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THE HL-20 AS THE PERSONNEL LAUNCH SYSTEM

by

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To ensure manned access to space, the Personnel Launch System is under consideration by NASA as a complement to the Space Shuttle (fig.1). Its primary mission will be to transport crew and passengers to and from Space Station Freedom in low-earth orbits. There are currently two design studies being funded: a biconic, ballistic-shaped vehicle at the Johnson Space Center and a lifting body concept at Langley Research Center.

In the late 1950's, both NASA and the Air Force were engaged in the study of lifting bodies for low-earth orbit vehicles. Projects included the M2F2 series, the X24 series, and the HL-10 (developed here, at Langley) (fig. 2). These lifting bodies drive their lift solely from the shape of the fuselage. By the mid-1960's, full-scale models were actually built and tested with some success and some failure. Langley's HL-10 was one of the most successful of these projects. However, these studies were temporarily shelved while work progressed on the Space Shuttle. Some of the test results from these studies actually led to concept refinements on certain aspects of the Shuttle development.

Due to the more recent successes of the Shuttle program and a directive to place a Space Station in orbit, there has been renewed interest in developing a lifting body vehicle as the Personnel Launch System. The vehicle, the HL-20, is a Langley Research Center project in the Space Systems Division, involving the efforts of a number of individuals (figs.3,4,5).

Data on the research carried out thusfar for peer and lay review has been available in hard copy formats, but a need existed for actual video footage, combined with scientific visualization technology, for presentation and archival purposes (figs.6,7,8,9,10,11). This ASEE project will satisfy that need. An informational videotape is being produced which briefly identifies and explains the research conducted on the Personnel Launch System in development at Langley.

Areas of investigation to be covered include Computational Fluid Dynamics, Wind Tunnel Testing, Human Factors Research, and Flight Simulation. Since the individuals involved are more knowledgeable and hold far more credibility in their content areas than any producer, interviews with each them, including the Project Manager and the Chief of the Division, serve as the storyline for the narration of the visuals. Both the interviews and scientific visualization data have been collected by videotaped field recordings, Ethernet, and/or video laser disc (figs.6,7,8,9,10,11).

As indicated above, the target audience, identified by the Space Systems Division, would actually be two separate classes of viewers. This makes the producer's job of content explanation much more complicated. In an effort to resolve this, the technical scientific visualization data will be underscored by a simpler voice-over narration process whenever necessary.

The editing process is accomplished using the Composium, a state-of-the-art, high-end computer in the Analysis and Computational Division. The computer allows one to multi-layer up to four separate images. In addition, it is possible to enhance the image, simulate motion and actual environments (e.g., space), or to include titling on static and real images. As the Composium has been designed primarily for multi-layering and graphics, it is not typically a real-time videotape editing system. Therefore, the editing process is much more time-consuming; yet, the editor is capable of performing many additional features. Some of the visualization, including the actual model, will be placed in simulation situations for the purpose of explanation and clarification (fig. 12).

To date, all of the first phase (preproduction) has been completed. This included considerable time spent on researching hypersonic technology and the history behind the HL-20 in order to ask specific questions relevant to each area of investigation in an effort to have the correct content information necessary for the videotape, securing necessary equipment (Sony Betacam video camera, audio equipment and facilities for voice-over production, a field lighting kit and videotapes) and personnel (an employee in the Flight, Software & Graphics Branch was trained by the Producer), and scheduling. The Producer also attended an intensive week-long workshop on Composium Operations. Most of the second phase (production) has been completed. To date, one interview and additional cover video shots remain to be videotaped. The final phase (postproduction) will take place during the last two weeks of the program. The videotape will begin with an opening shot of the current HL-20 full-scale model simulated in a flight situation; then, a historical overview (with actual footage of predecessors of the vehicle), will be presented. At this point, the project participants will be the basis of audio portion with only connective or explanatory narration supplied. During their soundbites, video footage of their research will be edited in to accompany the explanations. However, due to unforeseen circumstances involving the equipment, a request has been made for an extension to complete the project.

