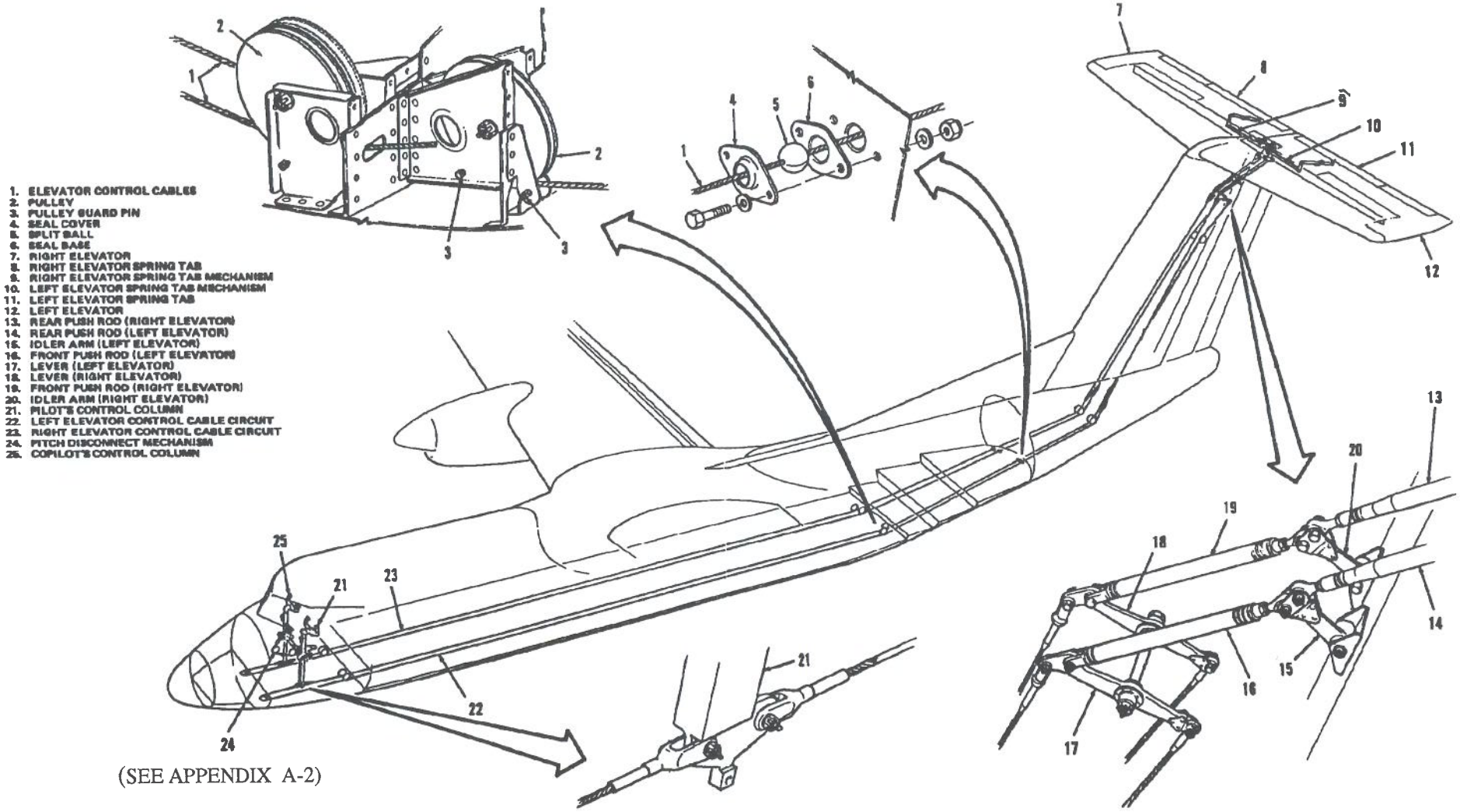
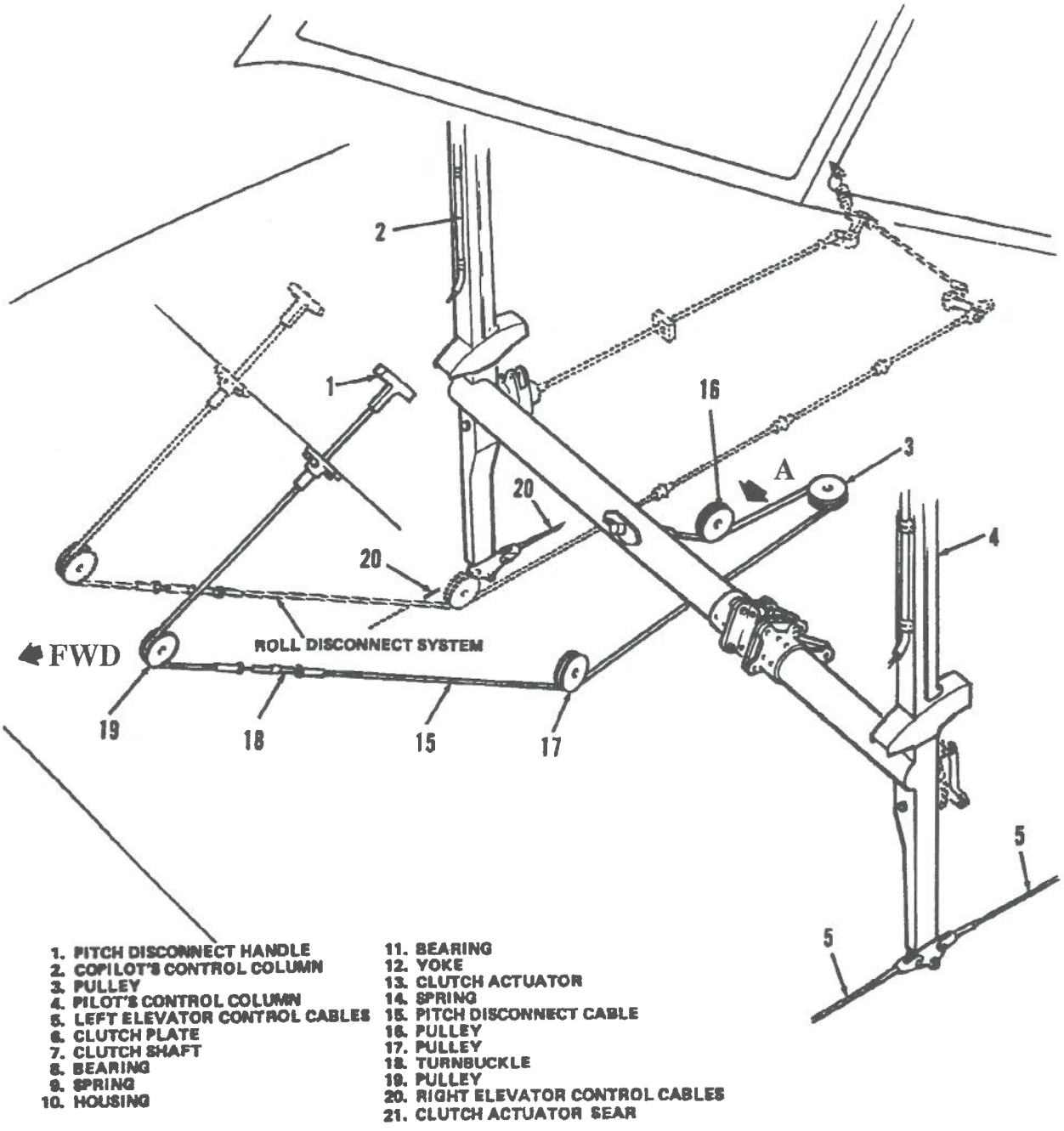
