

**Present Owner  
And Use:**

*Liberty Star* and *Freedom Star* were excessed through the U.S. General Services Administration processing system with subsequent transfer to the U.S. Department of Transportation Maritime Administration in September 2012. *Liberty Star* was assigned to the National Defense Reserve Fleet and relocated to the U. S. Merchant Marine Academy in Kings Point, New York, for use as a training vessel for midshipmen. *Freedom Star* was relocated to the Maritime Administration James River facility in Jamestown, Virginia.

**Significance:**

*Liberty Star* and *Freedom Star* were designed and constructed specifically for the task of SRB retrieval; each returned one of the two solid rocket boosters (SRBs) (*Liberty Star* retrieved and towed back the right booster stack and *Freedom Star* retrieved and towed back the black-striped forward skirt left booster stack) to CCAFS Hangar AF following launch. In 1998, the task of transporting external tanks (ETs) from Michoud Assembly Facility (MAF) in Louisiana, to the John F. Kennedy Space Center (KSC) was added. In addition, both retrieval vessels participated in the seven-month recovery mission (January 28 through August 28, 1986) following the *Challenger* accident. Their key function as SRB recovery vessels allowed NASA to reuse the boosters, thereby reducing costs and contributing significantly to the on-going operations of the Space Shuttle Program (SSP). Their use in towing the ET-carrying barge also was a NASA cost-saving initiative.

**Description:**

The specific design of the two retrieval vessels reflects the special needs of the SSP for the retrieval of SRBs and, since 1998, the transport of the ETs from their manufacture plant to the stacking site in the Vehicle Assembly Building. The vessels are identical, with each designed to retrieve one expended SRB. Booster retrieval operations were controlled from the aft bridge of the vessel; the forward area of the bridge was for the operation of the vessel itself. Each retrieval vessel held a maximum of twenty-four persons (ten crew and fourteen others), with a thirty-day food and water provision endurance.

*Liberty Star* and *Freedom Star* are of molded steel hull construction. They measure approximately 176' in length, 37' in width, and 72' in height, from the base to the top of the mast. The depth, from the main deck to the keel, is 15'; the draft, from waterline to keel bottom, is 12'. Each vessel displaces 1,052 tons, with gross and net tonnages of 484 and 329 tons, respectively; has a 30-ton towing pull capability; and has a cruising range of 6,000 miles and a cruising speed of 15 knots, or 17 miles per hour. The

SPACE TRANSPORTATION SYSTEM,  
MOTOR VESSELS *LIBERTY STAR* & *FREEDOM STAR*  
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retrieval vessels are similar in overall size and appearance to a medium class cutter.

Each vessel has four enclosed decks: the lower deck, the main deck, the forecastle deck, or Deck 01, and the bridge deck, or Deck 02. The lower deck (Figure No. 1) extends over the entire length and width of the vessel. It is composed of two principal areas: the crew quarters and the engine room, the latter of which also includes the oil and ballast tank areas and the steering compartment. The crew quarters, about 9' above the base, sit towards the forward end of the vessel, beginning approximately 28' from the bow, and extending 66' along the length of the deck. The individual rooms are arranged in a double-loaded corridor layout, with five rooms to either side. On the starboard side, from stern to bow, is the Chief Engineer's cabin, with its own bathroom, the First Mate cabin, the Second Mate cabin, and two crew cabins. The latter four cabins are each equipped with two beds, and have one bathroom per two cabins. On the port side, from stern to bow, is the Engineering Workshop, the Assistant Engineer's cabin, and three crew cabins. Each of the four cabins has two beds and one bathroom per two cabins.<sup>3</sup>

To the stern of the crew quarters is the engine room, which sits roughly 6.5' above the base and extends for 40' along the length of the vessel, and the entire width of the vessel. Within the engine room are the two 12-cylinder main General Motors (EMD 12-645E6A) diesel engines that provide a combined total of 2,900 horsepower. These main engines turn two 7' LIPS propellers<sup>4</sup> with controllable pitch, which provides greater response time and maneuverability. Auxiliary power is provided by stern and bow thrusters that can be steered to move the vessel in any direction, including sideways, without the use of propellers. This dual auxiliary propulsion thruster system was installed to protect endangered manatees, as well as divers working near the vessel. At sea, the water jet thrusters also are used to avoid entangling the main propellers in parachute lines. The stern thruster is a 425-horsepower White Gill<sup>5</sup> water jet system; at the bow is a 425-horsepower Schottel<sup>6</sup> bow thruster. Each is driven by a

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<sup>3</sup> Archaeological Consultants, Inc. (ACI), "Survey and Evaluation of NASA-owned Historic Facilities and Properties In the Context of the U.S. Space Shuttle Program, John F. Kennedy Space Center, Brevard County, Florida" (survey report, NASA KSC, 2007).

