# TECHNICAL MANUAL

# AVIATION UNIT AND AVIATION INTERMEDIATE MAINTENANCE MANUAL

# CH-47D HELICOPTER

**This manual together with TM 55-1520-240-23-1, TM 55-1520-240-23-2, TM 55-1520-240-23-3, TM 55-1520-240-23-4, TM 55-1520-240-23-5, TM 55-1520-240-23-6, TM 55-1520-240-23-7, TM 55-1520-240-23-8, TM 55-1520-240-23-10, TM 55-1520-240-23-11, supersedes TM 55-1520-240-23-1, TM 55-1520-240-23-2, TM 55-1520-240-23-3, TM 55-1520-240-23-4, TM 55-1520-240-23-5, TM 55-1520-240-23-7, TM 55-1520-240-23-8, TM 55-1520-240-23-9, TM 55-1520-240-23-10, 10 May 1983, and TM 55-1520-240-23-6, 6 May 1983, including all changes.**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY**
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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 19 SEPTEMBER 2002

# AVIATION UNIT AND AVIATION INTERMEDIATE MAINTENANCE MANUAL

## CH-47D HELICOPTER

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual, directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our fax number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual immediately preceding the hard copy 2028. For the World Wide Web use: https://amcom2028.redstone.army.mil.

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*This manual together with TM 55-1520-240-23-1, TM 55-1520-240-23-2, TM 55-1520-240-23-3, TM 55-1520-240-23-4, TM 55-1520-240-23-5, TM 55-1520-240-23-6, TM 55-1520-240-23-7, TM 55-1520-240-23-8, TM 55-1520-240-23-10, TM 55-1520-240-23-11, supersedes TM 55-1520-240-23-1, TM 55-1520-240-23-2, TM 55-1520-240-23-3, TM 55-1520-240-23-4, TM 55-1520-240-23-5, TM 55-1520-240-23-7, TM 55-1520-240-23-8, TM 55-1520-240-23-9, TM 55-1520-240-23-10, 10 May 1983, and TM 55-1520-240-23-6, 6 May 1983, including all changes.

# CHAPTER 11
# FLIGHT CONTROLS SYSTEM

## SECTION I
## FLIGHT CONTROLS SYSTEM DESCRIPTION AND OPERATION

## 11-1 FLIGHT CONTROLS 11-1

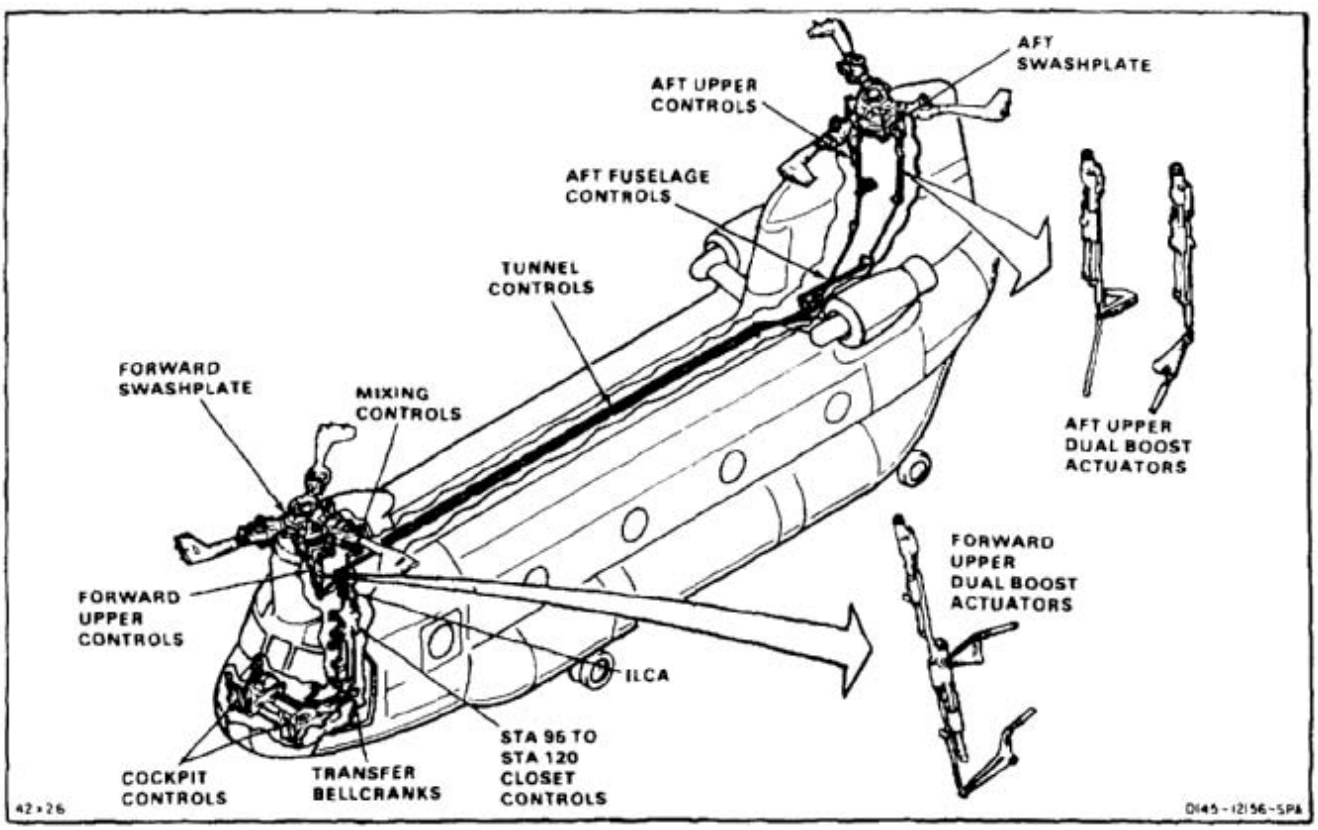
The flight control system is electrohydraulic operated and powered by two independent hydraulic boost systems. Control inputs from the cockpit are transmitted through mechanical linkage to the integrated lower control actuator (ILCA). The ILCA then transmits individual control motions to the first and second stage mixing units. The mixed outputs are then transmitted through a series of push-pull tubes to the upper dual-boost actuators attached to the forward and aft swashplates.

