Space Transportation System Solid Rocket Boosters

THIS TEXT IS A SAMPLE TEXT, IT WAS COPIED VERBATIM FROM "WINGS IN ORBIT" AS A PLACE HOLDER!

The Space Shuttle reusable solid rocket motors were the largest solid rockets ever used, the first reusable solid rockets, and the only solids ever certified for crewed spaceflight. In a class of its own, the Reusable Solid Rocket Motor Program was characterized from its inception by four distinguishing traits: hardware reusability, postflight recovery and analysis, a robust ground-test program, and a culture of continual improvement via process control.

The challenge NASA faced in developing the first human-rated solid rocket motor was to engineer a pair of solid-fueled rocket motors capable of meeting the rigorous reliability requirements associated with human spaceflight. The rocket motors would have to be powerful enough to boost the shuttle system into orbit. The motors would also need to be robust enough to meet stringent reliability requirements and survive the additional rigors of re-entry into Earth's atmosphere and subsequent splashdown, all while being reusable. The prime contractor— Morton Thiokol, Utah—completed its first full-scale demonstration test within 3 years.

To construct the reusable solid rocket motor, four cylindrical steel segments— insulated and loaded with a high-performance solid propellant—were joined together to form what was essentially a huge pressure vessel and combustion chamber.

The segmented design provided maximum flexibility in motor fabrication, transportation, and handling. Each segment measured 3.7 m (12 ft) in diameter and was forged from D6AC steel measuring approximately 1.27 cm (0.5 in.) in thickness.

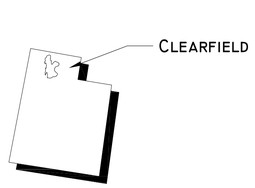
Case integrity and strength were maintained during flight by insulating the case interior. The insulating liner was a fiber-filled elastomeric (rubber-like) material applied to the interior of the steel cylinders. A carefully formulated tacky rubber bonding layer—or "liner"—was applied to the rubber insulator surface to facilitate a strong bond with the propellant.

The propellant was formulated from three major ingredients: aluminum powder (fuel); ammonium perchlorate (oxidizer); and a synthetic polymer binding agent. The ingredients were batched, fed into large 2,600-L (600-gal) mix bowls, mixed, and tested before being poured into the insulated and lined segments. Forty batches were produced to fill each case segment. The propellant mixture had an initial consistency similar to that of peanut butter, but was cured to a texture and color that resembled a rubber pencil eraser—strong, yet pliable. The propellant configuration or "shape" inside each segment was carefully designed and cast to yield the precise thrust trace upon ignition.

Once each segment was insulated and cast with propellant and finalized, the segments were shipped from ATK's manufacturing facility in Utah to Kennedy Space Center (KSC) in Florida, on specially designed, heavy-duty covered rail cars. At KSC, they were stacked and assembled into the flight configuration.

This recording project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering, industrial, and maritime works in the United States. The HAER program is administered by the National Park Service, U.S. Department of the Interior. The Space Transportation System recording project was cosponsored during 2011 by the Space Shuttle Program Transition and Retirement Office of the Johnson Space Center (JSC), with the guidance and assistance of Barbara Severance, Integration Manager, JSC, Jennifer Groman, Federal Preservation Officer, NASA Headquarters and Ralph Allen, Historic Preservation Officer , Marshall Space Flight Center. The field work and measured drawings were prepared under the general direction of Richard O'Connor, Chief, Heritage Documentation Programs, National Park Service. The project was managed by Thomas Behrens, HAER Architect and Project Leader. The Space Transportation System Recording Project consisted architectural delineators, John Wachtel, Iowa State and Joseph Klimek, Illinois Institute of Technology. This documentation is based high-definition laser scans provided by Smart GeoMetrics, Houston, Texas and documentation provided by NASA's Headquarters, Johnson Space Center and Marshall Space Flight Center. Written historical and descriptive data was provided by Archaeological Consultants Inc., Sarasota, Florida. Large-format photographs were produced by NASA's Imaging Lab at Johnson Space Flight Center with supplimental images provided by Jet Lowe, HAER photographer.