References

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2. Hallion, Richard P., ed., The Hypersonic Revolution, Eight Case Studies In The History of Hypersonic Technology, From Max Valier to Project Prime, Volume I, 1924-1967, Special Staff Office, Aeronautical Systems Division, Wright-Patterson Air Force Base Office, Ohio, 1987.

3. Hallion, Richard P., On The Frontier, Flight Research at Dryden, 1946-1981, The NASA History Series, Scientific and Technical Information Branch, NASA, Washington, D.C., 1984.

4. Piland, William M., Theodore A. Talay, and Howard W. Stone, "Personnel Launch System Definition," IAF-90-160, NASA Langley Research Center, Virginia, 1990.

5. Wilkinson, Stephan, "The Legacy of Lifting Body," Air & Space, April/May 1991, pp. 50-62.

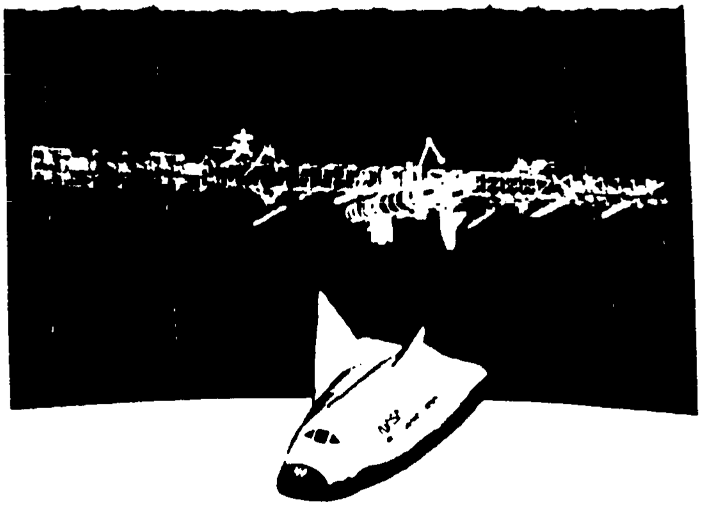

Figure 1. NASA Langley lifting-body PLS.

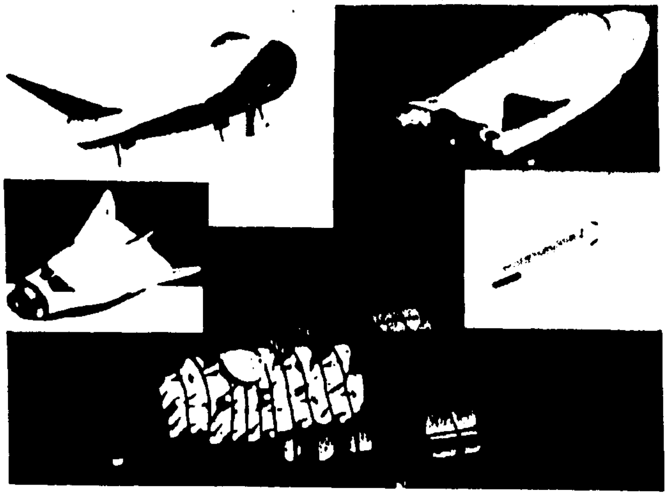

Figure 3 Aspects of the NASA Langley PLS.

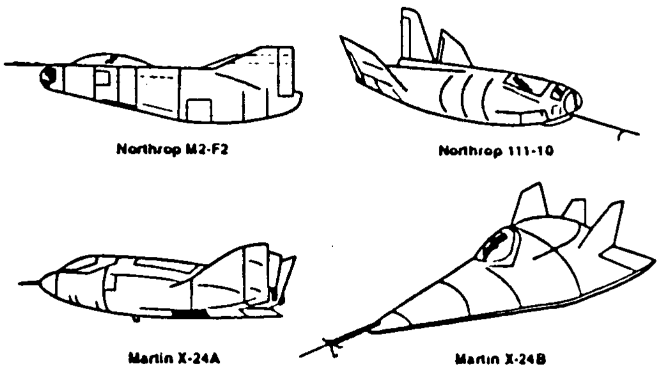

Figure 2. U.S. lifting-body configurations (1960's-1970's).