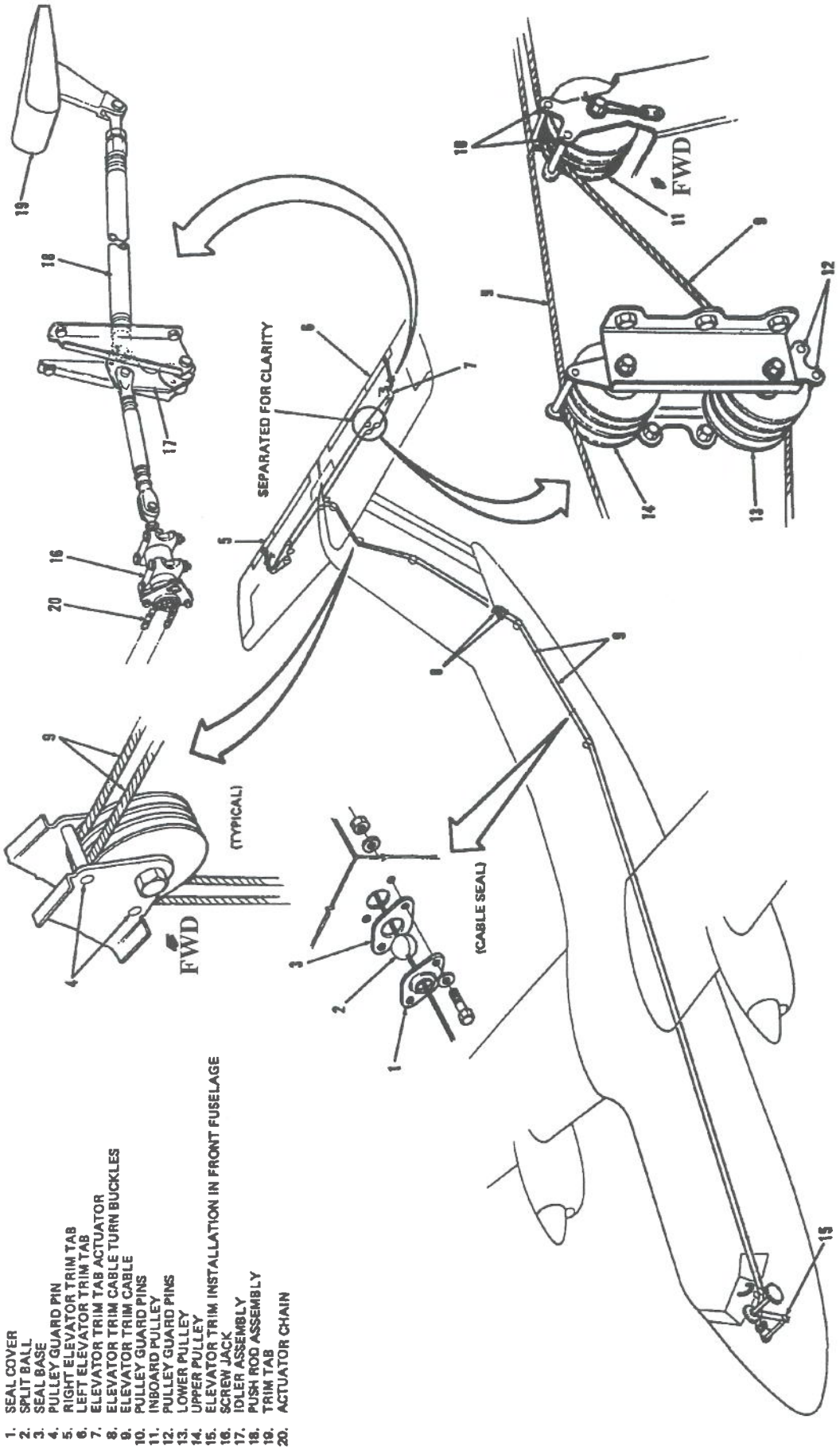


