NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C. 20594

June 25, 2003

ADDENDUM NUMBER 3 TO THE SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION – FLIGHT CONTROL LINKAGE

DCA02MA001

A. ACCIDENT

Operator: American Airlines
Aircraft: A300-600R
Location: Belle Harbor, New York
Date: November 12, 2001
Time: 09:16 EDT

B. SYSTEMS GROUP

Chairman — Steven Magladry
National Transportation Safety Board
Washington, DC

Member — Gerald Gaubert
Bureau Enquetes - Accidents
Paris Le Bourget, France

Member — David Seratt
American Airlines
Tulsa, Oklahoma

Member — Francois Carmignani
Airbus France
Toulouse Blagnac, France

C. SUMMARY

On November 12, 2001, American Airlines flight 587, an Airbus Industrie A300-600R, N14053, crashed at Belle Harbor, New York, shortly after takeoff from John F. Kennedy International Airport (JFK), Jamaica, New York. The aircraft was equipped with General Electric CF6-80C2A5 engines. The airplane had taken off from runway 31 left and had turned southbound when it crashed. The aircraft was operated under the provisions of Title 14 of the U.S. Code of Federal Regulations Part 121 as a regularly scheduled

international passenger flight from JFK to Santo Domingo, Dominican Republic. The 2 pilots, 7 flight attendants, and 246 passengers plus 5 lap children on board were killed.

A review of the Flight Data Recorder information for accident flight showed large motion of flight control linkage and surfaces, primarily in the roll and yaw controls. Representatives of the Systems Group convened at the American Airlines maintenance base in Tulsa, Oklahoma on May 15, 2003 to inspect the flight control linkage of an A300-600 airplane. The airplane inspected was manufacturer's serial number 0508. All flight control linkage, from the cockpit back to the rudder frame assembly, was inspected for possible cross system coupling or interference with moving parts. The group did not identify any areas of potential flight control linkage coupling or interference. The following report presents the architecture of the roll and yaw control linkage and summarizes the inspection activities.

D. DETAILS OF THE INVESTIGATION

1.0 Description of roll and yaw controls in and below the cockpit

Illustrations of the roll control linkage below the cockpit are provided in Figure 1 and Figure 2.

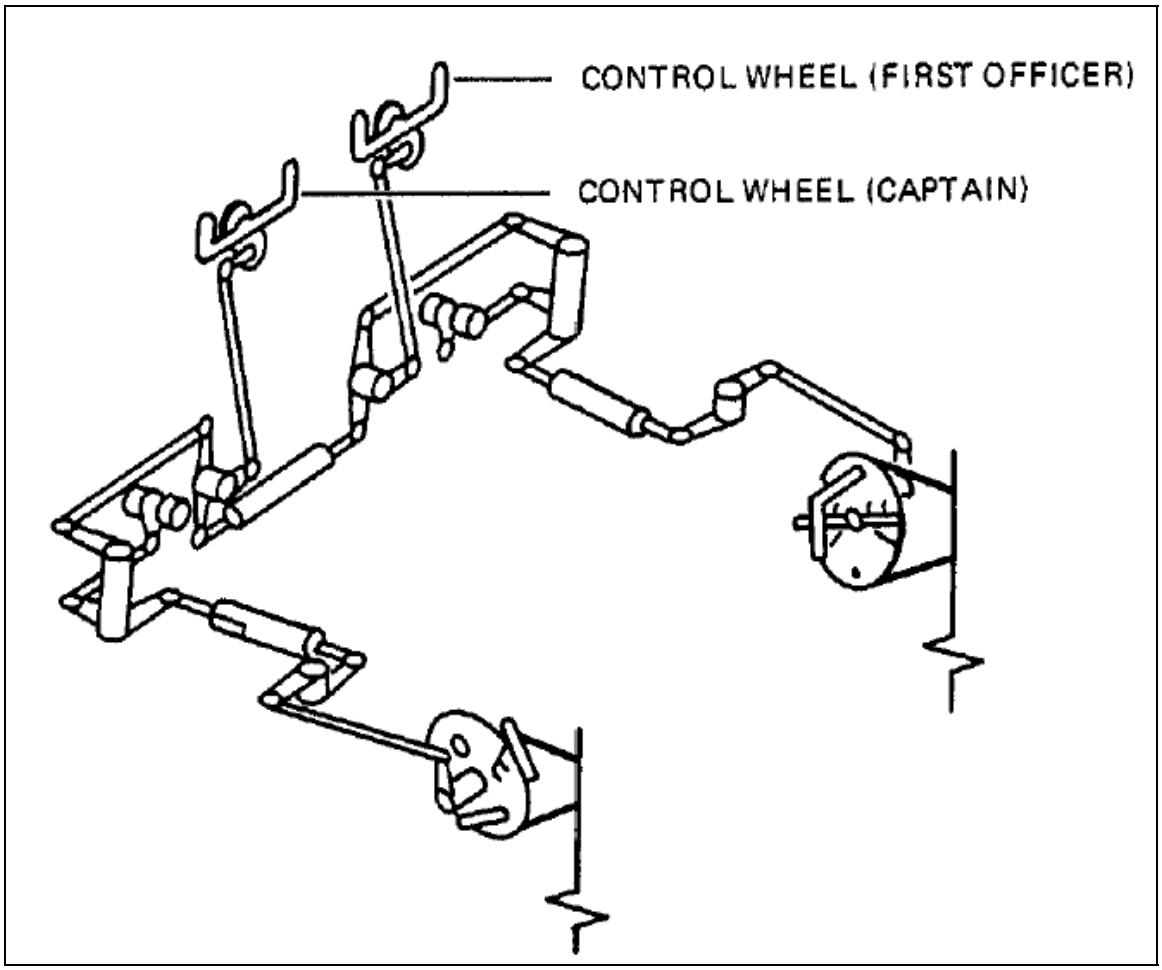

Figure 1. Roll control linkage.

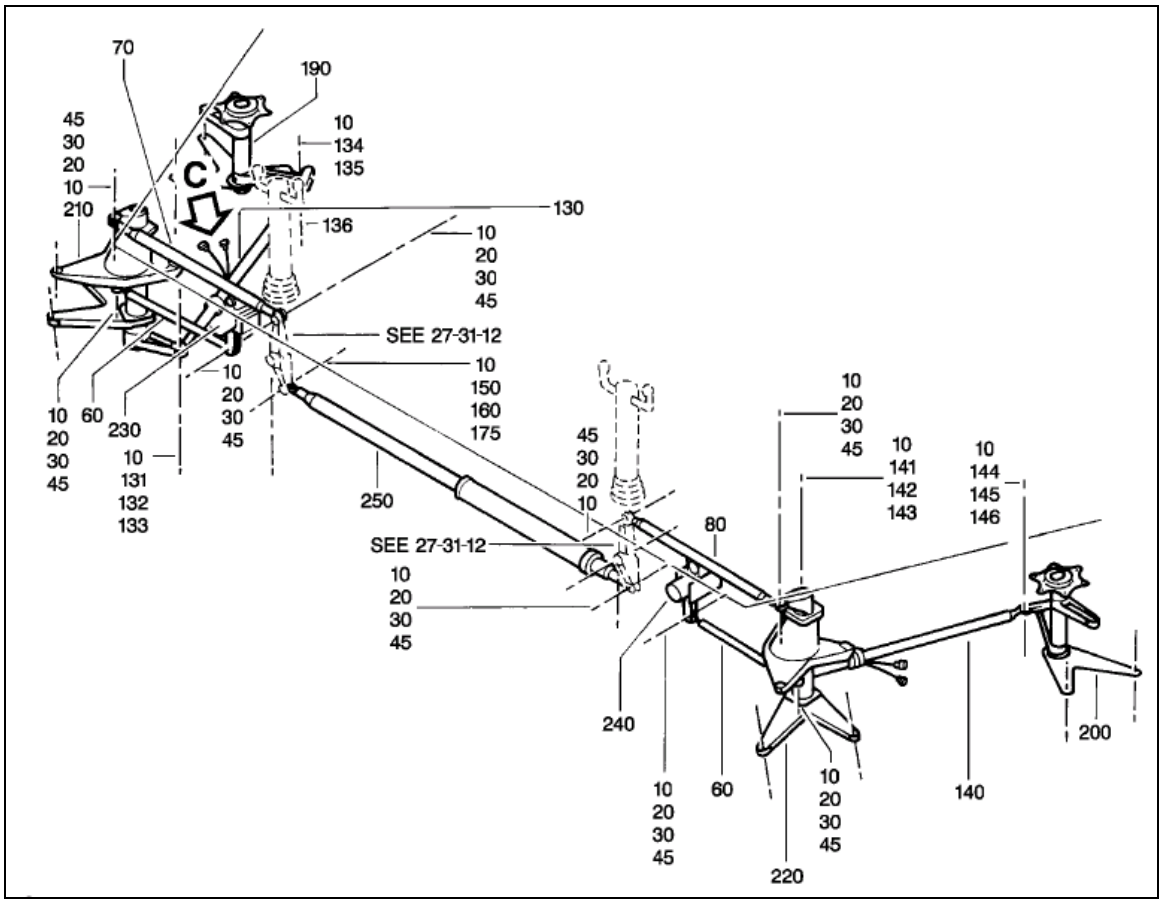

Figure 2. Roll control linkage with item numbers.

Illustrations of the yaw control linkage below the cockpit are provided in Figure 3 and Figure 4.

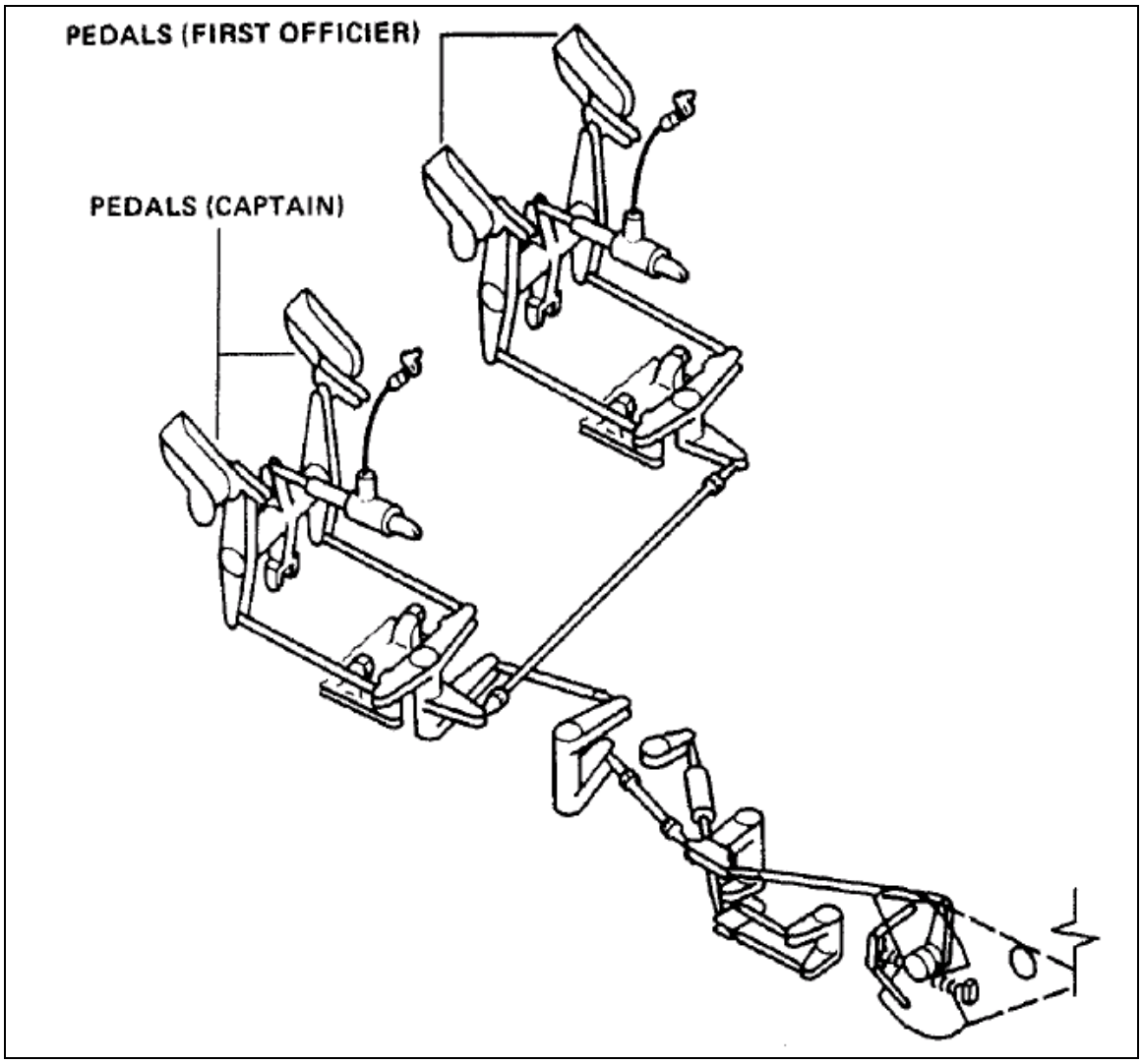

Figure 3. Yaw control linkage.