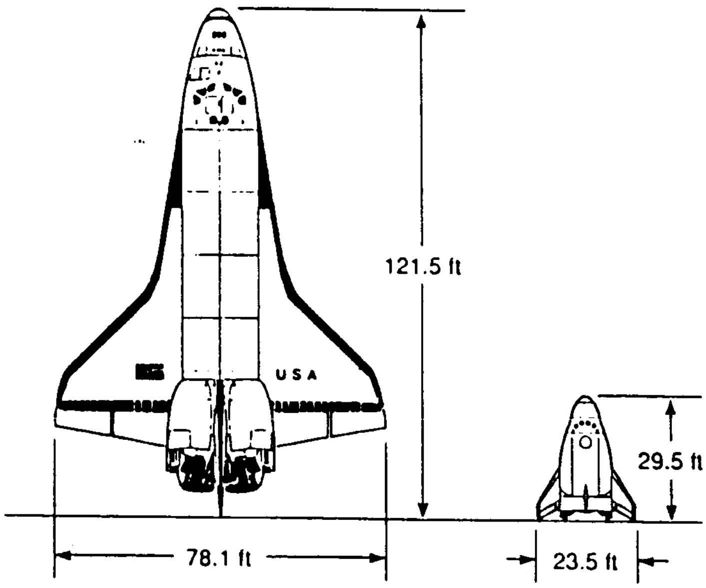

Figure 4. STS Orbiter and PLS planform comparison. (Courtesy Rockwell International Corp.)

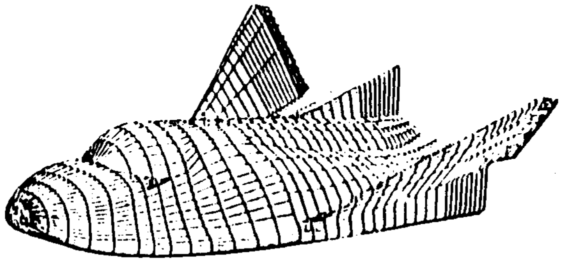

Fig. 5. A PLS Shape Proposed by LaRC.