VICINITY MAP CLEARFIELD, UTAH



UTAH

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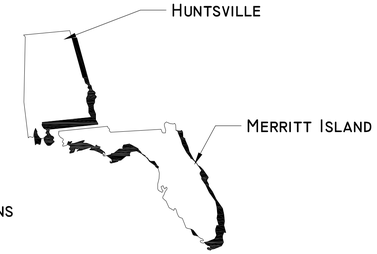

ALABAMA FLORIDA

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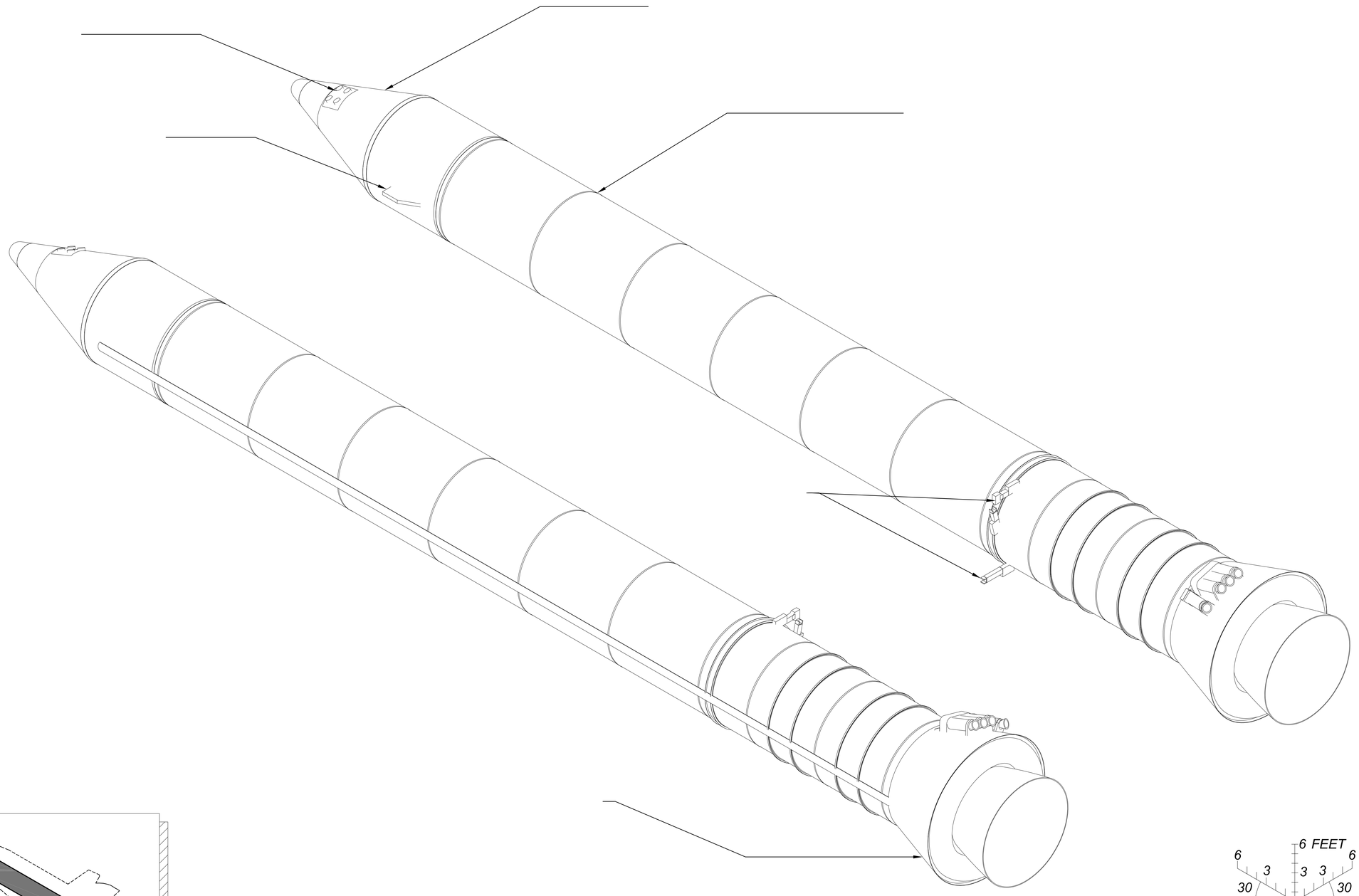

