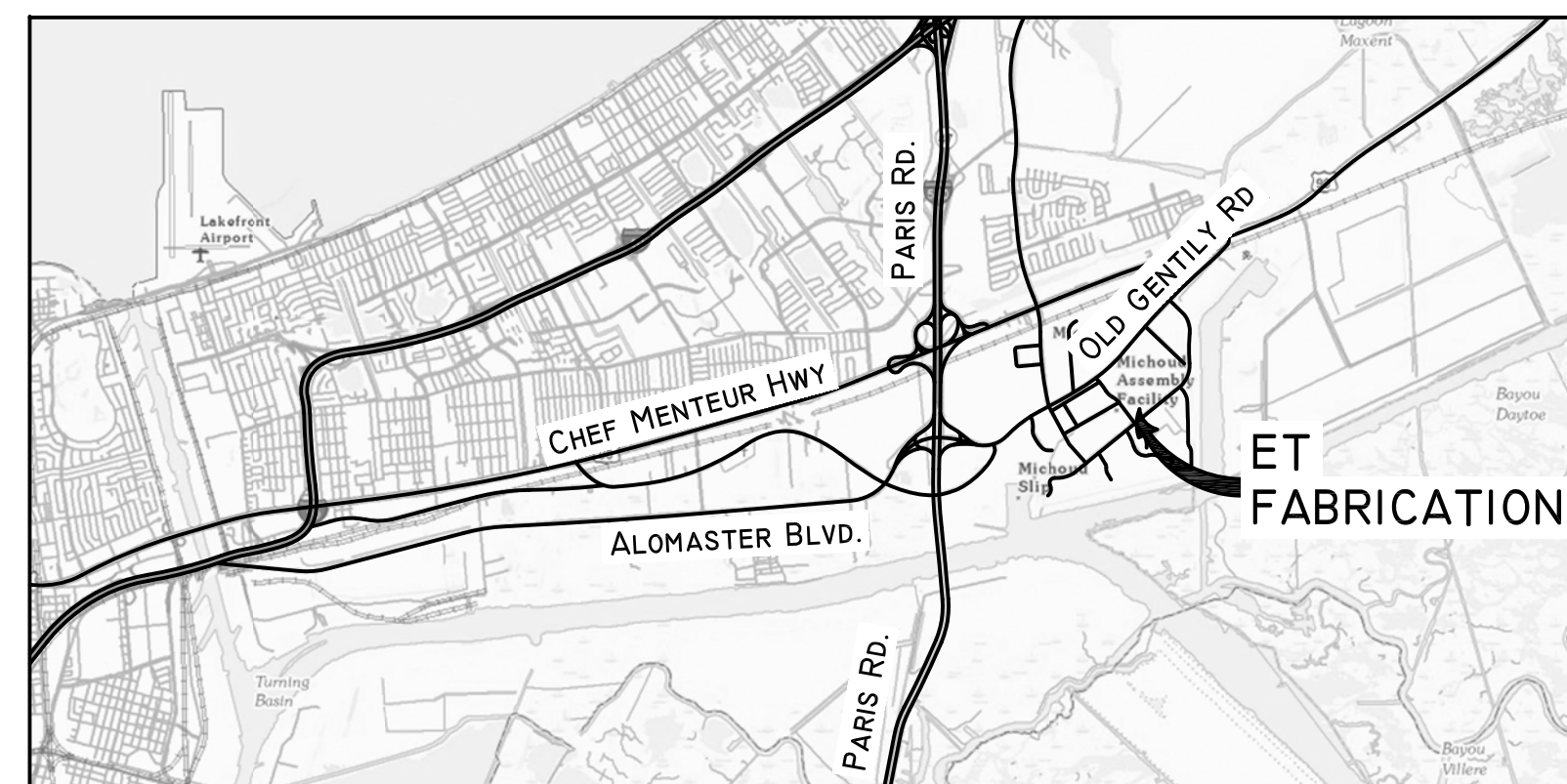


Space Transportation System External Tank



The first External Tank rolling out of the Michoud Assembly Facility on September 9, 1977. Image courtesy of NASA Marshall Space Flight Center. Photographer unknown.

The External Tank (ET) was the largest and heaviest component of the stack assembly at approximately 154 feet long, 28 feet in diameter and over 1.5 million pounds when loaded with propellants. The ET was comprised of three distinct major elements, the forward or top liquid oxygen tank, an unpressurized inter-tank that housed the electronic components and an aft or bottom liquid hydrogen tank. Both liquid oxygen and liquid hydrogen are cryogenic fuels, oxygen becomes a liquid at minus 296 degrees Fahrenheit and hydrogen liquefies at minus 423 degrees Fahrenheit. The familiar orange color of the ET is from the spray-on polyurethane foam insulation used to keep the propellants at an optimum cryogenic temperatures and also protect the tanks from high temperatures during ascent. The foam also was also designed to withstand a potential 180 days exposure to the harsh marine climate at the launch pad with temperatures that could reach 115 degrees Fahrenheit and 100 percent humidity, with sand, salt, heavy rain and intense solar radiation.