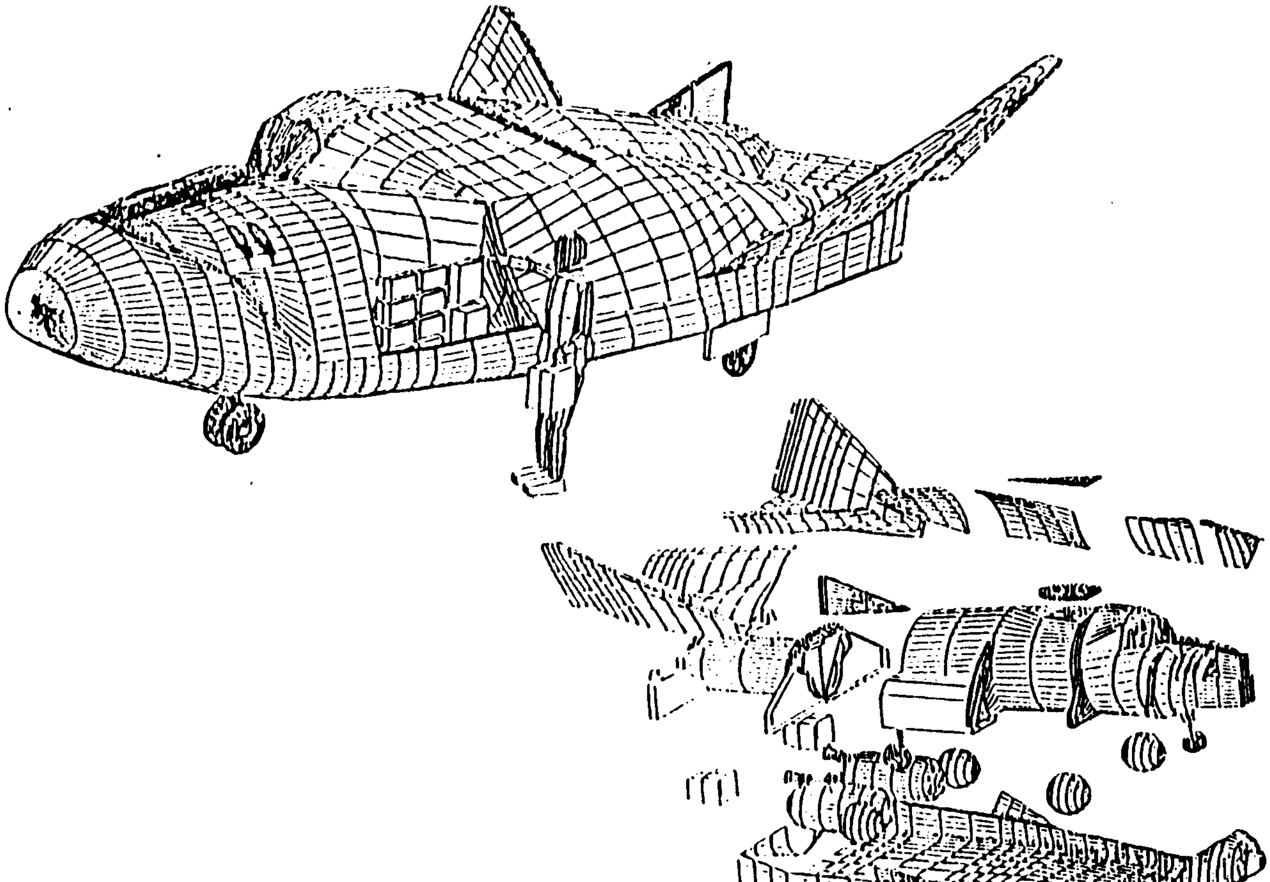

Figure 6. PLS hypersonic test model.

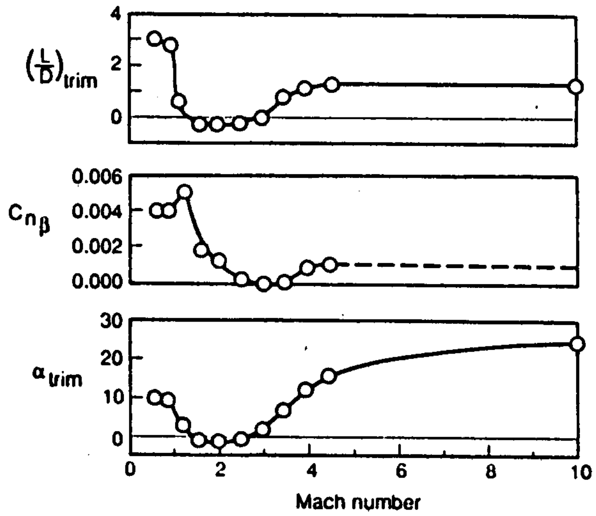

Figure 7. Summary PLS aerodynamic characteristics.

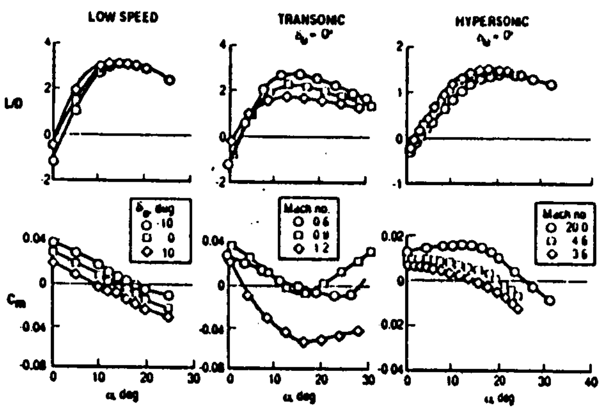

Figure 8. PLS longitudinal aerodynamic characteristics (moment ref. = 0.54L).

