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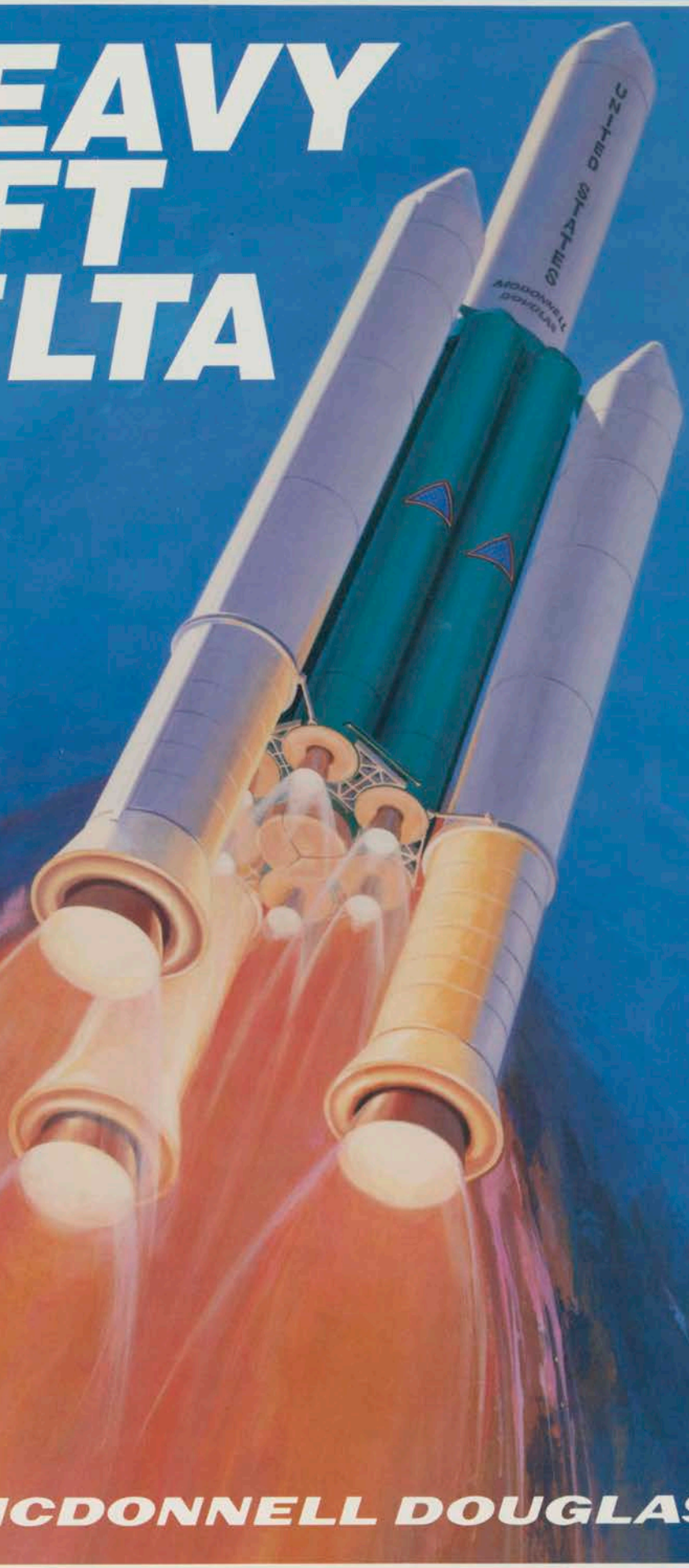
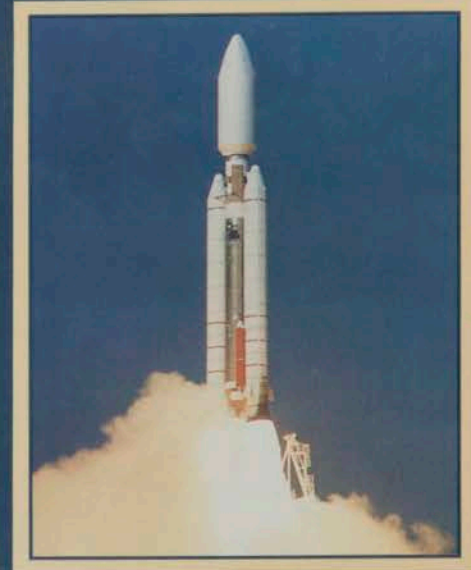
HEAVY LIFT DELTA