The helicopter is vertically controlled with the thrust control lever, through application of equal pitch to all blades. Directional control is obtained with the directional (yaw) pedals by imparting equal but opposite inputs to the forward and aft swashplates. Lateral control is obtained with cyclic (roll) stick by application of equal inputs left or right tilting the swashplates causing both rotor discs to tilt equally moving the helicopter either left or right.

The helicopter is longitudinally controlled with the cyclic (pitch and roll) stick through application of differential collective pitch. For forward motion, the pitch of the forward rotor blades is decreased while the pitch of the aft rotor blades is increased. The opposite action occurs with aft movement of the helicopter. The helicopter has an Advanced Flight Control System (AFCS) for stabilization and coupled flight control operations.

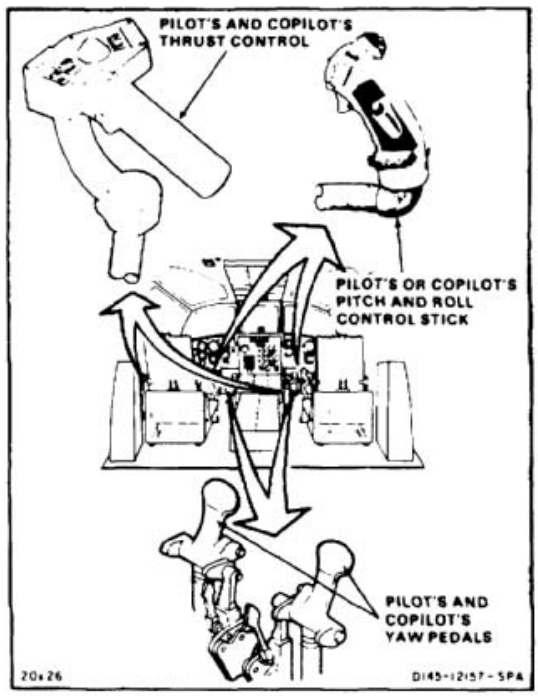
The flight control system is divided into seven main sections:

Cockpit controls
Closet controls between sta. 95 and 120
First and second stage mixing controls
Forward upper controls
Tunnel controls
Aft fuselage controls
Aft upper controls



### *COCKPIT CONTROLS*

The pilot and copilot each have a set of controls. They are interconnected under the cockpit floor so that if one set is moved, the other set moves in the same direction. Each set of controls contains a pitch and roll control stick, a thrust control, and yaw pedals.