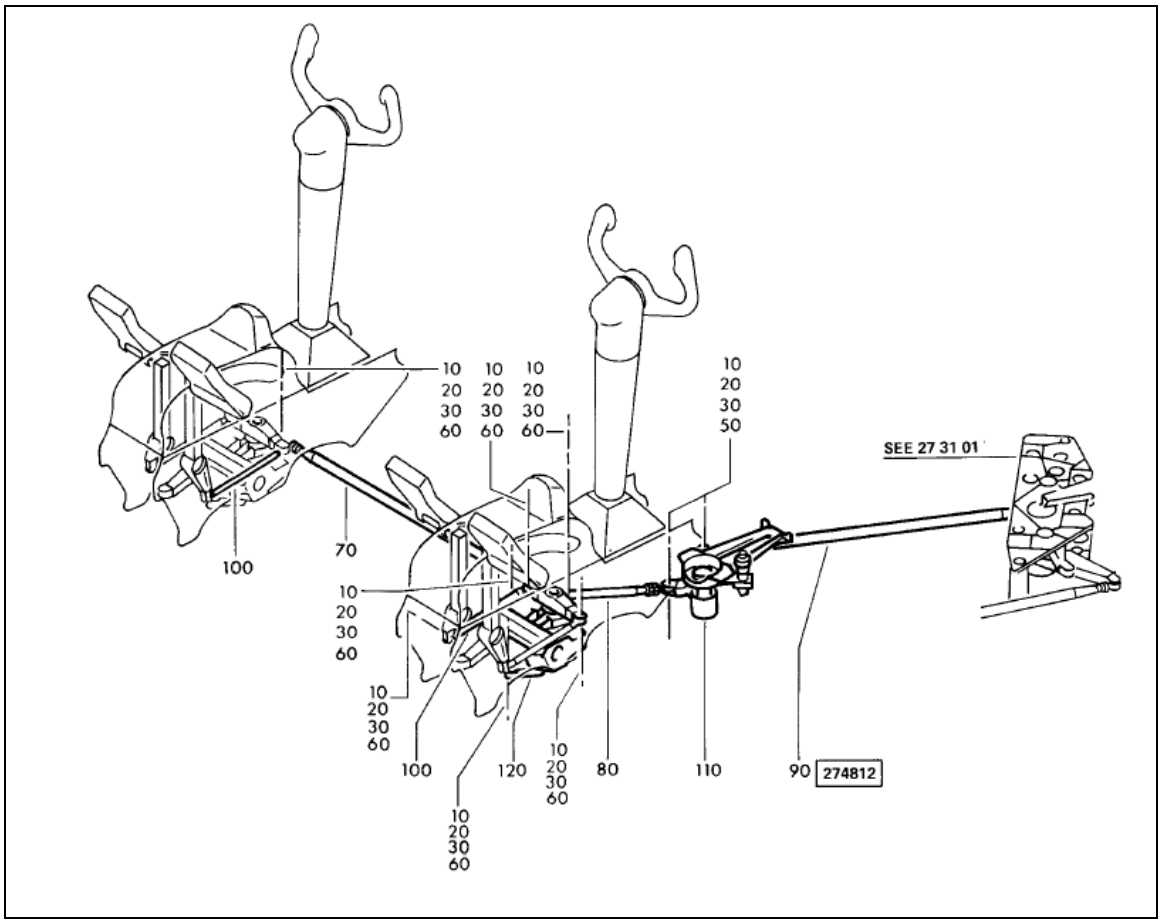

Figure 4. Yaw control linkage with item numbers.

Figure 5 shows a plan view of all primary flight control components in the area of the cockpit. The roll control linkages are highlighted in blue, the yaw control in pink, and the pitch control in yellow.

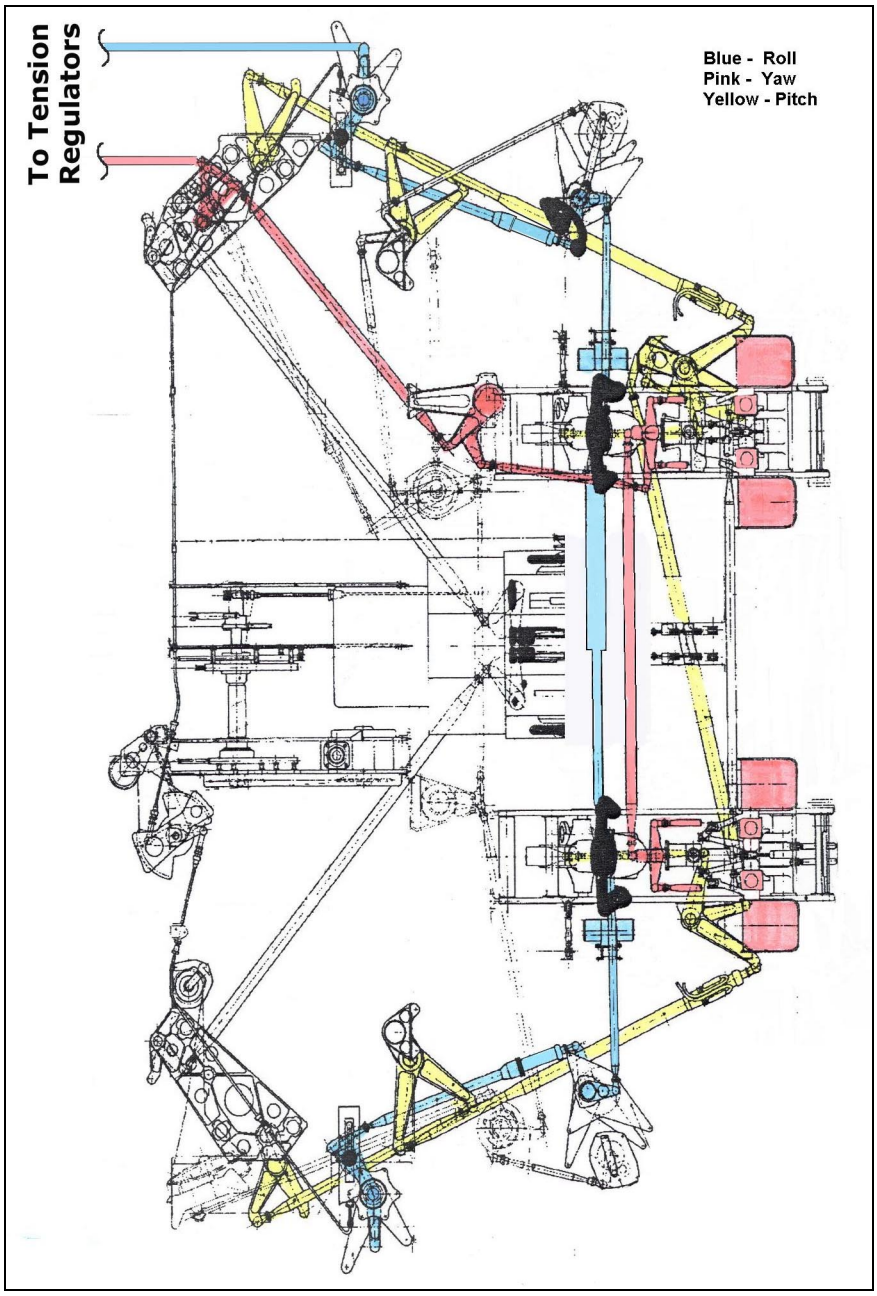

Figure 5. View of roll, yaw and pitch controls looking down.

Figure 6 shows a view of some of the roll control components looking forward.

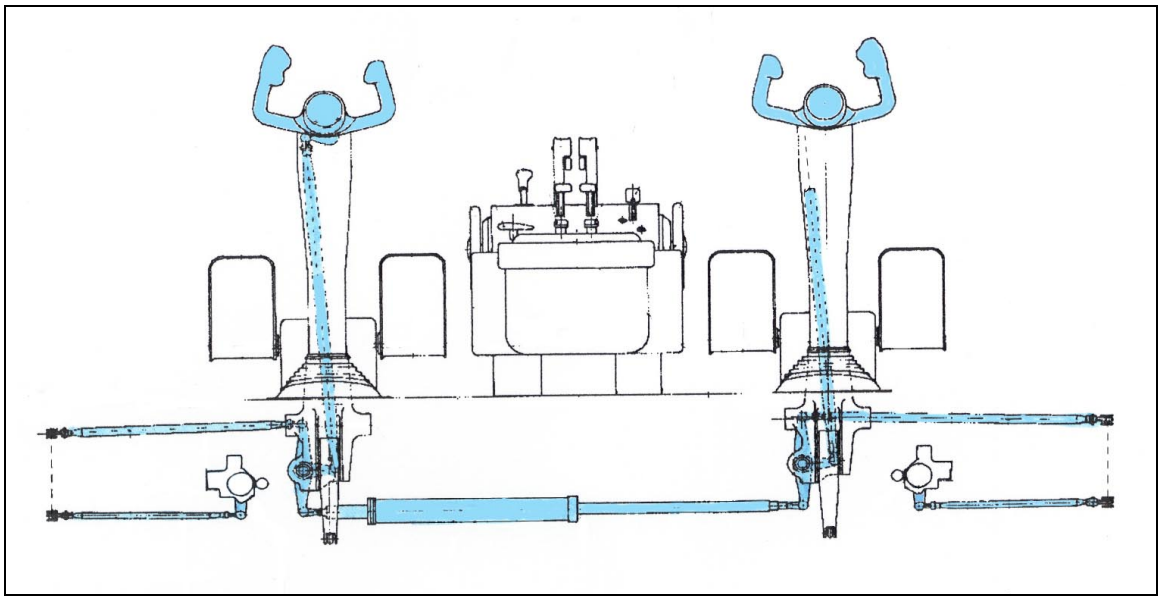

Figure 6. Control wheels and linkage looking forward.

2.0 Observations on the airplane

The left pedal was pushed, the rudder tension regulator rotated clockwise when observed looking outboard.

The control wheel was rotated to the left (counter clockwise) the left aileron cable tension regulator rotated counter clockwise.

Figure 7 and Figure 8 show the control linkage below the cockpit looking forward and up.

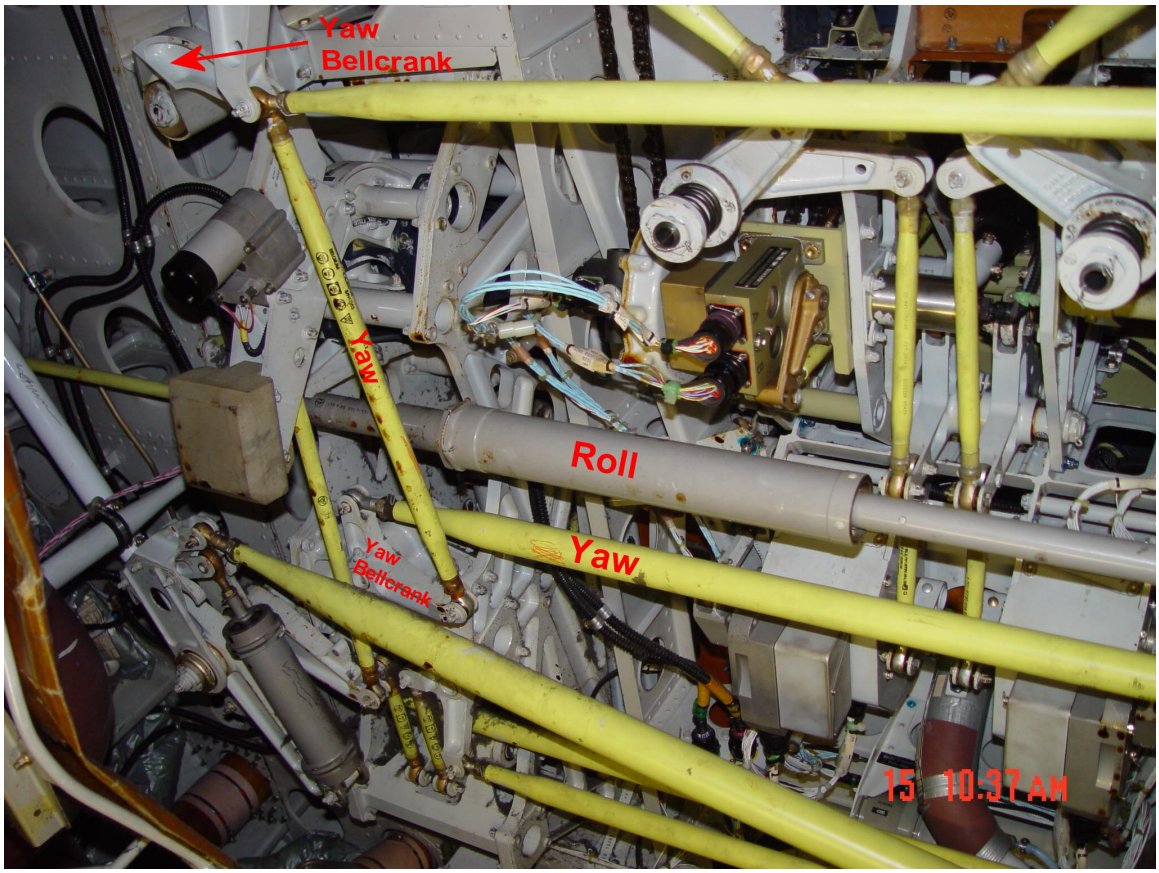

Figure 7. View looking forward, up and left.

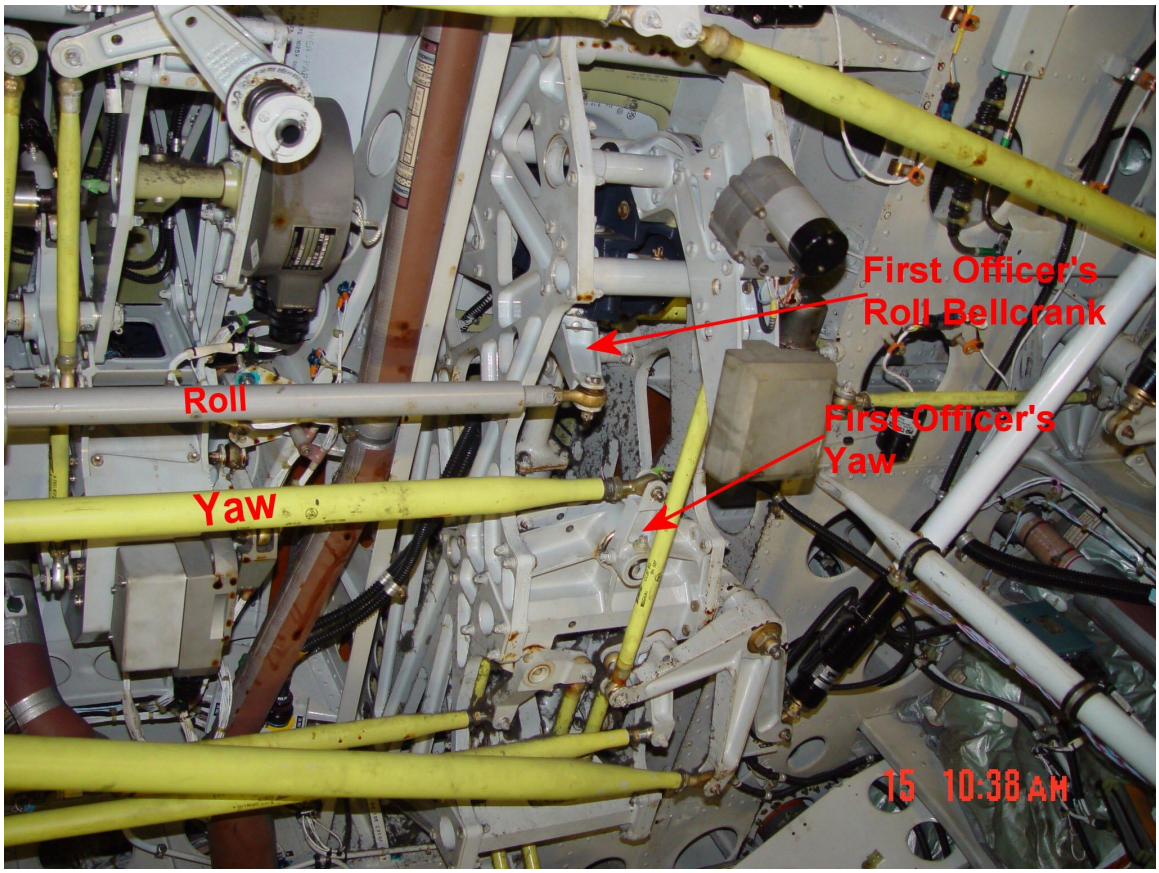

Figure 8. View looking forward, up and right.