(SEE APPENDIX A-2)

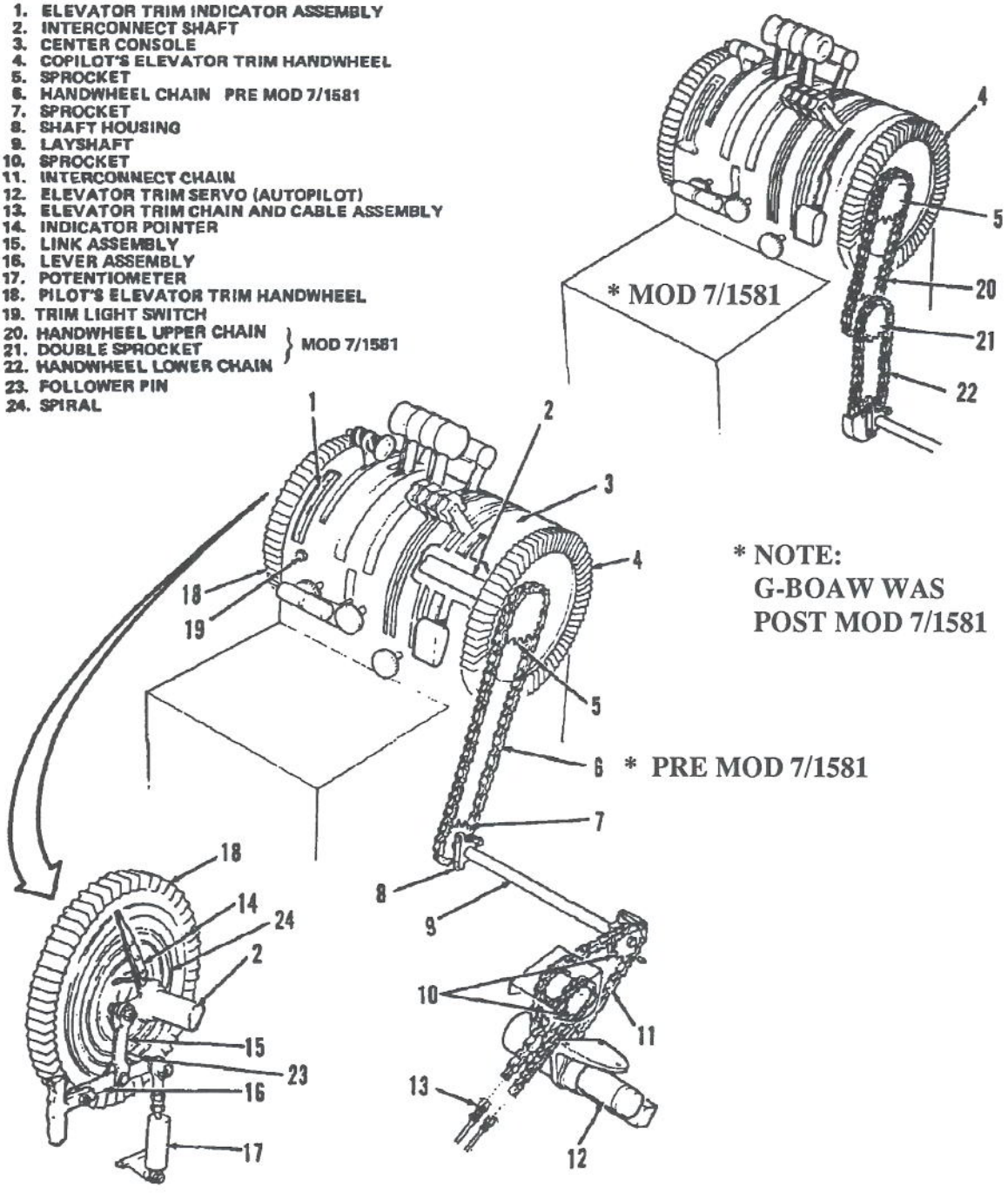
PITCH CONTROL SYSTEM



PITCH DISCONNECT SYSTEM

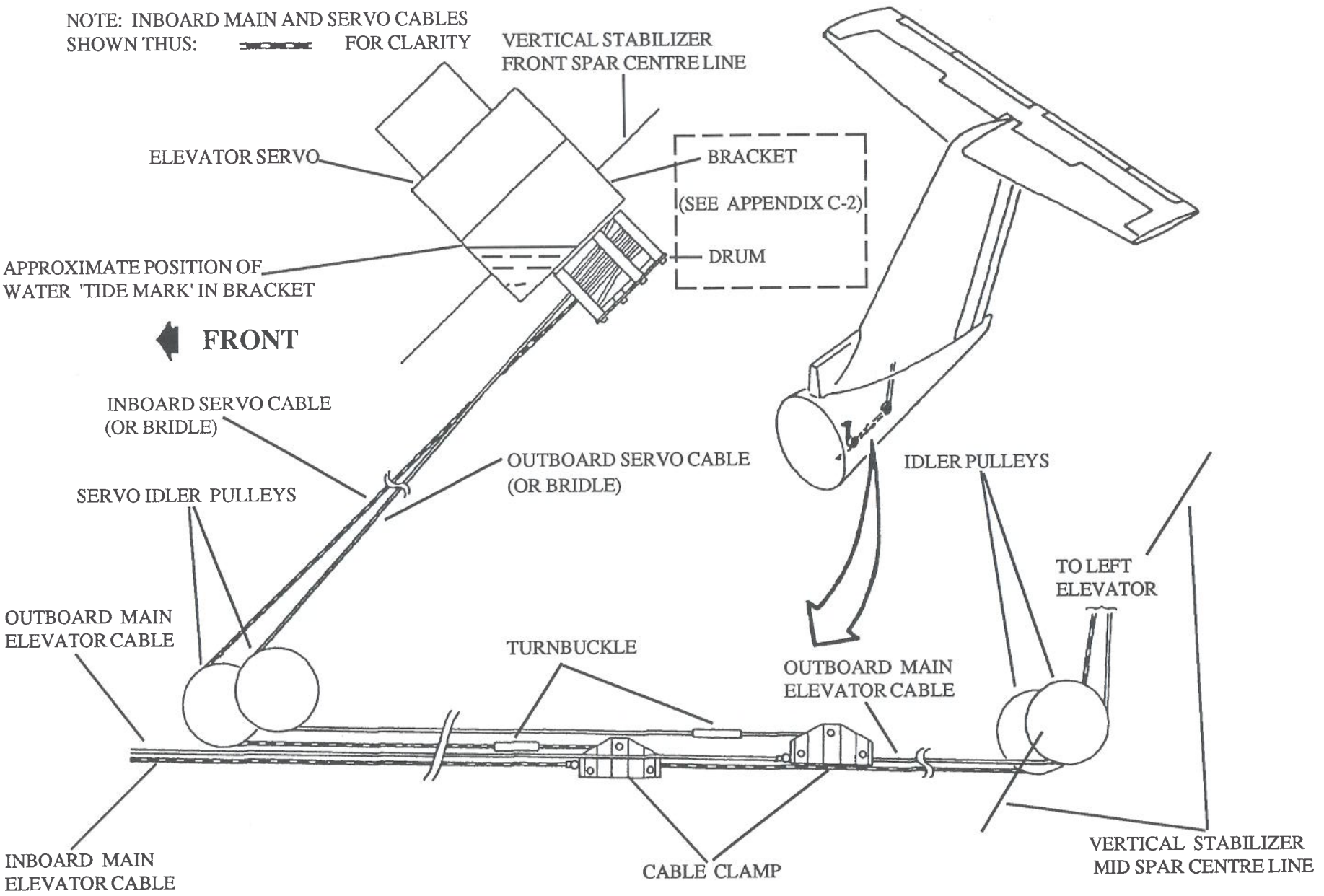


