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Tools and Crew Aids

Although the Hubble Space Telescope (HST) was designed and built with a number of handholds and other accessories to help spacewalking astronauts service the observatory, the crew of STS-61 will take more than 150 other tools and crew aids with them when they blastoff on their planned 11-day servicing mission in December 1993.

The tools and crew aids, known as Space Support Equipment (SSE) hardware, range from a simple bag for carrying some of the smaller tools to sophisticated, battery-operated power tools. They will be used by the EVA crew members who will make at least five spacewalks to carry out the challenging task of servicing the spacecraft.

Crew aids are defined as those fixed-in-place or portable equipment items, not hand tools, used to assist crew members in accomplishing servicing mission tasks. SSE equipment crew aids permit the crew members to maneuver safely or to restrain themselves, transfer Orbital Replacement Units (ORUs) and other portable items, protect equipment and crew during changeout activities and temporarily stow or tether equipment during Extra Vehicular Activities (EVAs). Examples of crew aids are: handrails, handholds, translation devices, transfer equipment, protective covers, tethering devices, grapple fixtures, foot restraint sockets and stowage and parking fixtures.

Tools are hand operated or manipulated devices that allow the EVA astronauts to increase the efficiency of performing intricate, labor intensive tasks. Tools allow the operation of HST and SSE interfaces to permit access to equipment, removal and replacement of ORUs and the worksite restraint of crew members, tools and hardware using platforms, caddies or equipment tethers. Tools also provide for temporary storage of hardware items, supplemental lighting and manual operation of spacecraft and payload appendages and mechanisms during EVAs.

The tools and crew aids will be stowed on the Solar Array Carrier (SAC), ORU Carrier (ORUC), Flight Support System (FSS), HST Tool Box, Sidewall-

mounted adapter plates, Provisions Stowage Assembly (PSA), an Adaptive Payload Carrier (APC), mid-deck lockers, aft flight deck and in the airlock. The tools and crew aids are provided by both the Johnson Space Center, Houston, Tex., and the Goddard Space Flight Center, Greenbelt, Md.

Tools and crew aids considered "general" with a wide variety of uses on the planned 11-day, five-EVA mission include the Power Ratchet Tool (PRT), Multi-setting Torque Limiter (MTL), adjustable extension with 7/16" sockets, ingress aids, portable work light receptacle and a locking connector tool. More specific "general" items are a low gain antenna (LGA) cover, umbilical connector covers, a flight support system (FSS) berthing and positioning system (BAPS) support post and a multi-layer insulation (MLI) repair kit.

To be used to changeout the Wide Field/Planetary Camera (WF/PC) will be the WF/PC handholds, WF/PC guide studs, quick-release zip nuts, WF/PC pick-off mirror cover, forward fixture, aft fixture and the HST radial bay cover.

For the High Speed Photometer (HSP) replacement with the Corrective Optics Space Telescope Axial Replacement (COSTAR), tools and aids to be used will be the COSTAR contamination cover, a COSTAR handling aid, a HSP handling aid, forward fixture, aft fixture and an axial science instrument protective enclosure (SIPE) safety bar.

For the solar array replacement, the astronauts will use articulating foot restrains (AFRs), solar array primary drive mechanism handles, solar array temporary stowage brackets (TSBs), solar array transfer handles, solar array jettison handle, solar array spines, portable flight releasable grapple fixture (PFRGF) and a Marmon clamp.

For the changeout of the gyro rate sensor units, the crew members will use a portable foot restraint (PFR) socket converter (90-degree), fixed head star tracker (FHST) light shade covers and a FHST delta plate cover.

The Goddard-provided power ratchet tool (PRT) is powered by a 28-volt battery. Made of titanium and

aluminum, the tool will be used for tasks requiring controlled torque, speed or turns and can be used where right-angled access is required. It will provide 25 foot pounds of pressure in the motorized mode and 75 foot pounds of pressure in the manual mode and has a speed of 10 to 30 RPMs. The power ratchet tool wrench is approximately 17 inches long. A spare PRT will be carried on the mission, as will spares for all other tools to be used by the astronauts.

The seven crew members on the first Hubble Space Telescope servicing mission (STS-61) are Dick Covey, commander; Ken Bowersox, pilot; Story Musgrave, payload commander; Claude Nicollier, ESA mission specialist; and Tom Akers, Kathy Thornton and Jeff Hoffman, mission specialists.

The mission is scheduled for liftoff from the Kennedy Space Center. The space shuttle Endeavour will be the orbiter for the mission.

The first servicing mission tool and crew aids complement includes:

Tool/Crew Aid	Stowage Location
Axial Safety Bar	ORUC
BAPS Support Post	FSS Latch Beam
Co-Processor/DF-224	
Stabilization Post	ORUC
COSTAR Contamination Cover	ORUC (launch); starboard PSA (return)
Delta Plate Cover, FHST	Starboard PSA
FSS Handrails	FSS
FSS PFR Sockets	FSS
Light Shade Cover, FHST	Starboard PSA
Low Gain Antenna Cover	FSS
ORUC BISIPE Handrails	ORUC
ORUC BISIPE PFR Sockets	ORUC
ORUC Pallet Handrails	ORUC
ORUC Shelf Handrails	ORUC
ORUC LOPE Handrails	ORUC
ORUC SOPE Handrails	ORUC
ORUC PFR Sockets	ORUC
PFR Socket Converter (90 degrees)	Starboard PSA
PFR Ingress Aid	ORUC
Portable Grapple Fixture	Solar Array Carrier
Solar Array PDM Handle	Solar Array Carrier
Solar Array Spines	Solar Array Carrier
Solar Array Transfer Handle	Solar Array Carrier
Solar Array AFR	Solar Array Carrier
Solar Array Carrier Handrails	Solar Array Carrier
Solar Array Carrier PFR Socket	Solar Array Carrier
COSTAR Handling Aid	ORUC
High Speed Photometer Handling Aid	FSS (launch); HSP (return)
Umbilical P105, P106, Connector Cover	Middeck Locker
WF/PC Portable Handhold with zip nuts	ORUC
WF/PC Guide Stud Adapter	Middeck Locker
WF/PC Mirror Cover	ORUC
HST Radial Bay Cover	Solar Array Carrier
7/16-inch Socket Extension, Long	Middeck Locker
7/16-inch Socket Extension, Short	Middeck Locker
Connector Locking Tool	Middeck Locker
Multi-setting Torque Limiter	HST Tool Box and Middeck Locker
Power Ratchet Tool Wrench	Middeck Locker
Power Ratchet Tool Controller	Middeck Locker
Power Ratchet Tool Battery Module	Middeck Locker
Power Ratchet Tool Transfer Bag	Middeck Locker