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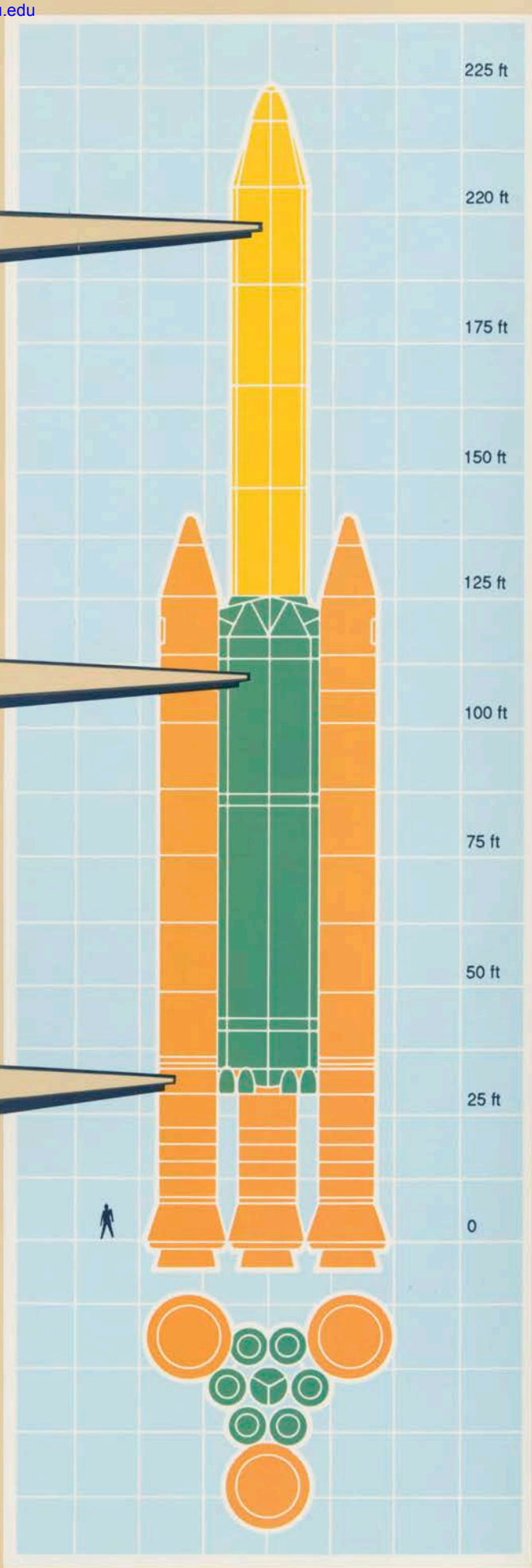