3.0 Roll control linkage below the cockpit.

Figure 9 through Figure 13 show the roll control linkage for the first officer.

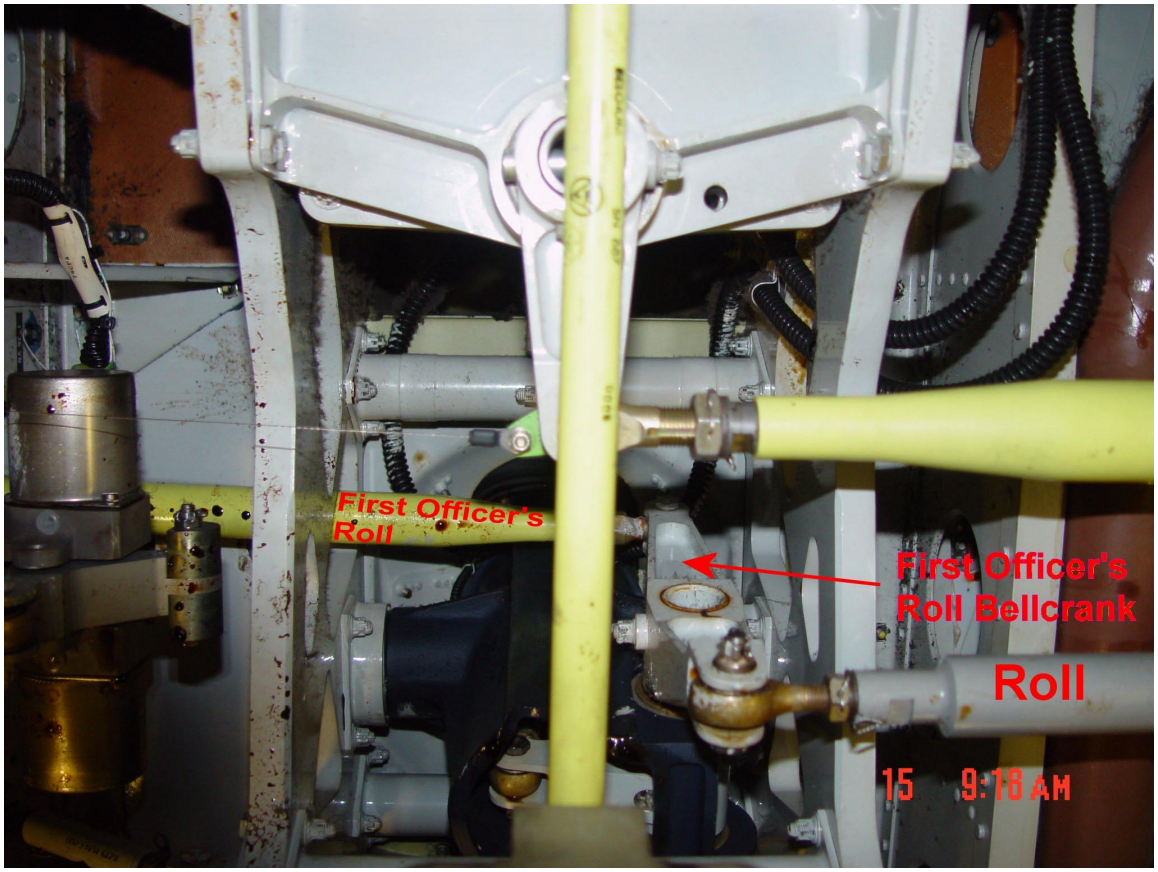

Figure 9. First officer's roll control linkage.

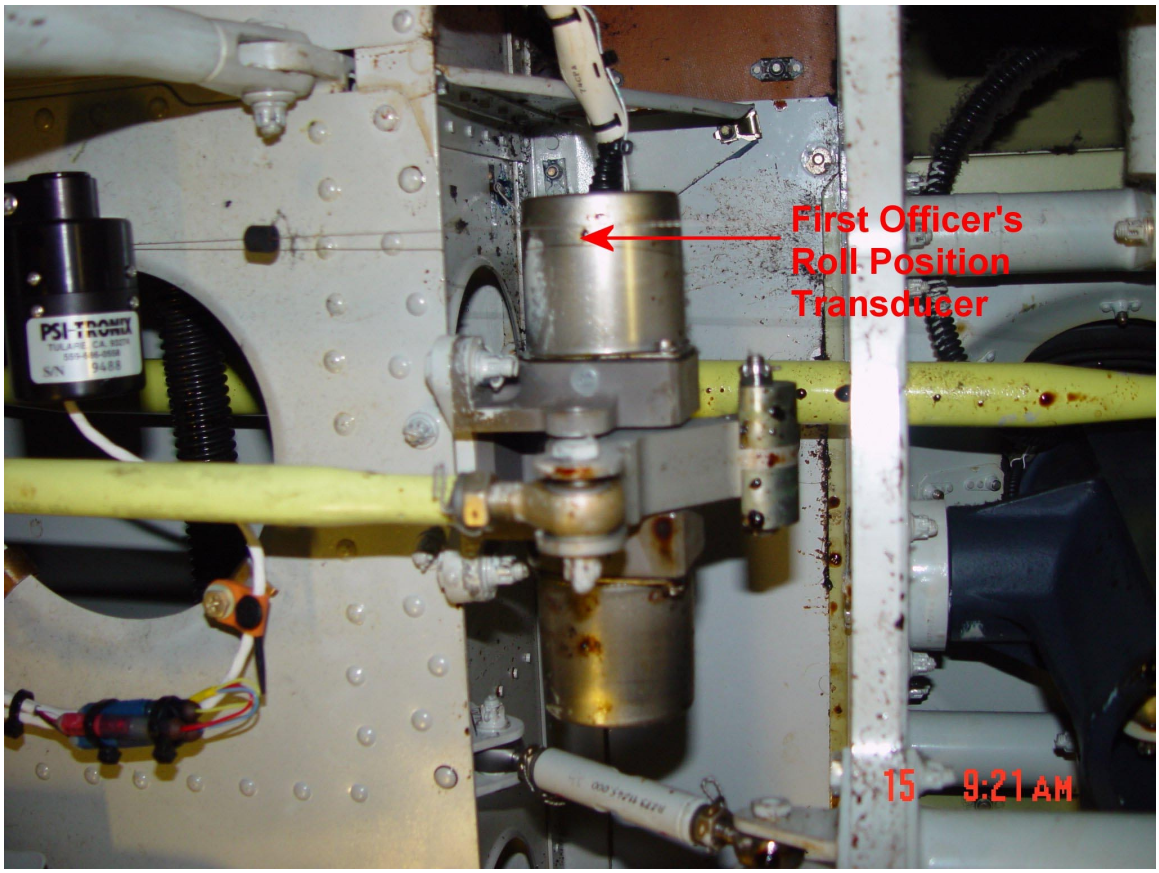

Figure 10. First officer's control linkage and wheel position transducer.

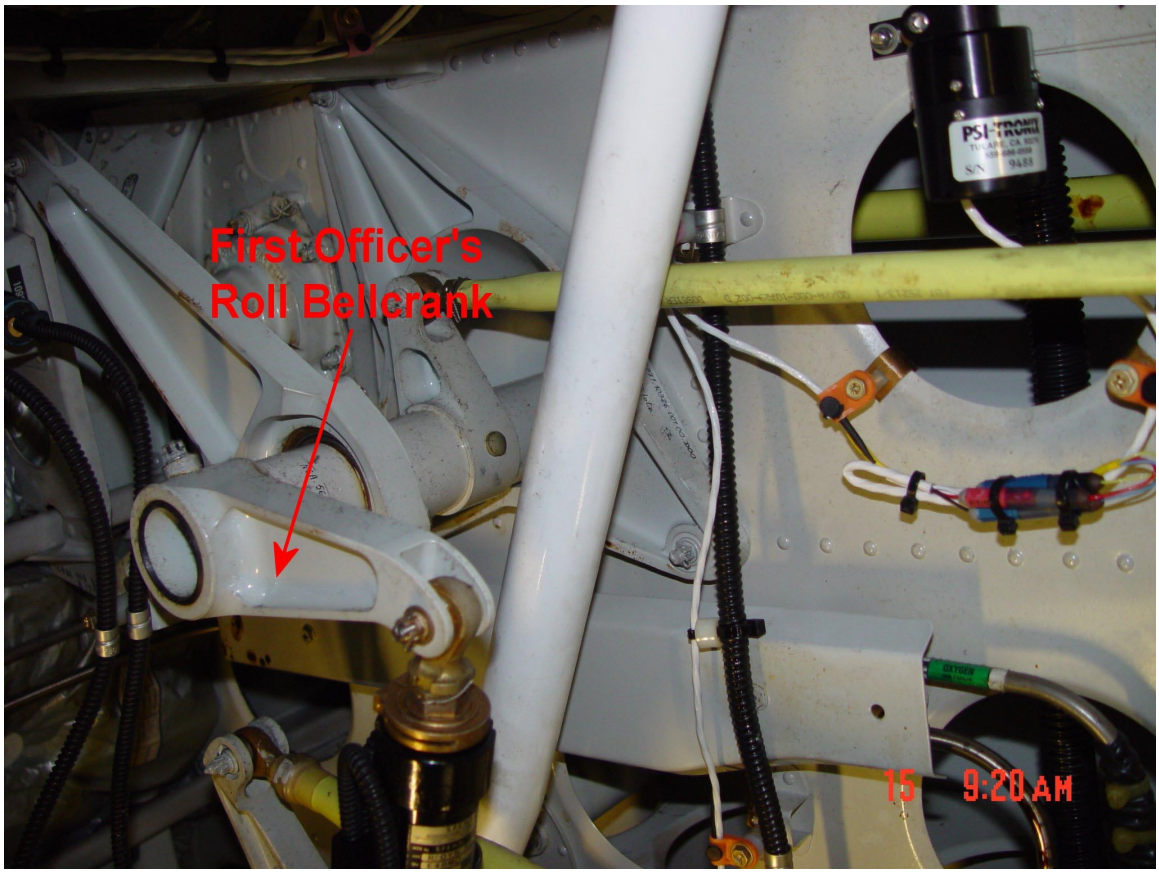

Figure 11. First officer's forward bellcrank and connection to dynamometric rod.

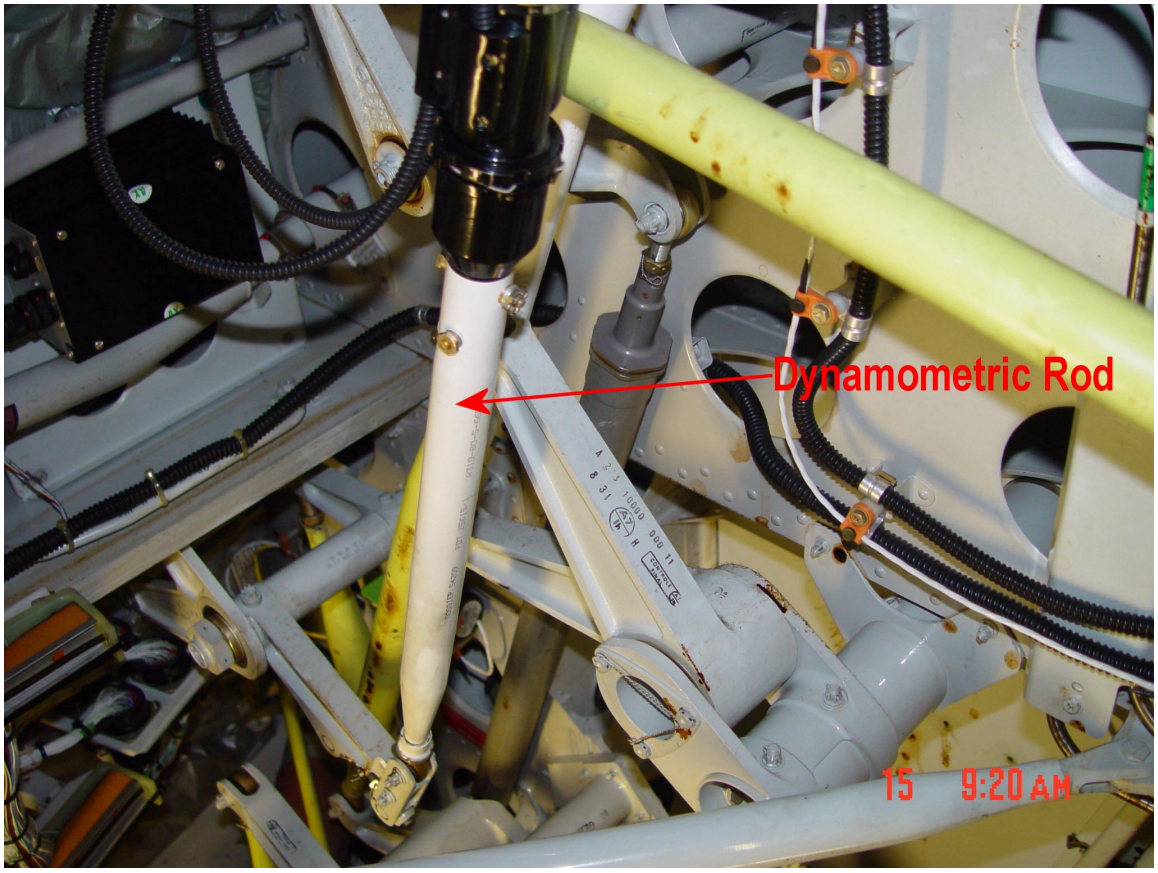

Figure 12. First officer's dynamometric rod.