VICINITY MAP NEW ORLEANS, LA

External Tank

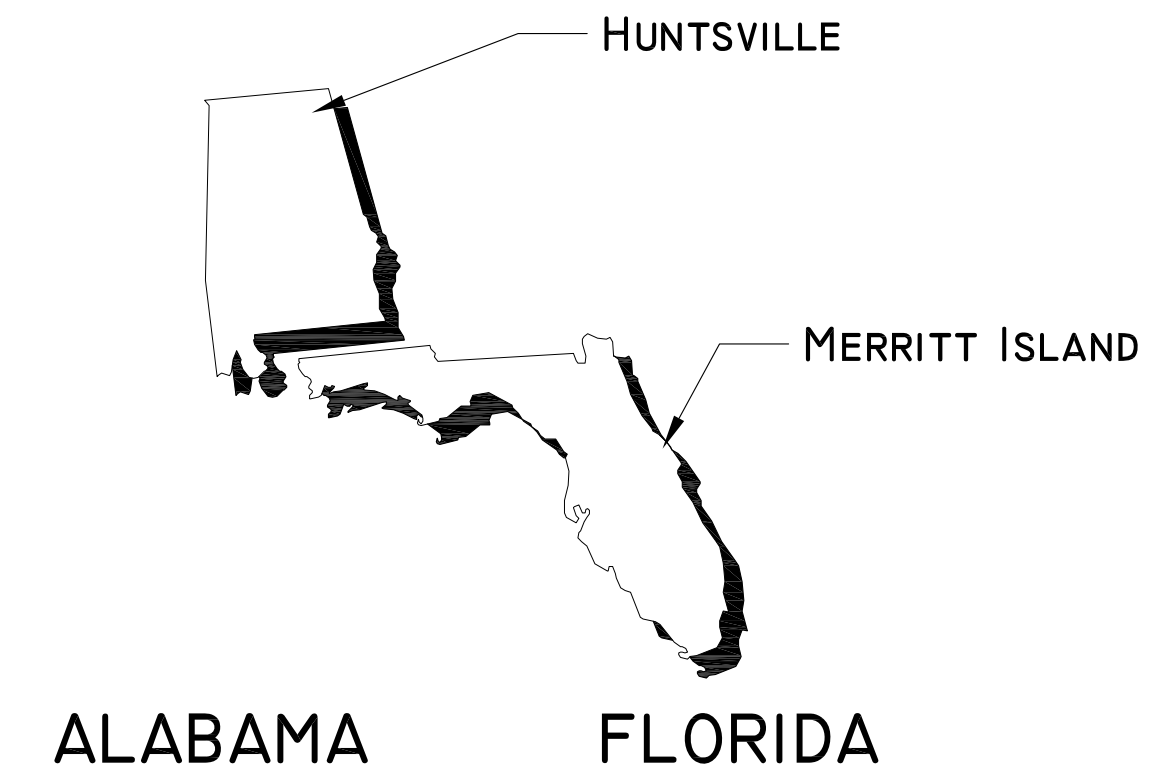
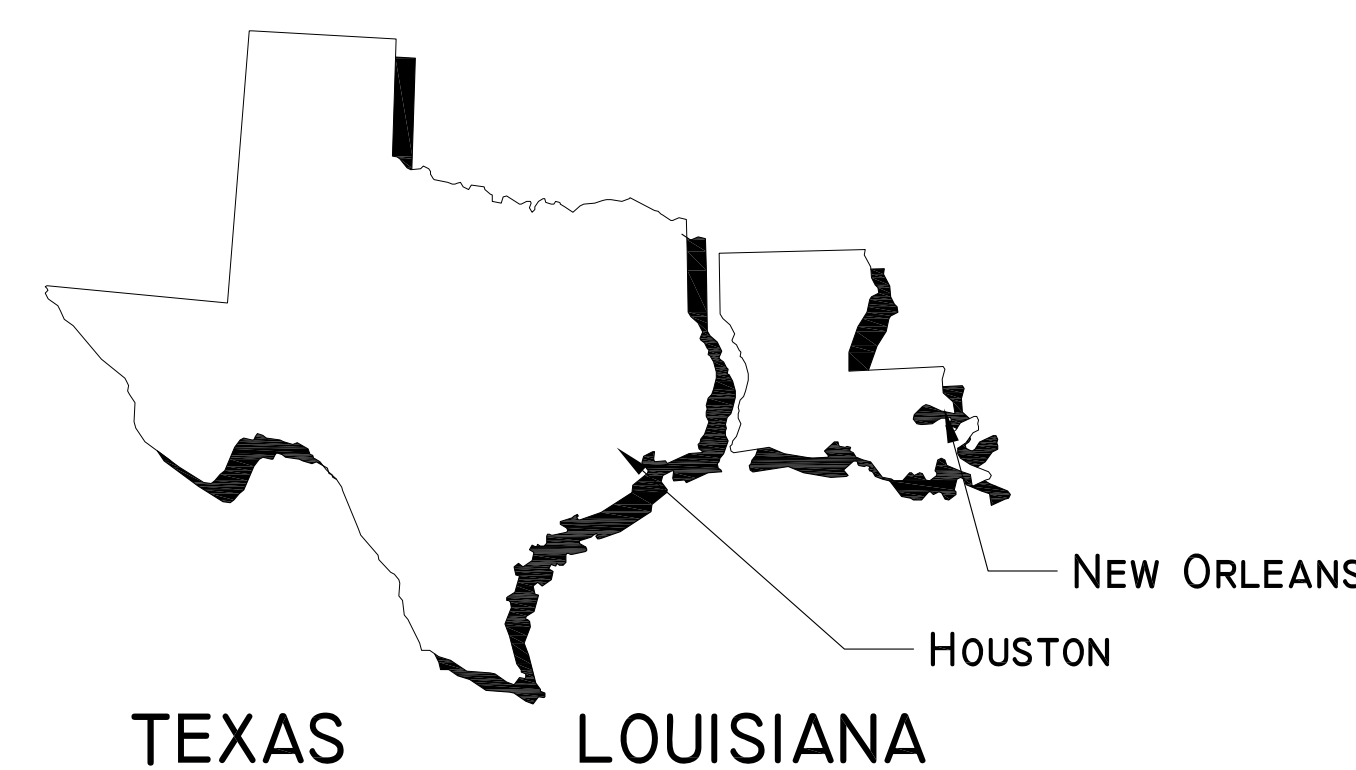
The hydrogen tank, which was the bigger of the two tanks could hold a maximum of about 230,000 pounds of hydrogen, or about 390,000 gallons. The smaller oxygen tank, located at the top of the ET, could hold a maximum of about 1,375,000 pounds of oxygen or 145,000 gallons. During powered flight the ET provided approximately 47,000 gallons per minute of hydrogen and approximately 18,000 gallons per minute of oxygen to all three Space Shuttle Main Engines (SSME) with a 6-to-1 mixture ratio, by weight, of liquid oxygen to liquid hydrogen.

