SPACE TRANSPORTATION SYSTEM HAER No. TX-116
Lyndon B. Johnson Space Center
Houston
Harris County
Texas

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
U.S. Department of the Interior
12795 W. Alameda Parkway
Denver, Colorado 80228-2838

HISTORIC AMERICAN ENGINEERING RECORD

SPACE TRANSPORTATION SYSTEM
HAER No. TX-116

Location: Lyndon B. Johnson Space Center
Houston
Harris County
Texas

Present Owner: Smithsonian Institution
Washington, DC

Present Use: Museum exhibit.

Significance: The Orbiter *Discovery*, OV-103, is considered eligible for listing in the National Register of Historic Places (NRHP) in the context of the U.S. Space Shuttle Program (1969-2011) under Criterion A in the areas of Space Exploration and Transportation and under Criterion C in the area of Engineering. Because it has achieved significance within the past fifty years, Criteria Consideration G applies. Under Criterion A, *Discovery* is significant as the oldest of the three extant orbiter vehicles constructed for the Space Shuttle Program (SSP), the longest running American space program to date; she was the third of five orbiters built by NASA. Unlike the Mercury, Gemini, and Apollo programs, the SSP's emphasis was on cost effectiveness and reusability, and eventually the construction of a space station. Including her maiden voyage (launched August 30, 1984), *Discovery* flew to space thirty-nine times, more than any of the other four orbiters; she was also the first orbiter to fly twenty missions. She had the honor of being chosen as the Return to Flight vehicle after both the *Challenger* and *Columbia* accidents. *Discovery* was the first shuttle to fly with the redesigned SRBs, a result of the *Challenger* accident, and the first shuttle to fly with the Phase II and Block I SSME. *Discovery* also carried the Hubble Space Telescope to orbit and performed two of the five servicing missions to the observatory. She flew the first and last dedicated Department of Defense (DoD) missions, as well as the first unclassified defense-related mission. In addition, *Discovery* was vital to the construction of the International Space Station (ISS); she flew thirteen of the thirty-seven total missions flown to the station by a U.S. Space Shuttle. She was the first orbiter to dock to the ISS, and the first to perform an exchange of a resident crew.

Under Criterion C, *Discovery* is significant as a feat of engineering. According to Wayne Hale, a flight director from Johnson Space Center, the Space Shuttle orbiter represents a "huge technological leap from

expendable rockets and capsules to a reusable, winged, hypersonic, cargo-carrying spacecraft." Although her base structure followed a conventional aircraft design, she used advanced materials that both minimized her weight for cargo-carrying purposes and featured low thermal expansion ratios, which provided a stable base for her Thermal Protection System (TPS) materials. The Space Shuttle orbiter also featured the first reusable TPS; all previous spaceflight vehicles had a single-use, ablative heat shield. Other notable engineering achievements of the orbiter included the first reusable orbital propulsion system, and the first two-fault-tolerant Integrated Avionics System. As Hale stated, the Space Shuttle remains "the largest, fastest, winged hypersonic aircraft in history," having regularly flown at twenty-five times the speed of sound.

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Date: November 2012

Project Information: Archaeological Consultants, Inc. (ACI), under contract to Innovative Health Applications (IHA; now InoMedic Health Applications, still IHA), and in accordance with NASA Lyndon B. Johnson Space Center's (JSC's) Memorandum of Agreement for the Retirement of the Space Transportation System (STS) from service, dated September 29, 2011. The documentation package, as a whole, includes an overview of the Space Shuttle Program, as well as the development of the Space Transportation System. Per the Memorandum of Agreement, *Discovery* (OV-103) is considered the "shuttle of record," and is therefore the focus of this documentation package. A technological history of *Discovery*, a physical description of her structure and system, as well as her missions and milestones, is included. Where appropriate, the engineering uniqueness of *Atlantis* (OV-104) and *Endeavour* (OV-105) are discussed in relation to *Discovery*. Also included in the documentation package is a historical discussion and description of the other components of the Space Transportation System: the space shuttle main engines (SSMEs), the external tank (ET), and the solid rocket boosters/reusable solid rocket motors (SRBs/RSRMs).

The field team for black and white photograph efforts consisted of photographers Jeffrey Wolfe, Adam Nehr, and Tom Farrar, all from

QinetiQ North America, and architectural historian, Patricia Slovinac (ACI). The negatives were processed by the photography lab at JSC.

Research was conducted at JSC and the archives at the University of Houston-Clear Lake, John F. Kennedy Space Center (KSC) and George C. Marshall Space Flight Center (MSFC) by principal investigator, Joan Deming (ACI), and Ms. Slovinac. Additional information for the written narrative was gathered through formal interviews with current NASA and contractor personnel, which were conducted by Dr. Jennifer Ross-Nazzal and Ms. Rebecca Wright, of DB Consulting Group, Inc, in Houston, Texas. Assistance with research and the completion of the written historical and descriptive data was provided by numerous people, as noted in the acknowledgements. The written narrative was prepared by Ms. Deming and Ms. Slovinac, with contributions by Architectural Historian Christopher Berger (ACI).

Measured drawings of *Discovery*, the SSME, the ET, and the SRBs/ RSRMs were completed by the National Park Service, HABS/HAER/ HALS program, Washington, D.C., under the leadership of Thomas M. Behrens, HAER Architect.