PITCH TRIM TAB SYSTEM

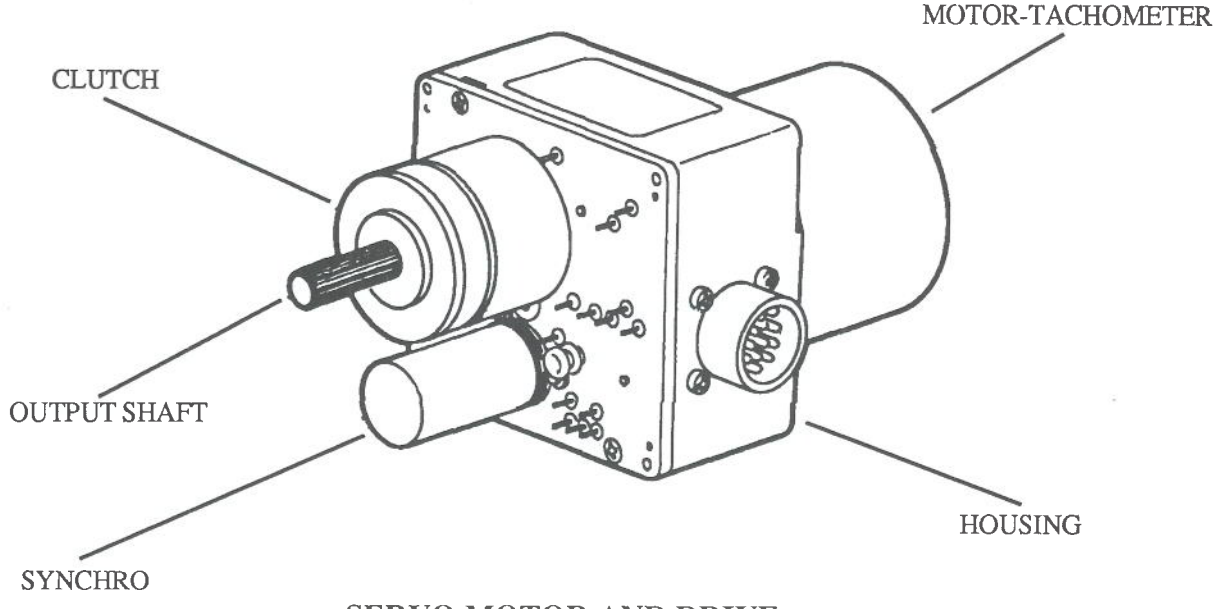


PITCH TRIM INSTALLATION IN FRONT FUSELAGE

ELEVATOR SERVO CONTROL SYSTEM LAYOUT