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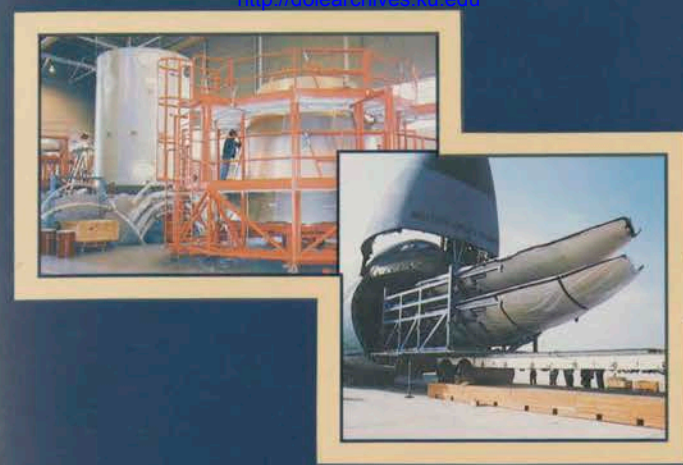
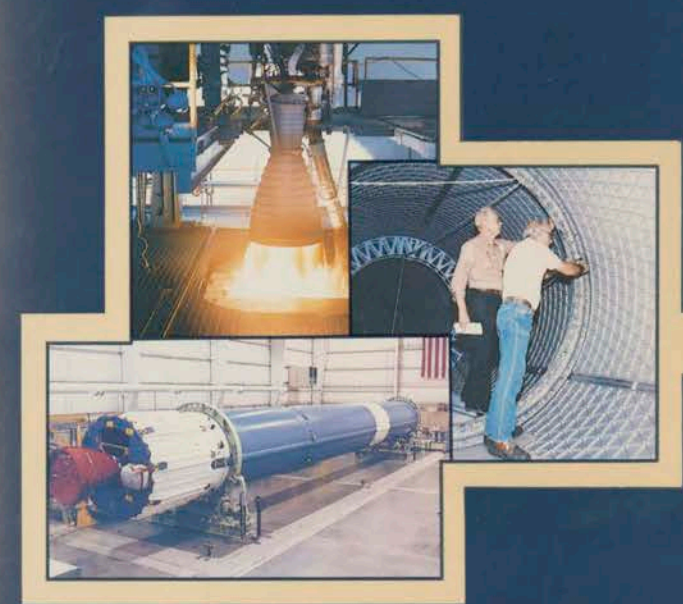
Titan IV – For the Heavy Lift Delta, the payload fairing is a Titan IV configuration. A separate cylindrical section is added to increase the total payload area length to 100 ft. This payload area is the same diameter as the shuttle cargo bay, and longer, providing increased payload volume.

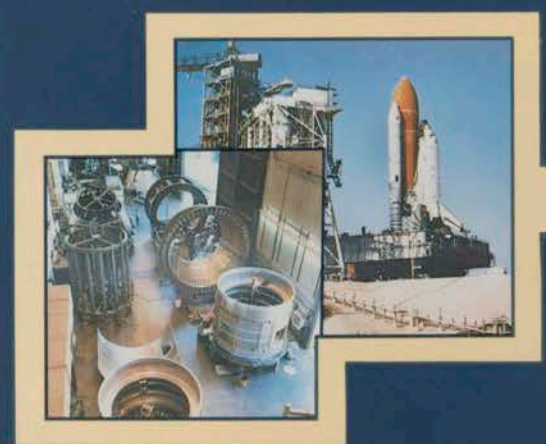
Delta II – Current, flight-proven systems constitute all HLD propulsive stages. Ignited at liftoff as part of the HLD first stage, a cluster of six interplumbed liquid propellant Delta II first stages provides 1,244,100 lb of thrust. The HLD second stage employs a single air-started Delta II first stage nested within the cluster of booster stages.