<sup>4</sup> LIPS, now Wartsila, is a designer and manufacturer of marine propulsion systems; the company is based in Finland.

<sup>5</sup> White Gill is a designer and manufacturer of marine thruster systems. It is now part of Tees Components Limited, which is based in the United Kingdom.

<sup>6</sup> Schottel is a German-based designer and manufacturer of marine propulsion systems.

turbo-intercooled Detroit diesel generator.<sup>7</sup> At the stern of the engine room are the diesel oil and ballast tanks, one to each side, followed by the steering compartment, and two aft peak ballast tanks. Electrical power is supplied by two 166-kilowatt (kw) Kato generators and one 45-kw Kohler emergency generator.<sup>8</sup>

The main deck level of each vessel (Figure No. 2) sits approximately 19.5' above the base at the bow, and slants down to 15' above the base at the stern. Like the lower deck, the main deck can be divided into two distinct areas: the enclosed crew area at the bow of the vessel, and the open deck area at the stern of the vessel. The crew area begins approximately 17.5' from the bow of the vessel, and extends for about 62' along the vessel's length. The layout of the rooms mimics a double-loaded corridor plan; however, it does not have a defined corridor, but rather a small passage. On the starboard side of the vessel, from stern to bow, are the crew lounge, the mess hall, and the laundry facilities. A workshop/locker area, the cook's cabin, the galley, and the galley storage area sit on the port side of the vessel. To the starboard side of the storage room is the chill box and freezer. To the aft end of the crew areas, on the port side of the vessel, are the emergency generator room, the fan room, and the smoke stack. On the starboard side of the vessel, there is a four-person decompression chamber to the aft of the crew lounge.

The stern area of the main deck is open, and contains the auxiliary retrieval and support equipment required to retrieve the booster stacks, frustums, and parachutes. The equipment, which includes cranes and parachute reels, sits in this area. All the equipment on the aft deck, including the crane, parachute reels, tow bits, and the boat cradles is bolt-on, bolt-off, allowing the equipment layout to be reconfigured in a few hours to support a specific mission.<sup>9</sup>

Each retrieval vessel carried the equipment necessary to deploy a crew to plug the aft-end nozzle of the booster stacks, pump out water, bring the spent vertically-oriented (spar buoy mode) booster stacks into the horizontal position (log mode), and tow them back to the Hangar AF SRB

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<sup>7</sup> ACI, "Kennedy Space Center."

<sup>8</sup> NASA, KSC, *Space Shuttle Solid Rocket Booster Retrieval Vessels*, NASA Facts (Florida: Kennedy Space Center, 2006), [http://www.nasa.gov/centers/kennedy/pdf/167446main\\_SRBvessels06.pdf](http://www.nasa.gov/centers/kennedy/pdf/167446main_SRBvessels06.pdf).

<sup>9</sup> Steve Roy, "Welcome Aboard Liberty Star," NASA Blogs, October 19, 2009, accessed at [html:file:///D:/resources-vessel/Blog with Pegasus/SRB Welcome Aboard Liberty Star\\_.mht](html:file:///D:/resources-vessel/Blog%20with%20Pegasus/SRB%20Welcome%20Aboard%20Liberty%20Star_.mht); David S. Fraine, interview by Rebecca Wright, *SRB Recovery Vessels Oral History Project*, April 10, 2012, 14-15, on file, Johnson Space Center History Office, Houston, Texas; ACI, "Kennedy Space Center."

Disassembly Facility at CCAFS. For the aft-end nozzle orifice plug operation, the support equipment included an Enhanced Diver Operated Plug, one 60-kw 400-cycle generator and a Quincy QR100 air-cooled, two-stage air compressor for dewatering the boosters. Four parachute reels (rollers) on each vessel were used to retrieve the three main parachutes and single drogue parachute (and pilot parachute, if recovered) on each booster. Each 5.5'-diameter reel has 8,000 pounds pull capability. A Model 410 Hallmark-Prentice 7,500-pound capability articulated deck crane with a power block was used for frustum retrieval. Each vessel also was equipped with one capstan (winch), one H-bit for towing the SRB, and a 1,200' air hose for booster dewatering. A conventional and a Nitrox compressor for diver breathing air and a hyperbaric chamber for diver emergencies were also provided.

