

DOCKET NO. **SA - 510**

EXHIBIT NO. **13X - B**

**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.**

**Group Chairman's Report of Investigation**  
**Simulator Calibration Flight Test**

# **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Research and Engineering  
Washington, D.C.

November 9, 1995

## **Group Chairman's Report of Investigation - Simulator Calibration Flight Test**

### **A. ACCIDENT                      DCA-94-MA-076**

Location        :     Aliquippa, Pennsylvania  
Date            :     September 8, 1994  
Time            :     1904 Eastern Daylight Time  
Aircraft        :     Boeing 737-300, N513AU

### **B. GROUP IDENTIFICATION**

The Aircraft Performance Group met at Boeing Field in Seattle, Washington on September 20 and September 21, 1995. The following group members participated in this investigative effort:

Chairman       :     Thomas R. Jacky, NTSB  
Member        :     Bob McCullough, USAir  
Member        :     James Kerrigan, Boeing

Additionally, the following persons assisted the group during this phase of the investigative effort:

Martin Ingham, Boeing  
James Wilborn, Boeing  
Mike Carriker, Boeing  
Les Berven, FAA  
John Cox, ALPA  
Jim Gibbs, USAir

### **C. SUMMARY**

On September 8, 1994 at 1904 Eastern Daylight Time, USAir Flight 427, a Boeing 737-3B7, N513AU, crashed while maneuvering to land at Pittsburgh International Airport, Pittsburgh, Pennsylvania. The airplane was being operated on an instrument flight rules (IFR) flight plan under the provisions of Title 14, code of Federal Regulation (CFR), Part 121, on a regularly scheduled flight from Chicago O'Hare International Airport, Chicago, Illinois, to Pittsburgh. The airplane was destroyed by impact forces and fire near Aliquippa, Pennsylvania. All 132 persons on board the airplane were fatally injured.

#### **D. DETAILS OF INVESTIGATION**

The Aircraft Performance Group conducted a Simulator Calibration Flight Test at the Boeing facility at Boeing Field, Seattle, Washington on September 20 and 21, 1995. The test objective was to measure a Boeing 737-300's lateral and directional responses and performance. For the test, a 737-300, N533AU, was leased from USAir. An upgraded Flight Data Recorder (FDR), Cockpit Voice Recorder (CVR), and an additional on-board performance measuring system, known as PADDs, were installed on the airplane. In addition, sensors to measure cockpit control wheel, control column, and rudder pedal were added and wired into the airplane's FDR system; the airplane's FDR already was wired to record aileron, elevator, and rudder surface positions.

Two flights were conducted, one flight per day. The flights were of a duration of 3:27 and 2:54, respectively. The flights were performed by a Boeing flight test pilot, with assistance from FAA, USAir, and ALPA pilots. In addition to the two flights in Seattle, WA, several simulator calibration flight conditions were attempted in Atlantic City, NJ during the wake vortex portion of the flight test. A daily summary of the flight test is included in Attachment 1.

In general, the following maneuvers were performed during the flight test:

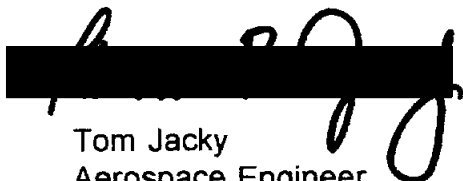
- 1) Steady heading sideslips at 1/3, 2/3, and full rudder input at airspeeds of  $V_2$ , 170, 190, 210, and 225 knots calibrated airspeed (KCAS). Performed with yaw damper on and off, both left and right rudder. (Conditions B1.41.0081.001 to .020)
- 2) Roll responses with wheel only using 1/3, 2/3, full wheel input, at 170 and 190 KCAS, yaw damper on and off. (Conditions B1.41.0081.021 to .036)
- 3) Roll responses with rudder pedal only using 1/4, 1/2, and 3/4 rudder pedal input at 170 and 190 KCAS, yaw damper on/off. (Conditions B1.41.0081.037 to .060)
- 4) Roll responses with cross controls using 1/4 and 1/2 rudder pedal, 1/4 and 1/2 opposite control wheel inputs, 190 KCAS, yaw damper on. (Conditions B1.41.0081.061 to .062)
- 5) Roll responses with combined controls using 1/4 and 1/2 rudder pedal and control wheel inputs, 190 KCAS, yaw damper on. (Conditions B1.41.0081.063 to .064)
- 6) Auto-pilot turns of 40 degree heading change. (Conditions B1.41.0081.065 to .066)

- 7) Slowdown turns to aerodynamic stall, yaw damper on. (Condition B1.41.0081.67)

During the two flights, 86 individual flight conditions were attempted. A detailed explanation of each test condition, including pilot instructions, is included in Exhibit 13X-F. A chronological listing of the conditions attempted is included in Attachment 2. A listing of the attempted conditions, grouped by condition number, is included in Attachment 3.

From the 86 test conditions attempted, a selected number of conditions were plotted, and the resultant data included in Attachment 4. Generally, plotted data were recorded by the PADDs system. Each condition is represented by two plots - page A and B, respectively.

Data collected during the flight test is to be compared against the Boeing simulator model described by the Aerodynamic Data And Control System Description for the 737-300 Simulator (Boeing Document D6-37908, rev. C). The model is used in Boeing's Multipurpose Engineering Cab (MCAB) Simulator. Selected flight test conditions will be used as Boeing proof-of-match with the 737-300 simulator model. These plots are included in Exhibit 13X-S. Finally, the flight test data will be used to further refine the kinematic study of the accident FDR data.

  
Tom Jacky  
Aerospace Engineer

#### Attachments

1. Daily Summary of Simulator Calibration Flight Test
2. Chronological Listing of Attempted Conditions
3. Listing of Conditions, Grouped by Condition Number
4. Selected Plots of Simulator Calibration Conditions

ATTACHMENT 1

**Daily Summary of Simulator Calibration Flight Test**

## **Summary of Simulator Calibration Flight Tests**

(Tests Flown from out of Boeing Field, Seattle, Washington)

| <b><u>#</u></b> | <b><u>Flight Test #</u></b> | <b><u>Date</u></b> | <b><u>Time</u></b> | <b><u>Cameras</u></b> | <b><u>Comments</u></b>                  |
|-----------------|-----------------------------|--------------------|--------------------|-----------------------|-----------------------------------------|
| 1               | 19-03                       | Wed, 9/20          | 3:27               | OFF                   | Lateral, Directional Man. 49 conditions |
| 2               | 19-04                       | Thur, 9/21         | 2:54               | ON                    | Lateral, Directional Man. 37 conditions |

ATTACHMENT 2

**Chronological Listing of Attempted Conditions**

727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST ORDERED CHRONOLOGICALLY