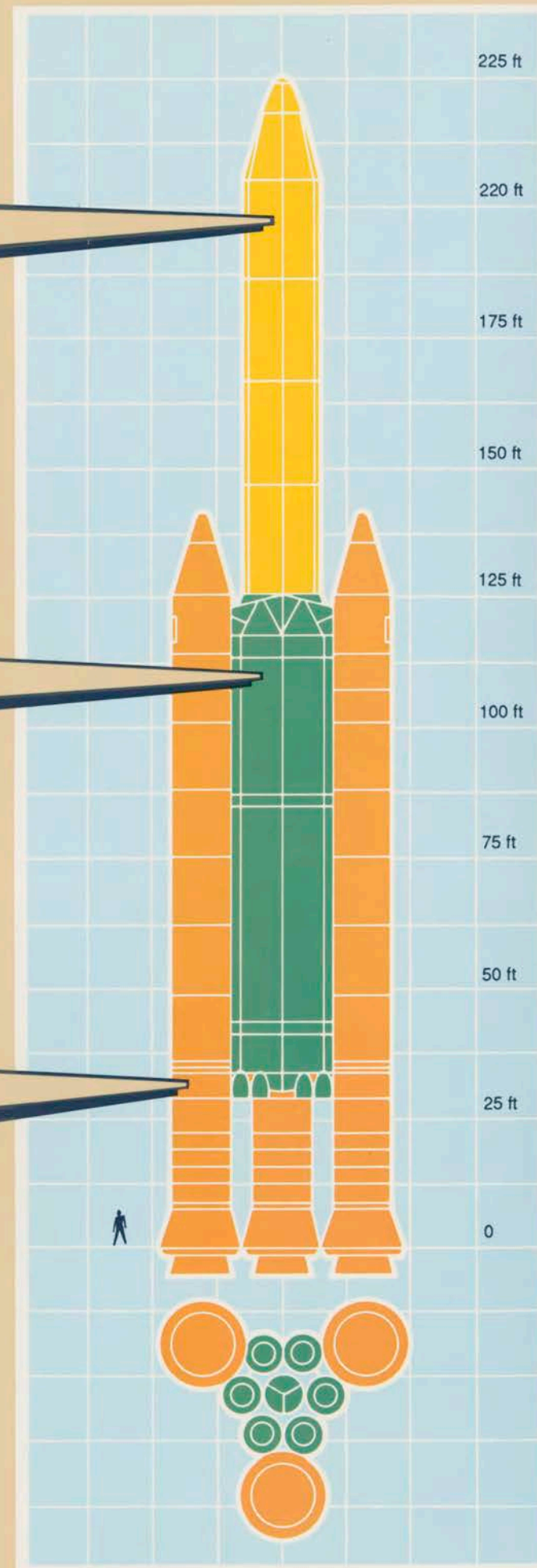
The standard Delta II inertial measurement unit and guidance computer are featured in the HLD avionics package. These highly reliable systems have flown on many missions without any flight failure.

Shuttle – Three solid rocket boosters proven on the Space Transportation System program provide interface with the launch mount. Ignited at liftoff, the three shuttle boosters provide 8,836,700 lb of thrust.









	Description	Dimension	Gross Weight	Thrust
Fairing	Stretched Titan IV	100 ft	13,900 lb	—
Second Stage	Delta II Booster	95 ft	228,000 lb	255,100 lb
Cluster	6 Delta II Boosters	98 ft	1,373,600 lb	1,244,100 lb
SRBs	3 Shuttle SRBs	149 ft	3,878,400 lb	8,836,700 lb
Overall Vehicle at Liftoff (Excluding Payload)		234 ft	5,493,900 lb	10,080,800 lb

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HEAVY LIFT DELTA

An Innovative, Low-Cost Means for the United States To Achieve Near-Term Heavy Lift Capability

In early 1987, McDonnell Douglas initiated studies of launch vehicle configurations that could be developed rapidly to extend Delta reliability to launch payloads exceeding existing US launch vehicle capabilities. Extensive analysis focused on launching 100,000-lb payloads to low Earth orbit. We used current, flight-proven, complete stage systems to meet all propulsion requirements so that schedule risk and development cost were minimized.

The result was the Heavy Lift Delta (HLD), an integration of stages from Delta, shuttle, and Titan IV launch vehicles. Because each stage is a complete, integrated system, development time and resources are significantly reduced. The HLD first stage consists of three shuttle solid rocket boosters (SRB) ignited at liftoff with six clustered Delta II first stages. A single Delta II first stage is used as the HLD second stage. A Titan IV fairing, with an additional cylindrical fairing section, provides additional payload volume.