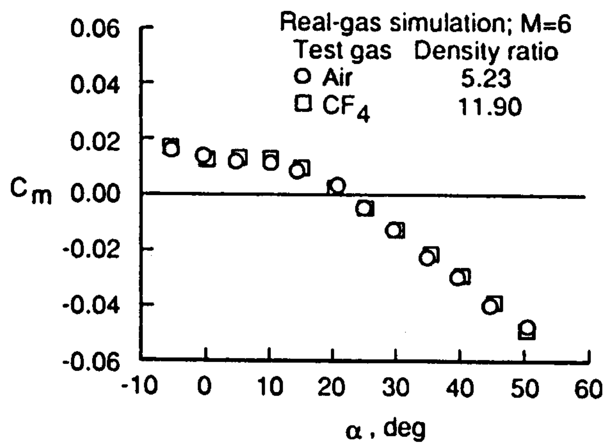

Figure 9. Hypersonic aerodynamic real-gas effects.

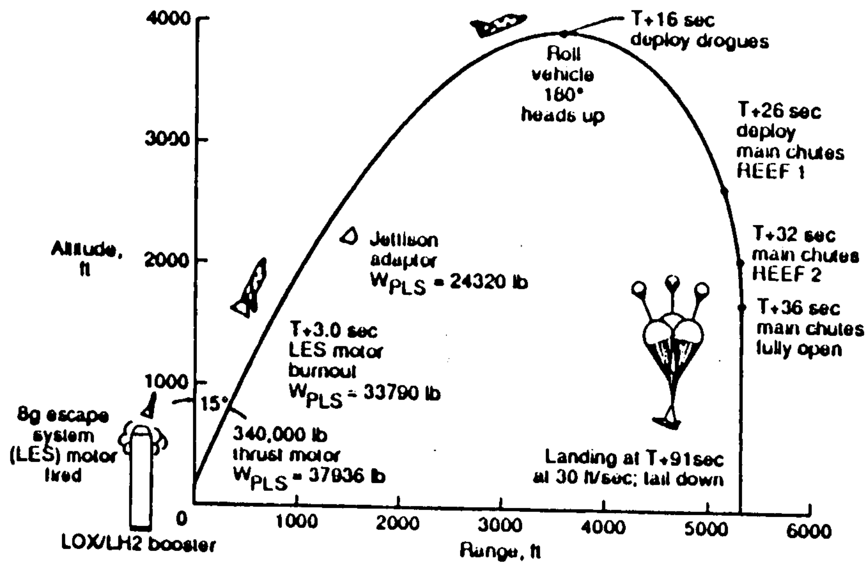

Figure 10 . On-pad launch escape sequence.

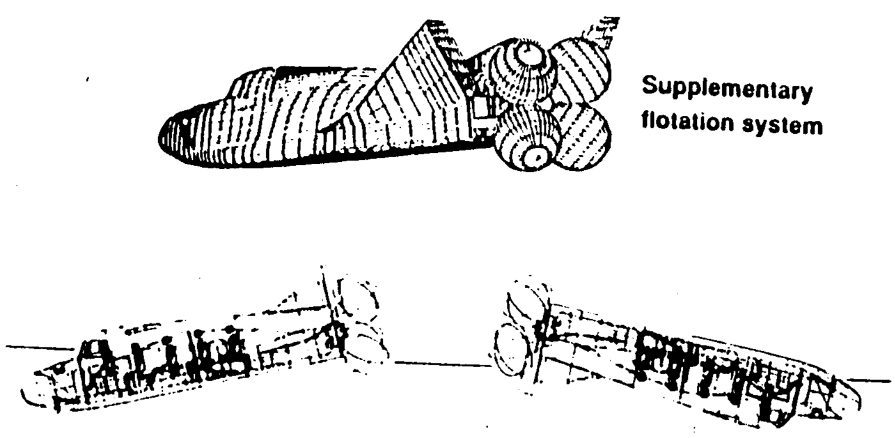

Figure 11 . Flotation concept for dry aft hatch. (Courtesy Rockwell International Corp.)