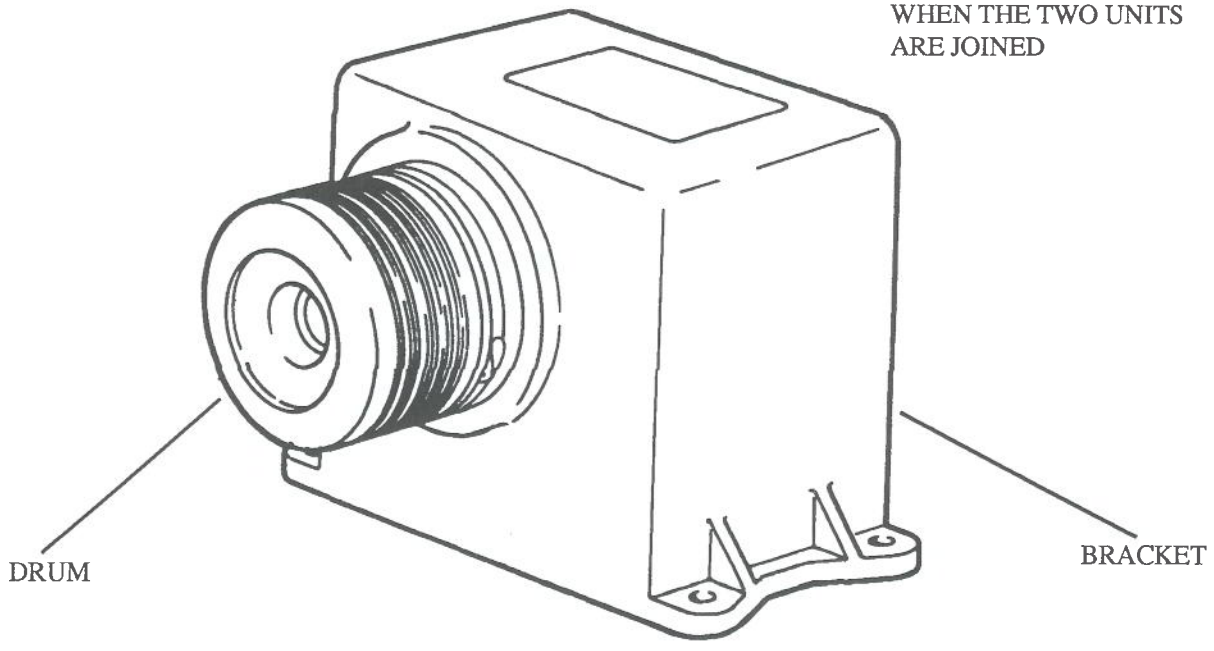


ELEVATOR SERVO COMPONENTS

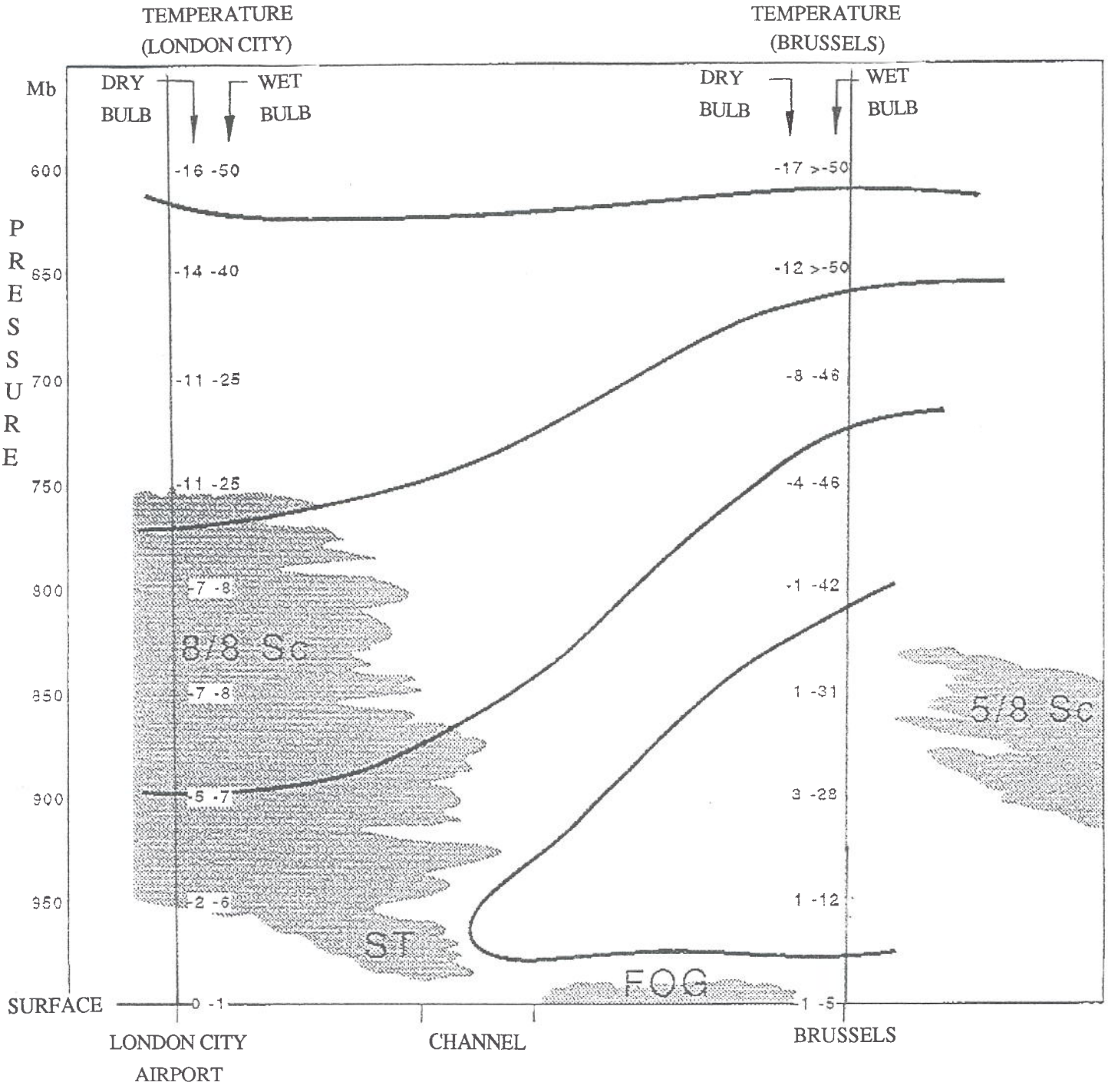


SERVO MOTOR AND DRIVE