HLD avionics utilize the current Delta/Delta II inertial measurement unit and guidance computer without modification. These systems are integrated so that all subsystems and components are maintained in thermal and acoustic environments within currently qualified limits.

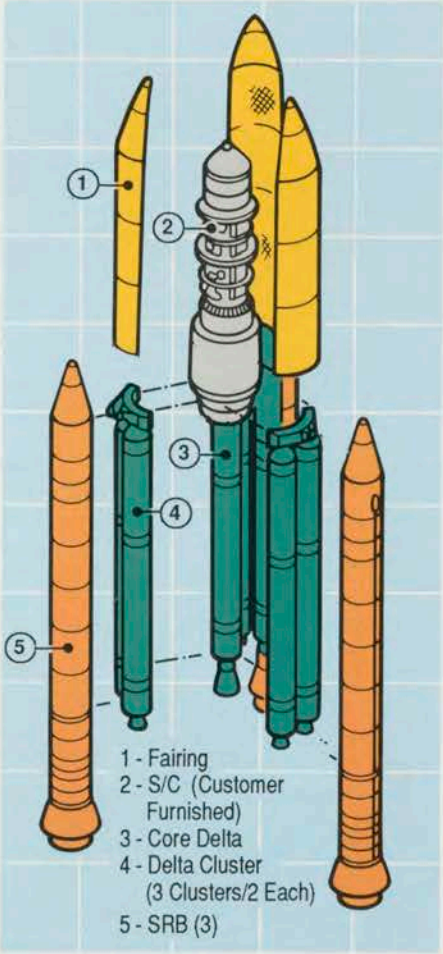
New structural and mechanical systems are designed conservatively, using conventional materials. Existing, flight-proven components are used wherever possible to meet sytem requirements.

New hardware will be appropriately tested. Few existing components require requalification for the HLD.

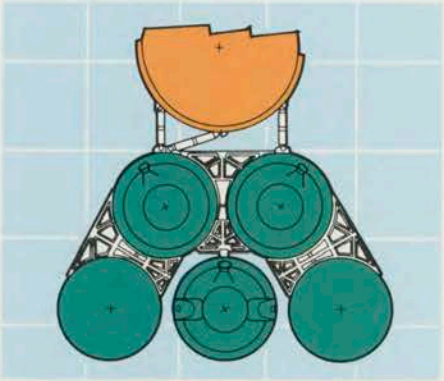
The seven Delta II stages are assembled in our facility in Pueblo, Colorado, and transported to the HLD launch facility in Florida for integration and checkout. The core Delta stage is taken to the Delta Mission Checkout Area, where its systems are calibrated and tested. Each of the six clustered Delta IIs is run through required hydraulic and electrical testing.

Final integration and testing of the vehicle components take place in an enclosed environmentally controlled mobile service structure at the launch pad. The SRB segments are processed in the current STS facility. They are then moved to the pad and assembled in their launch position. The six Delta II first stages, the Delta II core stage, and the intertank-interstage structure are transported to the pad, assembled, and mated to the SRBs. The spacecraft is then brought to the pad, hoisted into the clean room, and mated to the HLD. Final validation, simulation, and verification tests ensure the HLD is ready for launch and that the integrated spacecraft and launch vehicle are properly configured. Final ordnance installations and connections are made, range safety testing is conducted, and the HLD is ready for countdown and launch.

Heavy Lift Delta provides a cost-effective heavy lift (100,000-lb payload) capability at an affordable nonrecurring cost. HLD features a rapid development schedule (3-1/2 years from ATP to launch) and makes maximum use of major vehicle elements common with other programs, providing a flexible inventory and reducing schedule risks and development cost.



