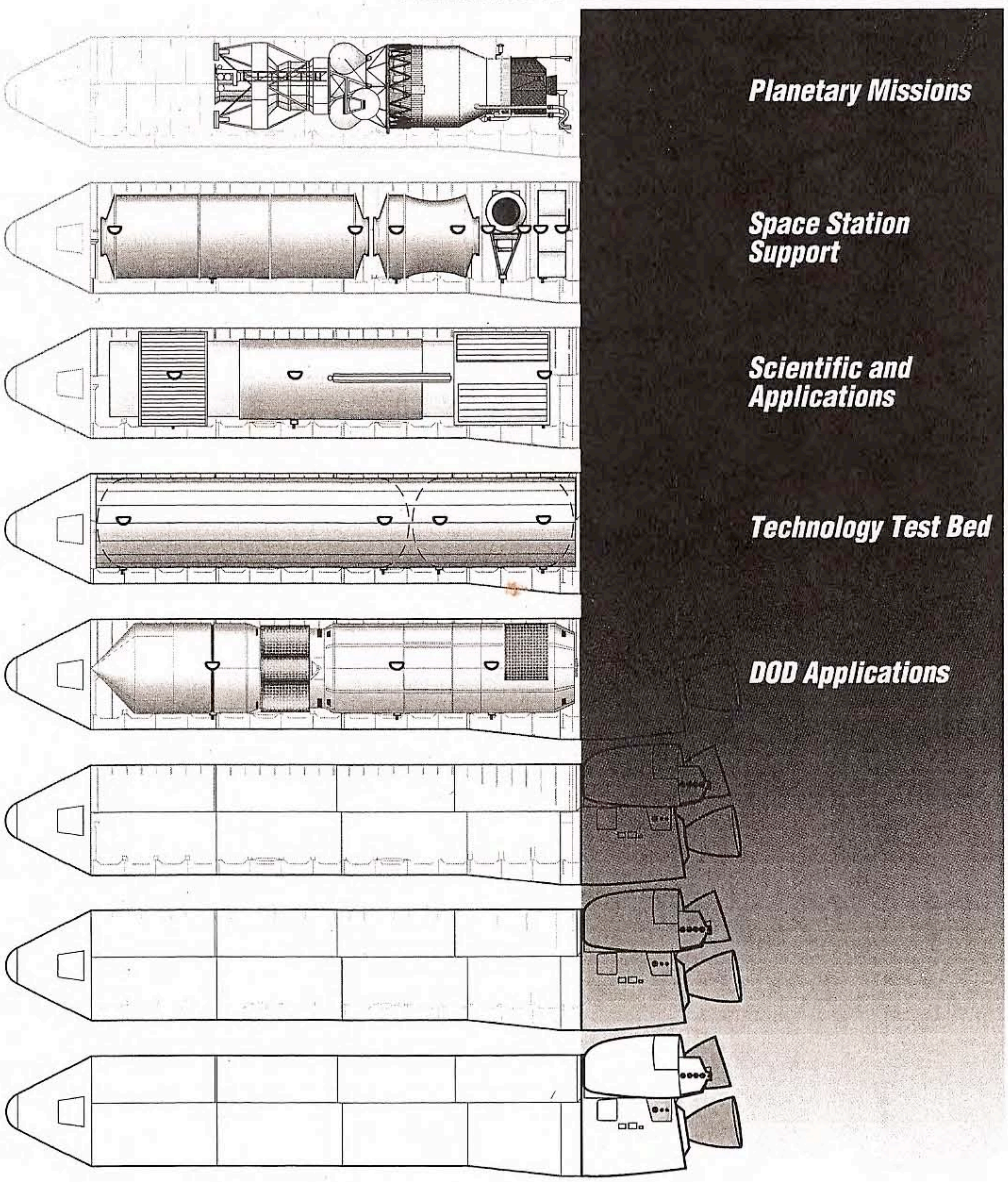