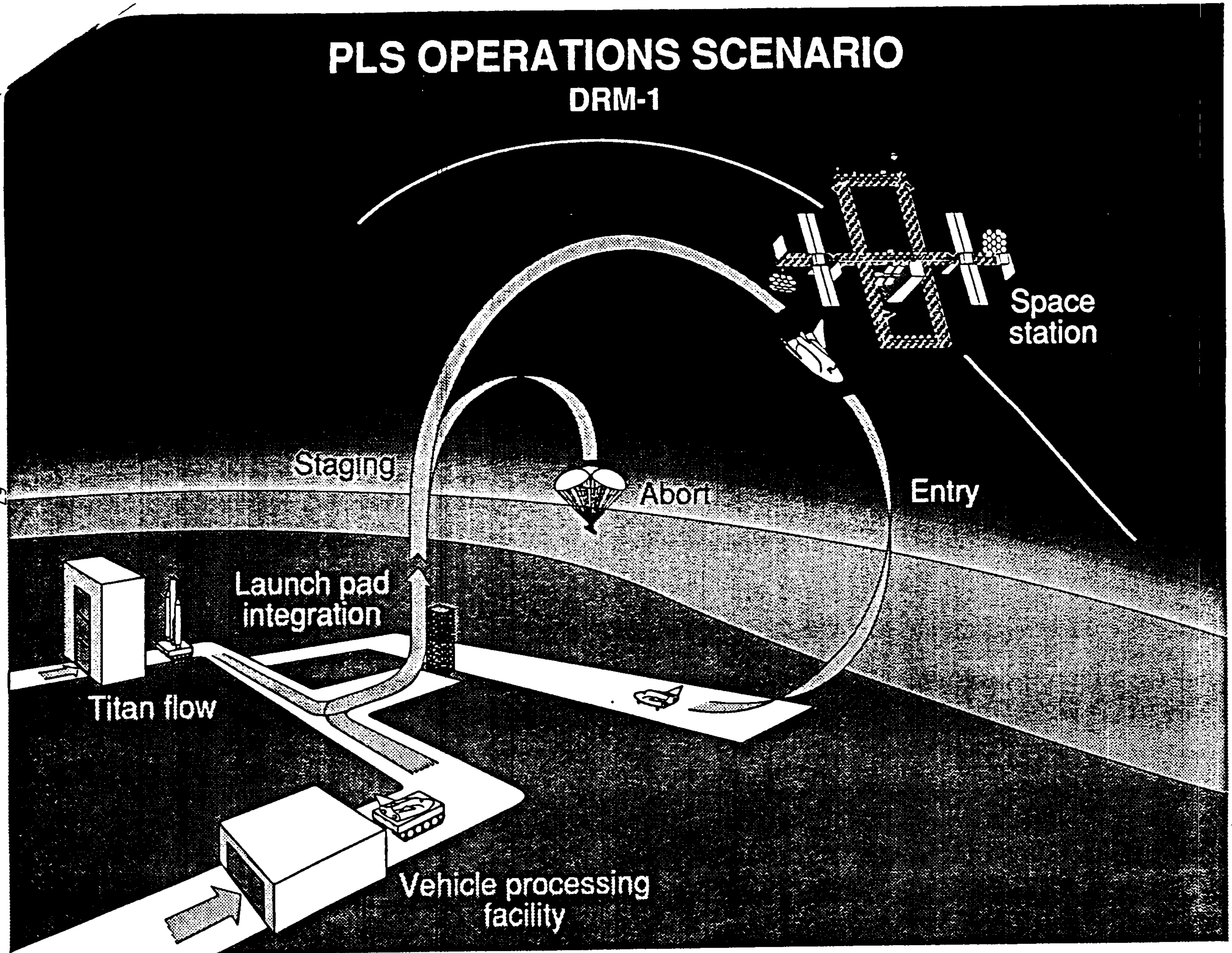
PLS OPERATIONS SCENARIO
DRM-1
Space station
Staging
Abort
Entry
Launch pad integration
Titan flow
Vehicle processing facility

Figure 12