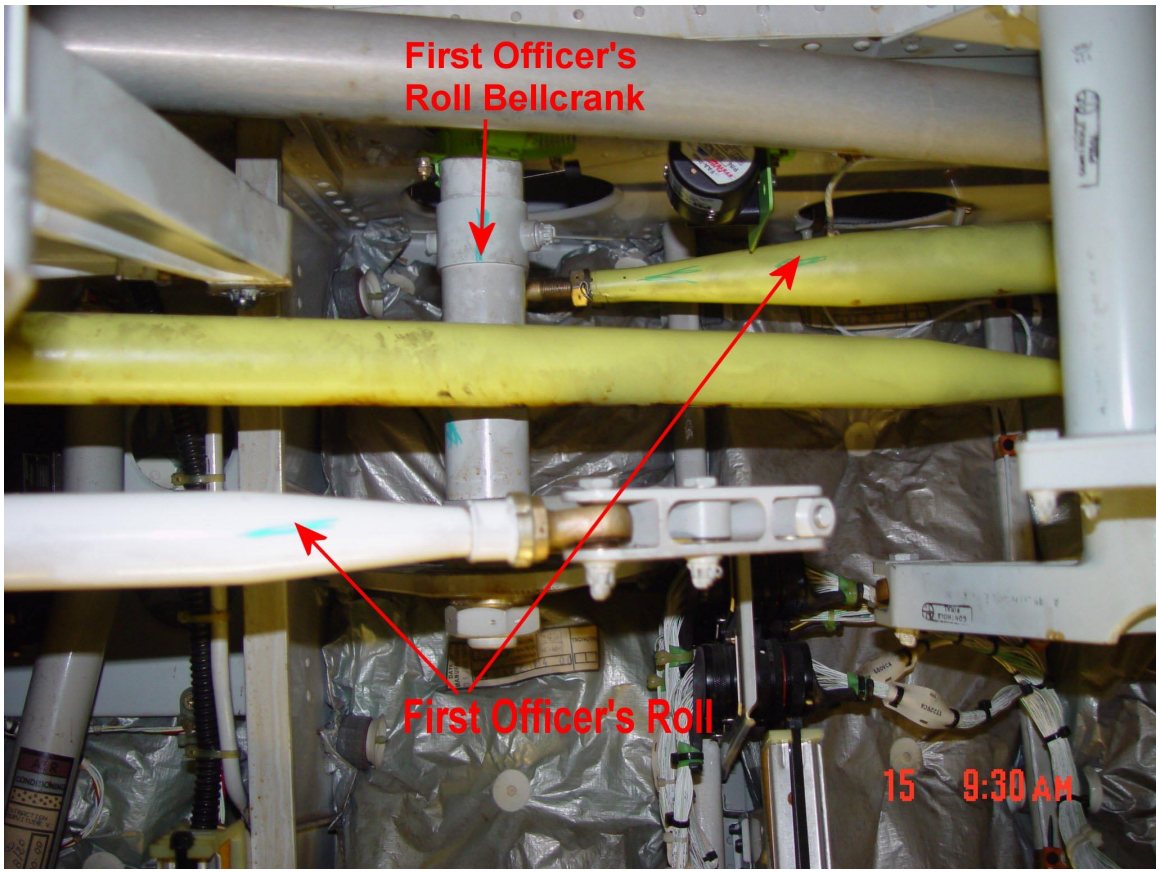

Figure 13. First officer's bellcrank between dynamometric rod and tension regulator rod.

The Flight Data Recorder wheel position transducer is shown near the top center of Figure 13.

Figures 14 through 17 show the roll control linkage for the captain.

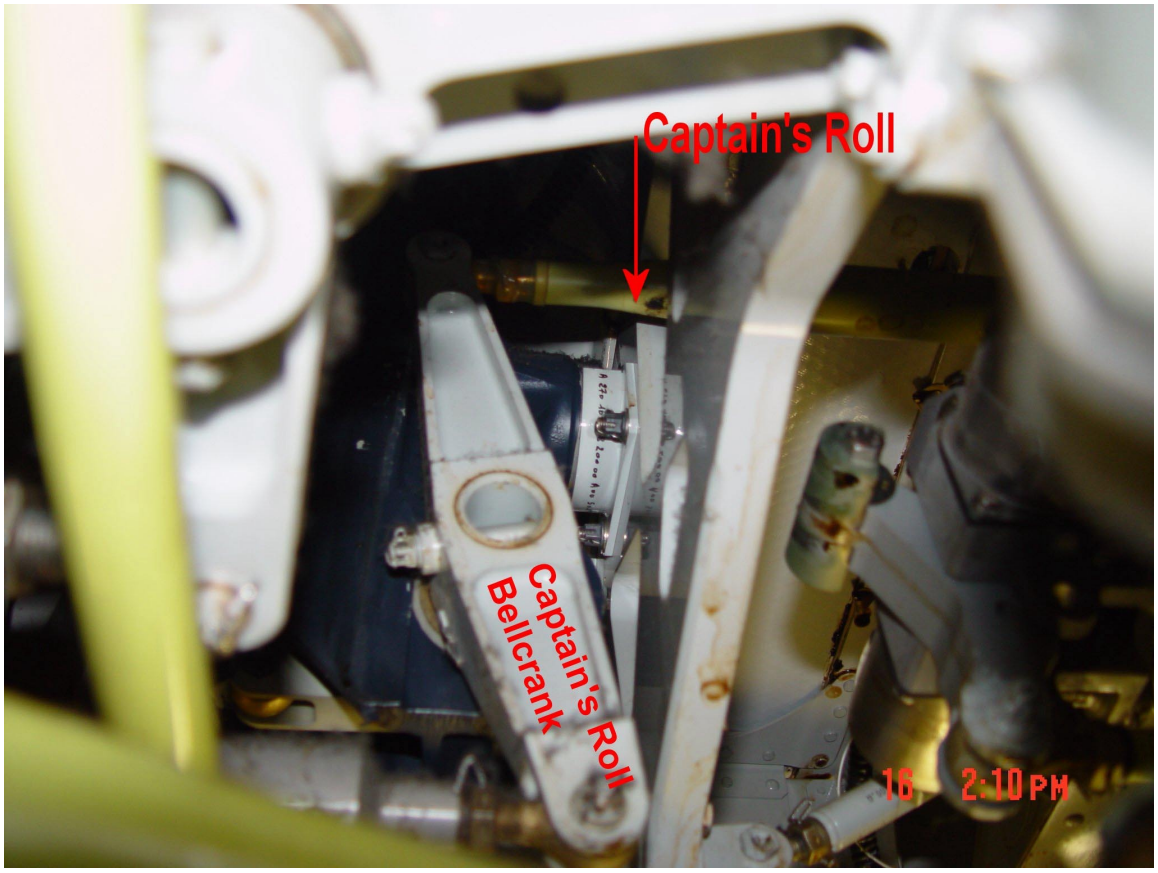

Figure 14. Captain's roll control linkage looking up and forward.

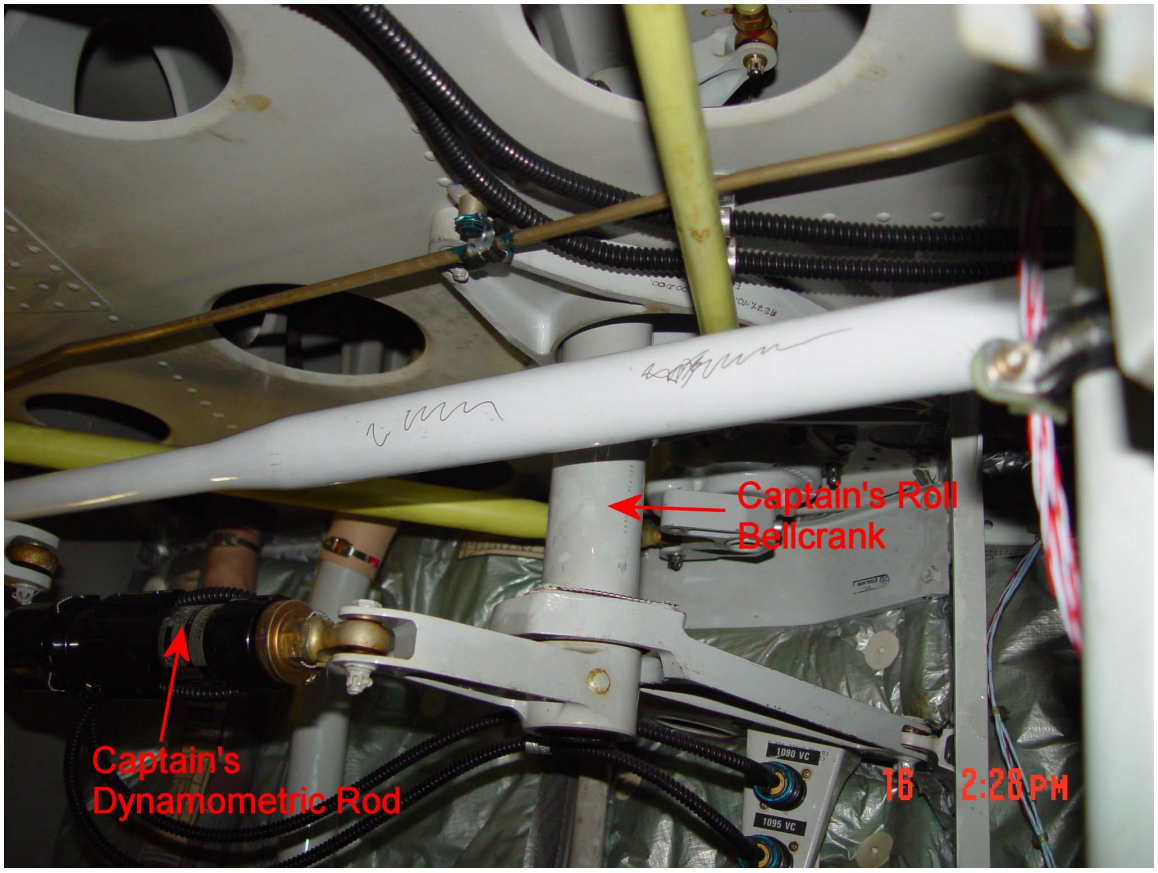

Figure 15. Captain's forward bellcrank and connection to dynamometric rod.

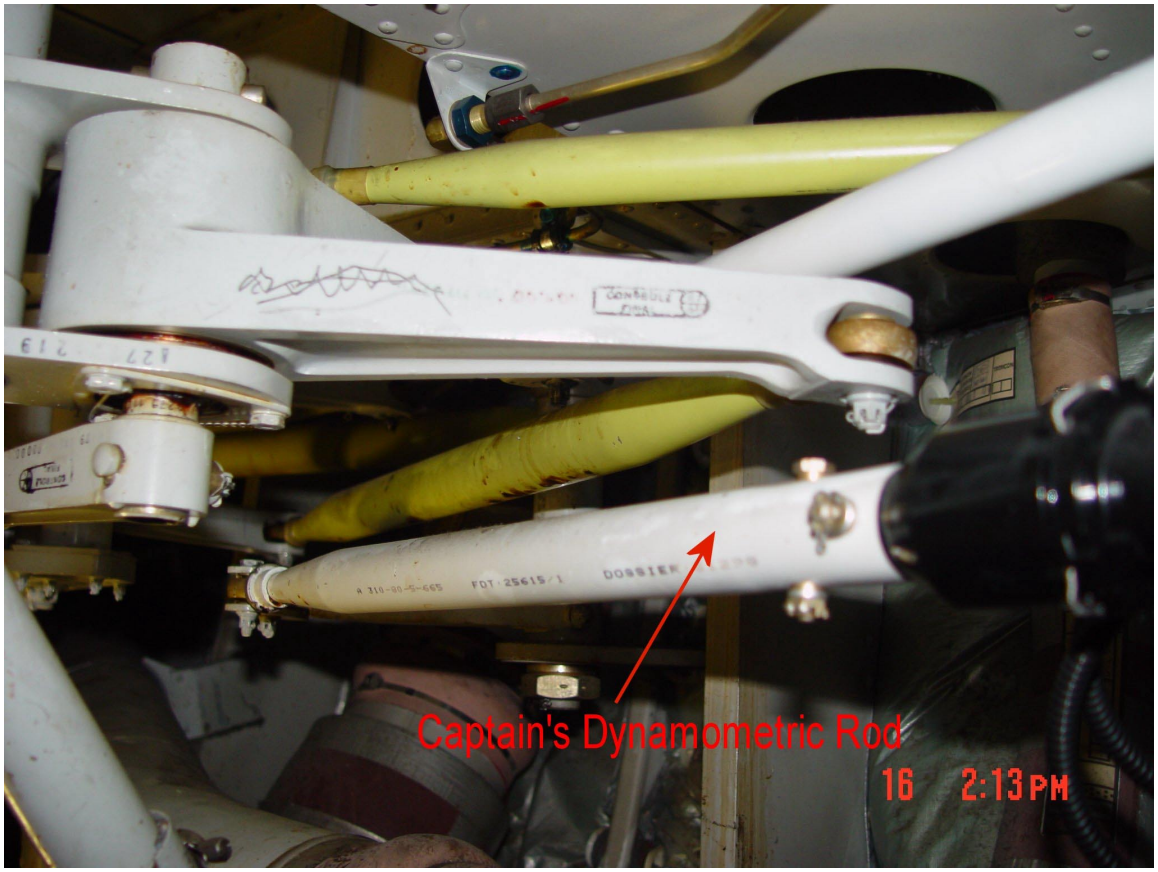

Figure 16. Captain's dynamometric rod to aft bellcrank.

Figure 17. Captain's aft bellcrank and pushrod to tension regulator.

4.0 Yaw control linkage below the cockpit.

Figures 18 through 20 show the first officer's yaw control linkage.

