Sally K. Ride Papers - Shuttle Remote Manipulator System Notes and Papers (and Letter from National Research Council Canada)

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SYSTEM DESIGN FEATURES OF THE SPACE SHUTTLE REMOTE MANIPULATOR

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ABSTRACT

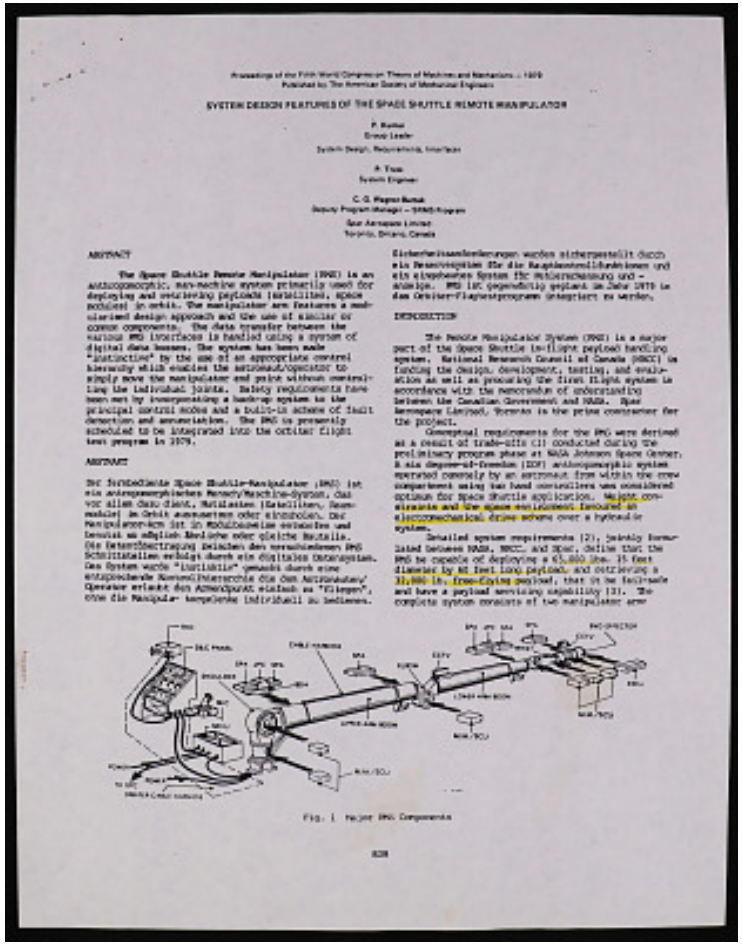
The Space Shuttle Remote Manipulator (RMS) is an anthropomorphic, man-machine system primarily used for deploying and retrieving payloads (satellites, space modules) in orbit. The manipulator arm features a modularized design approach and the use of similar or common components. The data transfer between the various RMS interfaces is handled using a system of digital data busses. The system has been made "instinctive" by the use of an appropriate control hierarchy which enables the astronaut/operator to simply move the manipulator end point without controlling the individual joints. Safety requirements have been met by incorporating a back-up system to the principal control modes and a built-in scheme of fault detection and annunciation. The RMS is presently scheduled to be integrated into the orbiter flight test program in 1979.

ABSTRAKT

Der fernbediente Space Shuttle-Manipulator (RMS) ist ein antropomorphisches Mensch/Machine-System, das vor allem dazu dient, Nutzlasten (Satelliten, Raum-module) im Orbit auszusetzen oder einzuholen. Der Manipulator-Arm ist in Modulbauweise entworfen und benutzt wo möglich ähnliche oder gleiche Bauteile. Die Datentübertragung zwischen den verschiedenen RMS Schnittstellen erfolgt durch ein digitales Datensystem. Das System wurde "instinktiv" gemacht durch Eine entsprechende Kontrollhiererchie die dem Astornauten/Operator erlaubt den Armendpunkt einfach zu "fliegen" ohne die Manipula- torgelenke individuell zu bedienen. Sicherheitsanforderungen wurden sichergestellt durch ein Reservesystem für die Hauptkontrollfunktionen und ein eingebautes System für Fehlererkennung und - anzeige. RMS ist gegenwärtig geplant im Jahr 1979 indas Orbiter-Flugtestprogram integriert zu warden.

INTRODUCTION

The Remote Manipulator System (RMS) is a major part of the Space Shuttle in-flight payload handling system. National Research Council of Canada (NROC) is funding the design, development, testing, and evaluation as well as procuring the first flight system in accordance with the memorandum of understanding between the Canadian Government and NASA. Spar Aerospace Limited, Toronto is the prime contractor for



the project.
Conceptual requirements for the RMS were derived as a result of trade-offs (1) conducted during the preliminary program phase at NASA Johnson Space Center. A six degree-of-freedom (DOF) anthropomorphic system operated remotely by an astronaut from within the crew compartment using two hand controller was considered optimum for Space Shuttle application. Weight constraints and the space environment favoured as electromechanical drive scheme over a hydraulic system.
Detailed system requirements (2), jointly formulated between NASA, NRCC, and Spar, define that the RMS be capable of deploying a 65,000 lbs. 15 feet diameter by 60 feet long payload, and retrieving a 32,000 lb. free-flying payload, that is be fail-safe and have a payload servicing capability (3). The complete system consists of two manipulator arms
[[RMS diagram]] Fig. 1 Major RMS Components
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