| Test No. | Sequence Number | Condition Number | Manuever Description                          | Yaw Damper | Control | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|-----------------------------------------------|------------|---------|-------------------|------------------|
| 19-03    | 008600          | B1.41.0081.SWP   | Pre-flight control sweeps                     | ON         | PILOT   | N/A               | 10:32:31.80      |
| 19-03    | 008601          | B1.41.0081.001C  | Full rudder calibration @ 146 kts             | ON         | PILOT   | N/A               | 10:54:06.80      |
| 19-03    | 008602          | B1.41.0081.001   | Sideslip to left @ 146 kts                    | ON         | PILOT   | N/A               | 10:58:18.80      |
| 19-03    | 008603          | B1.41.0081.006   | Sideslip to right @ 146 kts                   | ON         | PILOT   | N/A               | 11:05:58.75      |
| 19-03    | 008604          | B1.41.0081.011   | Sideslip to left @ 146 kts                    | OFF        | PILOT   | N/A               | 11:11:38.75      |
| 19-03    | 008605          | B1.41.0081.016   | Sideslip to right @ 146 kts                   | OFF        | PILOT   | N/A               | 11:16:03.75      |
| 19-03    | 008606          | B1.41.0081.002C  | Full rudder calibration @ 170 kts             | ON         | PILOT   | N/A               | 11:21:06.75      |
| 19-03    | 008607          | B1.41.0081.002R1 | 1/3 Left rud sideslip and release @ 170 kts   | ON         | PILOT   | N/A               | 11:25:34.75      |
| 19-03    | 008608          | B1.41.0081.002R2 | 2/3 Left rud sideslip and release @ 170 kts   | ON         | PILOT   | N/A               | 11:28:48.75      |
| 19-03    | 008609          | B1.41.0081.002R3 | Full Left rud sideslip and release @ 170 kts  | ON         | PILOT   | N/A               | 11:30:02.75      |
| 19-03    | 008610          | B1.41.0081.007R1 | 2/3 Right rud sideslip and release @ 170 kts  | ON         | PILOT   | N/A               | 11:33:22.75      |
| 19-03    | 008611          | B1.41.0081.007R2 | Full Right rud sideslip and release @ 170 kts | ON         | PILOT   | N/A               | 11:36:10.75      |
| 19-03    | 008612          | B1.41.0081.012R1 | 1/3 Left rud sideslip and release @ 170 kts   | OFF        | PILOT   | N/A               | 11:39:38.75      |
| 19-03    | 008613          | B1.41.0081.012R2 | 2/3 Left rud sideslip and release @ 170 kts   | OFF        | PILOT   | N/A               | 11:41:22.75      |
| 19-03    | 008614          | B1.41.0081.012R3 | Full Left rud sideslip and release @ 170 kts  | OFF        | PILOT   | N/A               | 11:42:49.75      |
| 19-03    | 008615          | B1.41.0081.017   | Sideslip to right @ 170 kts                   | OFF        | PILOT   | N/A               | 11:45:35.75      |
| 19-03    | 008616          | B1.41.0081.003C  | Full rudder calibration @ 190 kts             | ON         | PILOT   | N/A               | 11:50:36.75      |
| 19-03    | 008617          | B1.41.0081.003R1 | 1/3 Left rud sideslip and release @ 190 kts   | ON         | PILOT   | N/A               | 11:53:14.75      |
| 19-03    | 008618          | B1.41.0081.003R2 | 2/3 Left rud sideslip and release @ 190 kts   | ON         | PILOT   | N/A               | 11:54:46.70      |
| 19-03    | 008619          | B1.41.0081.003R3 | Full Left rud sideslip and release @ 190 kts  | ON         | PILOT   | N/A               | 11:55:36.75      |
| 19-03    | 008620          | B1.41.0081.008   | Sideslip to right @ 190 kts                   | ON         | PILOT   | N/A               | 11:57:55.75      |
| 19-03    | 008621          | B1.41.0081.013   | Sideslip to left @ 190 kts                    | OFF        | PILOT   | N/A               | 12:02:12.75      |
| 19-03    | 008622          | B1.41.0081.018   | Sideslip to right @ 190 kts                   | OFF        | PILOT   | N/A               | 12:06:08.75      |
| 19-03    | 008623          | B1.41.0081.013.1 | Sideslip to left @ 190 kts                    | OFF        | PILOT   | N/A               | 12:20:05.70      |
| 19-03    | 008624          | B1.41.0081.018.1 | Sideslip to right @ 190 kts                   | OFF        | PILOT   | N/A               | 12:23:08.70      |
| 19-03    | 008625          | B1.41.0081.004C  | Full rudder calibration @ 210 kts             | ON         | PILOT   | N/A               | 12:27:08.70      |
| 19-03    | 008626          | B1.41.0081.004   | Sideslip to left @ 210 kts                    | ON         | PILOT   | N/A               | 12:28:48.70      |
| 19-03    | 008627          | B1.41.0081.009   | Sideslip to right @ 210 kts                   | ON         | PILOT   | N/A               | 12:33:01.70      |
| 19-03    | 008628          | B1.41.0081.014   | Sideslip to left @ 210 kts                    | OFF        | PILOT   | N/A               | 12:36:38.70      |
| 19-03    | 008629          | B1.41.0081.019   | Sideslip to right @ 210 kts                   | OFF        | PILOT   | N/A               | 12:42:03.70      |
| 19-03    | 008630          | B1.41.0081.005C  | Full rudder calibration @ 225 kts             | ON         | PILOT   | N/A               | 12:45:42.65      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date



727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST ORDERED CHRONOLOGICALLY

| Test No. | Sequence Number | Condition Number | Manuever Description                     | Yaw Damper | Control   | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|------------------------------------------|------------|-----------|-------------------|------------------|
| 19-03    | 008631          | B1.41.0081.005   | Sideslip to left @ 225 kts               | ON         | PILOT     | N/A               | 12:47:03.65      |
| 19-03    | 008632          | B1.41.0081.010   | Sideslip to right @ 225 kts              | ON         | PILOT     | N/A               | 12:49:06.70      |
| 19-03    | 008633          | B1.41.0081.037   | 1/4 pedal release @ 190 kts              | ON         | FREE      | N/A               | 12:54:24.65      |
| 19-03    | 008634          | B1.41.0081.038   | 1/4 pedal release @ 190 kts- wrong way   | ON         | AUTOPILOT | N/A               | 12:55:48.65      |
| 19-03    | 008635          | B1.41.0081.038.1 | 1/4 pedal release @ 190 kts              | ON         | AUTOPILOT | N/A               | 12:57:36.65      |
| 19-03    | 008636          | B1.41.0081.043   | 1/4 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 12:59:35.65      |
| 19-03    | 008637          | B1.41.0081.044   | 1/4 pedal release @ 190 kts              | OFF        | AUTOPILOT | N/A               | 13:00:18.65      |
| 19-03    | 008638          | B1.41.0081.039   | 1/2 pedal release @ 190 kts              | ON         | FREE      | N/A               | 13:01:43.65      |
| 19-03    | 008639          | B1.41.0081.040   | 1/2 pedal release @ 190 kts              | ON         | AUTOPILOT | N/A               | 13:02:18.65      |
| 19-03    | 008640          | B1.41.0081.045   | 1/2 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 13:03:18.65      |
| 19-03    | 008641          | B1.41.0081.046   | 1/2 pedal release @ 190 kts              | OFF        | AUTOPILOT | N/A               | 13:04:08.65      |
| 19-03    | 008642          | B1.41.0081.041   | 3/4 pedal release @ 190 kts              | ON         | FREE      | N/A               | 13:05:08.65      |
| 19-03    | 008643          | B1.41.0081.042   | 1/2 pedal release @ 190 kts- pedal only  | ON         | FREE      | N/A               | 13:09:18.65      |
| 19-03    | 008644          | B1.41.0081.048   | 1/2 pedal release @ 190 kts - pedal only | OFF        | FREE      | N/A               | 13:10:39.65      |
| 19-03    | 008645          | B1.41.0081.047   | 3/4 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 13:12:08.65      |
| 19-03    | 008646          | B1.41.0081.049   | 1/4 pedal release @ 170 kts              | ON         | FREE      | N/A               | 13:17:03.65      |
| 19-03    | 008647          | B1.41.0081.050   | 1/4 pedal release @ 170 kts              | ON         | AUTOPILOT | N/A               | 13:18:13.65      |
| 19-03    | 008648          | B1.41.0081.055   | 1/4 pedal release @ 170 kts              | OFF        | FREE      | N/A               | 13:19:18.65      |
| 19-03    | 008649          | B1.41.0081.056   | 1/4 pedal release @ 170 kts              | OFF        | AUTOPILOT | N/A               | 13:20:38.65      |
| 19-03    | 008650          | B1.41.0081.051   | 1/2 pedal release @ 170 kts              | ON         | FREE      | N/A               | 13:22:03.65      |
| 19-03    | 008651          | B1.41.0081.052   | 1/2 pedal release @ 170 kts              | ON         | AUTOPILOT | N/A               | 13:22:48.65      |
| 19-03    | 008652          | B1.41.0081.057   | 1/2 pedal release @ 170 kts              | OFF        | FREE      | N/A               | 13:24:03.65      |
| 19-03    | 008653          | B1.41.0081.058   | 1/2 pedal release @ 170 kts              | OFF        | AUTOPILOT | N/A               | 13:25:18.65      |
| 19-03    | 008654          | B1.41.0081.054   | 1/2 pedal release @ 170 kts- pedal only  | ON         | FREE      | N/A               | 13:26:28.65      |
| 19-03    | 008655          | B1.41.0081.060   | 1/2 pedal release @ 170 kts- pedal only  | OFF        | FREE      | N/A               | 13:27:36.60      |
| 19-03    | 008656          | B1.41.0081.053   | 3/4 pedal release @ 170 kts              | ON         | FREE      | N/A               | 13:29:18.60      |
| 19-03    | 008657          | B1.41.0081.059   | 3/4 pedal release @ 170 kts              | OFF        | FREE      | N/A               | 13:30:26.60      |
| 19-03    | 008658          | B1.41.0081.067   | Slowdown turn at 1.5 g's                 | ON         | PILOT     | N/A               | 13:33:18.60      |
| 19-03    | 008659          | B1.41.0081.061   | 1/4 Cross control response @ 190 kts     | ON         | FREE      | N/A               | 13:37:28.60      |
| 19-03    | 008660          | B1.41.0081.063   | 1/4 Combined control response @ 190 kts  | ON         | FREE      | N/A               | 13:38:18.60      |
| 19-03    | 008661          | B1.41.0081.SWP.1 | Post-flight control sweeps               | ON         | PILOT     | N/A               | 14:08:09.60      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST ORDERED CHRONOLOGICALLY