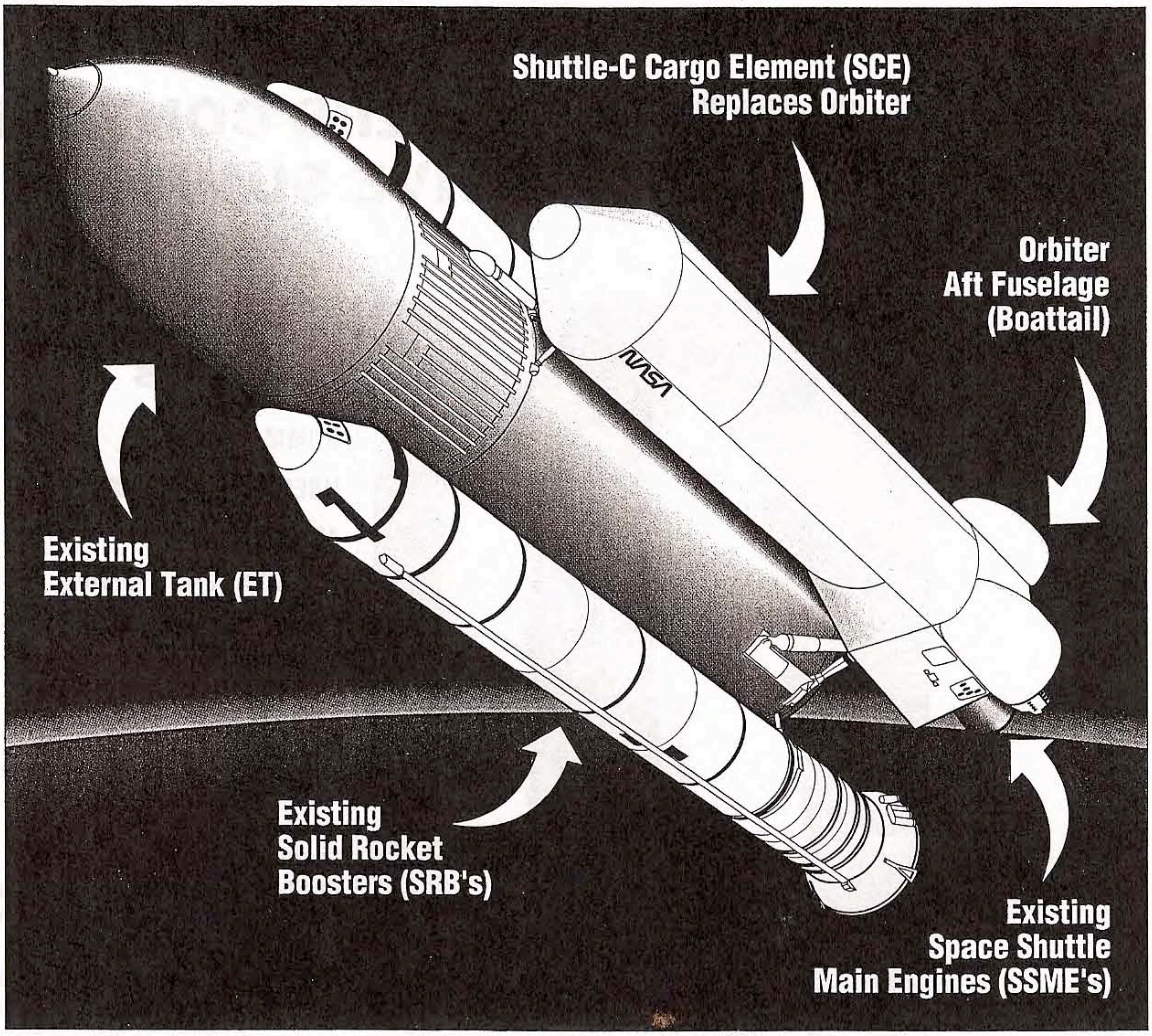
Shuttle-C Users Conference