In addition to containing and delivering cryogenic propellants to the Space Shuttle Main Engines the ET also served as the structural support for the attachment of the Orbiter and Solid Rocket Boosters. While the STS stack assembly is sitting on the Mobile Launch Platform (MLP) the ET transfers the weight of the Orbiter and itself to the Solid Rocket Boosters (SRBs) which are attached to the MLP. At launch and ascent the ET absorbs the thrust loads produced by the SSMEs and the SRBs. Despite its size and structural requirements the aluminum alloy skin of the ET is only one eighth of an inch thick in most areas. As with all of the other components of the STS stack assembly, the ET has undergone improvements during the STS operational lifespan. Most notably, was two weight-saving redesigns that made the ETs lighter and stronger. The original version of the ET weighed 76,000 pounds empty. The first redesign, flown on STS-6, was the Lightweight ET which dropped 10,000 pounds from the original ETs. The second redesign, flown on STS-91, was the Super Lightweight ET that dropped an additional 7,500 pounds from the Lightweight tank resulting in a weight of 58,500 pounds.

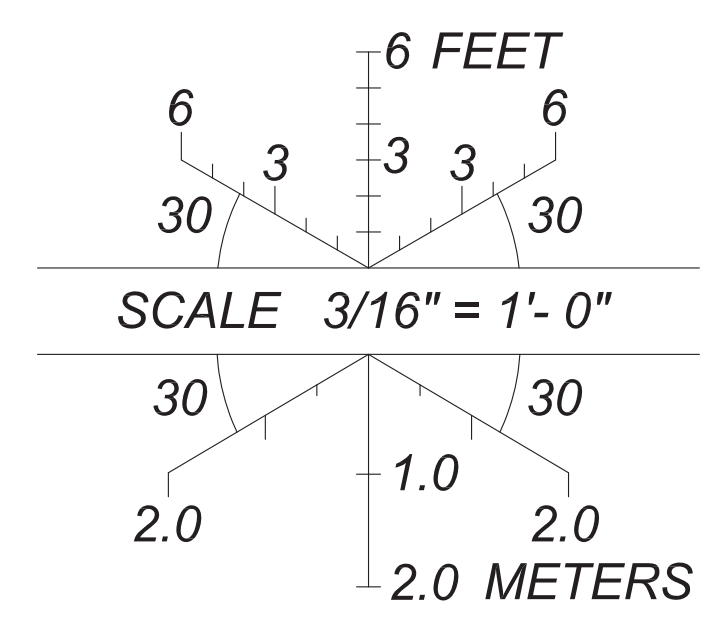
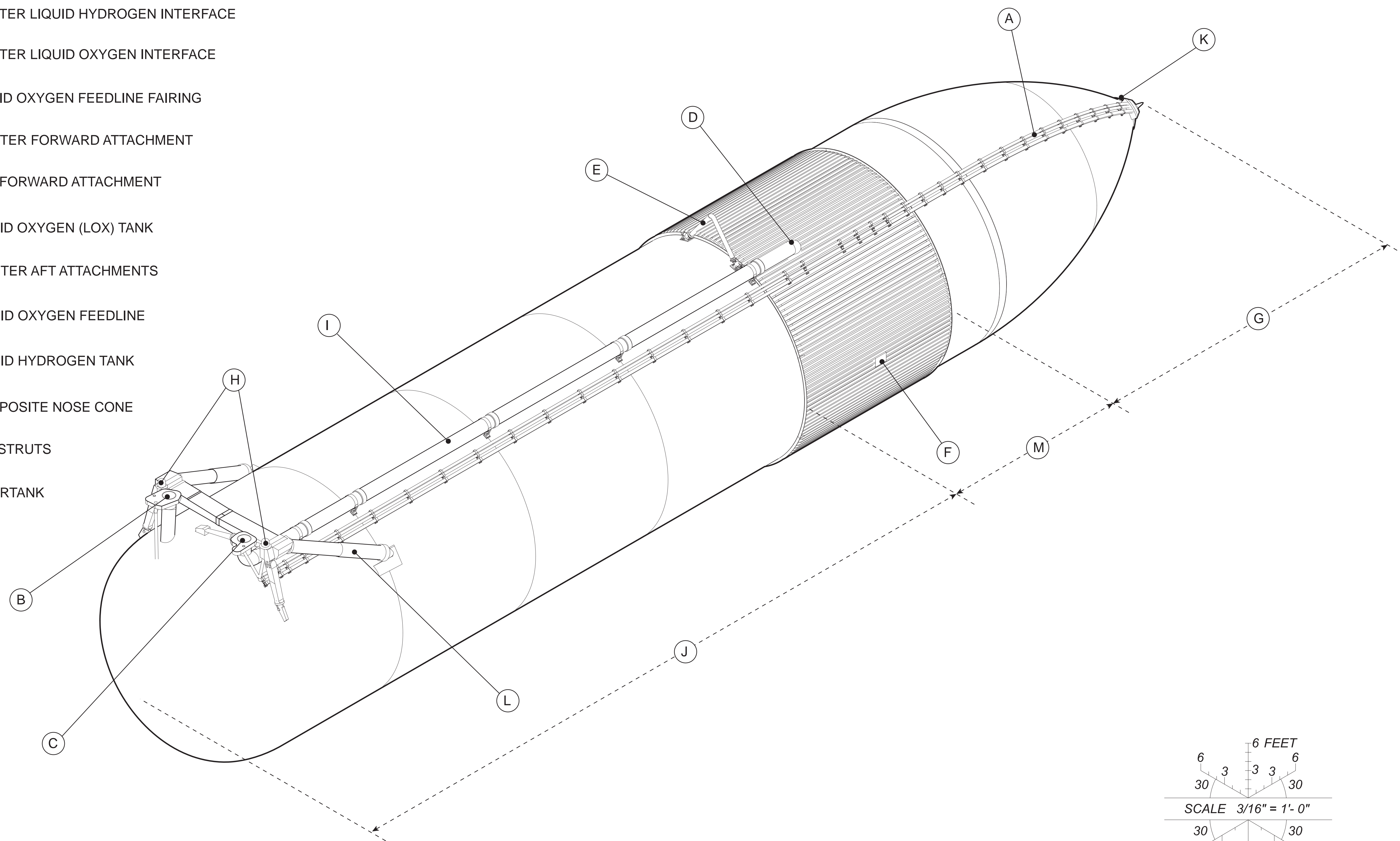
The ET is the only part of the stack assembly that is not reused. At approximately 8 minutes and 30 seconds after launch the propellant has been consumed and the SSMEs are shut down. The ET is no longer needed and is jettisoned from the Orbiter. The effects of gravity pull the ET back into the Earth's atmosphere where heat and friction cause it to break up over a remote part of the Pacific Ocean.