| Test No. | Sequence Number | Condition Number | Manuever Description                   | Yaw Damper | Control | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|----------------------------------------|------------|---------|-------------------|------------------|
|          |                 |                  |                                        |            |         |                   |                  |
|          |                 |                  |                                        |            |         |                   |                  |
| 19-04    | 008662          | B1.41.0081.SWP   | Pre-flight control sweeps              | ON         | PILOT   | N/A               | 10:30:32.20      |
| 19-04    | 008663          | B1.41.0081.070   | Full rudder w/throttle split @ 146 kts | ON         | PILOT   | N/A               | 10:56:19.40      |
| 19-04    | 008664          | B1.41.0081.002.C | Full rudder calibration @ 170 kts      | ON         | PILOT   | N/A               | 11:01:44.35      |
| 19-04    | 008665          | B1.41.0081.002.1 | Sideslip to left @ 170 kts             | ON         | PILOT   | N/A               | 11:06:39.35      |
| 19-04    | 008667          | B1.41.0081.007.1 | Sideslip to right @ 170 kts            | ON         | PILOT   | N/A               | 11:20:17.35      |
| 19-04    | 008668          | B1.41.0081.003.1 | Sideslip to left @ 190 kts             | ON         | PILOT   | N/A               | 11:25:05.35      |
| 19-04    | 008669          | B1.41.0081.008.1 | Sideslip to right @ 190 kts            | ON         | PILOT   | N/A               | 11:29:05.35      |
| 19-04    | 008670          | B1.41.0081.008.2 | Sideslip to right @ 190 kts            | ON         | PILOT   | N/A               | 11:34:29.40      |
| 19-04    | 008671          | B1.41.0081.021   | 1/3 wheel response @ 190 kts           | ON         | PILOT   | N/A               | 11:46:57.30      |
| 19-04    | 008672          | B1.41.0081.023   | 2/3 wheel response @ 190 kts           | ON         | PILOT   | N/A               | 11:48:53.30      |
| 19-04    | 008673          | B1.41.0081.024   | Full wheel response @ 190 kts          | ON         | PILOT   | N/A               | 11:49:32.30      |
| 19-04    | 008674          | B1.41.0081.022   | Full wheel response @ 190 kts          | ON         | PILOT   | N/A               | 11:51:14.30      |
| 19-04    | 008675          | B1.41.0081.025   | 1/3 wheel response @ 190 kts           | OFF        | PILOT   | N/A               | 11:53:42.35      |
| 19-04    | 008676          | B1.41.0081.027   | 2/3 wheel response @ 190 kts           | OFF        | PILOT   | N/A               | 11:55:26.30      |
| 19-04    | 008677          | B1.41.0081.028   | Full wheel response @ 190 kts          | OFF        | PILOT   | N/A               | 11:56:03.30      |
| 19-04    | 008678          | B1.41.0081.026   | Full wheel response @ 190 kts          | OFF        | PILOT   | N/A               | 11:57:09.30      |
| 19-04    | 008679          | B1.41.0081.029   | 1/3 wheel response @ 170 kts           | ON         | PILOT   | N/A               | 12:00:27.30      |
| 19-04    | 008680          | B1.41.0081.031   | 2/3 wheel response @ 170 kts           | ON         | PILOT   | N/A               | 12:01:42.30      |
| 19-04    | 008681          | B1.41.0081.032   | Full wheel response @ 170 kts          | ON         | PILOT   | N/A               | 12:02:23.30      |
| 19-04    | 008682          | B1.41.0081.033   | 1/3 wheel response @ 170 kts           | OFF        | PILOT   | N/A               | 12:04:03.30      |
| 19-04    | 008683          | B1.41.0081.035   | 2/3 wheel response @ 170 kts           | OFF        | PILOT   | N/A               | 12:05:25.30      |
| 19-04    | 008684          | B1.41.0081.036   | Full wheel response @ 170 kts          | OFF        | PILOT   | N/A               | 12:06:11.30      |
| 19-04    | 008686          | B1.41.0081.039   | 1/2 pedal release @ 190 kts            | ON         | FREE    | N/A               | 12:23:41.35      |
| 19-04    | 008687          | B1.41.0081.043   | 1/4 pedal release @ 190 kts            | OFF        | FREE    | N/A               | 12:24:50.30      |
| 19-04    | 008688          | B1.41.0081.045   | 1/2 pedal release @ 190 kts            | OFF        | FREE    | N/A               | 12:25:37.30      |
| 19-04    | 008689          | B1.41.0081.047   | 3/4 pedal release @ 190 kts            | OFF        | FREE    | N/A               | 12:27:02.25      |
| 19-04    | 008690          | B1.41.0081.061.1 | 1/4 cross control @ 190 kts            | ON         | PILOT   | N/A               | 12:29:35.25      |
| 19-04    | 008691          | B1.41.0081.062   | 1/2 cross control @ 190 kts            | ON         | PILOT   | N/A               | 12:30:50.25      |
| 19-04    | 008692          | B1.41.0081.062.1 | 1/2 cross control @ 190 kts            | ON         | PILOT   | N/A               | 12:32:20.25      |
| 19-04    | 008693          | B1.41.0081.063   | 1/4 combined controls @ 190 kts        | ON         | PILOT   | N/A               | 12:33:27.25      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

**727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST ORDERED CHRONOLOGICALLY**

| Test No. | Sequence Number | Condition Number | Manuever Description             | Yaw Damper | Control | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|----------------------------------|------------|---------|-------------------|------------------|
| 19-04    | 008694          | B1.41.0081.064   | 1/2 combined controls @ 190 kts  | ON         | PILOT   | N/A               | 12:34:10.25      |
| 19-04    | 008695          | B1.41.0081.064.1 | 1/2 combined controls @ 190 kts  | ON         | PILOT   | N/A               | 12:35:21.25      |
| 19-04    | 008696          | B1.41.0081.068   | Autoslat deploy in level flight  | ON         | PILOT   | N/A               | 12:39:52.35      |
| 19-04    | 008697          | B1.41.0081.068.1 | Autoslat deploy in 1.3 g pull    | ON         | PILOT   | N/A               | 12:42:24.25      |
| 19-04    | 008698          | B1.41.0081.065   | Autopilot turn in heading select | ON         | PILOT   | N/A               | 12:47:11.25      |
| 19-04    | 008699          | B1.41.0081.065.1 | Autopilot turn in heading select | ON         | PILOT   | N/A               | 12:48:56.25      |
| 19-04    | 008700          | B1.41.0081.066   | Autopilot turn in LNAV           | ON         | PILOT   | N/A               | 12:50:11.25      |
| 19-04    | 008701          | B1.41.0081.SWP.1 | Post-flight control sweeps       | ON         | PILOT   | N/A               | 13:24:11.25      |
|          |                 |                  |                                  |            |         |                   |                  |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

ATTACHMENT 3

**Listing of Conditions, Grouped by Condition Number**

727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST GROUPED BY CONDITION NUMBER

| Test No. | Sequence Number | Condition Number | Manuever Description                         | Yaw Damper | Control | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|----------------------------------------------|------------|---------|-------------------|------------------|
|          |                 |                  |                                              |            |         |                   |                  |
| 19-03    | 008602          | B1.41.0081.001   | Sideslip to left @ 146 kts                   | ON         | PILOT   | N/A               | 10:58:18.80      |
| 19-03    | 008601          | B1.41.0081.001C  | Full rudder calibration @ 146 kts            | ON         | PILOT   | N/A               | 10:54:06.80      |
| 19-04    | 008665          | B1.41.0081.002.1 | Sideslip to left @ 170 kts                   | ON         | PILOT   | N/A               | 11:06:39.35      |
| 19-04    | 008664          | B1.41.0081.002.C | Full rudder calibration @ 170 kts            | ON         | PILOT   | N/A               | 11:01:44.35      |
| 19-03    | 008606          | B1.41.0081.002C  | Full rudder calibration @ 170 kts            | ON         | PILOT   | N/A               | 11:21:06.75      |
| 19-03    | 008607          | B1.41.0081.002R1 | 1/3 Left rud sideslip and release @ 170 kts  | ON         | PILOT   | N/A               | 11:25:34.75      |
| 19-03    | 008608          | B1.41.0081.002R2 | 2/3 Left rud sideslip and release @ 170 kts  | ON         | PILOT   | N/A               | 11:28:48.75      |
| 19-03    | 008609          | B1.41.0081.002R3 | Full Left rud sideslip and release @ 170 kts | ON         | PILOT   | N/A               | 11:30:02.75      |
| 19-04    | 008668          | B1.41.0081.003.1 | Sideslip to left @ 190 kts                   | ON         | PILOT   | N/A               | 11:25:05.35      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST GROUPED BY CONDITION NUMBER