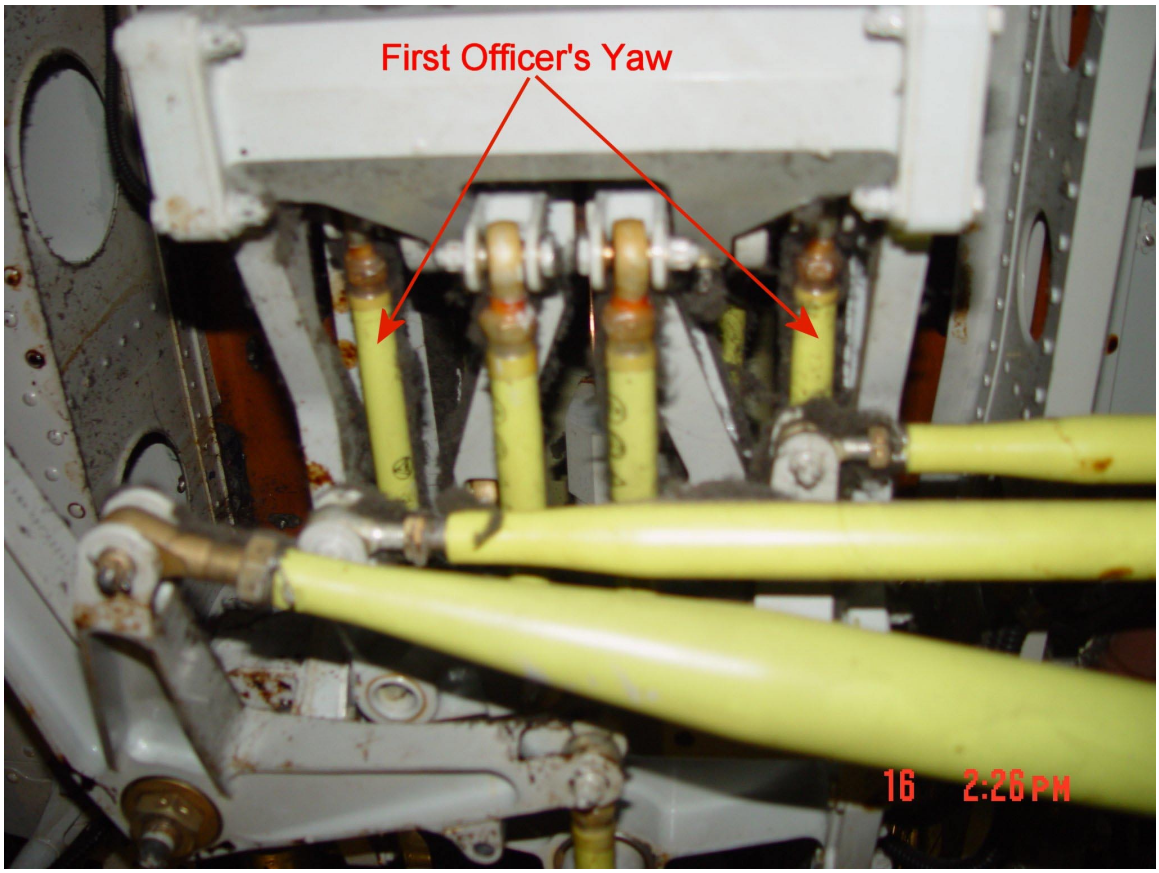

Figure 18. First officer's pedal pushrods.

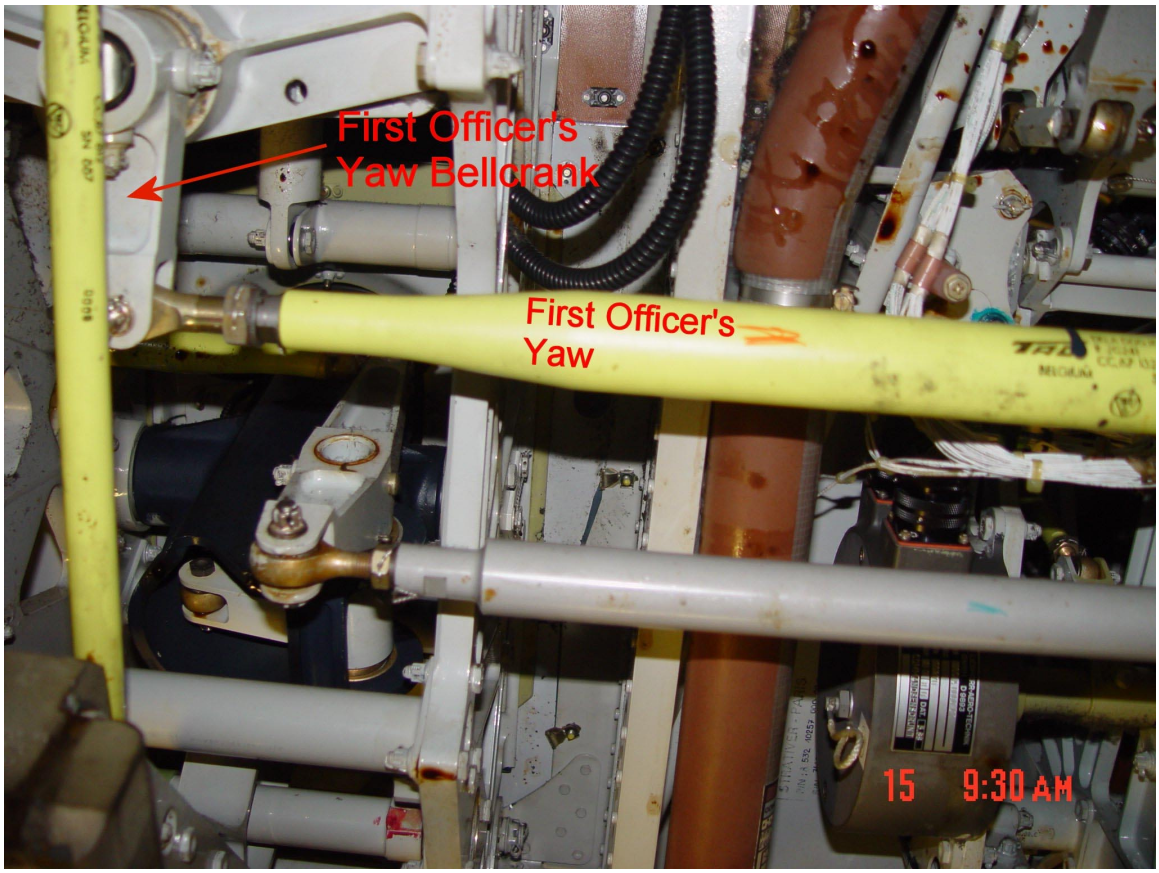

Figure 19. First officer's bellcrank and pushrod to captain's side.

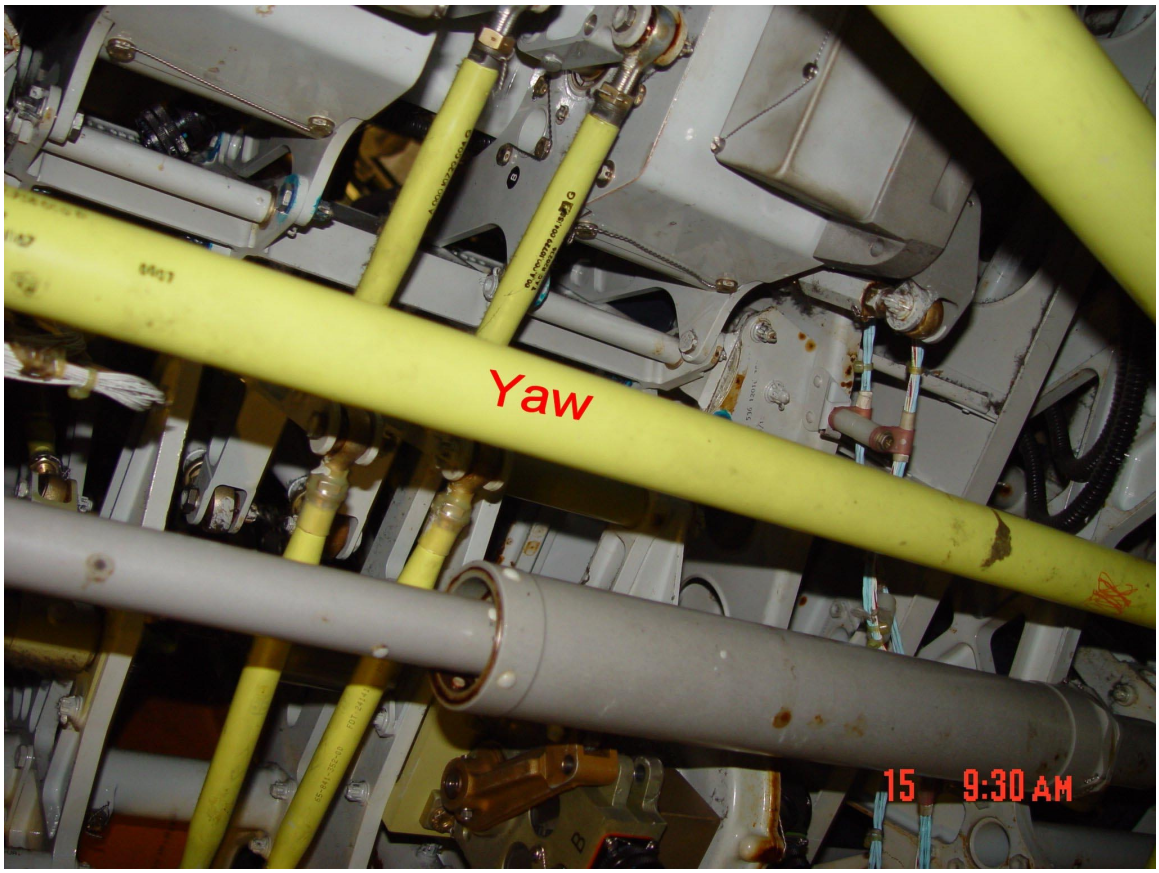

Figure 20. Yaw control pushrod which connects first officer's linkage to captain's.

Figure 21 and Figure 22 show the captain's yaw control linkage.

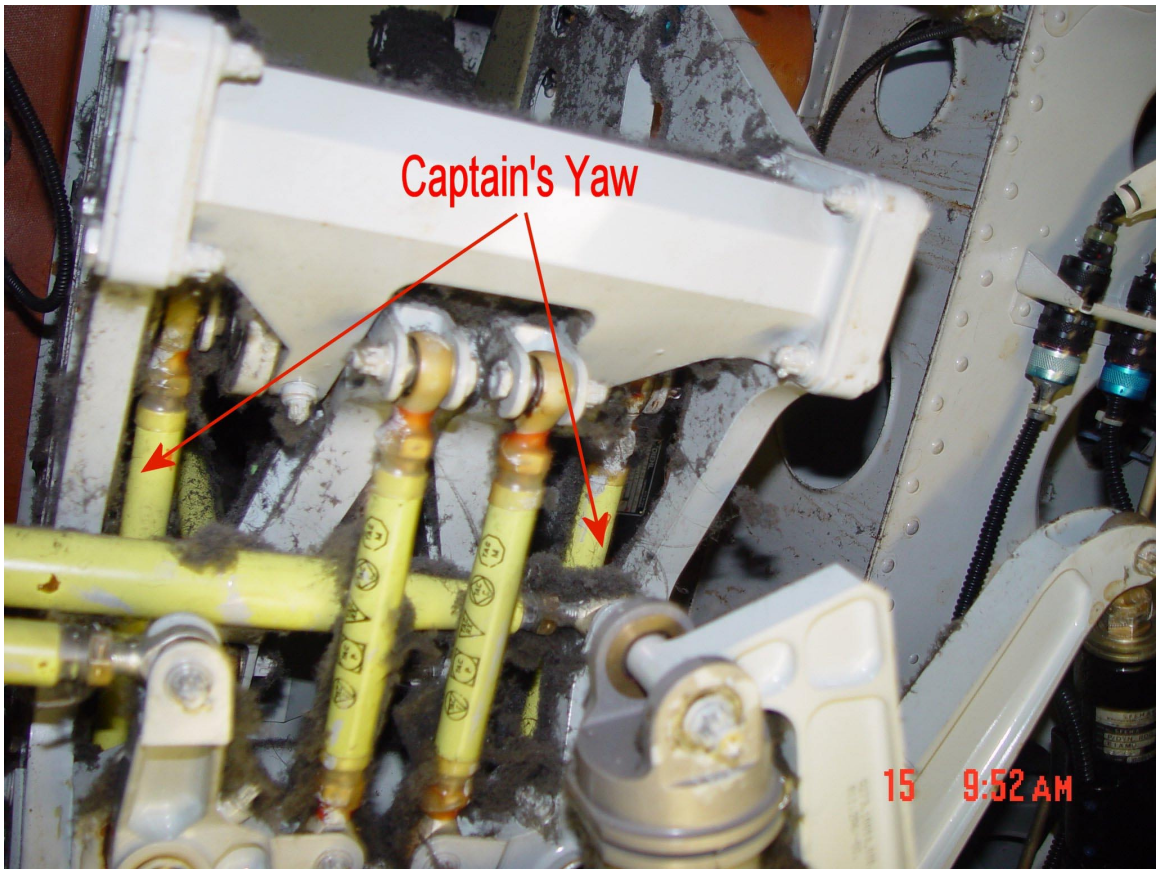

Figure 21. Captain's pedal pushrods.

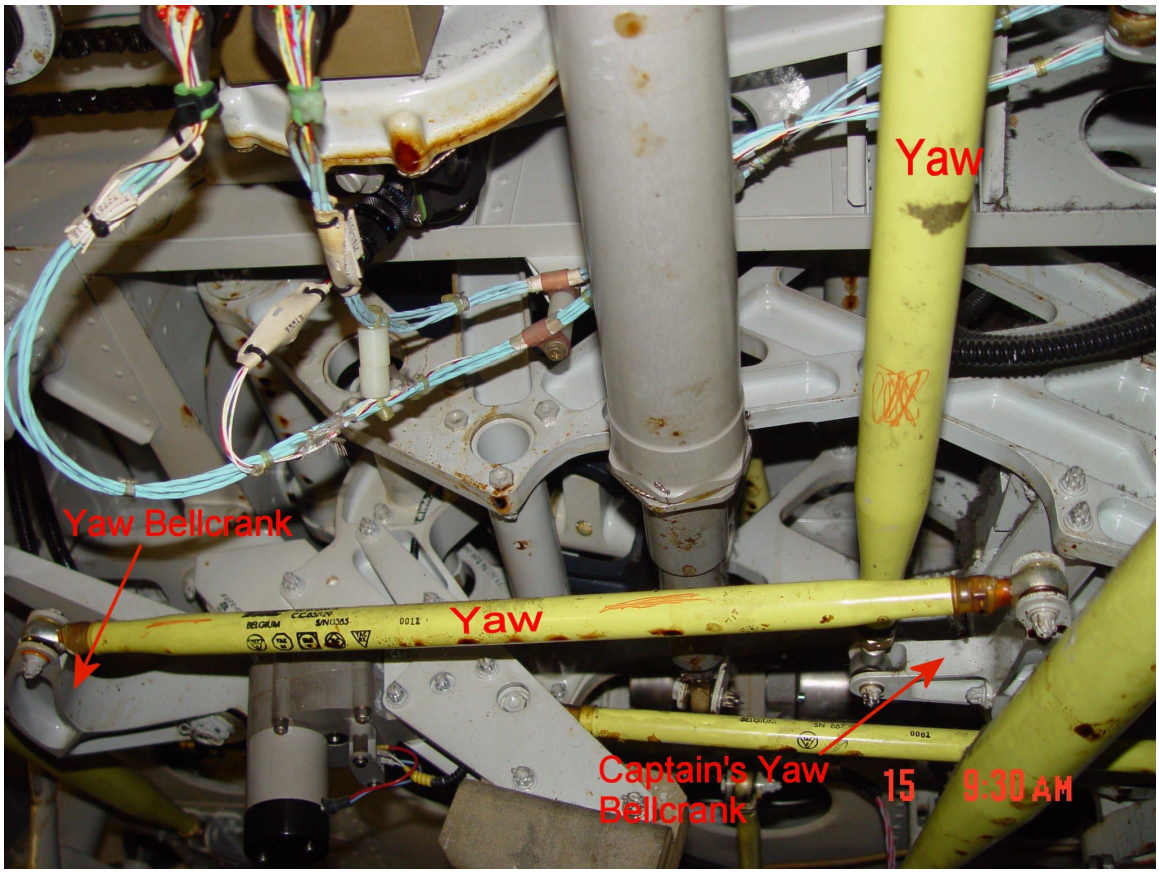

Figure 22. Captain's bellcrank and pushrods.