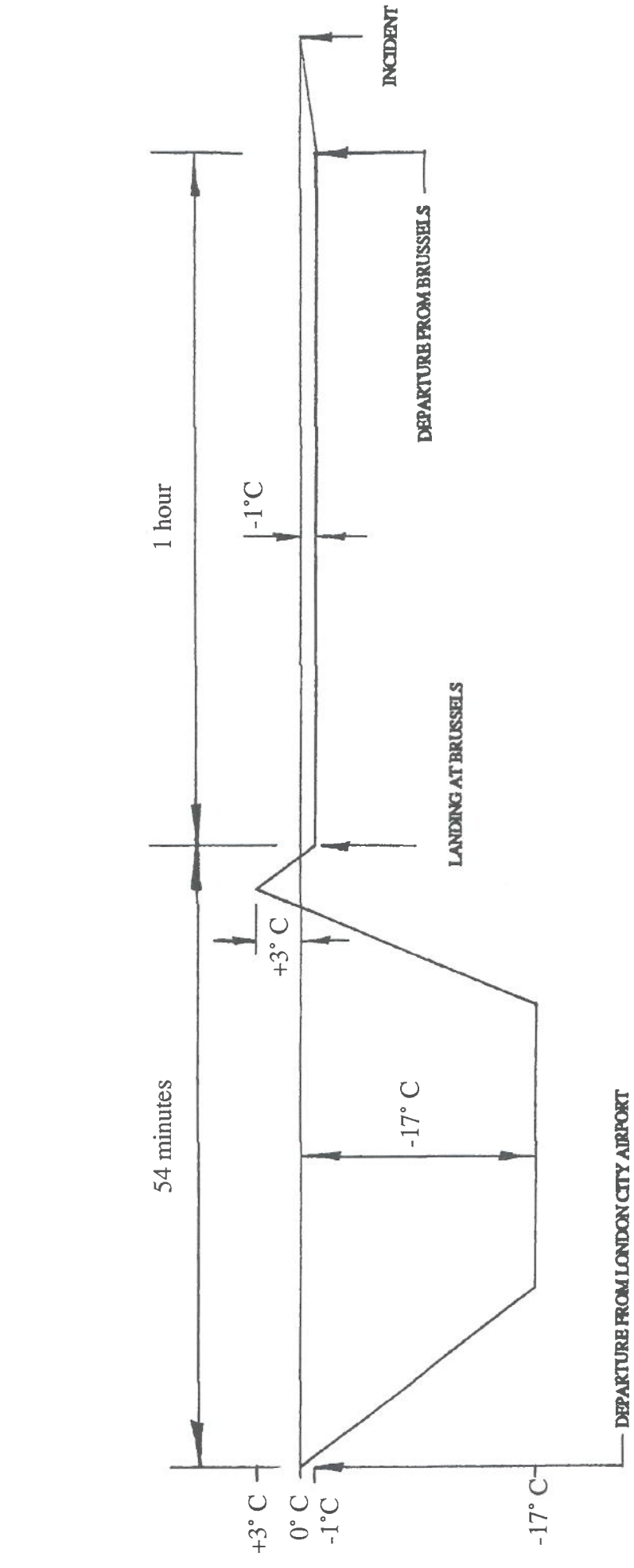
NOTE: SPLINED OUTPUT SHAFT OF SERVO MOTOR AND DRIVE ENGAGES IN DRUM WHEN THE TWO UNITS ARE JOINED