| Test No. | Sequence Number | Condition Number | Manuever Description                          | Yaw Damper | Control | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|-----------------------------------------------|------------|---------|-------------------|------------------|
| 19-03    | 008616          | B1.41.0081.003C  | Full rudder calibration @ 190 kts             | ON         | PILOT   | N/A               | 11:50:36.75      |
| 19-03    | 008617          | B1.41.0081.003R1 | 1/3 Left rud sideslip and release @ 190 kts   | ON         | PILOT   | N/A               | 11:53:14.75      |
| 19-03    | 008618          | B1.41.0081.003R2 | 2/3 Left rud sideslip and release @ 190 kts   | ON         | PILOT   | N/A               | 11:54:46.70      |
| 19-03    | 008619          | B1.41.0081.003R3 | Full Left rud sideslip and release @ 190 kts  | ON         | PILOT   | N/A               | 11:55:36.75      |
| 19-03    | 008626          | B1.41.0081.004   | Sideslip to left @ 210 kts                    | ON         | PILOT   | N/A               | 12:28:48.70      |
| 19-03    | 008625          | B1.41.0081.004C  | Full rudder calibration @ 210 kts             | ON         | PILOT   | N/A               | 12:27:08.70      |
| 19-03    | 008631          | B1.41.0081.005   | Sideslip to left @ 225 kts                    | ON         | PILOT   | N/A               | 12:47:03.65      |
| 19-03    | 008630          | B1.41.0081.005C  | Full rudder calibration @ 225 kts             | ON         | PILOT   | N/A               | 12:45:42.65      |
| 19-03    | 008603          | B1.41.0081.006   | Sideslip to right @ 146 kts                   | ON         | PILOT   | N/A               | 11:05:58.75      |
| 19-04    | 008667          | B1.41.0081.007.1 | Sideslip to right @ 170 kts                   | ON         | PILOT   | N/A               | 11:20:17.35      |
| 19-03    | 008610          | B1.41.0081.007R1 | 2/3 Right rud sideslip and release @ 170 kts  | ON         | PILOT   | N/A               | 11:33:22.75      |
| 19-03    | 008611          | B1.41.0081.007R2 | Full Right rud sideslip and release @ 170 kts | ON         | PILOT   | N/A               | 11:36:10.75      |
| 19-03    | 008620          | B1.41.0081.008   | Sideslip to right @ 190 kts                   | ON         | PILOT   | N/A               | 11:57:55.75      |
| 19-04    | 008669          | B1.41.0081.008.1 | Sideslip to right @ 190 kts                   | ON         | PILOT   | N/A               | 11:29:05.35      |
| 19-04    | 008670          | B1.41.0081.008.2 | Sideslip to right @ 190 kts                   | ON         | PILOT   | N/A               | 11:34:29.40      |
| 19-03    | 008627          | B1.41.0081.009   | Sideslip to right @ 210 kts                   | ON         | PILOT   | N/A               | 12:33:01.70      |
| 19-03    | 008632          | B1.41.0081.010   | Sideslip to right @ 225 kts                   | ON         | PILOT   | N/A               | 12:49:06.70      |
| 19-03    | 008604          | B1.41.0081.011   | Sideslip to left @ 146 kts                    | OFF        | PILOT   | N/A               | 11:11:38.75      |
| 19-03    | 008612          | B1.41.0081.012R1 | 1/3 Left rud sideslip and release @ 170 kts   | OFF        | PILOT   | N/A               | 11:39:38.75      |
| 19-03    | 008613          | B1.41.0081.012R2 | 2/3 Left rud sideslip and release @ 170 kts   | OFF        | PILOT   | N/A               | 11:41:22.75      |
| 19-03    | 008614          | B1.41.0081.012R3 | Full Left rud sideslip and release @ 170 kts  | OFF        | PILOT   | N/A               | 11:42:49.75      |
| 19-03    | 008621          | B1.41.0081.013   | Sideslip to left @ 190 kts                    | OFF        | PILOT   | N/A               | 12:02:12.75      |
| 19-03    | 008623          | B1.41.0081.013.1 | Sideslip to left @ 190 kts                    | OFF        | PILOT   | N/A               | 12:20:05.70      |
| 19-03    | 008628          | B1.41.0081.014   | Sideslip to left @ 210 kts                    | OFF        | PILOT   | N/A               | 12:36:38.70      |
| 19-03    | 008605          | B1.41.0081.016   | Sideslip to right @ 146 kts                   | OFF        | PILOT   | N/A               | 11:16:03.75      |
| 19-03    | 008615          | B1.41.0081.017   | Sideslip to right @ 170 kts                   | OFF        | PILOT   | N/A               | 11:45:35.75      |
| 19-03    | 008622          | B1.41.0081.018   | Sideslip to right @ 190 kts                   | OFF        | PILOT   | N/A               | 12:06:08.75      |
| 19-03    | 008624          | B1.41.0081.018.1 | Sideslip to right @ 190 kts                   | OFF        | PILOT   | N/A               | 12:23:08.70      |
| 19-03    | 008629          | B1.41.0081.019   | Sideslip to right @ 210 kts                   | OFF        | PILOT   | N/A               | 12:42:03.70      |
| 19-04    | 008671          | B1.41.0081.021   | 1/3 wheel response @ 190 kts                  | ON         | PILOT   | N/A               | 11:46:57.30      |
| 19-04    | 008674          | B1.41.0081.022   | Full wheel response @ 190 kts                 | ON         | PILOT   | N/A               | 11:51:14.30      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST GROUPED BY CONDITION NUMBER

| Test No. | Sequence Number | Condition Number | Manuever Description                     | Yaw Damper | Control   | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|------------------------------------------|------------|-----------|-------------------|------------------|
| 19-04    | 008672          | B1.41.0081.023   | 2/3 wheel response @ 190 kts             | ON         | PILOT     | N/A               | 11:48:53.30      |
| 19-04    | 008673          | B1.41.0081.024   | Full wheel response @ 190 kts            | ON         | PILOT     | N/A               | 11:49:32.30      |
| 19-04    | 008675          | B1.41.0081.025   | 1/3 wheel response @ 190 kts             | OFF        | PILOT     | N/A               | 11:53:42.35      |
| 19-04    | 008678          | B1.41.0081.026   | Full wheel response @ 190 kts            | OFF        | PILOT     | N/A               | 11:57:09.30      |
| 19-04    | 008676          | B1.41.0081.027   | 2/3 wheel response @ 190 kts             | OFF        | PILOT     | N/A               | 11:55:26.30      |
| 19-04    | 008677          | B1.41.0081.028   | Full wheel response @ 190 kts            | OFF        | PILOT     | N/A               | 11:56:03.30      |
| 19-04    | 008679          | B1.41.0081.029   | 1/3 wheel response @ 170 kts             | ON         | PILOT     | N/A               | 12:00:27.30      |
| 19-04    | 008680          | B1.41.0081.031   | 2/3 wheel response @ 170 kts             | ON         | PILOT     | N/A               | 12:01:42.30      |
| 19-04    | 008681          | B1.41.0081.032   | Full wheel response @ 170 kts            | ON         | PILOT     | N/A               | 12:02:23.30      |
| 19-04    | 008682          | B1.41.0081.033   | 1/3 wheel response @ 170 kts             | OFF        | PILOT     | N/A               | 12:04:03.30      |
| 19-04    | 008683          | B1.41.0081.035   | 2/3 wheel response @ 170 kts             | OFF        | PILOT     | N/A               | 12:05:25.30      |
| 19-04    | 008684          | B1.41.0081.036   | Full wheel response @ 170 kts            | OFF        | PILOT     | N/A               | 12:06:11.30      |
| 19-03    | 008633          | B1.41.0081.037   | 1/4 pedal release @ 190 kts              | ON         | FREE      | N/A               | 12:54:24.65      |
| 19-03    | 008634          | B1.41.0081.038   | 1/4 pedal release @ 190 kts- wrong way   | ON         | AUTOPILOT | N/A               | 12:55:48.65      |
| 19-03    | 008635          | B1.41.0081.038.1 | 1/4 pedal release @ 190 kts              | ON         | AUTOPILOT | N/A               | 12:57:36.65      |
| 19-03    | 008638          | B1.41.0081.039   | 1/2 pedal release @ 190 kts              | ON         | FREE      | N/A               | 13:01:43.65      |
| 19-04    | 008686          | B1.41.0081.039   | 1/2 pedal release @ 190 kts              | ON         | FREE      | N/A               | 12:23:41.35      |
| 19-03    | 008639          | B1.41.0081.040   | 1/2 pedal release @ 190 kts              | ON         | AUTOPILOT | N/A               | 13:02:18.65      |
| 19-03    | 008642          | B1.41.0081.041   | 3/4 pedal release @ 190 kts              | ON         | FREE      | N/A               | 13:05:08.65      |
| 19-09-2  | 008838          | B1.41.0081.041.1 | 3/4 pedal release @ 190 kts              | ON         | PILOT     | N/A               | 12:42:53.65      |
| 19-03    | 008643          | B1.41.0081.042   | 1/2 pedal release @ 190 kts- pedal only  | ON         | FREE      | N/A               | 13:09:18.65      |
| 19-03    | 008636          | B1.41.0081.043   | 1/4 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 12:59:35.65      |
| 19-04    | 008687          | B1.41.0081.043   | 1/4 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 12:24:50.30      |
| 19-03    | 008637          | B1.41.0081.044   | 1/4 pedal release @ 190 kts              | OFF        | AUTOPILOT | N/A               | 13:00:18.65      |
| 19-03    | 008640          | B1.41.0081.045   | 1/2 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 13:03:18.65      |
| 19-04    | 008688          | B1.41.0081.045   | 1/2 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 12:25:37.30      |
| 19-03    | 008641          | B1.41.0081.046   | 1/2 pedal release @ 190 kts              | OFF        | AUTOPILOT | N/A               | 13:04:08.65      |
| 19-03    | 008645          | B1.41.0081.047   | 3/4 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 13:12:08.65      |
| 19-04    | 008689          | B1.41.0081.047   | 3/4 pedal release @ 190 kts              | OFF        | FREE      | N/A               | 12:27:02.25      |
| 19-09-2  | 008839          | B1.41.0081.047.2 | 3/4 pedal release @ 190 kts              | ON         | PILOT     | N/A               | 12:43:59.65      |
| 19-03    | 008644          | B1.41.0081.048   | 1/2 pedal release @ 190 kts - pedal only | OFF        | FREE      | N/A               | 13:10:39.65      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST GROUPED BY CONDITION NUMBER