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 on 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 Center with supplemental images provided by Jet Lowe, HAER photographer.

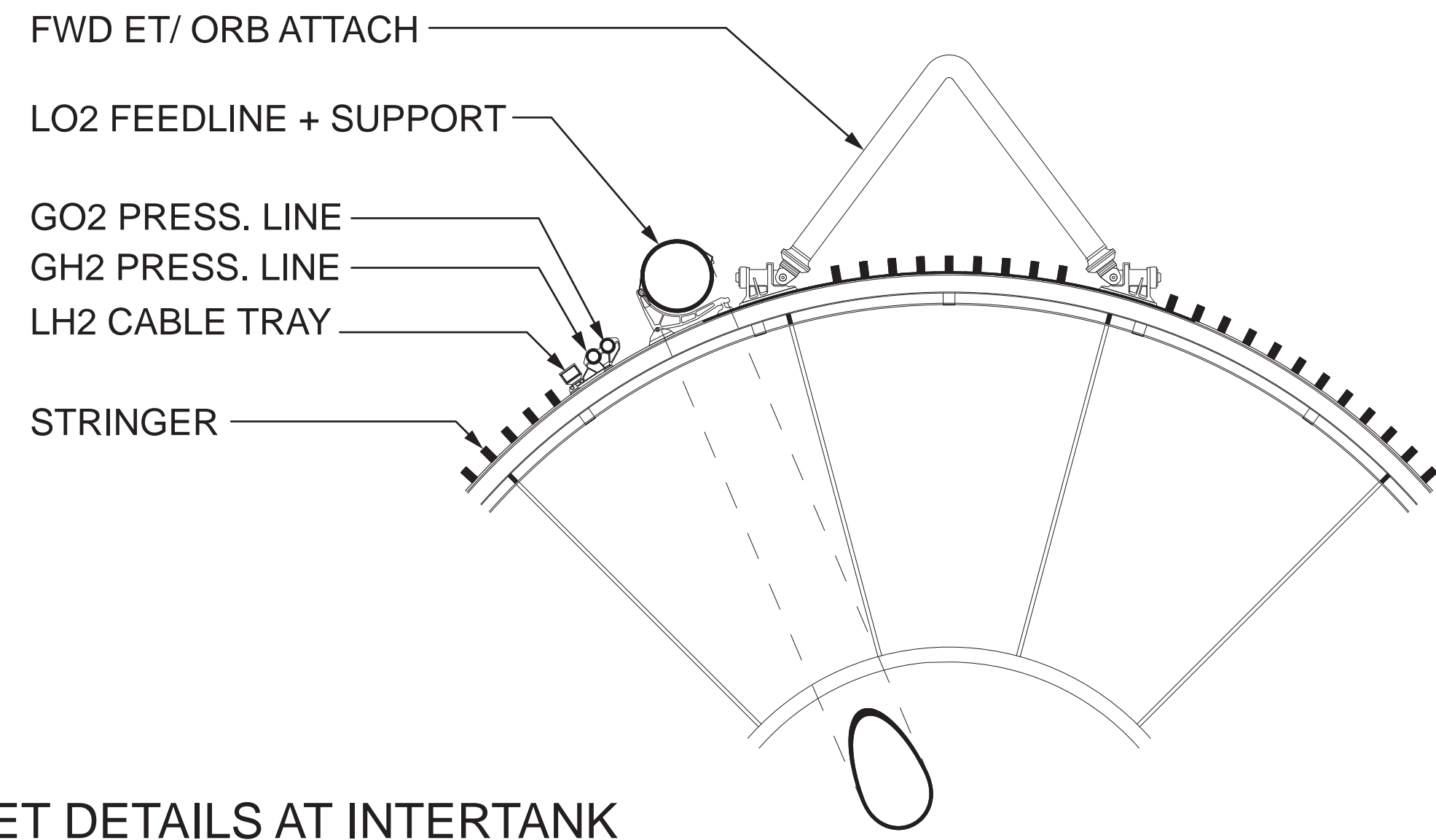


- (A) CABLE TRAY, FAIRINGS AND PRESSURIZATION LINES
- (B) ORBITER LIQUID HYDROGEN INTERFACE
- (C) ORBITER LIQUID OXYGEN INTERFACE
- (D) LIQUID OXYGEN FEEDLINE FAIRING
- (E) ORBITER FORWARD ATTACHMENT
- (F) SRB FORWARD ATTACHMENT
- (G) LIQUID OXYGEN (LOX) TANK
- (H) ORBITER AFT ATTACHMENTS
- (I) LIQUID OXYGEN FEEDLINE
- (J) LIQUID HYDROGEN TANK
- (K) COMPOSITE NOSE CONE
- (L) AFT STRUTS
- (M) INTERTANK