Figures 23 through 27 show the yaw control linkage aft to the tension regulator.

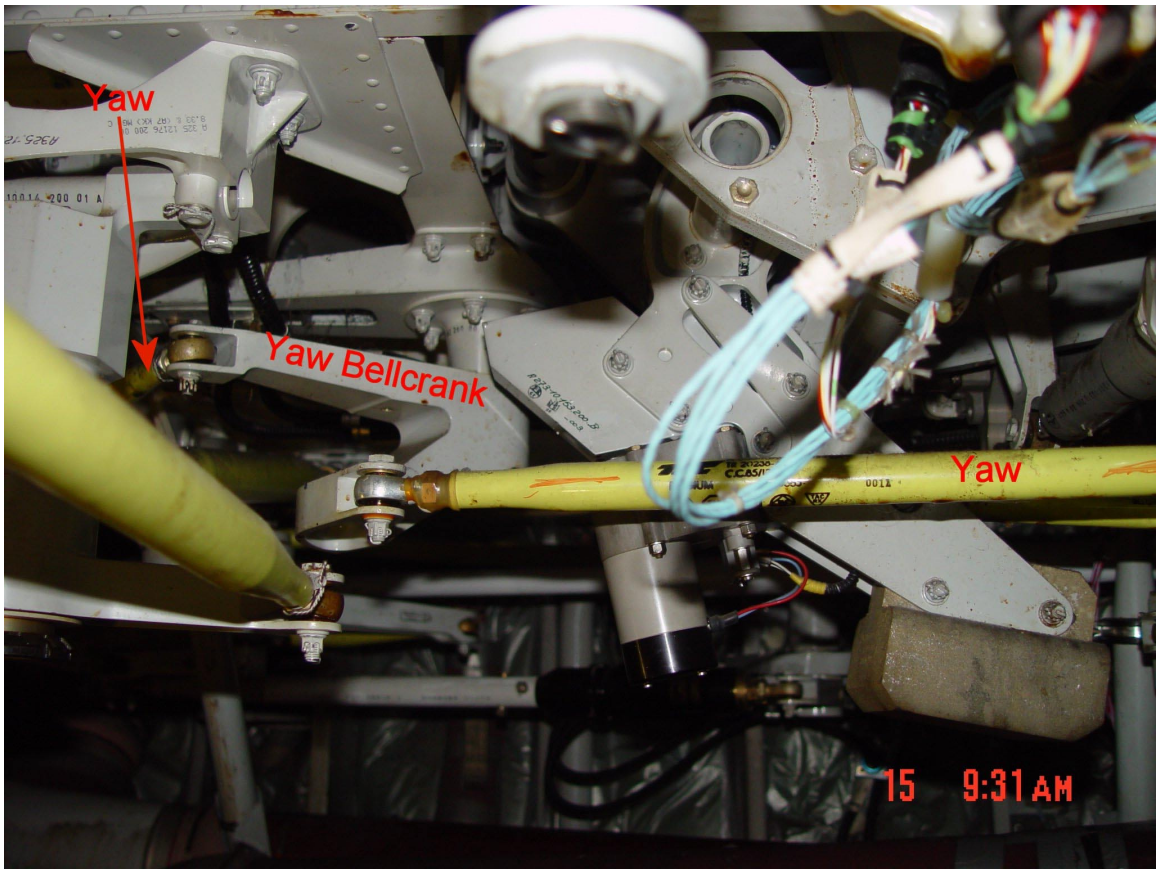

Figure 23. Pushrods and bellcrank.

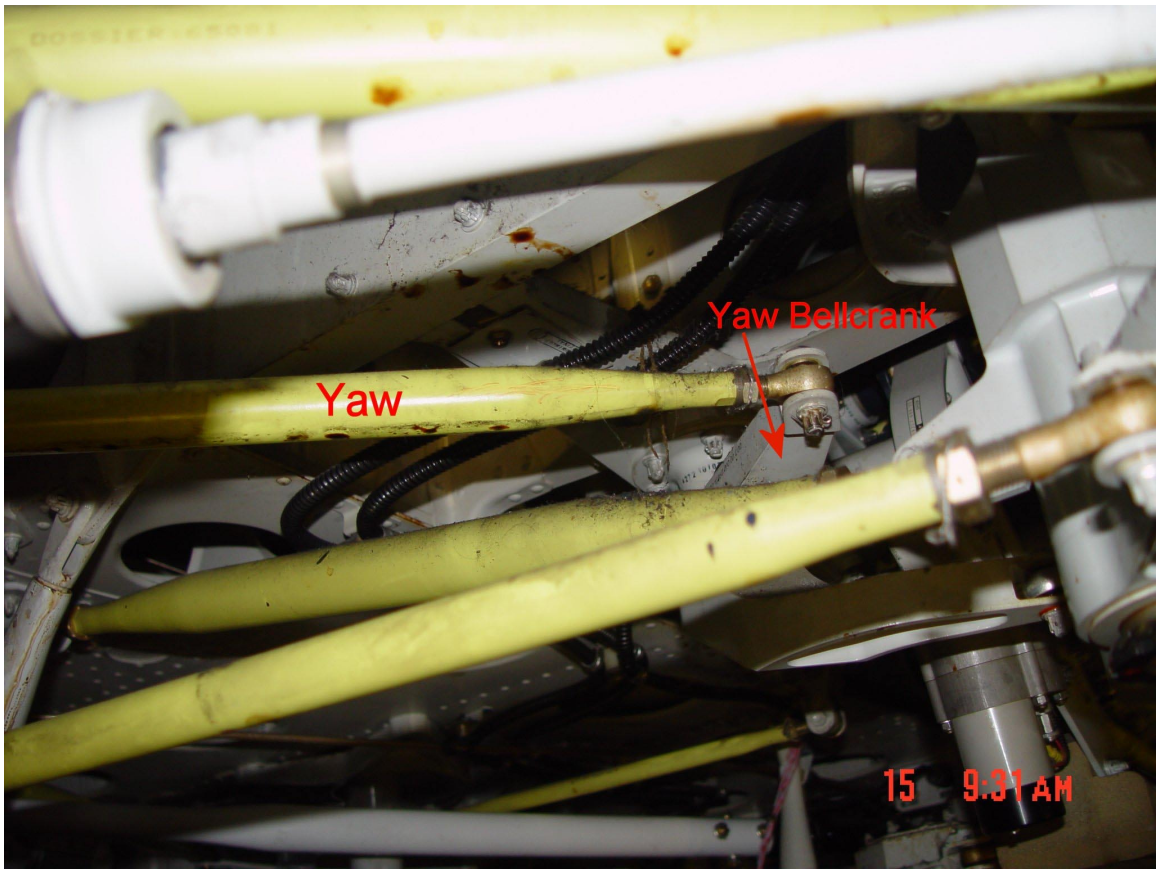

Figure 24. Pushrod and bellcrank.

Figure 25. Pushrod and bellcrank.

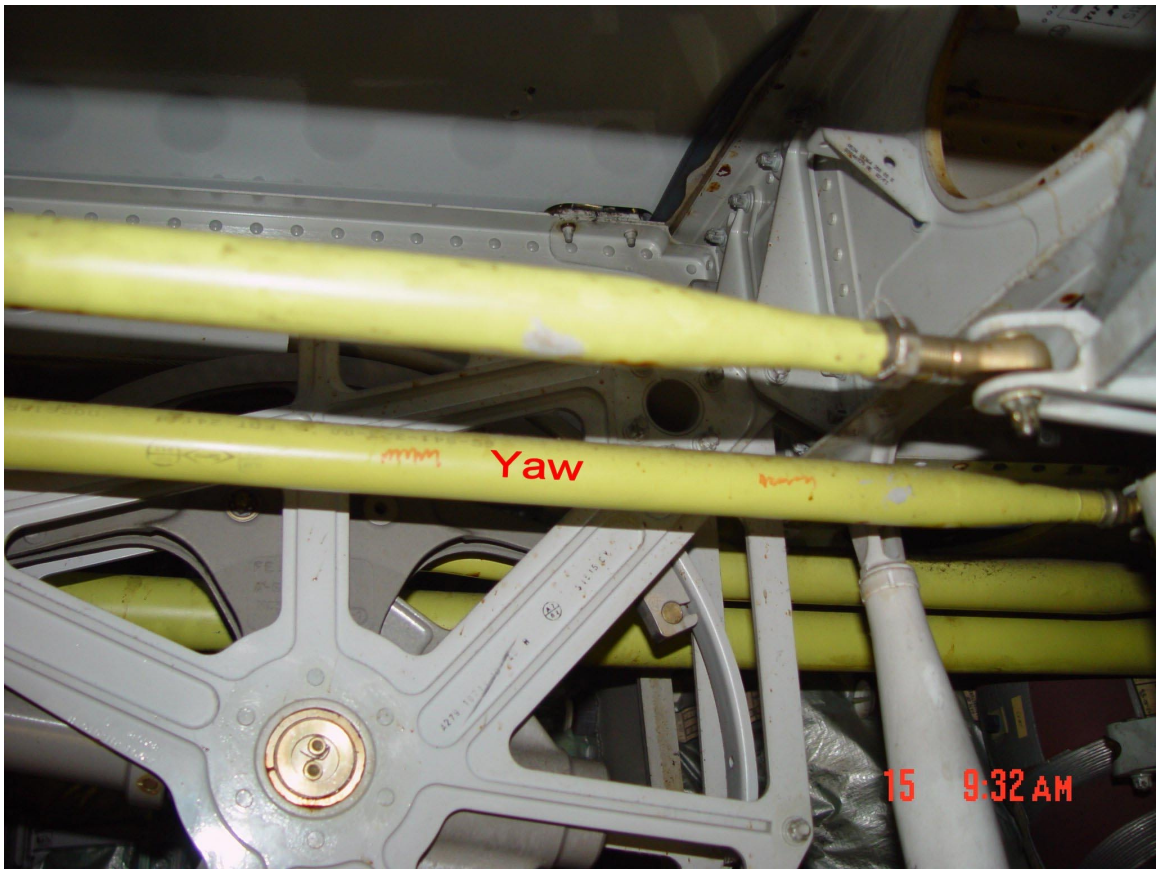

Figure 26. Pushrod to tension regulator.

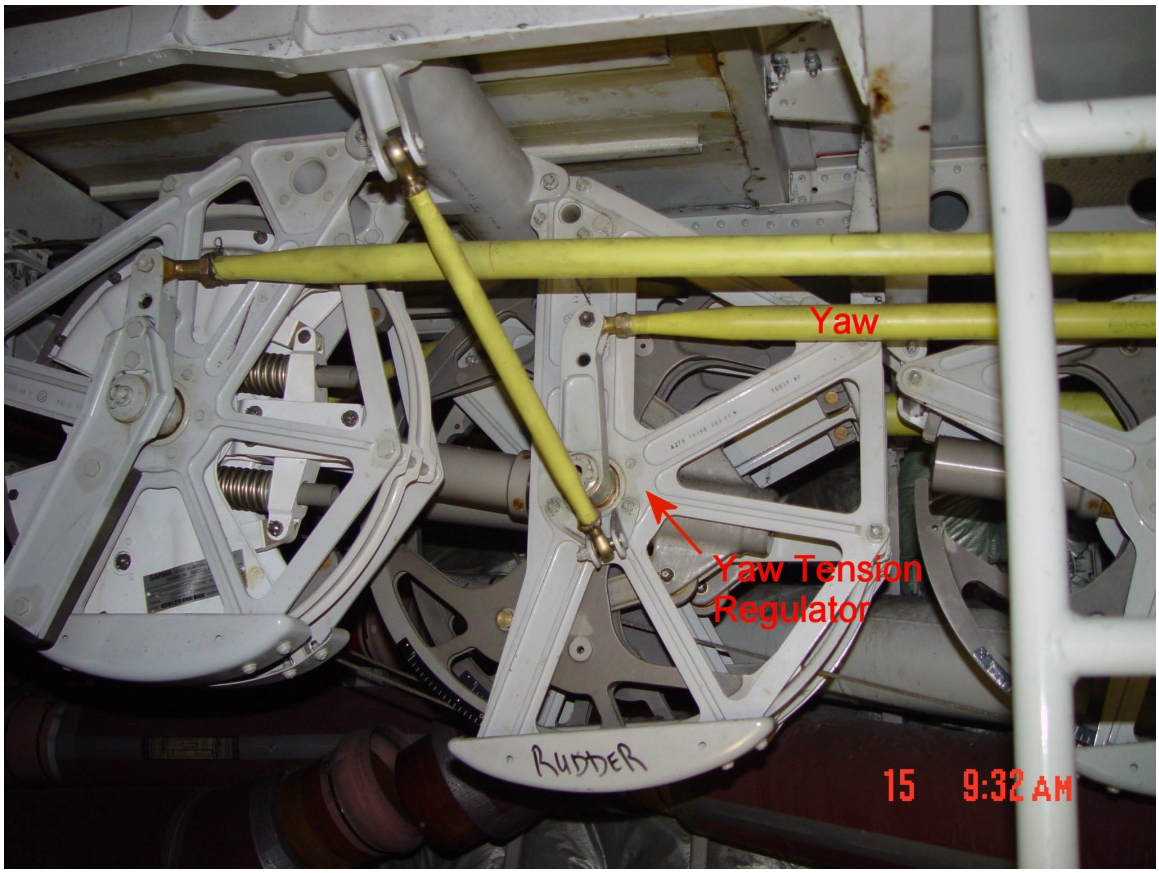

Figure 27. Pushrod connection to rudder tension regulator.