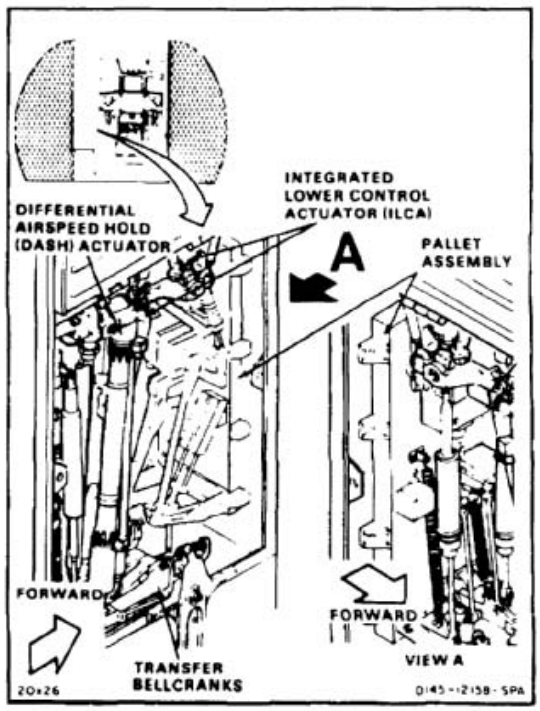



### *CLOSET CONTROLS*

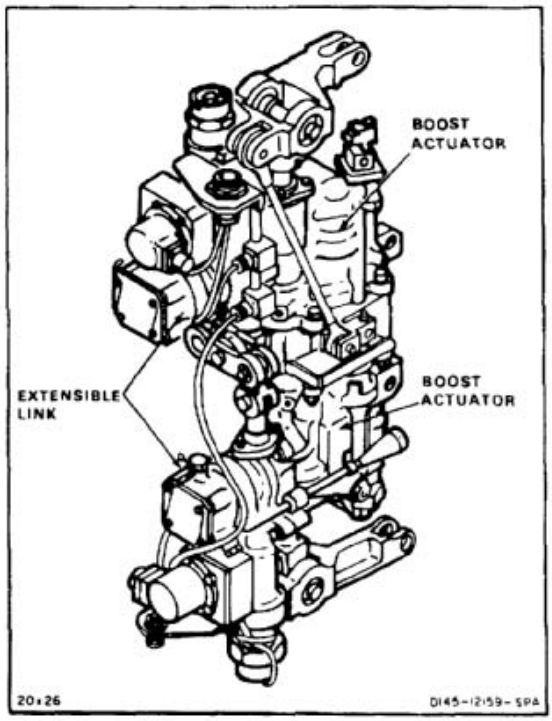
Cockpit control movements are transferred through linkage to the transfer bellcranks and vertical controls in the lower section of the controls closet.

Contained within this closet are the integrated lower control actuators (ILCA), differential airspeed hold actuator (DASH), and two pallet assemblies. The pallet assemblies contain spring assemblies, magnetic brakes, cockpit control drive actuators (CCDA) with integral magnetic brakes, viscous dampers, and control position transducers. The spring assemblies and magnetic brakes provide artificial feel to the cockpit controls, since normal feel is lost because of the hydraulic assist.

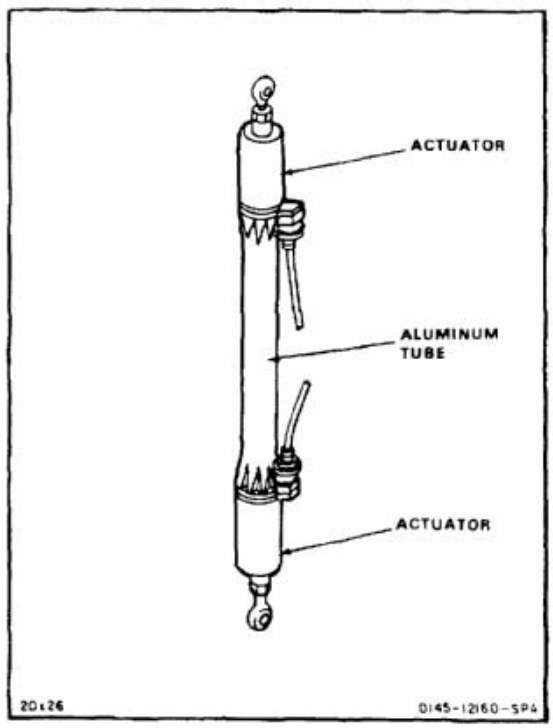
Connecting links in the upper closet with **26** have a special coating that increases their resistance to heat and fire.



