# Teleoperator for space shuttle - The space connection

**Canada stands to reap considerable industrial benefits from its investment in a unique area of high technology — the design and development of a remote manipulator system, a 50-foot (15 m) long mechanical arm, as part of NASA's space shuttle program.**

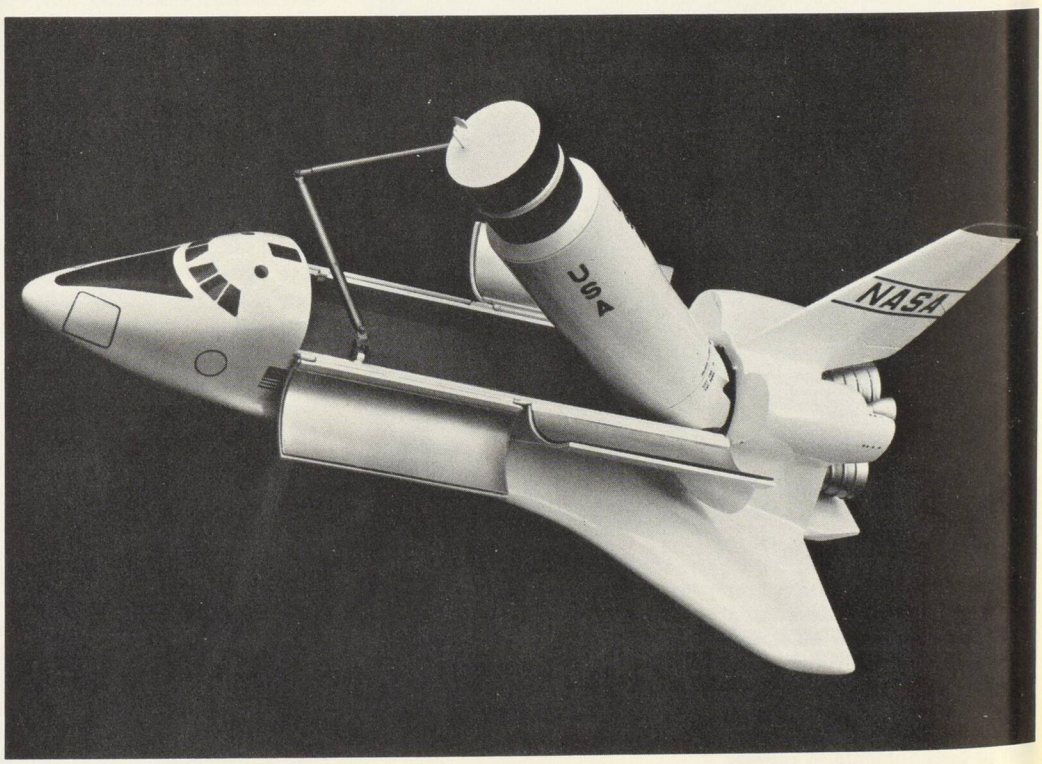
One of the major roles of the National Research Council of Canada, as stated in the 1974-1975 Report of the President, is to "complement and assist research in industry and . . . encourage and assist, where feasible, R & D projects to be carried out in industry." This quotation helps place in context one major NRC project in which the Council is acting as a coordinating and management agency rather than actively carrying out work in its own laboratories. The project is the design and development of the remote manipulator system (or "teleoperator") for the United States' re-usable Space Shuttle orbiter vehicle.

The concept for the U.S. Space Transportation System of which the Space Shuttle is a part dates back to shortly after the first moon landing when the National Aeronautics and Space Administration (NASA) began to direct its attention towards a post-Apollo manned space flight program which would offer maximum benefit to the world's scientific community, facilitate international cooperation and provide space flight opportunities to researchers who would not have to be trained astronauts. The resulting system dispenses with the massive Saturn launch vehicle, using instead a craft, the Orbiter, a wide-bodied delta-winged aircraft about the size of a DC-9 which, with the assistance of two solid-fuel recoverable booster rockets and a disposable fuel tank, is launched into earth orbit carrying up to 65,000 lb (29 500 kg) of payload. After completing its missions (usually within a seven-day period, although the Orbiter could remain in orbit for up to 30 days if required), it re-enters the earth's atmosphere and can be flown down to a conventional landing.

The large cargo-carrying capacity of the Orbiter is of particular significance since it permits the carrying into orbit of manned space laboratories and it is estimated by NASA that more than a third of the missions contemplated will be for this purpose. Use of the Orbiter for positioning automated satellites in orbit will result in a considerable increase in satellite reliability — the Orbiter will carry an unmanned satellite to the required altitude and, before the satellite is committed to space, it can be thoroughly checked; if there appear to be malfunctions which cannot be corrected on-board then the satellite can be returned to earth for repair. A study of 131 satellite failures, made by Lockheed on behalf of NASA in 1974, revealed that 78 were related to launch problems and 53 to spacecraft anomalies — had this system been available many of these failures could have been avoided. In addition, the cargo-carrying capacity of the Orbiter means that satellite designers will not have to operate under the severe weight constraints normally imposed by conventional launch vehicles, so comparatively inexpensive materials and standard laboratory equipment can replace expensive materials and highly miniaturized components.

With the formulation of the United States Space Transportation System concept, the Administrator of NASA visited Europe and Canada and other interested countries to inform the appropriate national research agencies of the post-Apollo program and to encourage their participation in it. Canadian representatives spent considerable time in discussions with NASA representatives in order to identify possible Canadian contributions to the program and to determine the form of any Canadian participation. An agreement reached between NASA and the European Space Agency (ESA — formerly the European Space Research Organization) for the latter organization's development of the manned space laboratory (Spacelab) suggested a pattern that the Canada-U.S. agreement could follow. In the ESA-NASA agreement, ESA assumed responsibility for the design, development, qualification and provision of a

**Development of remote handling technology could in the long term have significant implications for "spaceship earth". A scale model of the Orbiter using the remote manipulator to offload a cargo.**




**A long terme, le développement d'une technologie des télémanipulations pourrait avoir des applications importantes à bord du "vaisseau spatial Terre". Maquette de l'Orbiter en configuration de déchargement d'une charge utile à l'aide du télémanipulateur.**

NASA