Figures 28 through 30 show the tension regulator installations.

Figure 28. Tension Regulators, left side looking outboard and aft.

Figure 29. Roll (ailerons) and yaw (rudder) cable tension regulators, left to right respectively, looking forward.

Figure 30. Input rod to roll tension regulator (outboard side).

5.0 Roll, Yaw and Pitch Control Cable Runs

The roll, yaw and pitch control cables (two each) are shown in Figure 31. The cables run parallel to each other, through holes in the floor beams or frames. They pass through a number of pulleys and cable guides, which provide positive separation from other cables and structure. As shown in Figure 31, right to left are the roll, pitch, and yaw control cables. The two cables further inboard (left) are throttle control cables.

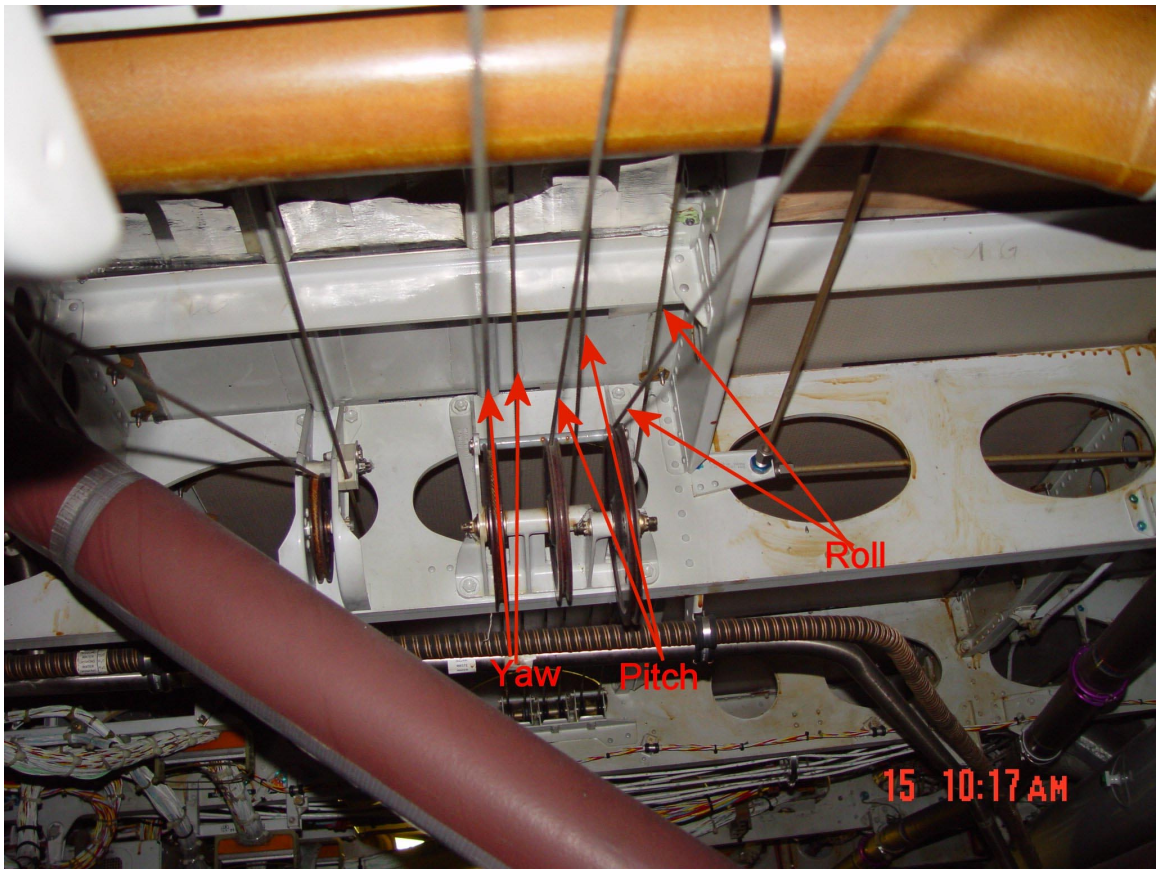

Figure 31. Pulleys and cables at frame C14 looking aft.

Figures 32 through 47 show selected photos of the path taken by all of the aft until the point where the roll control cables separate from the other cables.

Figure 32. Frame C14 looking forward.

Figure 33. Frame C15a looking aft.

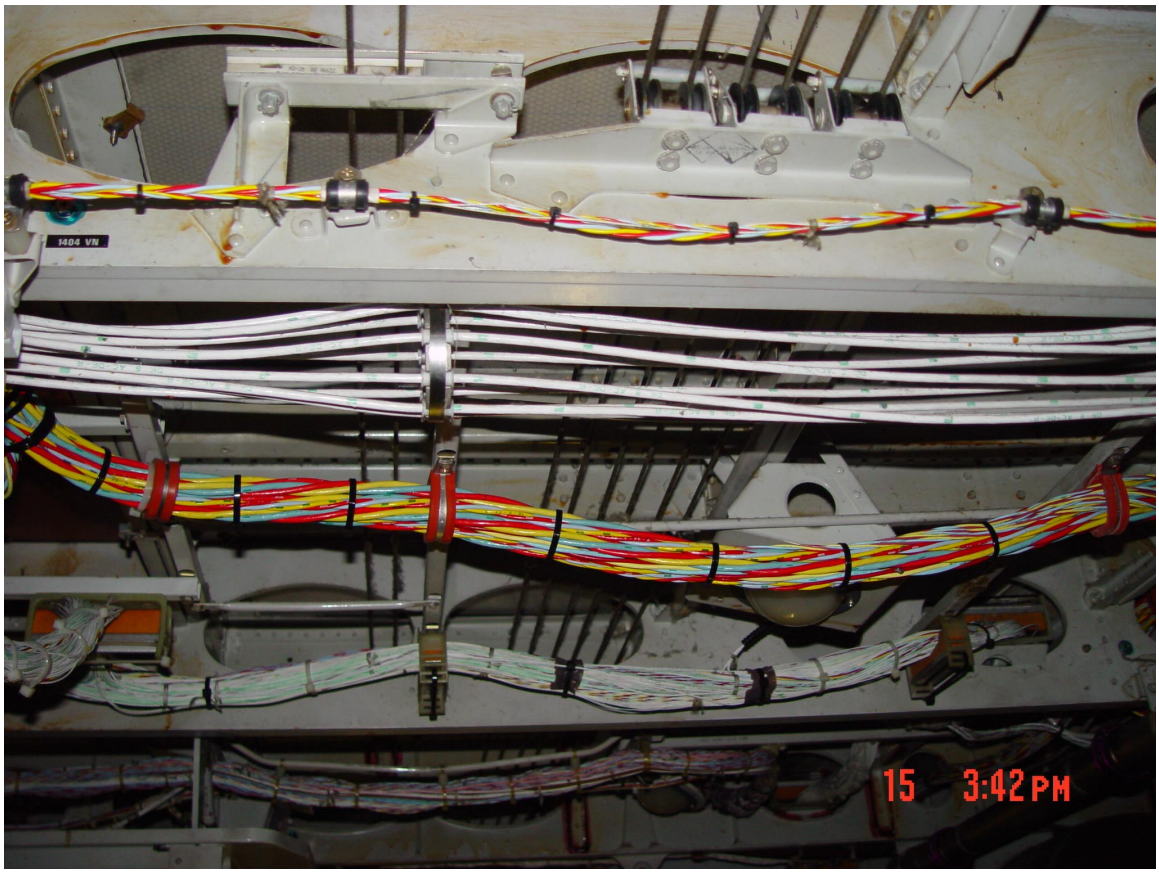

Figure 34. Frames C15a to C17 looking aft.

Figure 35. Frame C21 looking aft.

Figure 36. Frames C21 through C24 looking aft.

Figure 37. Frame C26 looking aft.

Figure 38. Frame C31 looking aft.

Figure 39. Frame C35 looking aft.

Figure 40. Frame 38.1 looking aft.

Figure 41. Frame 38.2 looking aft.

Figure 42. Frames C38.2 through C40 looking aft and down.

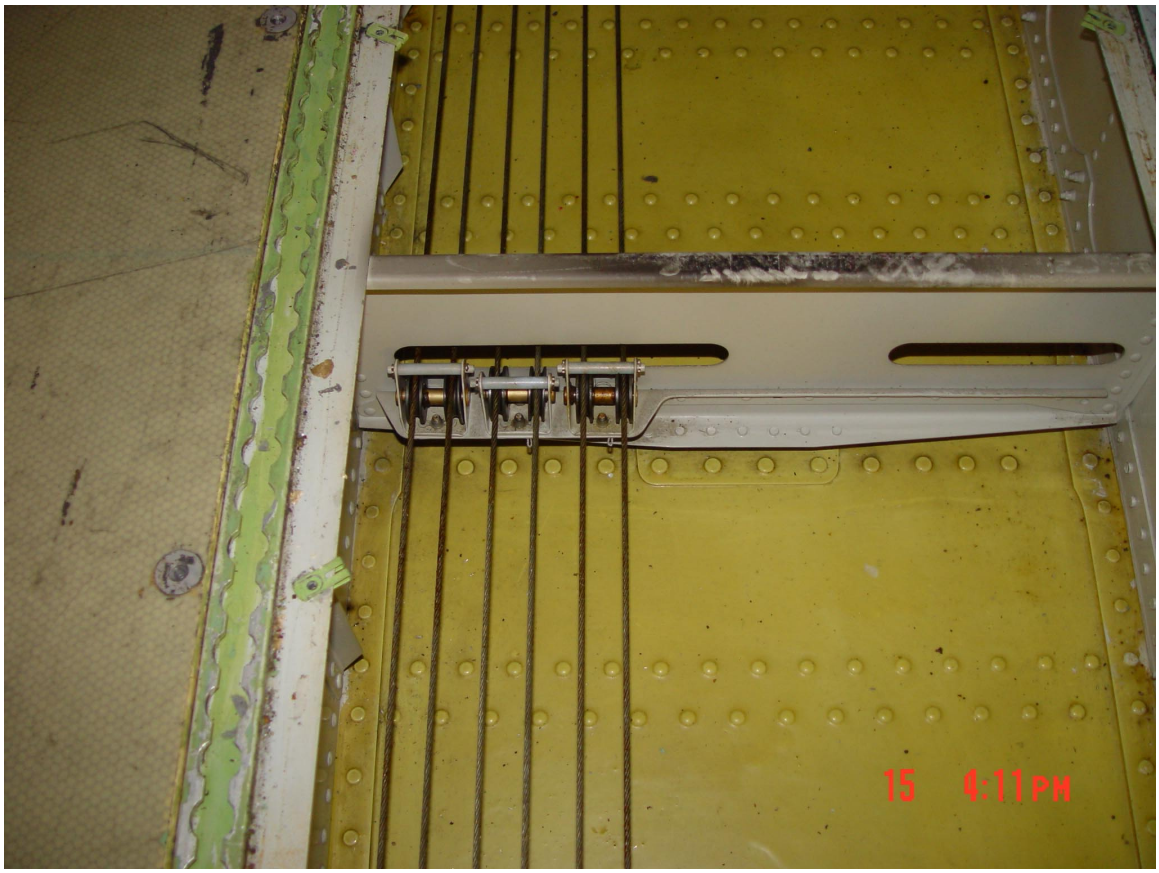

Figure 43. Frame C41 looking forward and down.

Figure 44. Frame C46 looking aft.

Figure 45. Frames C46 and roll control cable pulley looking aft and down.

Figure 46. Roll control cable pulley looking forward and down.

Figure 47. Roll control cables looking outboard and down near frame C47. Cables pass into wheel well.

Figures 48 through 62 show selected images of the yaw and pitch control cables aft to the point where the yaw control cables diverge to connect with the rudder frame assembly.

Figure 48. Frames C47 through C50 looking aft and down.

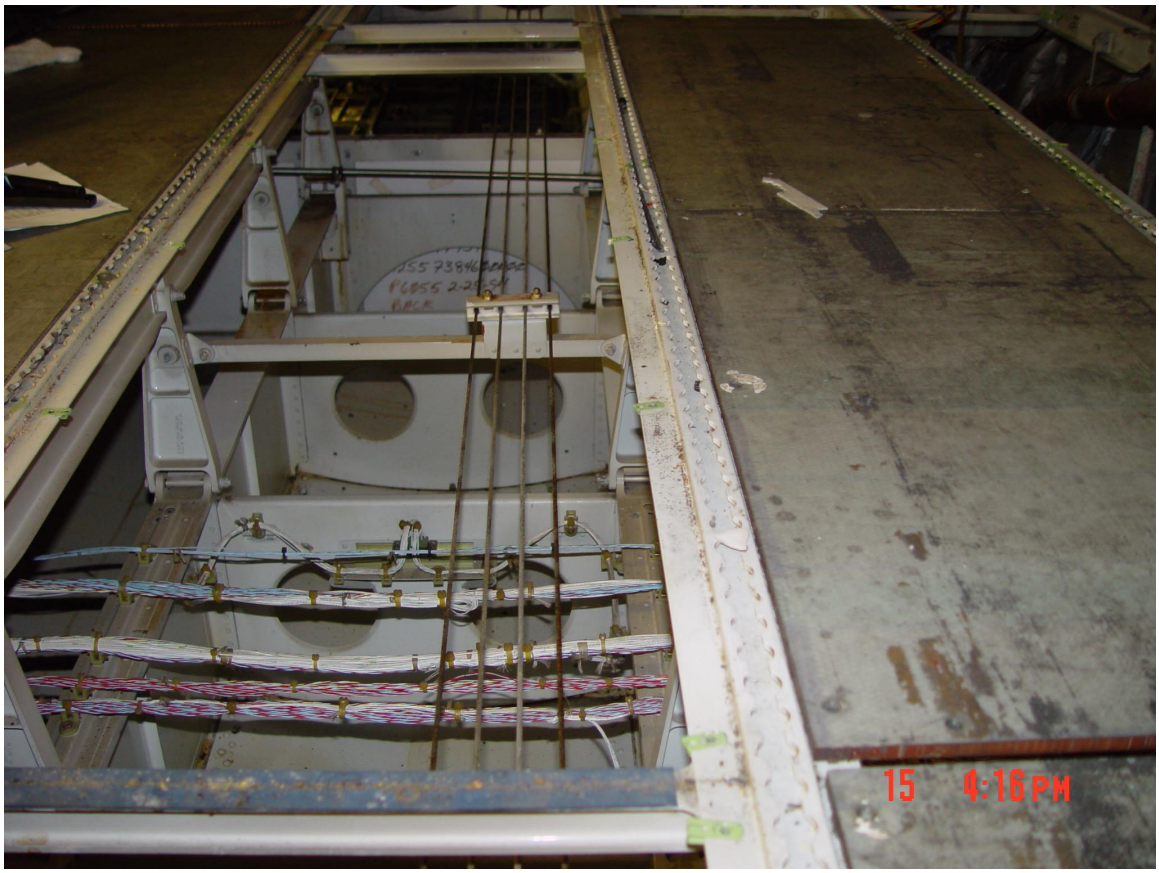

Figure 49. Frames C50 through C54 looking aft and down.