Acknowledgements: ACI is most appreciative of the assistance and generous cooperation provided by many individuals at the different NASA centers, including civil servants and contractors. Our most special thanks are extended to Perri E. Fox, JSC Transition Manager, Lead, STS Recordation Team, for organizing the documentation effort. We are also indebted to the entire STS Recordation Team, as follows:

- Headquarters: Jennifer Groman (NASA Federal Preservation Officer), Kathy Callister, John Emond, Tina Norwood, Heather Pizzamiglio, Valerie Vo;
- JSC: Barbara Severance, Kevin Templin, Sandra Tetley, Jill Lin, Peggy Wooten, Lynn Lefebre;
- KSC: Barbara Naylor, Nancy English
- MSFC: Ralph Allen, Jim Ellis;
- DRFC: Dan Morgan, Dara English;
- MAF: Francis Celino, Ernest Graham;
- SSC: Marco Giardino;
- DB Consulting Group, Inc.: Jennifer Ross-Nazzal;
- Futron Corporation: Jill Jahn, Nigel Clark;
- Ares Corporation: Catherine Kaminski; and
- IHA: Shannah Trout.

In addition to providing valuable information to ACI throughout the production of this documentation package, the members of the STS Recordation Team assisted in the scheduling of research trips to JSC, KSC, and MSFC, and coordinated meetings and interviews with key personnel. ACI would like to extend our gratitude to all of those who assisted us during the research trips, as follows:

- JSC: Kathleen Kaminski, Ron Bailey, John Casper, Hank Rotter, Elizabeth Johnson, Maura White;
- KSC: Denise Thaller, John Shaffer, Rob Stute, Stephanie Stilson, Foster Anthony, Donna Atkins, Tony Bartolone, Lynn Donovan, Steven Lewis, Elaine Liston, Douglass Lyons, Becky Thompson, Sandy Van Hooser, Jeff Wheeler, Rita Willcoxon;
- MSFC: Dominic Amatore, Mike Wright, Mike Allen, Mike Vanhooser, Linda Posey, Molly Porter, Roena Love, Tim Garner, Alan Grady, Brenda Sutherland, Jeffrey McCaleb, Anne Meinhold, Steve Glover, Dan McCranie, Len Bell, Robert Moran, Larry Caddy, Chet Young, Richard Leonard, Bob Carmac;
- Boeing: Bill Roberts, William Musty, Robert Kahl, Alan Branscomb, Frank Manriquez;
- DB Consulting Group, Inc.: Rebecca Wright;
- USA: Caryn Antes, Jim Carleton, Joe Chaput, Mike Cosgrove, Ralph Esposito, Tom Ford, Don Fountain, Greg Henry, Randy Holcom, Phil Ketron, Lois Kroupa, Sue Kundid, Dick Lewis, Scott Lockwood, Charles Martin, Jim Wise, Barry Bowen;
- Pratt & Whitney Rocketdyne: Calvin D. (DeWayne) Collins, Don Ewers, Eric Gardze, Daniel Hausman, Joseph Sylvestro;
- ATK: Michael Bowen;
- University of Houston-Clear Lake Archives: Shelly Kelly, Regina (Jean) Grant;
- IHA: Jane Provancha, Joanne Creech, Wilson Timmons, Teresa King, Mark Mercadante;
- DP Associates: James Garner, Stephen Brooks;
- Futron: Cindy Ocel; and
- Dennis Jenkins.

ACI would also like to extend our thanks to the subject matter experts, aside from the STS Recordation Team, who read and provided review comments for the individual draft sections, as follows:

- JSC: Darren Fasbender, A. Foxwort (orbiter structure), Dave Gruber, Doug Haskovec (TPS), Rick Henfling (Booster), R.A.

Jarvis (ECLSS), Terry Keeler, Dean Lenort (OMS, RCS, orbiter structure), Mike Maher, Kevin McCluney (Landing/Deceleration, Mechanical, additional systems), Randy McDaniel, Rachel Murphy, David Pogue (additional systems), Kara Pohlkamp (ECLSS, DPS, GNC), Jon Reding, Christine Reichert (additional systems), Robert Schwank (DPS), Ken Smith (APU/Hydraulic), and Karen Walsemann (Export Control);

- KSC: Robin Ferebee (SRB);
- MSFC: Steven Wofford, Allen Blair, and Katherine P. Van Hooser (SSME); James Garner (ET); Jeffery McCaleb, Daniel P. Mellen, Chester E. Young, and Jack Hengel (SRB); and
- BFA Systems, Inc.: Alan L. Norwood (SRB).

In addition, ACI would like to express our gratitude to the following:

- Tom McCullough, Advisory Council on Historic Preservation;
- Richard O'Connor and Thomas M. Behrens, National Park Service, Washington, DC;
- Greg Kendrick and Christine Whiteacre, NPS Intermountain Region;
- Mark Wolfe, Linda Henderson, Stan Graves, Elizabeth Butman, and Kelly Little, Texas Historical Commission;
- Frank White and Elizabeth Brown, Alabama Historical Commission;
- Milford Wayne Donaldson and Mark Beason, Office of Historic Preservation, State of California; and
- Laura Kammerer, Florida Division of Historical Resources.