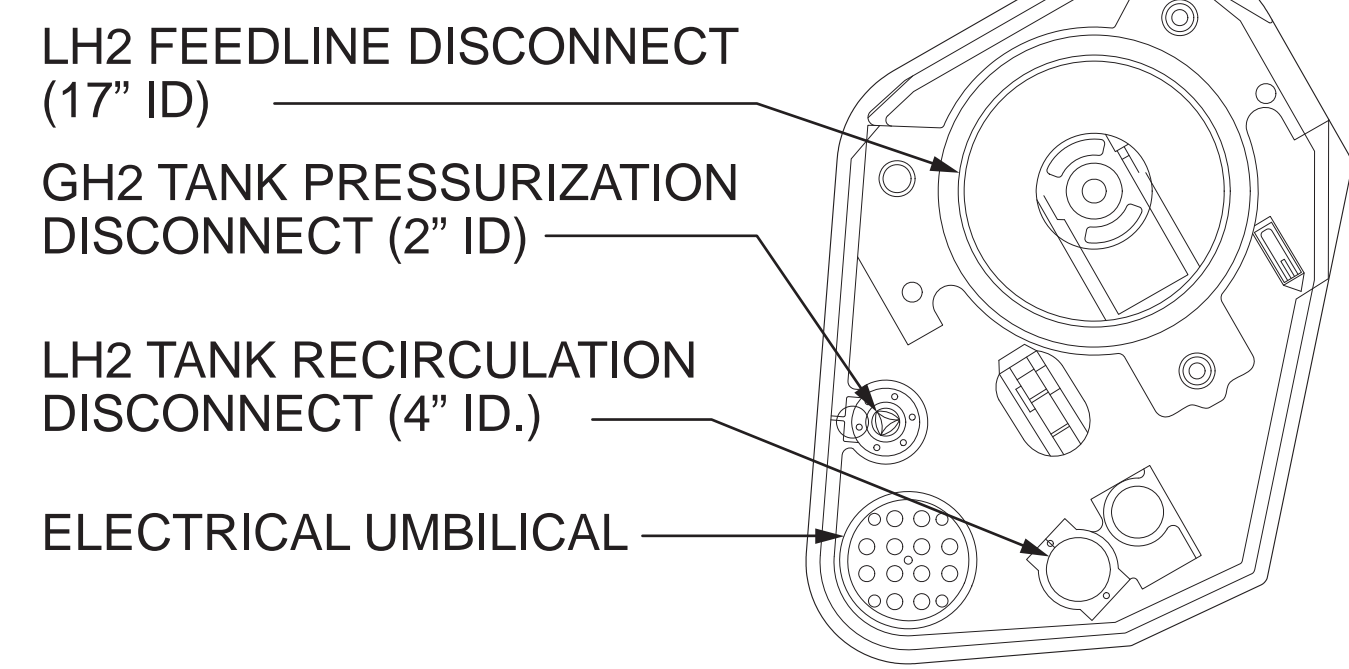


EXTERNAL TANK ISOMETRIC

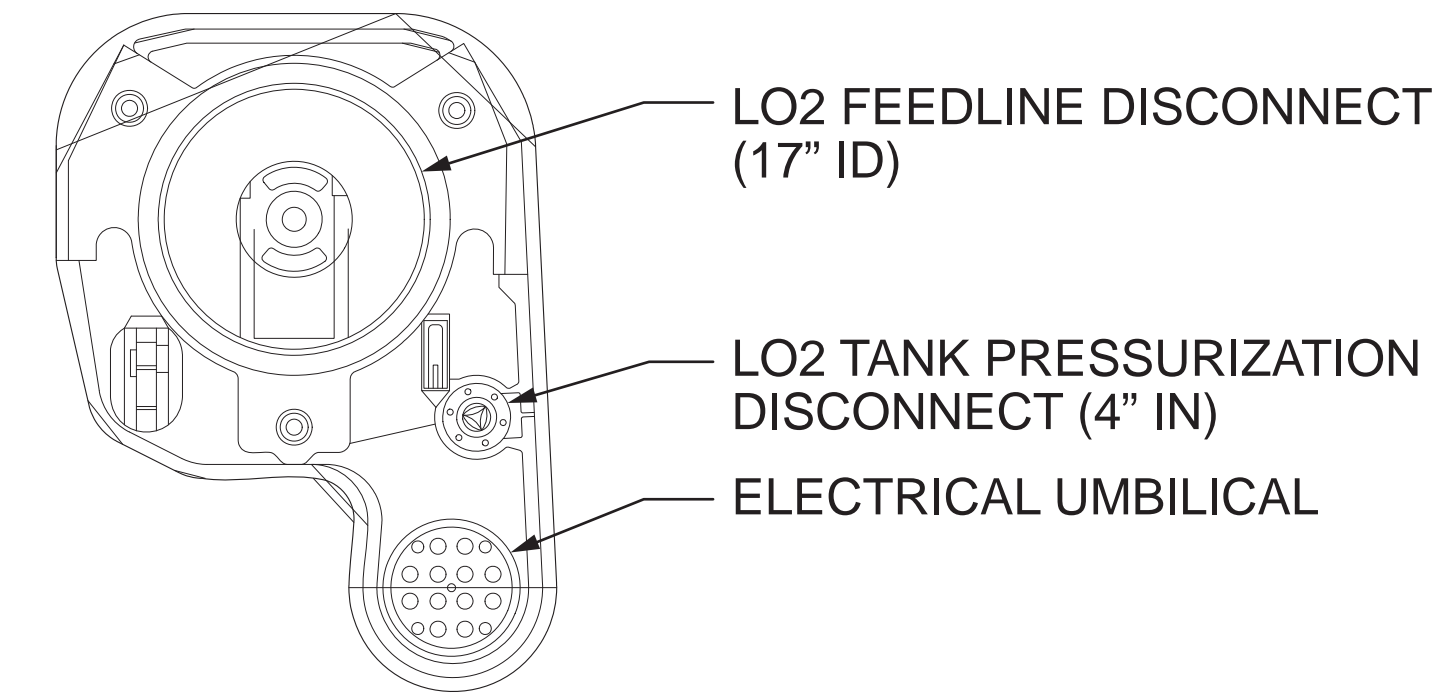
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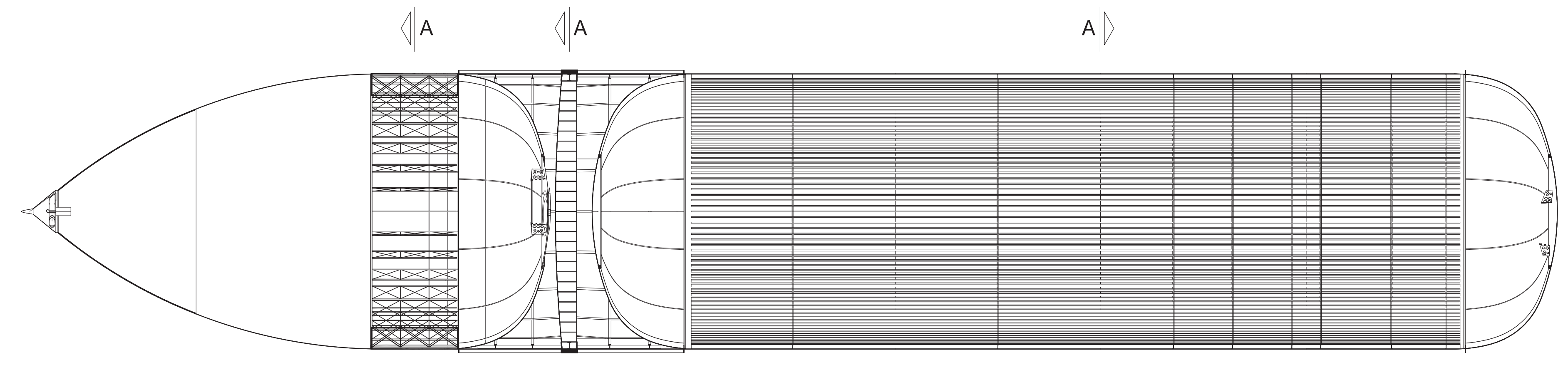
ET DETAILS AT INTERTANK
 SCALE: 1" = 3'-0"