Figure 50. Frame C54.2 looking aft and up.

Figure 51. Frame C54.3 looking aft and up.

Figure 52. Frame C57 looking aft and up.

Figure 53. Frame C58 looking aft.

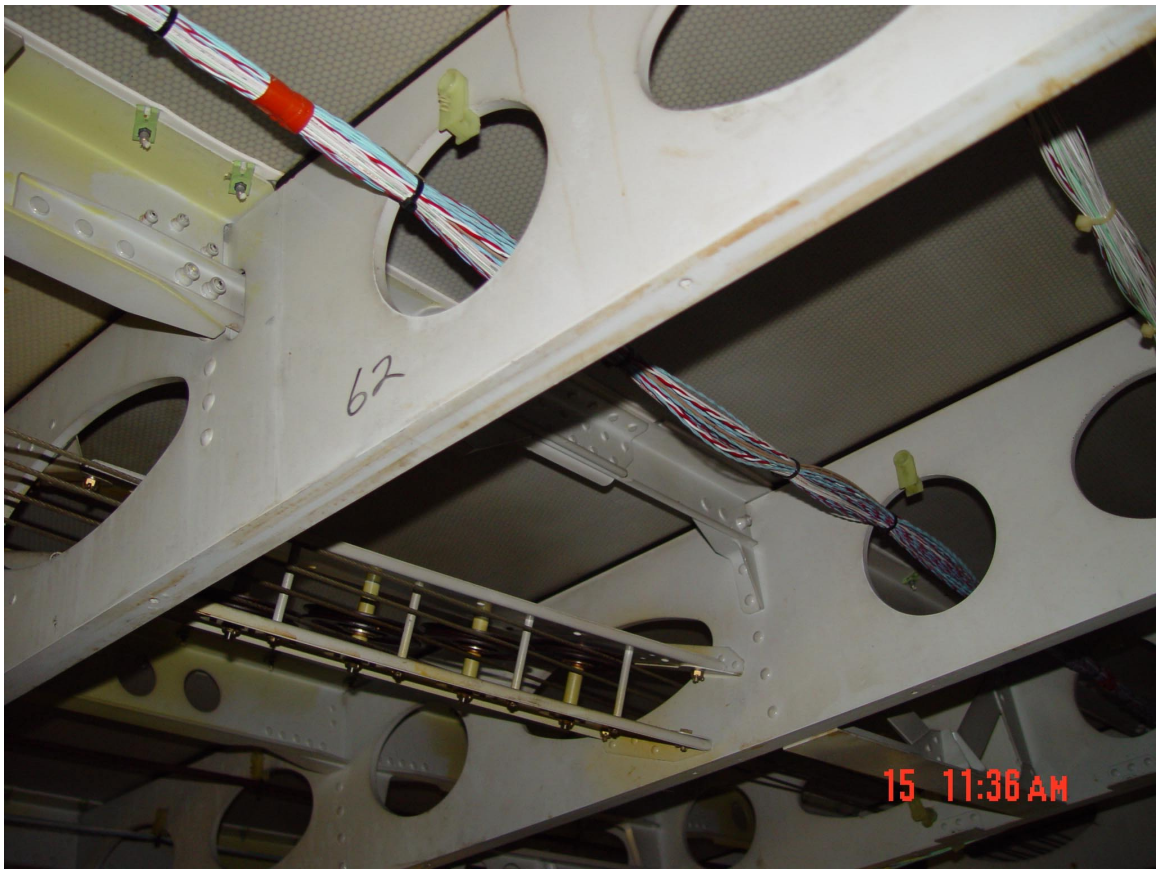

Figure 54. Pulleys between frames C62 and C63 looking up, aft and inboard.

Figure 55. Frames C70 through C69 looking forward.

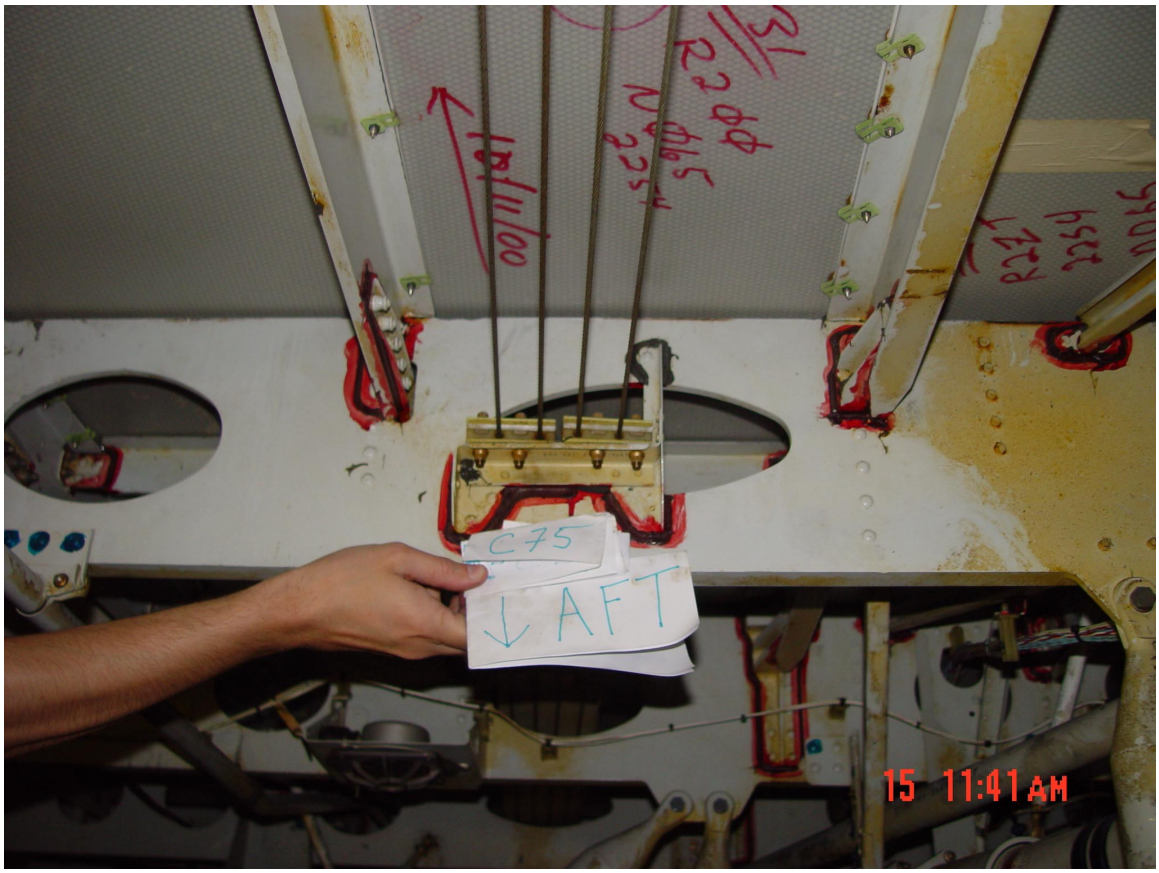

Figure 56. Frame C75 looking aft.

Figure 57. Frame C78 aft and outboard.

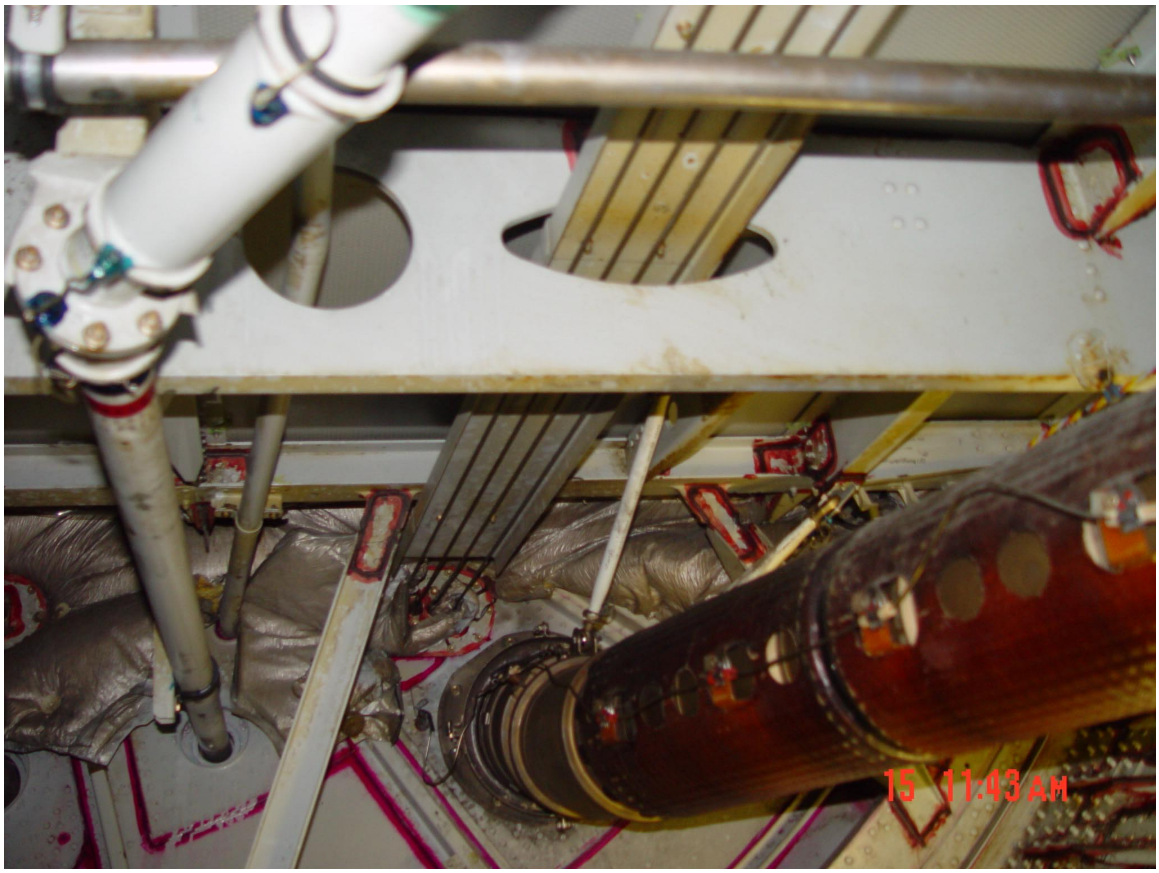

Figure 58. Frame C79 to the pressure bulkhead looking aft and outboard.

Figure 59. Pitch and yaw control cables pass through aft of pressure bulkhead looking down.

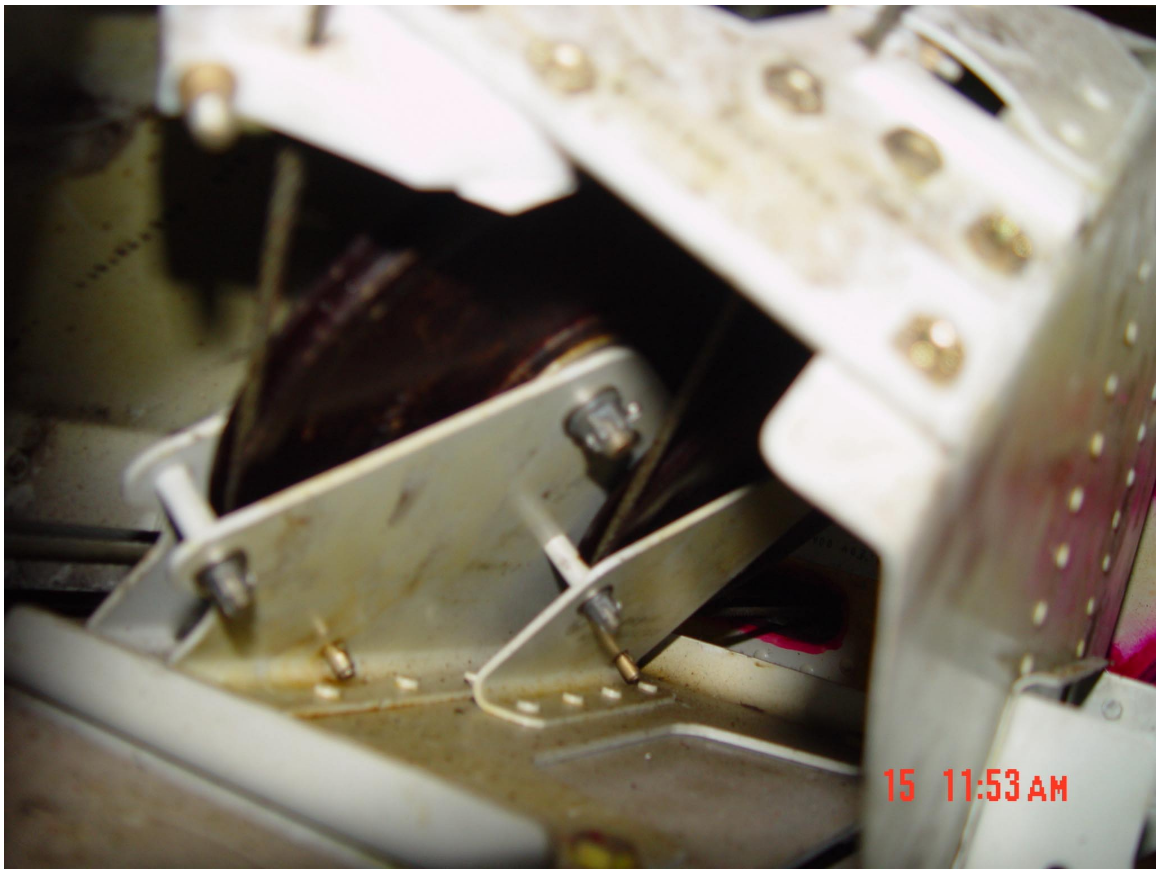

Figure 60. Yaw control cable pass around pulleys and separate from pitch control cables.

Figure 61. Yaw control cables and pulleys at rudder frame assembly.

Figure 62. Yaw control cables terminate at quadrant on rudder frame assembly.

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