There are four integrated lower control actuators. The actuators are similar but not interchangeable, once they are set up for a particular control. The pitch, roll, and yaw ILCA's have a dual boost actuator and two extensible link actuators. The thrust ILCA does not have the extensible links. The boost actuators provide hydraulic assist for cockpit control inputs. The extensible links are actuating cylinders, controlled by the AFCS, which provide inputs to the upper flight control servocylinders, without any corresponding motion of cockpit controls. If the AFCS is not in use, the extensible links act as rigid links.




The DASH actuator installed in the pitch control system consists of two electromechanical linear actuators mounted on an aluminum tube. Both actuators receive identical control signals from the AFCS, which extends or retracts the actuators, to position the helicopter as required by the control stick movement and to maintain the desired airspeed.

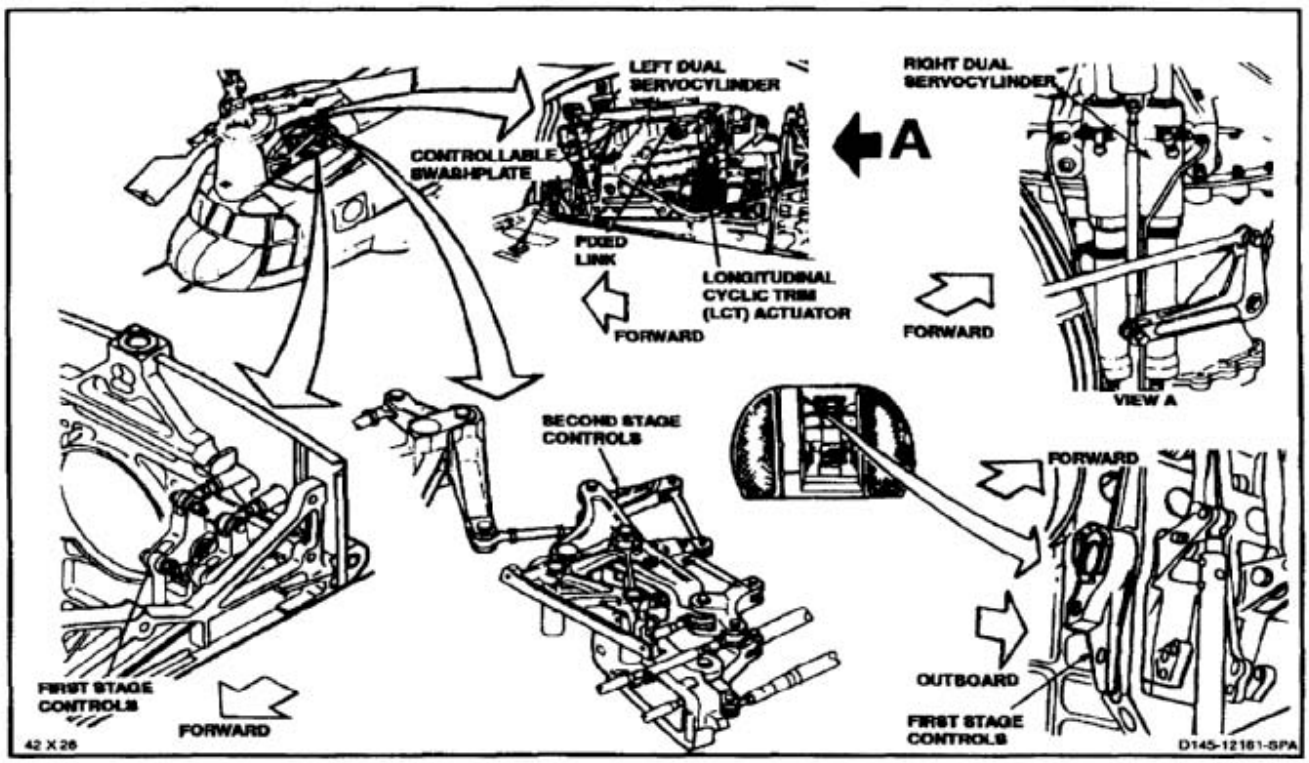


### First and Second Stage Controls

The first stage controls are above the closet controls between sta. 95 and 120. The second stage controls are aft of the forward transmission mounting structure. The first and second stage controls are connected by four connecting links. The first and second stage controls consist of bellcranks and linkage which mix inputs from the thrust, pitch, roll, and yaw closet control motions into two motions. These two motions are transmitted directly to the forward and aft controls.

### Forward Upper Controls

The forward upper controls are forward of the second stage controls on either side of the forward transmission. Links and bellcranks direct control motions to control valves located in two dual servocylinders. The servocylinders are connected to the forward transmission and the controllable swashplate. A longitudinal cyclic trim (LCT) actuator, yoke, and fixed link are part of the forward flight controls, and are located on the aft side and below the forward swashplate. The LCT actuator is controlled by manually applied electrical inputs from the cockpit or by the advanced flight control system (AFCS).