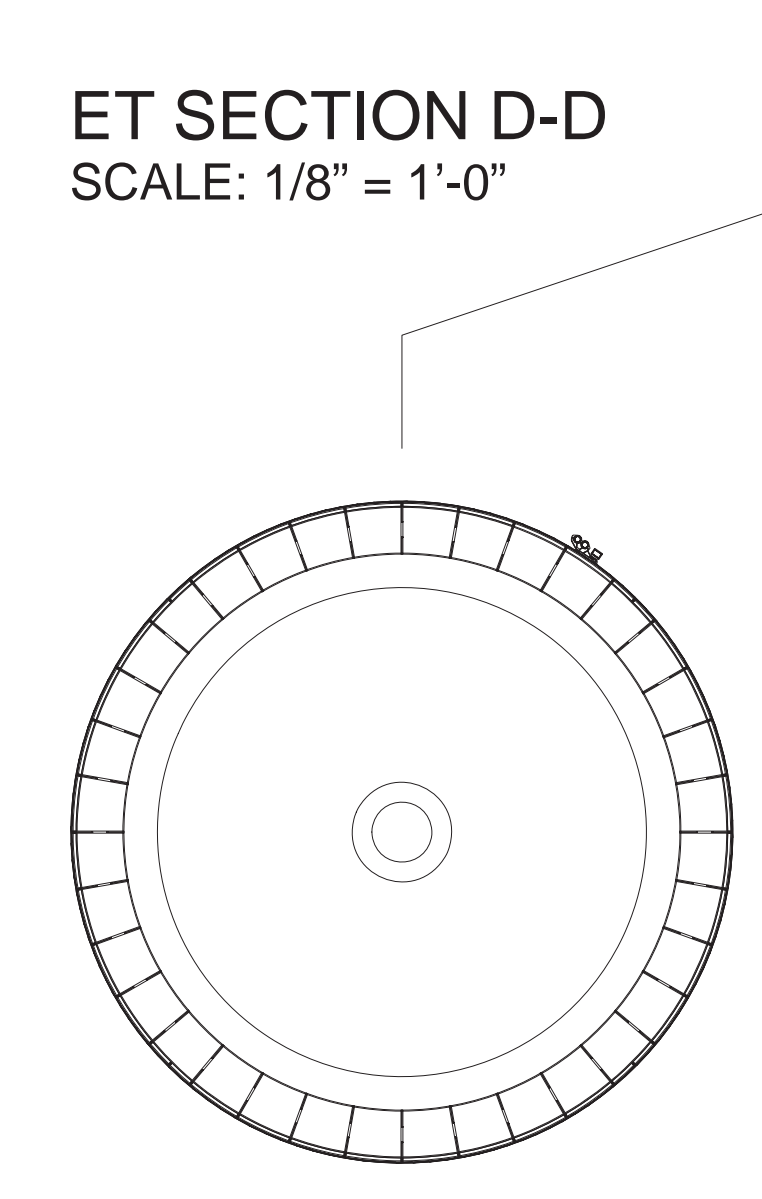
ORBITER/ ET LH2 FLUID INTERFACE
 SCALE: 1" = 1'-0"