EXECUTIVE SUMMARY

TODAY'S LAUNCH VEHICLE FOR TOMORROW







Shuttle-C Ascent Performance Capability (lb)

		ETR				WTR
		220 nmi 28.5 deg.	110 nmi 28.5 deg.	110 nmi 98.7 deg.	30x200 nmi 28.5 deg.	110 nmi 98.7 deg.
BASELINE DESIGN	2 SSME @ 100%	82,750	93,700	n/a	105,900	57,460
	@ 104%	88,180	99,100	n/a	112,400	62,800
	3 SSME @ 100%	141,300	151,100	53,200	162,900	111,000
	@ 104%	145,200	155,000	57,200	167,400	115,100
BASELINE + ASRM	2 SSME @ 104%	99,620	110,540	13,900	124,400	74,300
	3 SSME @ 104%	156,600	166,500	68,600	179,400	126,400

SUMMARY

OVERVIEW

Shuttle-C, the unmanned cargo version of the Space Shuttle, is the best near-term solution to America's expanding need to place large, heavy payloads in Earth orbit.

Shuttle-C is the only vehicle which can bridge the gap between the limitations of launch vehicles in the 1980's and the demands of payloads in the 1990's and early 21st century. Attendees at the Shuttle-C User's Conference , held May 25-26, 1989, in Huntsville, Ala., showed great enthusiasm for development of such a heavy-lift launch vehicle, and agreed that when it becomes available it will have a major impact on payload planning, including expansion beyond current design limits.

Shuttle-C will be of greatest advantage to large payloads—such as planetary missions, large-aperture telescopes and antennas, or Space Station—where cost or risk goes up due to orbital assembly or multiple Shuttle launches. Even with existing upper stages Shuttle-C can provide the high energy needed for many missions to geostationary orbit and the planets.

Because it is an upgrade to an existing vehicle—like the Delta, Atlas, and Titan familes for almost 30 years—Shuttle-C development and production require only a modest investment in new or modified systems and facilities. Further, many existing or planned payloads will be able to use Shuttle-C without modification as soon as the vehicle is available.

Many attending the conference expressed the belief that Shuttle-C will attract the most users if it is operated in a manner comparable to today's expendable launch vehicles (ELV's) with correspondingly easier payload integration and fewer flight restrictions than the manned Shuttle has.

Potential Shuttle-C users indicated that they will not design payloads for Shuttle-C until the program is approved as a "new start." However, experience shows that payloads expand to fill whatever envelope is offered.

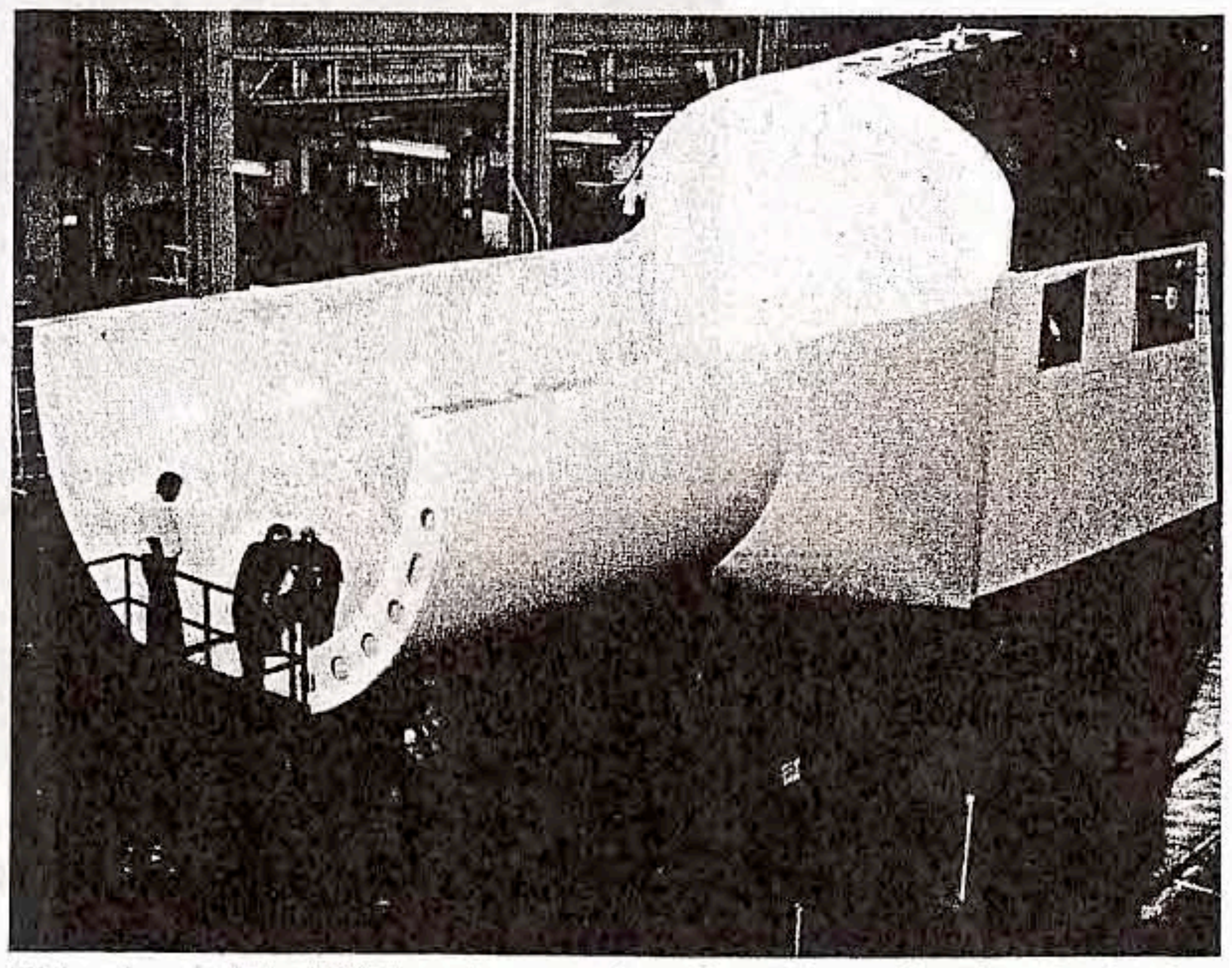
The Shuttle-C Users Conference was conceived as a means of fully explaining the purpose, design, and capabilities of Shuttle-C and to communicate better to the payload user community how they could best use Shuttle-C, how it would benefit their programs, and what changes might be needed to satisfy their needs. The conference was well-attended by more than 350 persons from government and industry. The morning session on May 25 provided an overview of Shuttle-C design and operations (see Appendix A). The afternoon session encompassed five user-oriented workshops, followed by a preliminary summary. A final summary was given the morning of May 26 after tours of the Shuttle-C Engineering Development Unit and Space Station at Marshall Space Flight Center.

