

June 23, 1961

SEA, of rendezvous docking apparatus

Project 3428

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June 23, 1961

From Langley Research Center
To NASA Headquarters, Washington, D. C. - Code RTM

Subject: Request for approval of rendezvous docking apparatus at Langley Field, Va.

1. It is requested that approval be granted for a rendezvous docking apparatus at Langley Field, Va.
2. A description and justification are attached.

Rufus O. House
Budget Officer

Approved by:

Floyd L. Thompson
Director

Director, CARP

cc: Engr. Div. Files
Budget
Cost
Planning
Chief, Procurement
Cost Engr. Staff
Tech. Assistant, Research Facilities
Plant Engineering
Research Equipment Design Section
Electrical Engineering Branch

NASA Headquarters' approval: 8 -15 -61
Project number: 3422
Not to exceed: \$ 243,020 .00

June 23, 1961

LANGLEY RESEARCH CENTER

REQUEST FOR APPROVAL OF RENDEZVOUS DOCKING APPARATUS AT LANGLEY FIELD, VA.

1. DESCRIPTION:

(This project will consist of a rendezvous docking apparatus to be located in building 1244 (formerly flight research hanger) at Langley Field, Va.) Included in this project will be an overhead bridge crane from which will be suspended an existing three-axis gimbal system containing a representation of the rendezvous vehicle (controls, instruments, and pilot). The bridge crane will be mounted below the roof trusses of building 1244 and will provide approximately 200 feet of linear travel in the closure direction with less travel in the transverse directions. The crane will be driven by motors capable of providing up to 0.25g linear accelerations and speeds up to 20 to 30 ft/sec. (The suspended gimbal system will provide the required rotational degrees of freedom and the apparatus will be designed to operate in conjunction with an existing analog computer and other existing elements that have been used in previous Langley simulation experiments. The rendezvous vehicle will be controlled from either the cockpit in the gimbal system or remotely.)

2. JUSTIFICATION:

Langley has conducted extensive analytical and analog computer studies of the guidance and control problems associated with the launch, midcourse, and terminal phases of the rendezvous maneuver. The results of these studies have shown that the various phases can be accomplished using either automatically or manually controlled vehicles. However, little research has been carried out involving the problems associated with the final or docking phase of the rendezvous maneuver. Some of the problem areas of extreme interest in the docking operation are:

- (a) Guidance, control, and propulsion requirements for both automatic and piloted systems
- (b) Required instruments and visual aids necessary for a pilot to effect the maneuver
- (c) Operational and design requirements for coupling and transfer (personnel and material) systems

- (d) Import loads developed during coupling and how these loads affect the structural design of the coupling systems and the vehicles

The problems associated with the docking maneuver are very complex due to the fact that relative motions and spatial relationships of two approaching and contacting vehicles are involved. To simulate the docking maneuver properly requires equipment that will provide the necessary six degrees of freedom (three linear and three angular) plus sufficient linear travel to provide realistic visual cues. At the present time no equipment exists which provides these capabilities. The proposed facility is designed to provide the motions and linear travel required for a realistic simulation.

The rendezvous docking facility, although designed primarily to investigate docking problems, also has the capability of providing useful information concerning a variety of other problems such as:

- (a) Final touchdown phase of either a manually or automatically controlled lunar soft landing
- (b) A manually or automatically controlled launch from the lunar surface to rendezvous with an orbiting satellite
- (c) Control problems associated with reentry
- (d) Basic studies of human response (transfer functions) as affected by quality and quantity of motion cues provided in order to improve the realism of simulators
- (e) Evaluation of controller configurations during realistic applications
- (f) Take-off, touchdown, and hovering of STOL and VTOL aircraft

July 7, 1961

3. COST ESTIMATE:

By contractual services:

Engineering design	\$ 20,550
Crane, rails, and support	45,970
Hoist and gimbal support	45,275
Electrical and controls	<u>122,250</u>

*Palmer -
Harold Johnson - PEES
Chippelle - ELECT -*

Total by contractual services \$234,045

By Langley labor:

Engineering and associated services	<u>8,975</u>
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Total estimated cost \$243,020

4. TIME SCHEDULE:

Design and award of contract 130 days

Construction and installation 300 days

Total completion time 430 days

This project will not interfere with research operations.