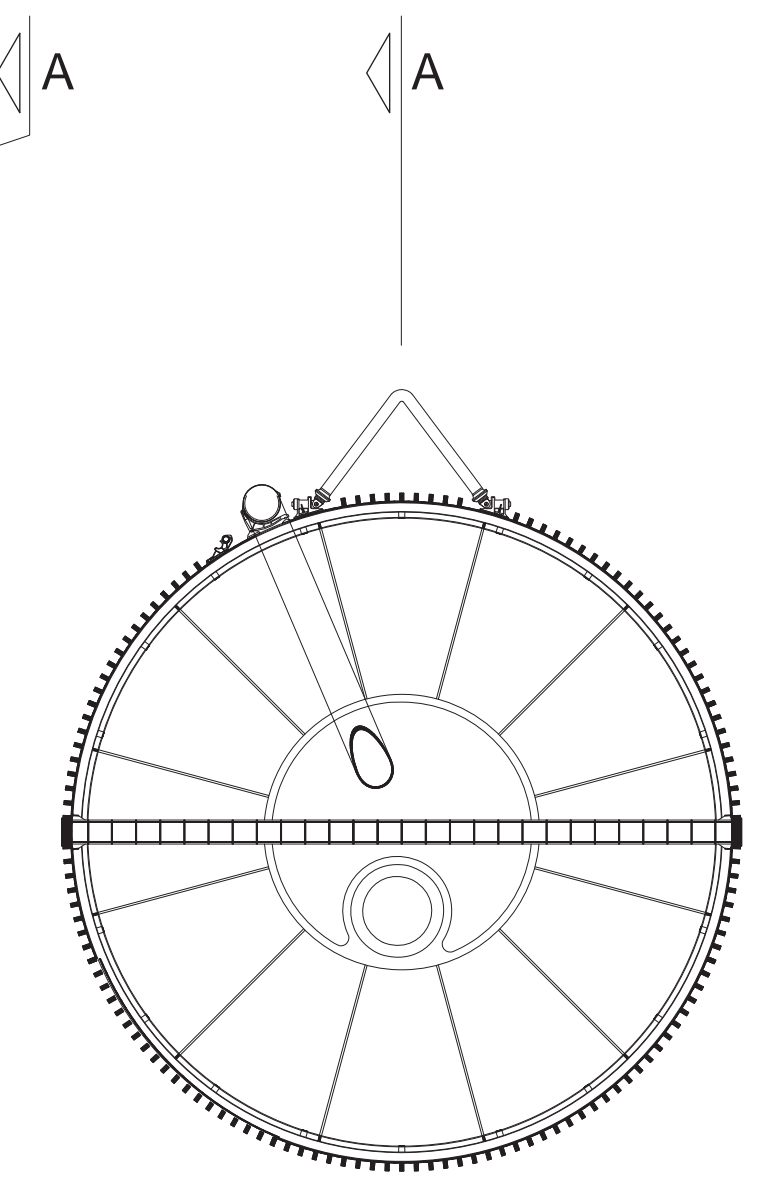
ORBITER/ ET LO2 FLUID INTERFACE
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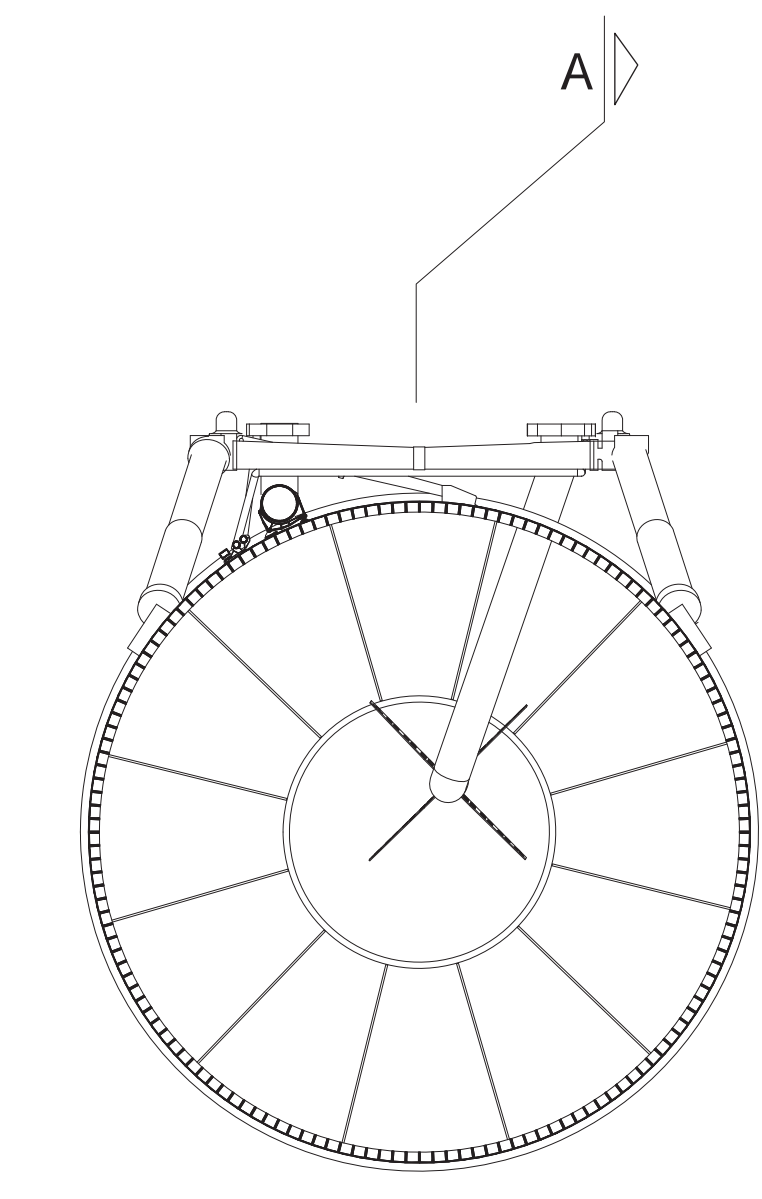
ET SECTION D-D
 SCALE: 1/8" = 1'-0"