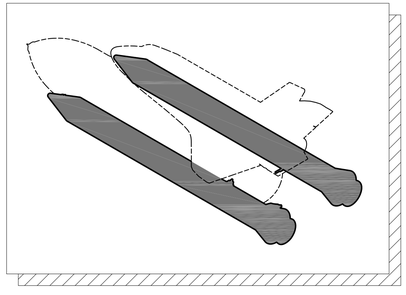

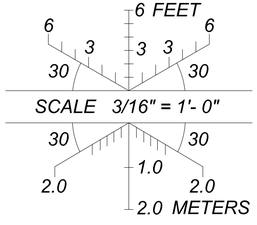

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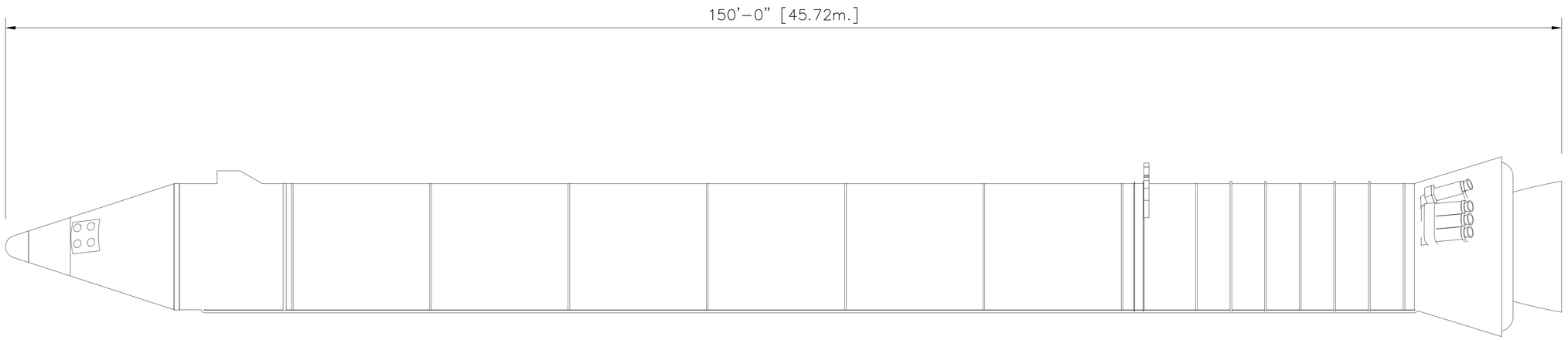

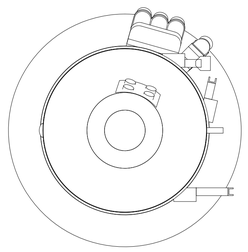

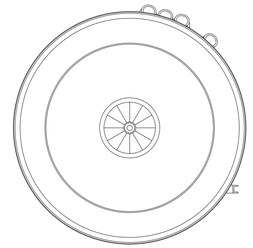

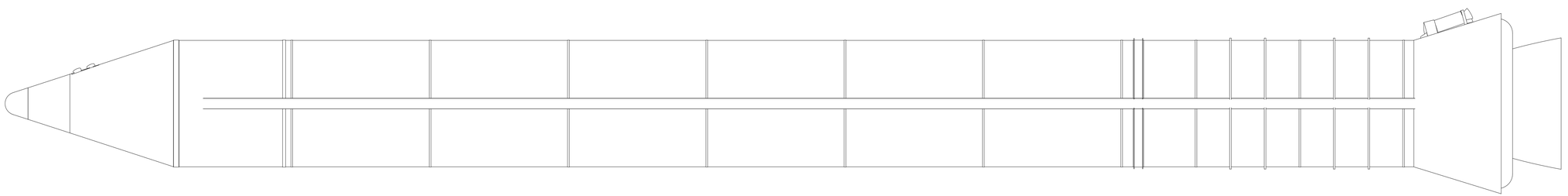

SOLID ROCKET BOOSTERS

SCALE: 3/16" = 1'-0"