| Test No. | Sequence Number | Condition Number | Manuever Description                    | Yaw Damper | Control   | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|-----------------------------------------|------------|-----------|-------------------|------------------|
| 19-03    | 008646          | B1.41.0081.049   | 1/4 pedal release @ 170 kts             | ON         | FREE      | N/A               | 13:17:03.65      |
| 19-03    | 008647          | B1.41.0081.050   | 1/4 pedal release @ 170 kts             | ON         | AUTOPILOT | N/A               | 13:18:13.65      |
| 19-03    | 008650          | B1.41.0081.051   | 1/2 pedal release @ 170 kts             | ON         | FREE      | N/A               | 13:22:03.65      |
| 19-03    | 008651          | B1.41.0081.052   | 1/2 pedal release @ 170 kts             | ON         | AUTOPILOT | N/A               | 13:22:48.65      |
| 19-03    | 008656          | B1.41.0081.053   | 3/4 pedal release @ 170 kts             | ON         | FREE      | N/A               | 13:29:18.60      |
| 19-09-2  | 008840          | B1.41.0081.053.1 | 3/4 pedal release @ 170 kts             | ON         | PILOT     | N/A               | 12:48:59.60      |
| 19-03    | 008654          | B1.41.0081.054   | 1/2 pedal release @ 170 kts- pedal only | ON         | FREE      | N/A               | 13:26:28.65      |
| 19-03    | 008648          | B1.41.0081.055   | 1/4 pedal release @ 170 kts             | OFF        | FREE      | N/A               | 13:19:18.65      |
| 19-03    | 008649          | B1.41.0081.056   | 1/4 pedal release @ 170 kts             | OFF        | AUTOPILOT | N/A               | 13:20:38.65      |
| 19-03    | 008652          | B1.41.0081.057   | 1/2 pedal release @ 170 kts             | OFF        | FREE      | N/A               | 13:24:03.65      |
| 19-03    | 008653          | B1.41.0081.058   | 1/2 pedal release @ 170 kts             | OFF        | AUTOPILOT | N/A               | 13:25:18.65      |
| 19-03    | 008657          | B1.41.0081.059   | 3/4 pedal release @ 170 kts             | OFF        | FREE      | N/A               | 13:30:26.60      |
| 19-09-2  | 008841          | B1.41.0081.059.1 | 3/4 pedal release @ 170 kts             | ON         | PILOT     | N/A               | 12:50:44.60      |
| 19-03    | 008655          | B1.41.0081.060   | 1/2 pedal release @ 170 kts- pedal only | OFF        | FREE      | N/A               | 13:27:36.60      |
| 19-03    | 008659          | B1.41.0081.061   | 1/4 Cross control response @ 190 kts    | ON         | FREE      | N/A               | 13:37:28.60      |
| 19-04    | 008690          | B1.41.0081.061.1 | 1/4 cross control @ 190 kts             | ON         | PILOT     | N/A               | 12:29:35.25      |
| 19-04    | 008691          | B1.41.0081.062   | 1/2 cross control @ 190 kts             | ON         | PILOT     | N/A               | 12:30:50.25      |
| 19-04    | 008692          | B1.41.0081.062.1 | 1/2 cross control @ 190 kts             | ON         | PILOT     | N/A               | 12:32:20.25      |
| 19-03    | 008660          | B1.41.0081.063   | 1/4 Combined control response @ 190 kts | ON         | FREE      | N/A               | 13:38:18.60      |
| 19-04    | 008693          | B1.41.0081.063   | 1/4 combined controls @ 190 kts         | ON         | PILOT     | N/A               | 12:33:27.25      |
| 19-04    | 008694          | B1.41.0081.064   | 1/2 combined controls @ 190 kts         | ON         | PILOT     | N/A               | 12:34:10.25      |
| 19-04    | 008695          | B1.41.0081.064.1 | 1/2 combined controls @ 190 kts         | ON         | PILOT     | N/A               | 12:35:21.25      |
| 19-04    | 008698          | B1.41.0081.065   | Autopilot turn in heading select        | ON         | PILOT     | N/A               | 12:47:11.25      |
| 19-04    | 008699          | B1.41.0081.065.1 | Autopilot turn in heading select        | ON         | PILOT     | N/A               | 12:48:56.25      |
| 19-04    | 008700          | B1.41.0081.066   | Autopilot turn in LNAV                  | ON         | PILOT     | N/A               | 12:50:11.25      |
| 19-03    | 008658          | B1.41.0081.067   | Slowdown turn at 1.5 g's                | ON         | PILOT     | N/A               | 13:33:18.60      |
| 19-04    | 008696          | B1.41.0081.068   | Autoslat deploy in level flight         | ON         | PILOT     | N/A               | 12:39:52.35      |
| 19-04    | 008697          | B1.41.0081.068.1 | Autoslat deploy in 1.3 g pull           | ON         | PILOT     | N/A               | 12:42:24.25      |
| 19-04    | 008663          | B1.41.0081.070   | Full rudder w/throttle split @ 146 kts  | ON         | PILOT     | N/A               | 10:56:19.40      |
| 19-09-1  | 008831          | B1.41.0081.100   | Full rudder calibration @ 190 kts       | ON         | PILOT     | N/A               | 08:48:58.00      |
| 19-09-1  | 008832          | B1.41.0081.101   | Sideslip to left @ 190 kts              | ON         | PILOT     | N/A               | 08:52:35.00      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date



727/737 WAKE ENCOUNTER FLIGHT TEST  
CONDITION LIST GROUPED BY CONDITION NUMBER

| Test No. | Sequence Number | Condition Number | Manuever Description        | Yaw Damper | Control | Trailing Distance | IRIG at Time = 0 |
|----------|-----------------|------------------|-----------------------------|------------|---------|-------------------|------------------|
| 19-09-1  | 008833          | B1.41.0081.104   | Sideslip to right @ 190 kts | ON         | PILOT   | N/A               | 09:06:25.65      |
| 19-09-2  | 008836          | B1.41.0081.107   | Sideslip to left @ 190 kts  | ON         | PILOT   | N/A               | 12:23:49.75      |
| 19-09-2  | 008837          | B1.41.0081.110   | Sideslip to right @ 190 kts | ON         | PILOT   | N/A               | 12:35:39.65      |
| 19-03    | 008600          | B1.41.0081.SWP   | Pre-flight control sweeps   | ON         | PILOT   | N/A               | 10:32:31.80      |
| 19-04    | 008662          | B1.41.0081.SWP   | Pre-flight control sweeps   | ON         | PILOT   | N/A               | 10:30:32.20      |
| 19-03    | 008661          | B1.41.0081.SWP.1 | Post-flight control sweeps  | ON         | PILOT   | N/A               | 14:08:09.60      |
| 19-04    | 008701          | B1.41.0081.SWP.1 | Post-flight control sweeps  | ON         | PILOT   | N/A               | 13:24:11.25      |

\*Nominal target trailing distance is provided when TCAS distance is not available