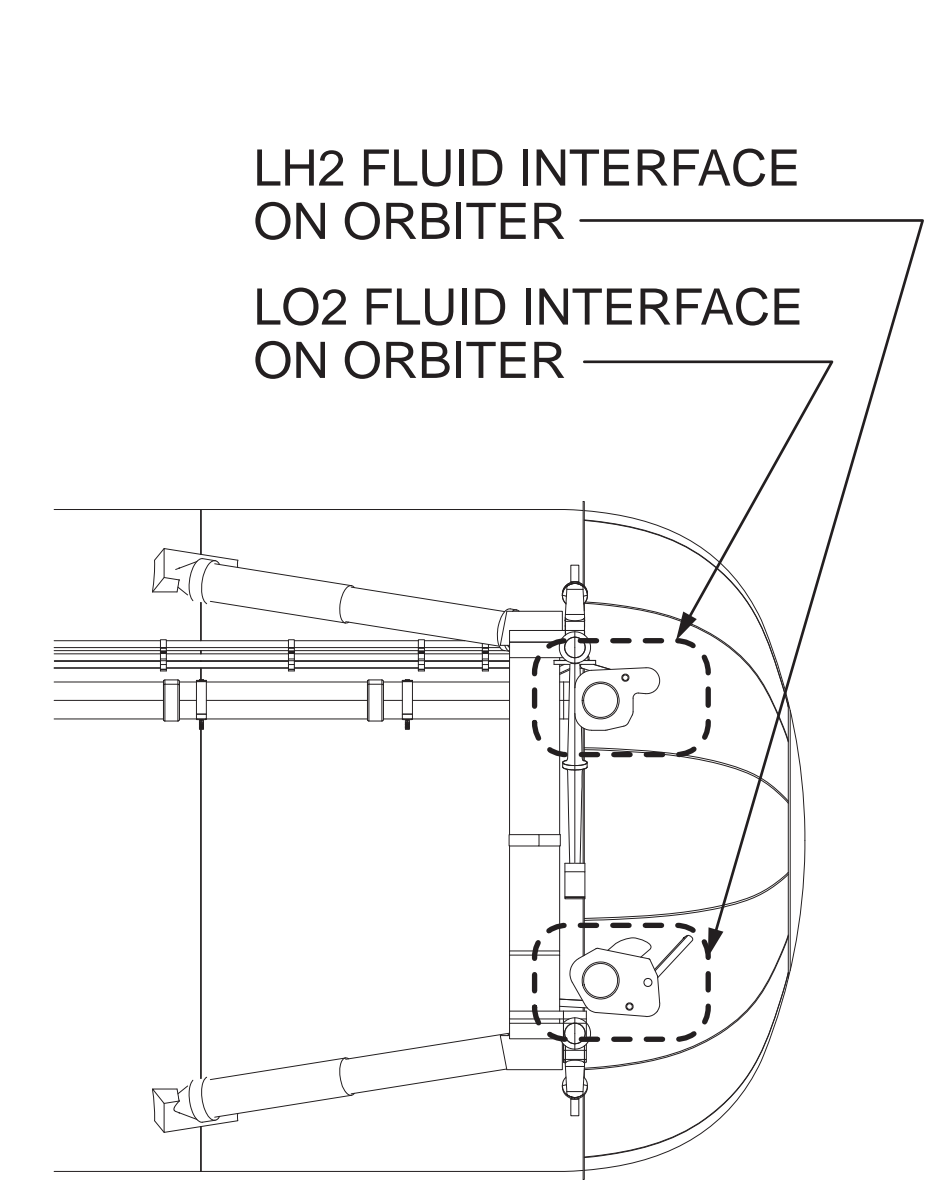
LO2 TANK SECTION
 SCALE: 1/8" = 1'-0"



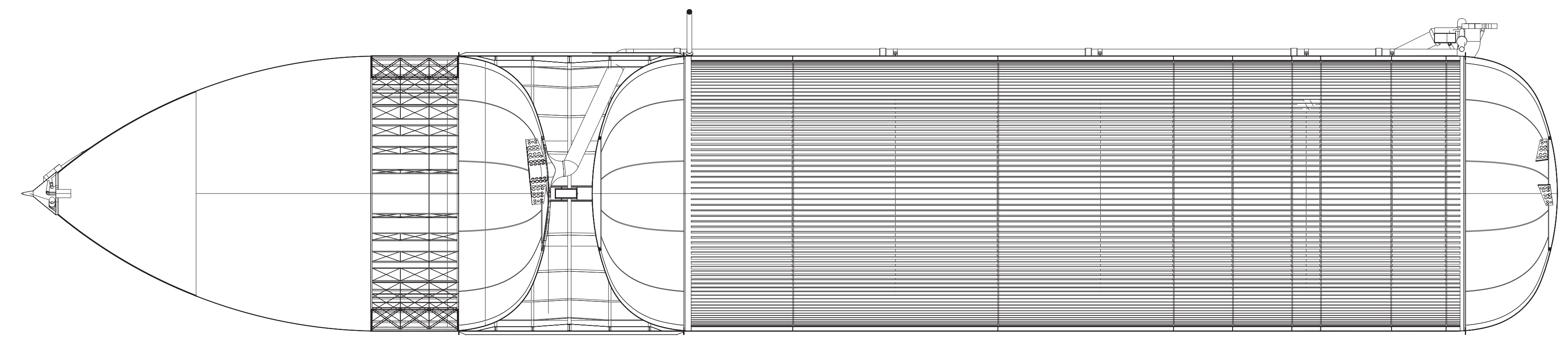
INTERTANK TANK SECTION
 SCALE: 1/8" = 1'-0"



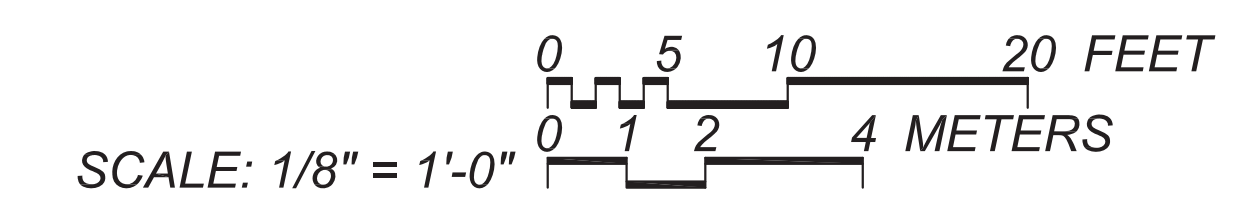
LH2 TANK SECTION
 SCALE: 1/8" = 1'-0"



OV CONNECTION @ AFT
 SCALE: 1/8" = 1'-0"



ET SECTION E-E
 SCALE: 1/8" = 1'-0"



EXTERNAL TANK DETAILS

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