Highlights of the five user workshops (discussed in the next section) include:

- **Planetary Missions**—Shuttle-C combined with the Centaur upper stage can put large probes on direct trajectories to the planets, thus reducing mission time, cost, and complexity. However, a more powerful upper stage is still needed for the more ambitious missions now planned.
- **Space Station Support**—Shuttle-C can reduce both the number of launches required to assemble Space Station Freedom and the work required to assemble and outfit the Station.
- **Scientific and Applications**—Shuttle-C can launch large, heavy platforms that will soon be required by Mission to Planet Earth and by the astrophysics and life sciences disciplines. On-orbit assembly will be required for the larger platforms and telescope apertures now envisioned without a heavy-lift vehicle.
- **Technology Test Bed**—Shuttle-C can be used to test new and modified systems including advances in propulsion for Shuttle, ALS, and other launchers—without risk to human life or national resources such as the Shuttle orbiter, and as a platform for low-cost experiments.
- **DOD Applications**—Shuttle-C can place large masses into polar orbit from both the Western and Eastern Test Ranges, and in retrograde orbits from the Western Test Range for new coverage methods.

Not all matters concerning Shuttle-C and potential users were resolved at this conference. Users expressed their desire that launch vehicle loads be defined and disseminated as soon as possible, and that Shuttle-C not be bound by manned flight safety requirements. Interest was expressed in follow-on analyses of "low cost" systems to determine their true cost, and of trajectory options for launching deep-space missions without major changes to Shuttle-C or current upper stages. Considerable interest was expressed in payload carriers wider than the current 15 feet for Space Station support, large scientific payloads, and DOD missions.

Finally, the attendees agreed that further meetings should be held with specific user groups to maintain the dialogue initiated by this conference.