\*\*Data will be provided at a future date

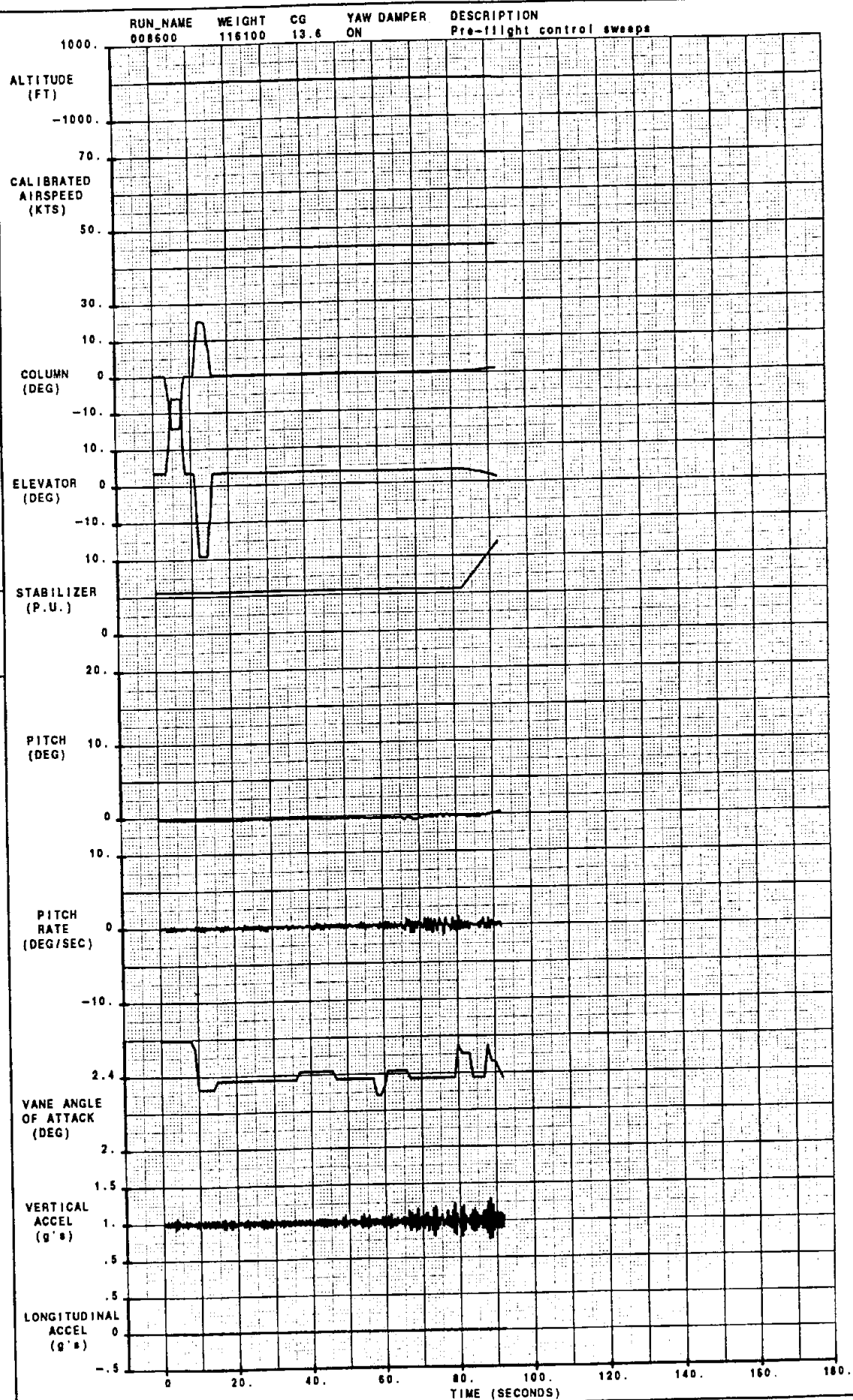
## ATTACHMENT 4

### **Plots of Selected Simulator Calibration Conditions**

|       |          |         |          |      |
|-------|----------|---------|----------|------|
| CALC  | AERO SIG | 3000195 | REVIEWED | DATE |
| CHECK |          |         |          |      |
| APR   |          |         |          |      |
| APR   |          |         |          |      |

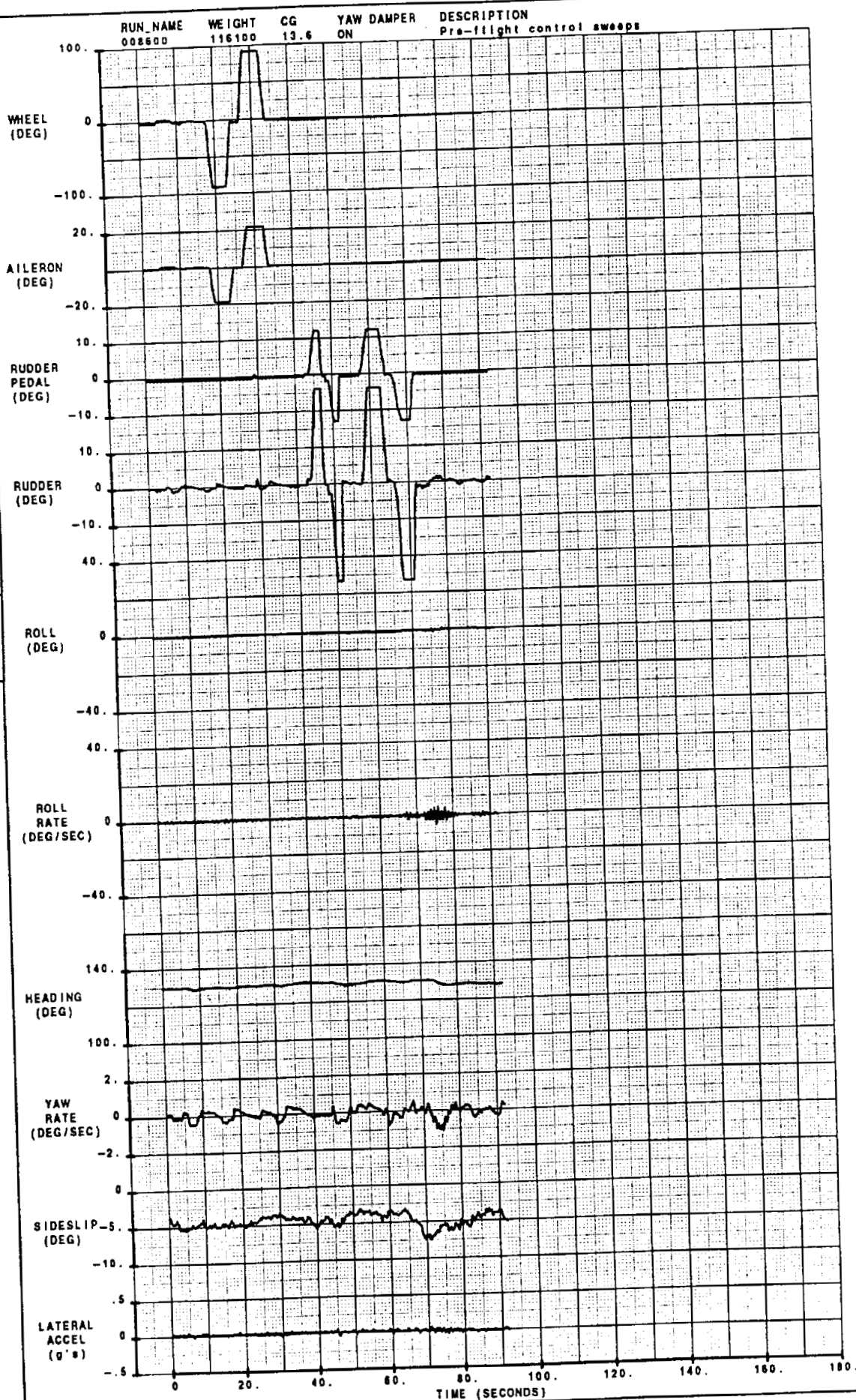
|                              |      |
|------------------------------|------|
| FLIGHT: 019-03               |      |
| CONDITION NO: B1.41.0081.SWP |      |
| TEST DATE: 09/20/95          |      |
| THE BOEING COMPANY           |      |
| 737-380                      | PM53 |
| PAGE                         |      |



///140/disk4/wakefest/11\_database/  
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 8008600A - data\_pilot/wakefest.plb

|                                                                                                     |          |        |         |      |
|-----------------------------------------------------------------------------------------------------|----------|--------|---------|------|
| CALC                                                                                                | AERO SAC | 200195 | REVISED | DATE |
| CHECK                                                                                               |          |        |         |      |
| APR                                                                                                 |          |        |         |      |
| APR                                                                                                 |          |        |         |      |
| FLIGHT: 019-03<br>CONDITION NO: 81.41.0081.SMP<br>TEST DATE: 09/20/95<br>THE BOEING COMPANY<br>PAGE |          |        |         |      |
| 727-300<br>PPS3                                                                                     |          |        |         |      |

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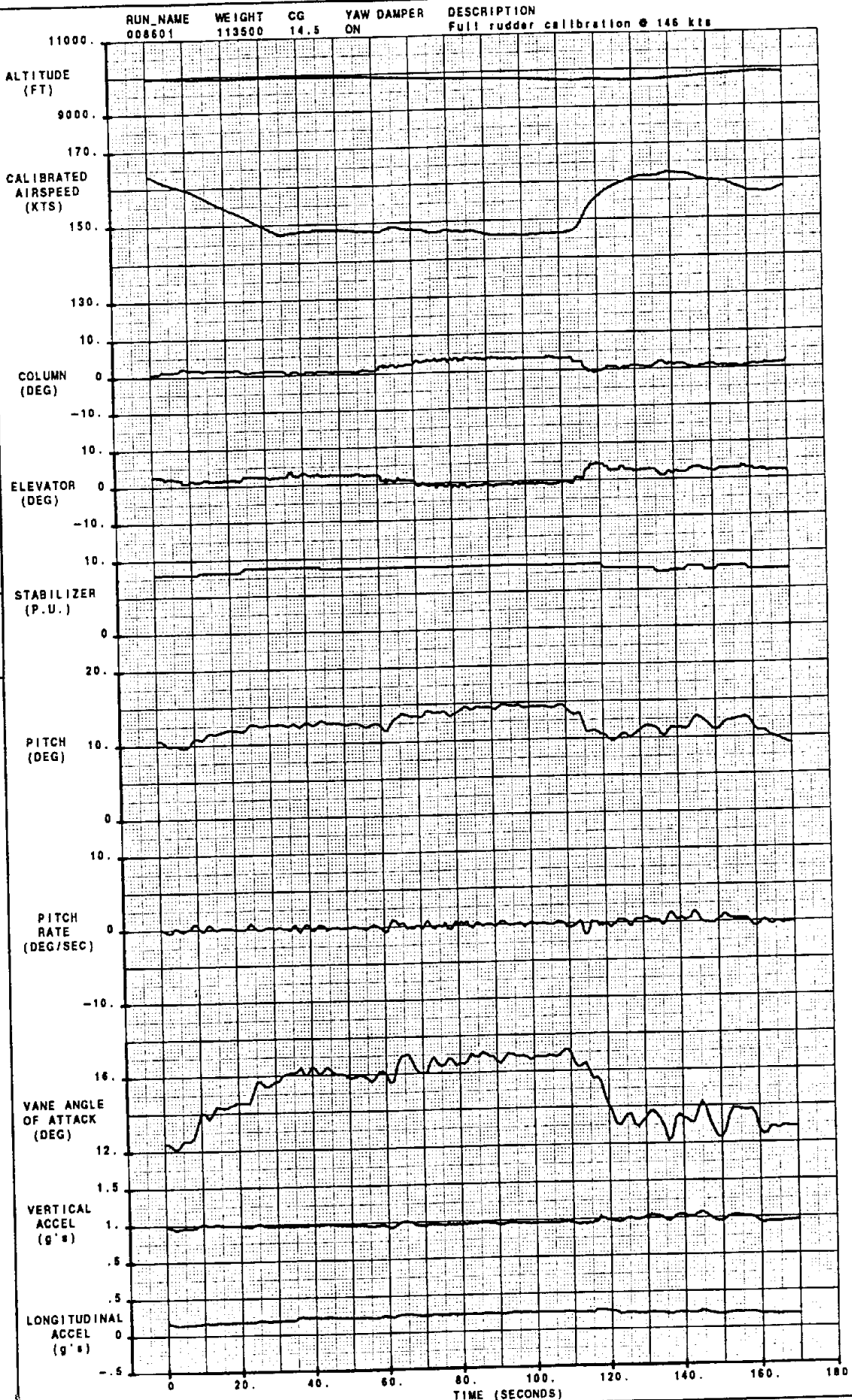