The forecastle deck, or Deck 01 (Figure No. 3), sits within the forward 100' of the vessel, slanting from approximately 29' above the base at the forward end to 23' above the base at the aft end. It consists of an enclosed area surrounded by an open deck area. The enclosed portion of the deck begins 40' from the bow of the vessel, and has approximate overall dimensions of 36' in length and 26' in width. Its layout is based on a double-loaded corridor plan, with the Chief Scientist's (or NASA Operations) cabin and the Captain's cabin on the starboard side, and the vessel's office (or Owner's Study Room) and Captain's office on the port side. On the aft end of the deck, along the starboard side, is the boat deck. The smoke stack pierces through this deck on the aft end of the port side.

The bridge deck, or Deck 02 (Figure No. 4), sits directly over the enclosed area of Deck 01, slanting from approximately 33' above the base at the forward end to 31' above the base at the aft end. It is comprised of a single room, which measures roughly 34' in length and 17' in width, and as the name suggests, it contains the equipment necessary for the vessel's operations, including the wheel, engine controls, and electronic chart plotters table. Each vessel has consoles for a Kongsberg dynamic position system with joystick control, X-band and S-band radars with integrated automatic radar plotting aid and automatic identification systems, wide area surveillance system global positioning navigation systems, differential global positioning systems (GPS), handheld very high frequency (VHF) radios, tow wire monitoring and tension digital video and recording systems, voice and broadband satellite communication capability, VHF automatic direction finding, high frequency (HF) single-side band radios, night vision scope, collision-avoidance sonar, underwater communication unit, electronic chart plotter, direction finders,

fathometers, gyro compasses, and Sea Area-3 Global Maritime Distress Safety and System consoles. It is the only deck that contains large, fixed windows on all sides, and is surrounded on all four sides by an open walkway, which measures approximately 3' in width.<sup>10</sup>

**History:**

In December 1976, NASA awarded the contract for the checkout and assembly of SRBs, at both KSC and MSFC, to USBI of Huntsville, Alabama.<sup>11</sup> A supplement to this parent contract gave USBI the responsibility for the location and retrieval of expended SRB casings, parachutes, and other flight elements from the Atlantic Ocean, and delivery to the Hangar AF SRB Disassembly Facility located on the eastern shore of the Banana River at CCAFS. On July 13, 1979, NASA signed a letter contract with USBI, allowing the company to establish and operate a two-vessel SRB recovery force; the contract was managed by KSC. The letter was formalized in June 1980, through a contract that amounted to \$7,230,976, and covered the period through February 28, 1982, with the option of extension through February 28, 1995.<sup>12</sup>

In 1977, the Naval Undersea Center, San Diego, and the U.S. Navy Supervisor of Salvage, under contract with NASA, formulated and developed the final operational scheme and retrieval vessel specifications for the SRB Retrieval System.<sup>13</sup> NASA specified that the at-sea recovery operations be developed around using commercially available oilfield tug/supply vessels measuring at least 170 feet long. The design task was first to investigate the availability of such vessels suited to SRB recovery,

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<sup>10</sup> ACI, "Kennedy Space Center."

<sup>11</sup> USBI was a subsidiary of United Technologies Corporation (UTC) of Sunnyvale, California. Eleanor H. Ritchie, *Astronautics and Aeronautics, 1976, A Chronology* (Washington, DC: NASA, Office of Scientific and Technical Information, 1984), 300, <http://history.nasa.gov/AAchronologies/1976.pdf>.

<sup>12</sup> NASA KSC, "Alabama Firm To Conduct Shuttle Booster Retrieval Operations," News Release No: KSC 101-80, June 10, 1980, Sweetsir Collection, File No. ARCH00009097, Kennedy Space Center Archives Department, Florida. A third retrieval vessel, *Independence*, was built in 1985 by Halter Marine in Moss Point, Mississippi to support shuttle launch operations at Vandenberg Air Force Base in California. It was owned by the U.S. Air Force. After construction, she spent time at KSC getting ready for service. *Independence*, along with *Freedom Star* and *Liberty Star*, also was used in the salvage and recovery operations following the *Challenger* accident. On August 22, 1987, *Independence* left KSC for Port Hueneme, California, where the Air Force turned the vessel over to the Navy. "Photo caption," *Spaceport News*, September 11, 1987, 8; "KSC Welcomes VAFB's "Independence," *Spaceport News*, June 7, 1985, 3.

<sup>13</sup> The Technical Report for the SRB Retrieval System Final Design Concept was prepared in 1977 by the Naval Undersea Center (NUC TN 1822). Anker M. Rasmussen, "Solid Rocket Booster Retrieval Operations," in *Space Shuttle Technical Conference, Part 1*, ed. Norman Chaffee (Springfield, VA: National Technical Information Service, U.S. Department of Commerce, 1985), 505.