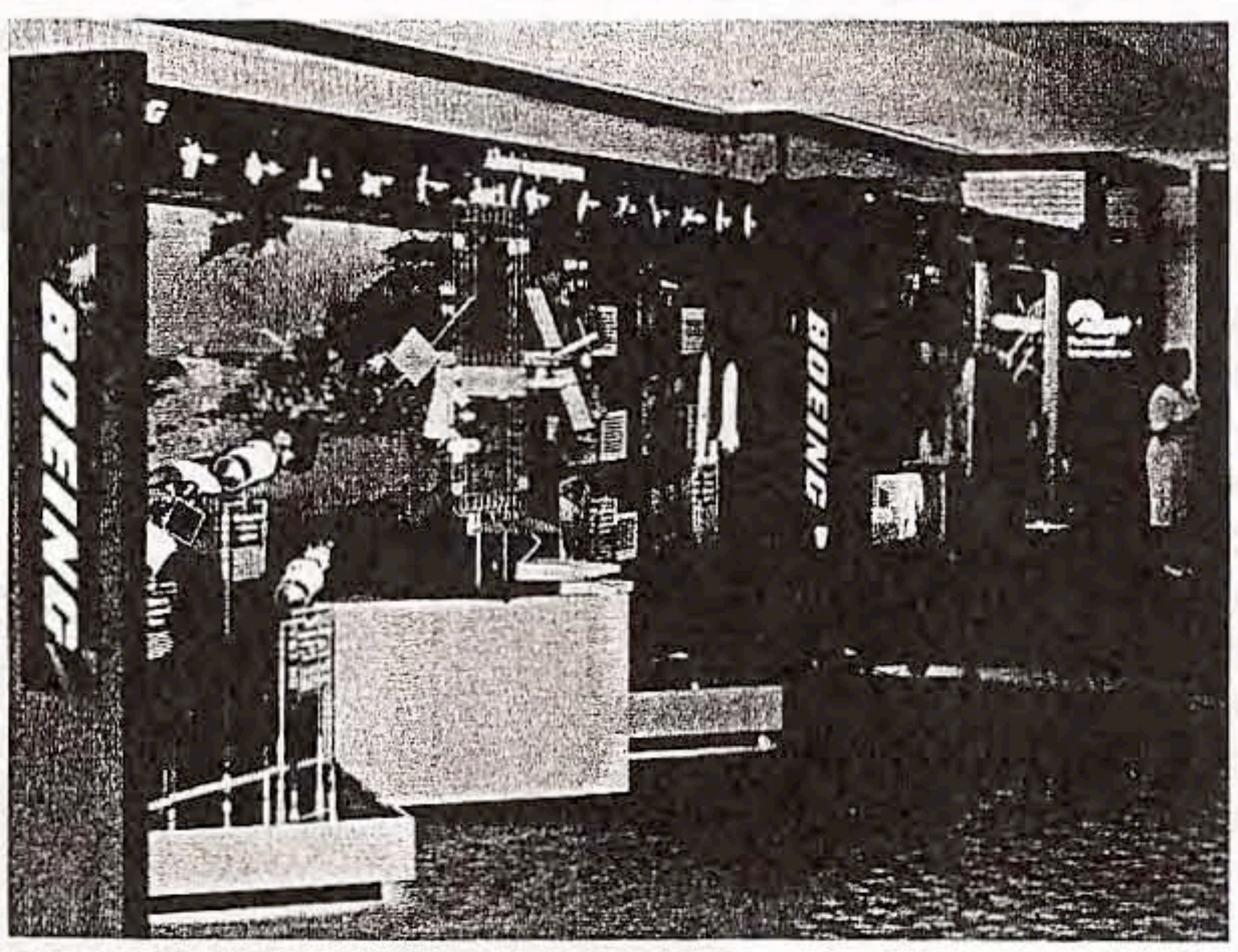


This view of the EDU under construction shows its simple design approach.

ADDITIONAL FINDINGS

Additional findings and suggestions from the workshops include:

- Shuttle-C should be justified primarily on the basis of expanded mission capabilities, and on reduction in cost-per-pound of payload to orbit rather than on cost-per-flight economics.
- NASA should investigate the problems attendant with manned space flight, and make recommendations to simplify the Shuttle-C payload process as much as possible.
- Flight loads and requirements should be defined as soon as possible, and the design of Shuttle-C altered as necessary to maintain those loads rather than forcing payloads to change as Shuttle-C changes.
- A three-engine Shuttle-C placing a Centaur/planetary payload into a highly elliptical orbit, and variable launch azimuth capabilities, should be assessed to see if they improve direct trajectory missions. Tandem Centaur arrangements should also be investigated.
- IUS should also be considered as an upper stage for Shuttle-C; Centaur is not the only possibility.
- The impact of Shuttle-C on upper stage design should be assessed, especially for deep-space missions with large energy requirements.
- Risk and contingency analyses are needed for combined OMV/Shuttle-C operations with Space Station.
- Securing the Shuttle Cargo Element (SCE) Processing Facility for national defense payloads should be investigated.
- Development of both baseline (15-foot-diameter) and widebody (beyond 15 feet) payload carriers should be investigated, including the costs and facility impacts of having both, or of having only the widebody carrier and flying narrower payloads within it.



Clockwise from above, attendees reviewed exhibits provided by Lockheed and Martin Marietta; General Dynamics; UTC; and Boeing and Rockwell. Morton Thiokol and Metier Management Systems also provided exhibits.