18B

|       |           |         |         |      |
|-------|-----------|---------|---------|------|
| CALC  | APPRO SEC | 200/195 | REVISED | DATE |
| CHECK |           |         |         |      |
| APR   |           |         |         |      |
| APR   |           |         |         |      |

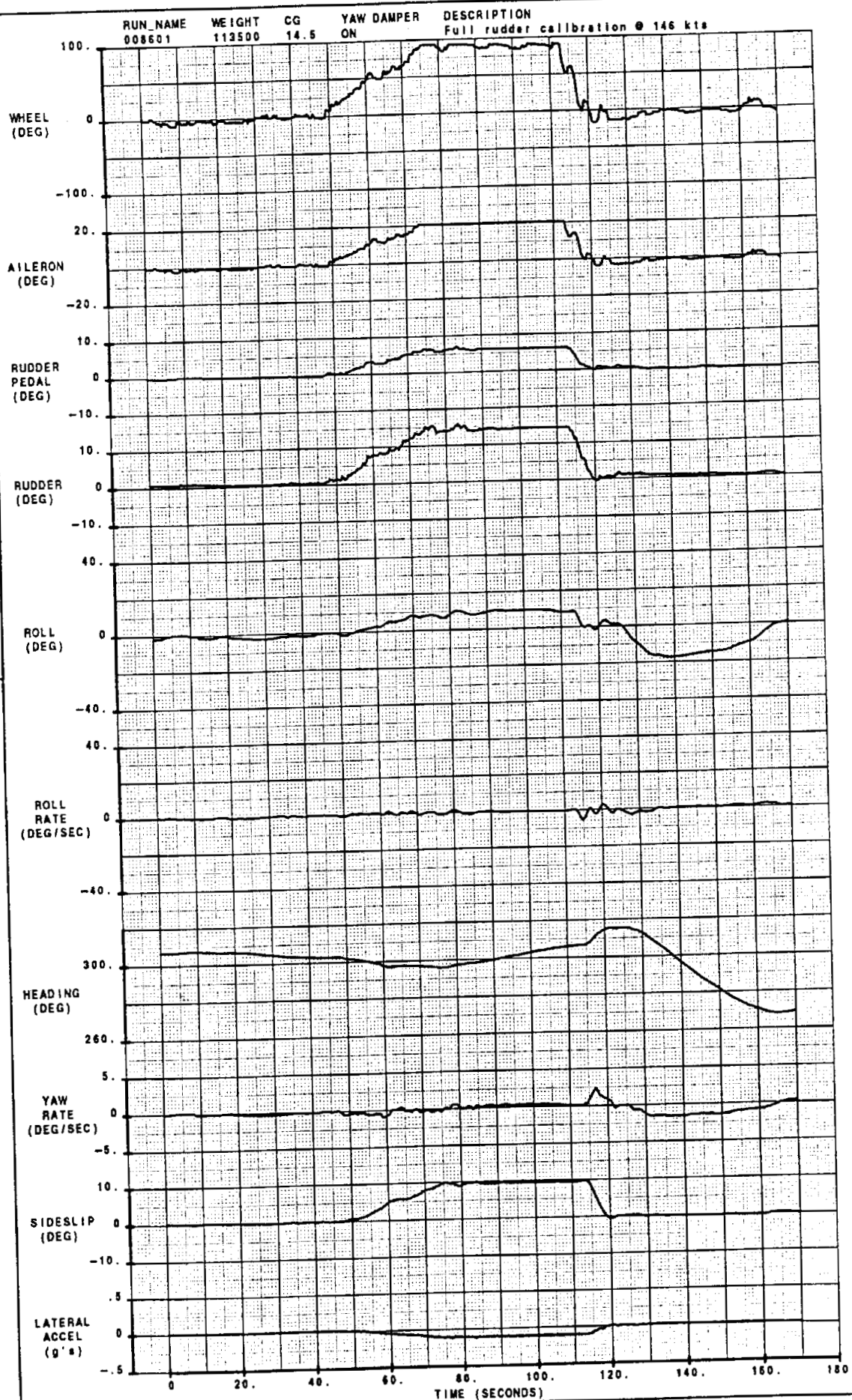
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|-------------------------------|---------|
| FLIGHT: 019-03                |         |
| CONDITION NO: B1.41.0081.001C |         |
| TEST DATE: 09/20/95           |         |
| THE BOEING COMPANY            |         |
| PAGE                          | 137-380 |
|                               | PP953   |



\\ra40\disk4\makeit\11\_database\11\_19\_03\_combined.osb  
008601A - data\_plots\makeit.pib

|                                                                                                                      |          |         |         |      |
|----------------------------------------------------------------------------------------------------------------------|----------|---------|---------|------|
| CALC                                                                                                                 | MEMO SAC | 2002155 | REVISED | DATE |
| CHECK                                                                                                                |          |         |         |      |
| APR                                                                                                                  |          |         |         |      |
| APR                                                                                                                  |          |         |         |      |
| FLIGHT: 019-03<br>CONDITION NO: B1.41.0081.001C<br>TEST DATE: 09/20/95<br>THE BOEING COMPANY<br>PAGE 737-308<br>PMS3 |          |         |         |      |

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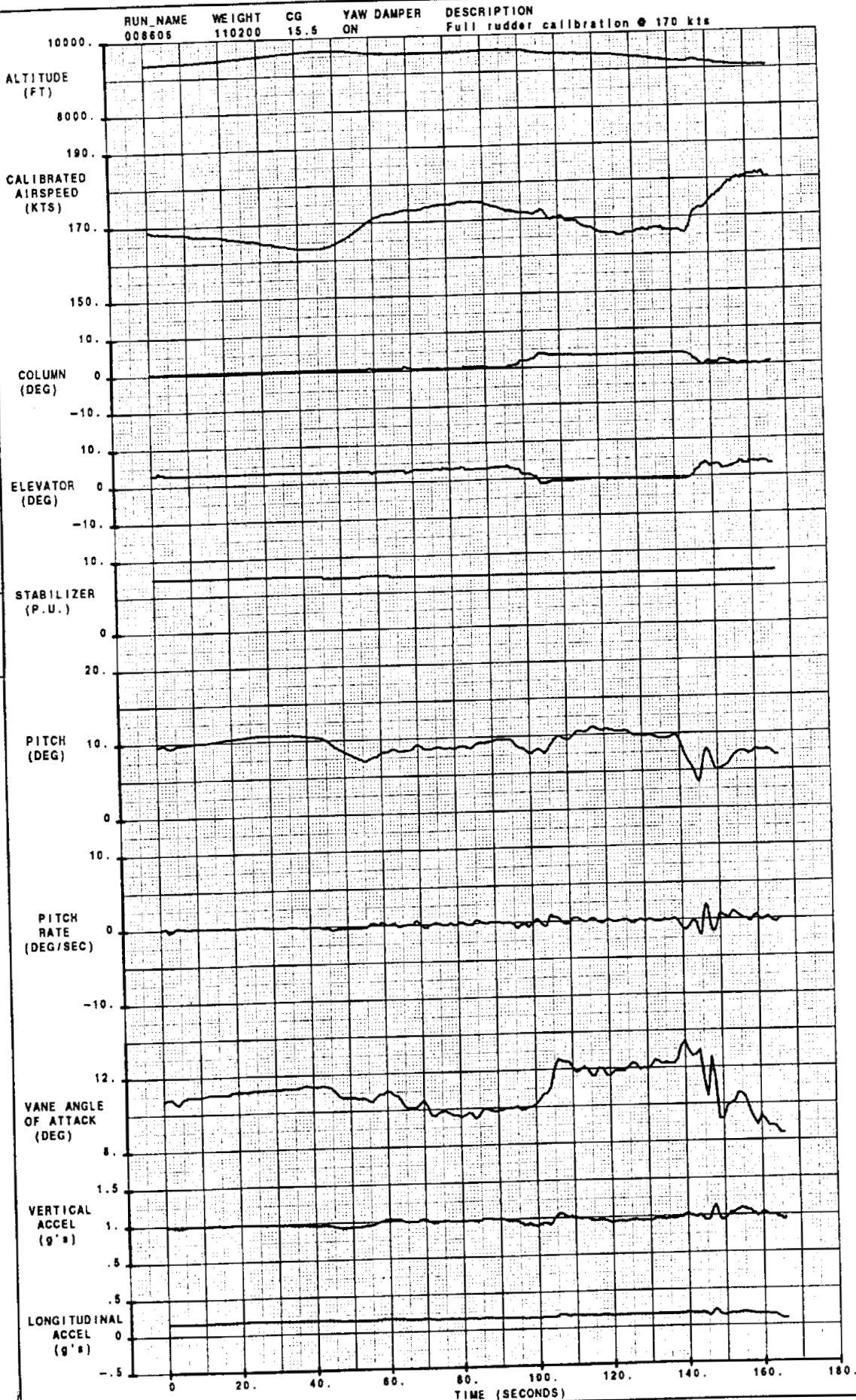




|       |        |         |         |      |
|-------|--------|---------|---------|------|
| CALC  | APPROX | 2000/95 | REVISOR | DATE |
| CHECK |        |         |         |      |
| APR   |        |         |         |      |
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| FLIGHT: 019-03                |      |
| CONDITION NO: 81.41.0081.002C |      |
| TEST DATE: 09/20/95           |      |
| THE BOEING COMPANY            | Page |