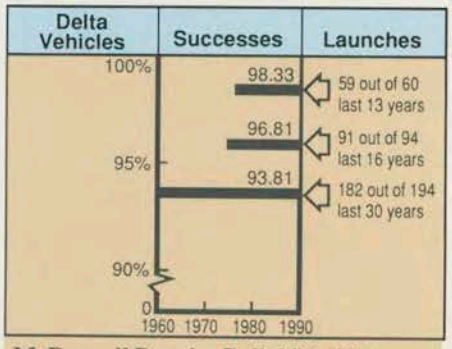
HEAVY LIFT DELTA – Ninety percent of the HLD recurring hardware cost is for proven vehicle elements that are common with other ongoing programs.



Aft Structure Attachment Resulting From HLD Design Studies

Fairings	Successes	Launches
Delta Type	100%	263
Titan II & III	100%	43
Saturn/Skylab	100%	1
Titan IV	100%	1

Stages	Successes	Launches
Saturn	100%	27



McDonnell Douglas Reliability History – The reliability of our supplied systems is unmatched by any other in the industry.

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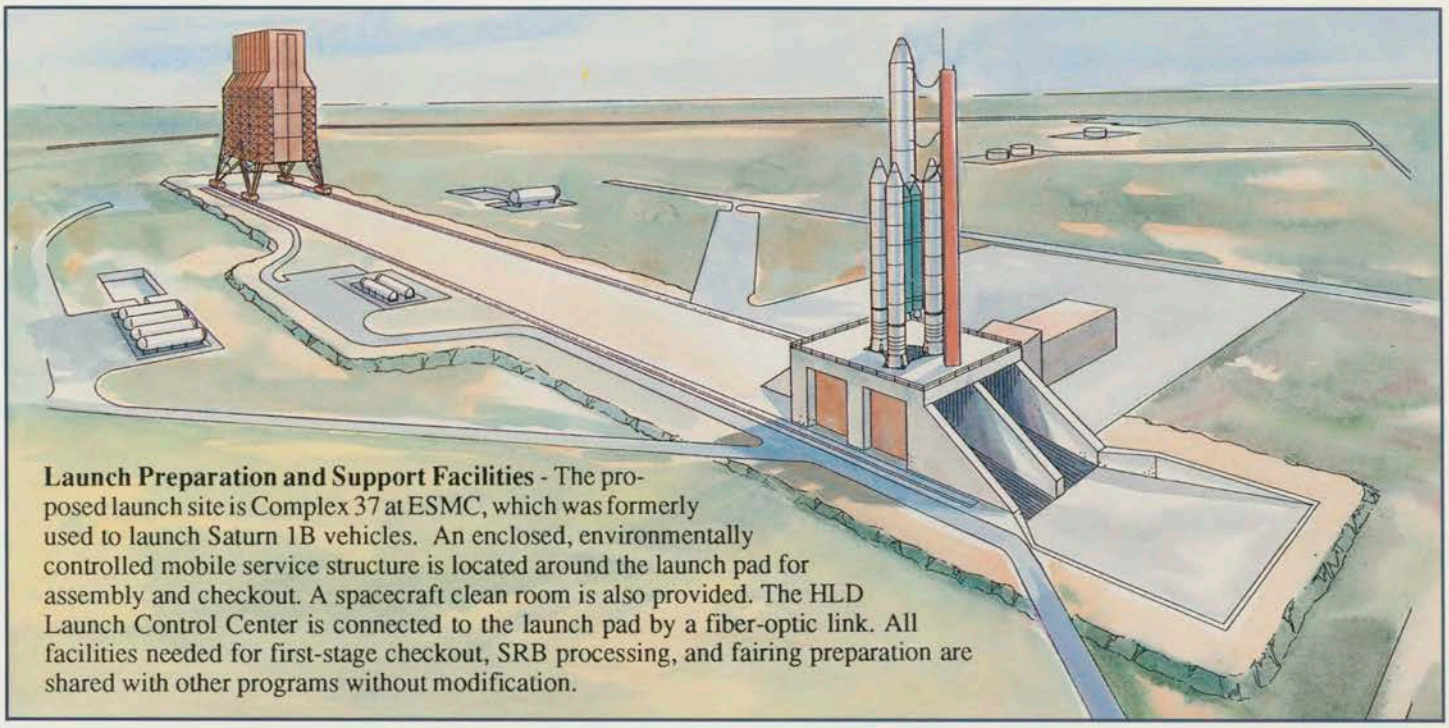
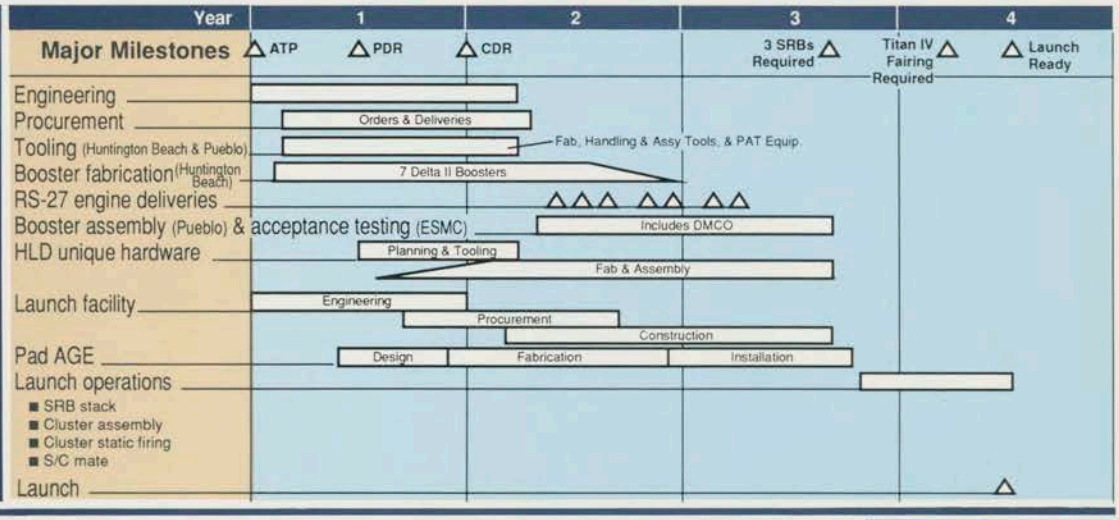


