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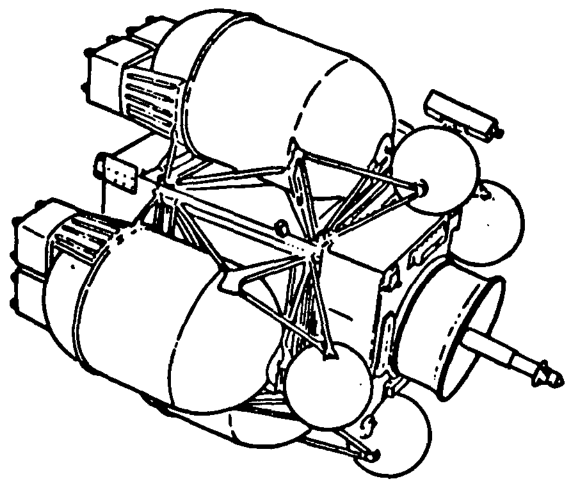

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Project Teleoperator Retrieval System

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NASA DEVELOPS TELEOPERATOR RETRIEVAL SYSTEM

Background

A Teleoperator Retrieval System (TRS) is being developed by NASA for first use in late 1979. Ordered by the NASA administrator in late October 1977, the retrieval system's first assignment will be either to re-boost the Skylab orbiting space laboratory to a higher orbit or to de-orbit it to a remote ocean area. The decision to re-boost or de-orbit is expected early in 1979.

NASA's Marshall Space Flight Center, Huntsville., Ala., was assigned management responsibility for TRS development in October 1977.

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The design concept has evolved from teleoperator supporting research and development that has been underway since the mid-1960s. Hardware fabricated by the Marshall Center as part of this development has been used to validate subsystem design and to develop control and operation techniques.

Anticipated long-range usefulness of the TRS for payload survey, stabilization, retrieval and delivery missions; its recovery and re-use capability; and its adaptability for the Skylab re-boost/de-orbit mission; led to its selection.

Preliminary design was initiated in November 1977 under a contract with Martin Marietta Corp., Denver Division. Negotiations for a complete development contract with Martin Marietta are scheduled to be completed by April 1, 1978. Estimated total costs are about $35 million.

Description

The TRS has a central core with its own propulsion system. It is designed to accommodate strap-on kits for additional propulsion.

The core is equipped with a 24-nozzle attitude control system that provides six degrees of freedom in controlling the vehicle during rendezvous, docking and initial orientation. Its thrusters originally were designed for cold gas propulsion, but designers are now studying the possibility of using a lower cost hydrazine (hot gas) adaptation.

The strap-on propulsion kits contain a propulsion fuel tank and pressurant supply and eight hydrazine rocket engines.

Guidance and attitude control maneuvers can be controlled either through pre-programmed instruction in the core communication and data management computer, or through manual control by a Shuttle crew member, using support equipment in the orbiter. Rendezvous maneuvering and docking with the Skylab or any other objects in space would be accomplished remotely by the crew member, who can view the area around the docking adapter on a TV monitor.

A schedule allowing less than two years for development, plus the low cost objective, dictated maximum use of developed hardware. While the TRS structure and orbiter structure will be new designs, all other systems are designed almost completely with components that are either off-the-shelf qualified hardware from other programs, or are under contract and will be available, qualified and flown before the TRS is used.

Systems

The basic TRS core vehicle is box-like, 1.2 by 1.2 by 1.5 meters (4 by 4 by 5 feet), with a triad of attitude control thrusters on each of its eight corners. The thrusters, in the 2.25 to 4.5-kilograms (5 to 10-pound) range, will provide three-axis attitude control and backward and forward maneuverability.

The core houses a guidance, navigation and control system, a communications and data management system and a propellant tank. A docking system is mounted on the forward end of the core, together with two TV cameras.

A Skylab re-boost or de-orbit mission will require four strap-on propulsion kits. One kit, 0.9 m (3 ft.) in diameter and 1.5 m (5 ft.) long, will be attached to each of the four long sides of TRS core. Each kit will carry 680 kg (1,500 lb.) of hydrazine and each of its eight rocket engines will have a minimum of 111 newtons (25 lb.) of thrust, providing a total of at least 3,500 N (800 lb.) of thrust for the Skylab re-boost/de-orbit mission.

Many payload delivery missions will require only two strap-on kits.

Orbiter Command Station

The TRS communications and data management hardware in the orbiter will be located on the aft flight deck. Special hand controls, a TV monitor and other controls and displays are required here so that a crew member can remotely control or monitor the teleoperator through all phases of the mission.

The command station will be used for transmitting, receiving and processing telemetry to and from the TRS and to issue commands and receive TV pictures.

Skylab Re-Boost/De-Orbit Mission

The TRS will be mounted on a special support structure in the Shuttle's cargo bay for launch from NASA's Kennedy Space Center, Fla. The Shuttle will park in orbit in the vicinity of the Skylab's position.

The TRS will self-eject from the cargo bay and, using the core thrusters for propulsion, the orbiter crew member will accomplish the Skylab rendezvous and docking maneuver through the command station control system.

The TRS system is designed for docking with payloads having moderate dynamic motions, such as tumble, rolling and coning.

When docking is completed, the core thrusters will be used again to maneuver the Skylab into the proper attitude for re-boost or de-orbit. At this point, rockets of the four strap-on kits will be fired. Two burns of about 13.5 minutes each will be required for the re-boost mission, and one long burn of about 27 minutes will accomplish the de-orbit mission.

Following re-boost or de-orbit, the TRS will be separated from the Skylab and will be placed in an orbital storage mode for retrieval on a subsequent Shuttle flight.

Future TRS Uses

The TRS core vehicle will complement Shuttle orbiter capabilities for safe payload inspection and retrieval operations. Its compact, small size offers minimal cargo bay encroachment, as well as propellant savings for on-orbit maneuvering of payloads.

The core system is designed with a built-in versatility for growth applications. Growth kits, such as manipulators and steerable high gain antennas, can be added with minimum integration cost.

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Typical of the growth applications are: payload retrieval at higher orbits than Shuttle is designed to achieve; large structure assembly; emergency payload repairs; and retrieval of unstable objects or space debris.

A photograph (artist's drawing) to illustrate this fact sheet release will be distributed without charge only to media representatives in the United States. It may be obtained by writing or phoning:

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