0 5 10 20 FEET

0 1 2 3 4 5 METERS

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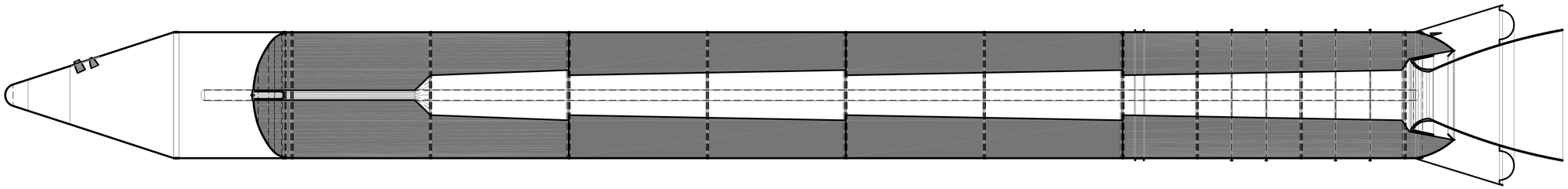

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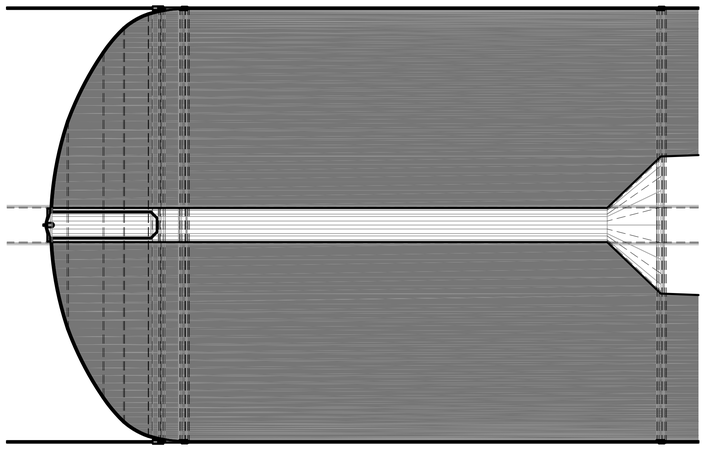
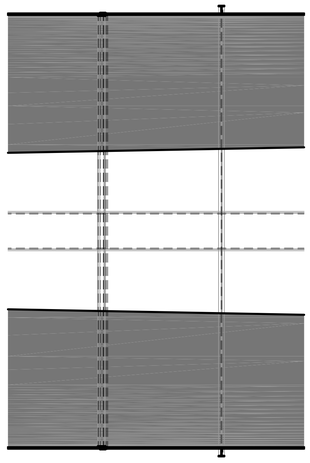
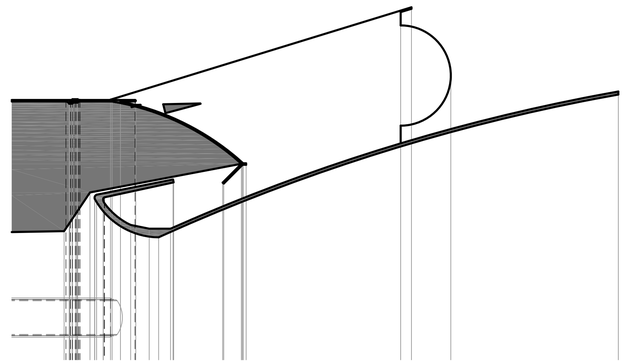


IGNITER DETAIL SECTION

0 1 2 3 4 5 FEET
SCALE: 1/2" = 1'-0" 0 50 100 150 CENTIMETERS



O RING DETAIL SECTION



NOZZLE DETAIL SECTION

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SCALE: 1/2" = 1'-0" 0 50 100 150 CENTIMETERS

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