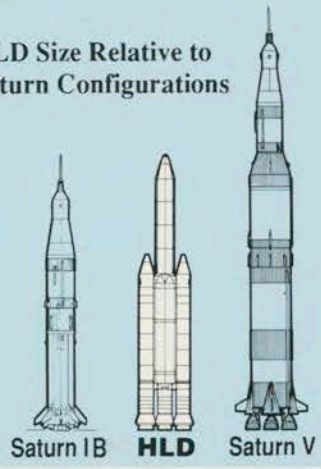
Launch Preparation and Support Facilities - The proposed launch site is Complex 37 at ESMC, which was formerly used to launch Saturn 1B vehicles. An enclosed, environmentally controlled mobile service structure is located around the launch pad for assembly and checkout. A spacecraft clean room is also provided. The HLD Launch Control Center is connected to the launch pad by a fiber-optic link. All facilities needed for first-stage checkout, SRB processing, and fairing preparation are shared with other programs without modification.

HLD Development Schedule

3.5 Years



HLD Size Relative to Saturn Configurations



Multi-tank/Multi-engine Capability – The HLD features a multi-tank/multi-engine design with many similarities to that previously flown on the Saturn program. Selected high-payoff performance and reliability enhancements are incorporated. For example, tank interplumbing of the clustered Delta II booster stages improves propellant utilization and provides an engine out capability. (If one of the six engines fails, it is safely shut down by a sensing system. The other five engines continue to burn the remaining propellant from all six booster stages.) Intertank plumbing also enables simultaneous depletion of propellant from all stages, even if the flow rate varies from engine to engine.

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