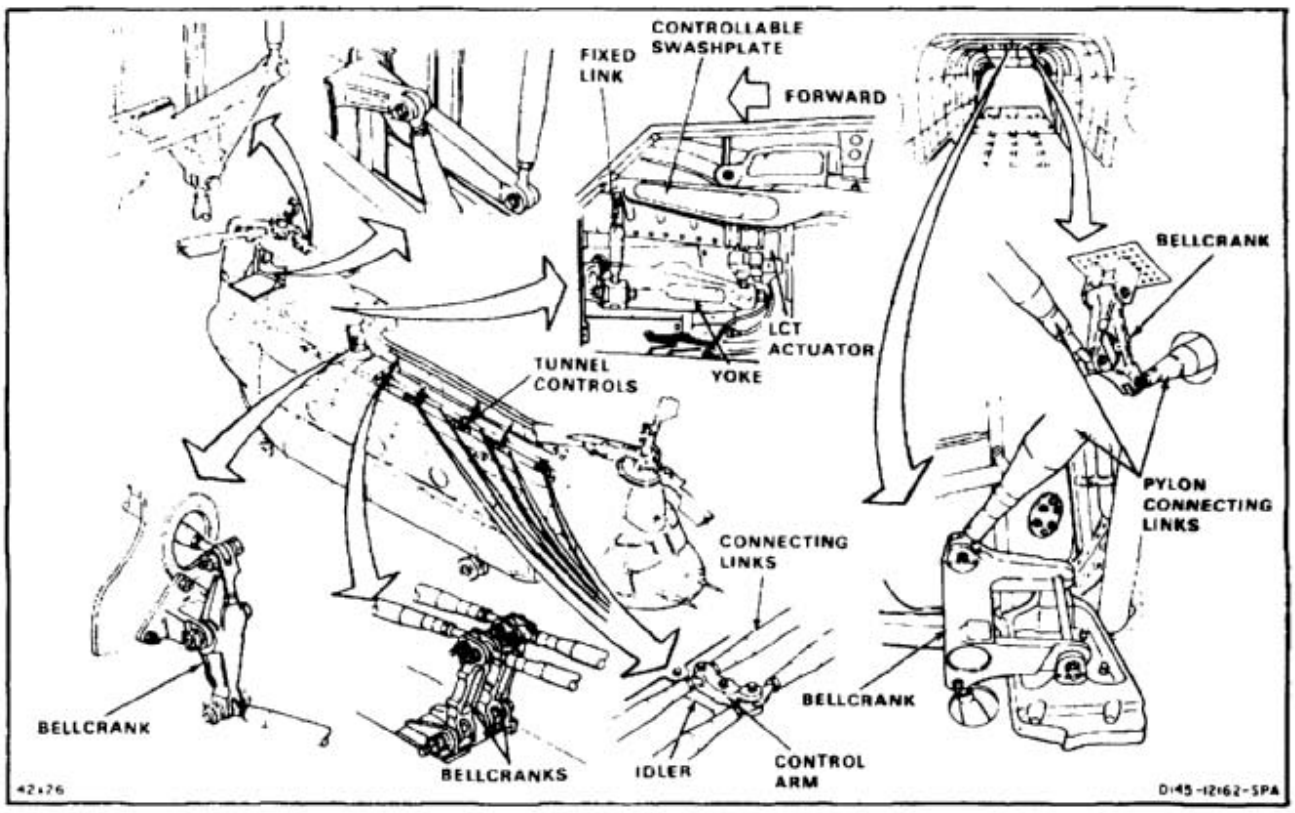


### Tunnel Controls

The tunnel controls are a series of connecting links, idlers, and control arms mounted on top of the cabin section. The tunnel controls transmit second stage control motions aft to the aft flight controls. Connecting links with 26 have a special coating that increases their resistance to heat and fire.

### Aft Controls

The aft controls are in the pylon. Connecting links and bellcranks transmit tunnel control motions to control valves located in two dual servocylinders. The servocylinders are connected to the structure and the controllable swashplate. An LCT actuator, yoke and forward fixed link are part of the aft flight controls and are located on the forward side and below the aft swashplate. The LCT actuator is controlled by manually applied electrical inputs from the cockpit or by the AFCS. Bellcranks and connecting links with 26 have a special coating that increases their resistance to heat and fire.

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