DRUM AND BRACKET

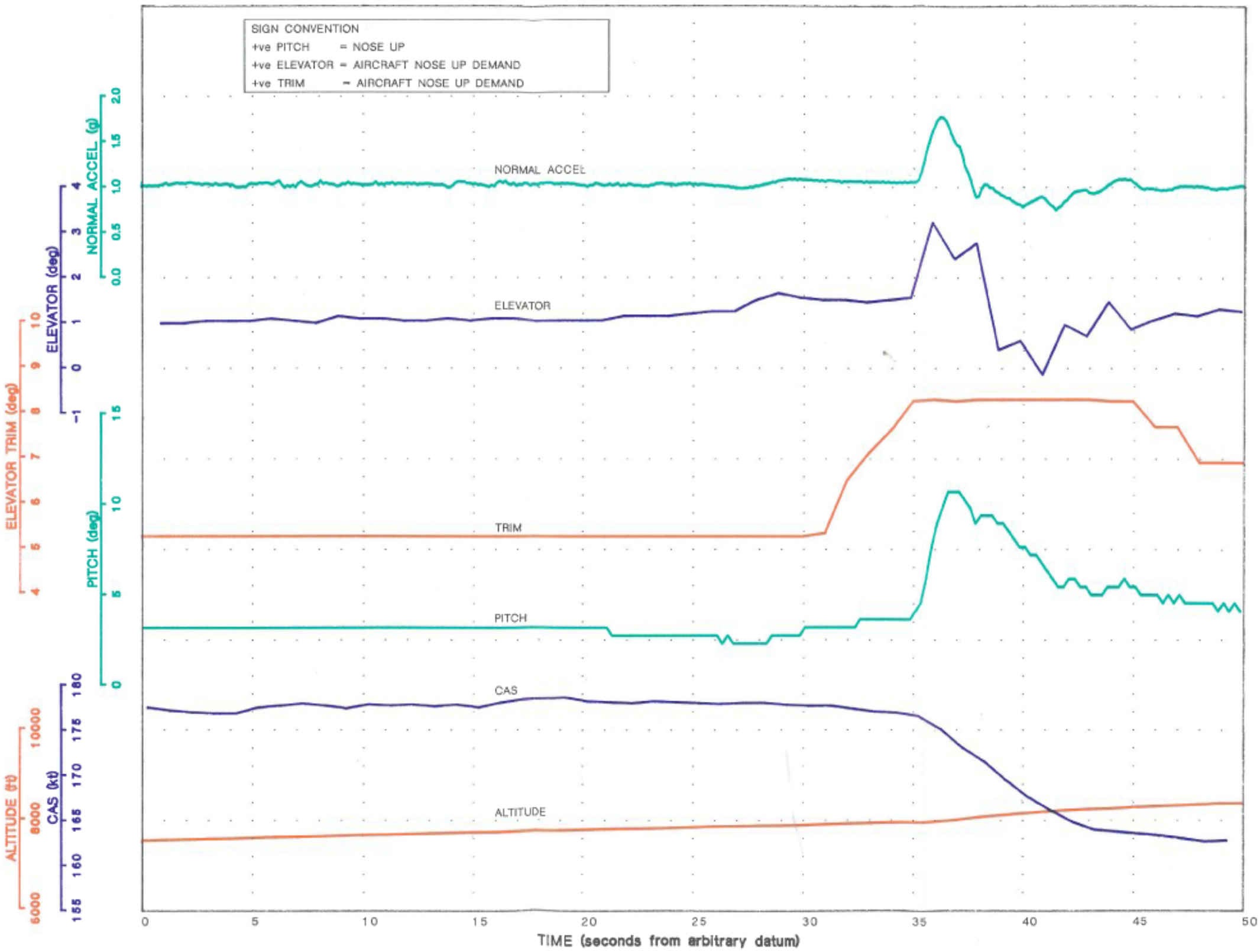


TEMPERATURE CROSS SECTION
LONDON TO BRUSSELS
30-JAN-1991 1800 UTC



Approximate Ambient Temperature / Time Relationship for 2 hour period preceding pitch-up incident

SELECTED DFDR PARAMETERS FOR PITCH UP EVENT



PREPARED G. Bolter CHECKED G.M. Bolter DATE July 3, 1991	Boeing Canada de Havilland Division DHC-7 ELEVATOR AUTOPILOT SYSTEM	DTR 7/590 SECT. PAGE 1 ISSUE 1

DHC-7 ELEVATOR SERVO ICING TEST TEST REPORT

REFERENCES:

MEMO AE-3610-16/RH-91-97
RT NO. 8/590
E.O. X 75645

TEST PERIOD MAY 14 - MAY 23, 1991

TEST CONDUCTED BY: A. DE ROSA

1. INTRODUCTION

1.1 An icing test on a DHC-7 elevator autopilot servo drum assembly was required to investigate the effect of water ingress, followed by freezing, on operating torque.

2. TEST ARRANGEMENT

2.1 A servo drum assembly Sperry P/N 400584 S/N 80105477 was mounted at a representative angle on a support stand as seen in Figure 1. The cable circuit shown was installed to apply a representative side load to the drum and to investigate the effect of ice formation on the cable itself.

3. TEST EQUIPMENT

3.1 Temperature chamber Superline Model TARF.

3.2 Water spray unit - capable of spraying a fine mist at approx. .25 l/min.

3.3 Spring Scales.

4. TEST PROCEDURE AND RESULTS

4.1 Test No. 1 was conducted on the assembly without the cables attached. The drum was sprayed with a fine water mist for approximately 2 minutes to allow thorough wetting including the air gap between the drum and the housing. The specimen was then cold soaked at - 10° C. After removal from the temperature chamber, a breakout torque of 26 in lb. was required to free the drum. This was measured by attaching a spring scale to a nylon cord wrapped around the drum in place of the normal cable. After approximately 1 minute at ambient temperature 10 in. lb torque was required to turn the drum slowly.

4.2 For Test No. 2 water was poured into the housing up to the point of overflow through the drive shaft cavity. The drum was then rotated a few turns to encourage seepage into the internal cavity. After leaving overnight the specimen was cold soaked for 4 hours. On removal from the chamber at - 7.5 ° C breakout torque was 24 in. lb. After 3 minutes 10 in. lb was required to turn the drum slowly.

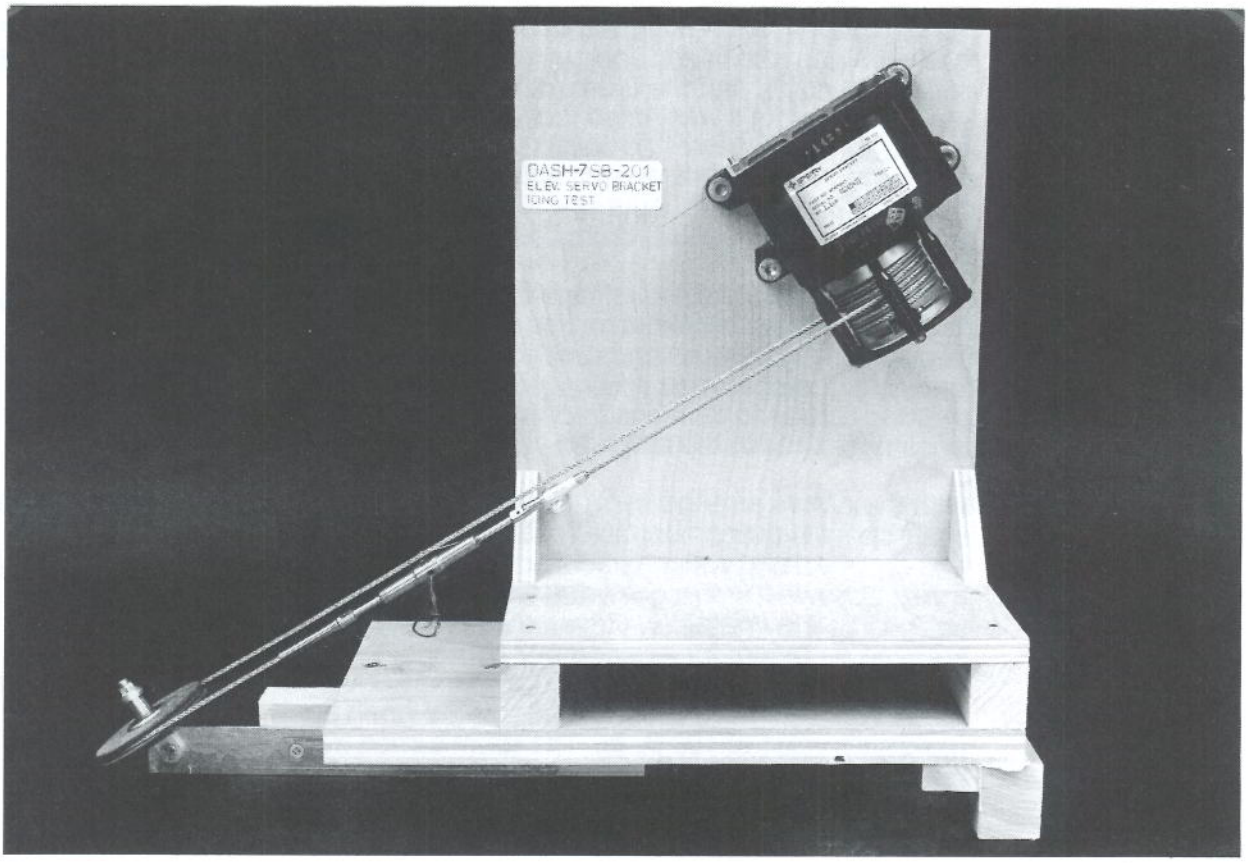
4.3 Before commencing Test No. 3 cables were attached to the drum and, unlike the later arrangement shown in Figure 1, the cable ends were attached to the test frame. Cable tension was adjusted to 25 lb. The drum was sprayed with water for 2 minutes as per Test No. 1, Para 4.1. After 1 hour, 20 minutes cold soak at - 11 ° C, the unit was removed from the chamber. After releasing the cables, a drum breakout torque of 10 in. lb was measured.

4.4 For Test No. 4, with cables attached, water was sprayed onto the drum as for Test No 3, and in addition, water was poured into the housing up to the drive shaft cavity and the drum rotated per Test No. 2, Para 4.2. After leaving overnight it was noted that over a period of approx. 15 hours a small quantity of water had collected in a container placed under the specimen. The drum area was sprayed for 6 minutes and the unit then cold soaked for 3 3/4 hours at - 10° C. After removal from the chamber and releasing the cables, drum breakout torque was found to be 10 IN.LB

4.5 It was suspected that the release of the cable tension in Tests 3 and 4 may have affected the breakout torque values by applying load to the ice, and this was in any case an unrepresentative procedure. Before the next test, therefore, the specimen was rigged with a pulley as shown in Figure 1, allowing torque to be measured with cable tension maintained. Cable tension was within the range 20 - 25 lb.

4.6 With the above arrangement, the housing was filled to the level of the drive shaft cavity in preparation for Test No. 5. One hour later the water level had dropped and water had collected in the container below the assembly. It was observed at this point that while turning the drum, additional water spilled into the container. After leaving overnight the drum area was sprayed as before for a period of 7 minutes, then cold soaked for 3 hours 40 minutes. Chamber temperature was -11.3 ° C when the specimen was removed. The drum could not be rotated when applying torque up to a maximum value of 100 in. lb. The drum turned freely 8 to 10 minutes after removal from the chamber.

FIGURE 1.



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