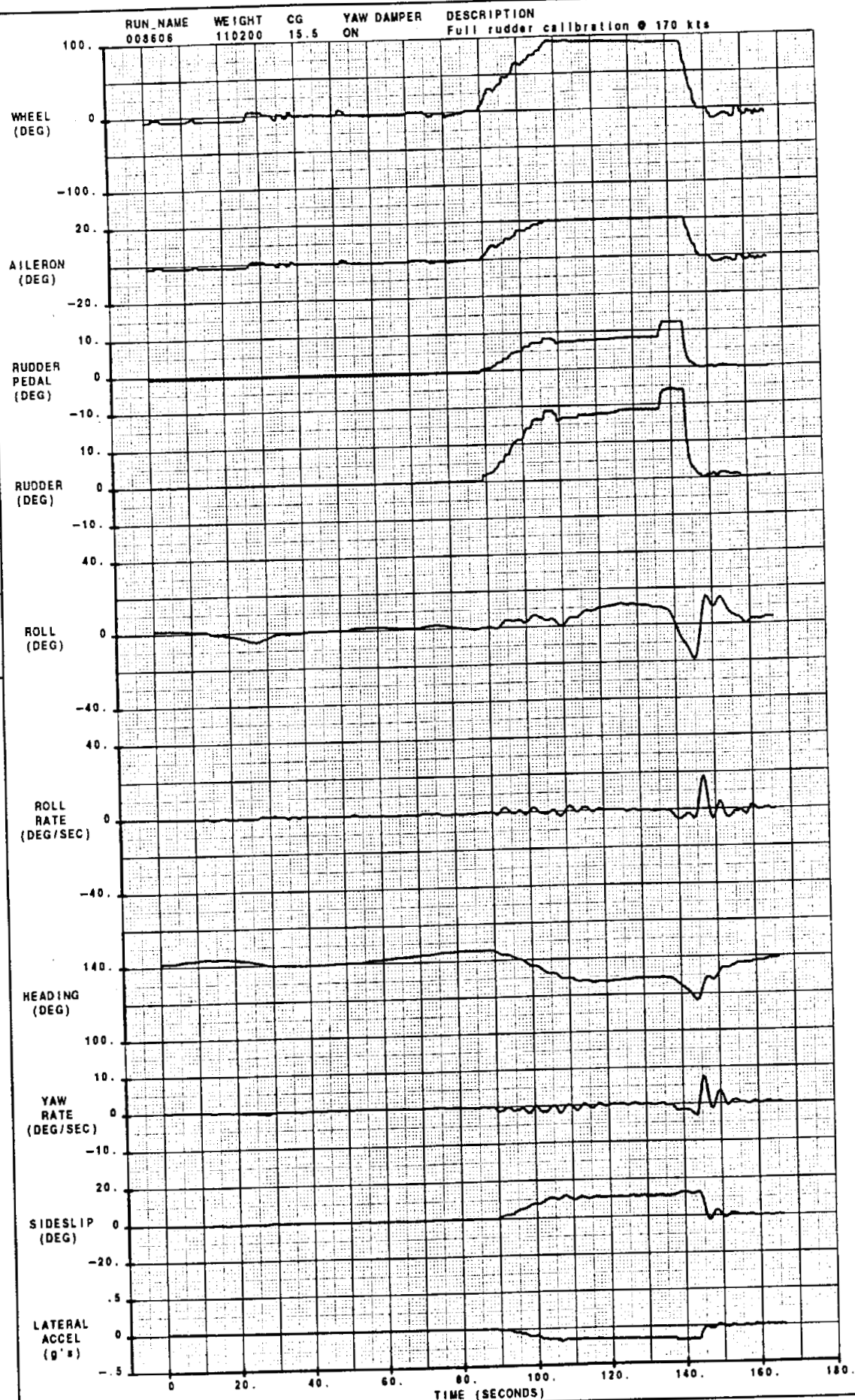


//rad4/disk4/wakeos//f1\_database/  
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 008605A - data\_plots/wakeos.plb

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| CALC  | AERO SKC | 200C195 | REVISED | DATE |
| CHECK |          |         |         |      |
| APP   |          |         |         |      |
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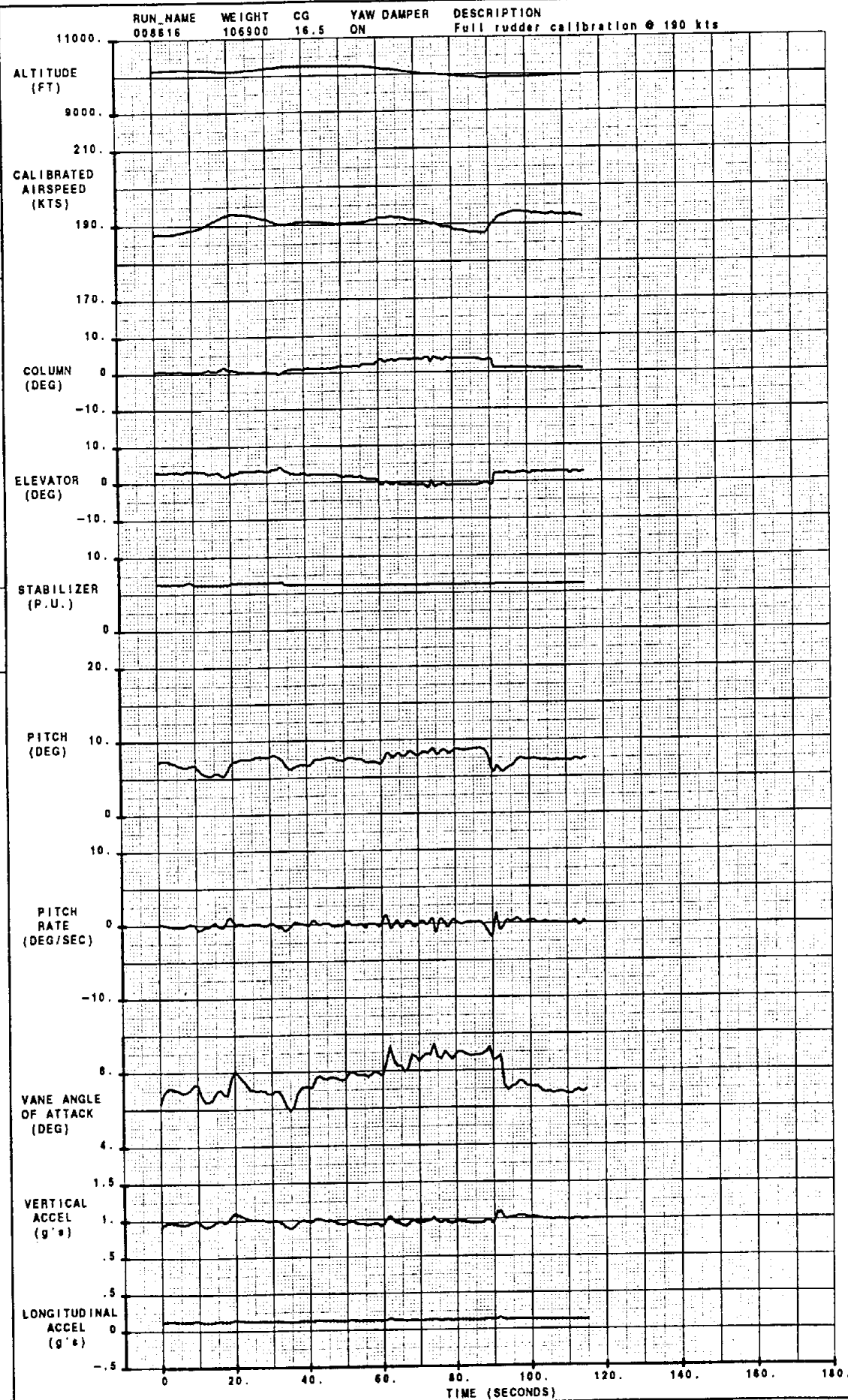
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| CONDITION NO: 81.41.0081.0020 |         |
| TEST DATE: 08/20/95           |         |
| THE BOEING COMPANY            |         |
| PAGE                          | 737-300 |
|                               | P983    |



//rao/disk4/makeest/it\_database/  
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 80086068 - data\_plots/makeest.plb



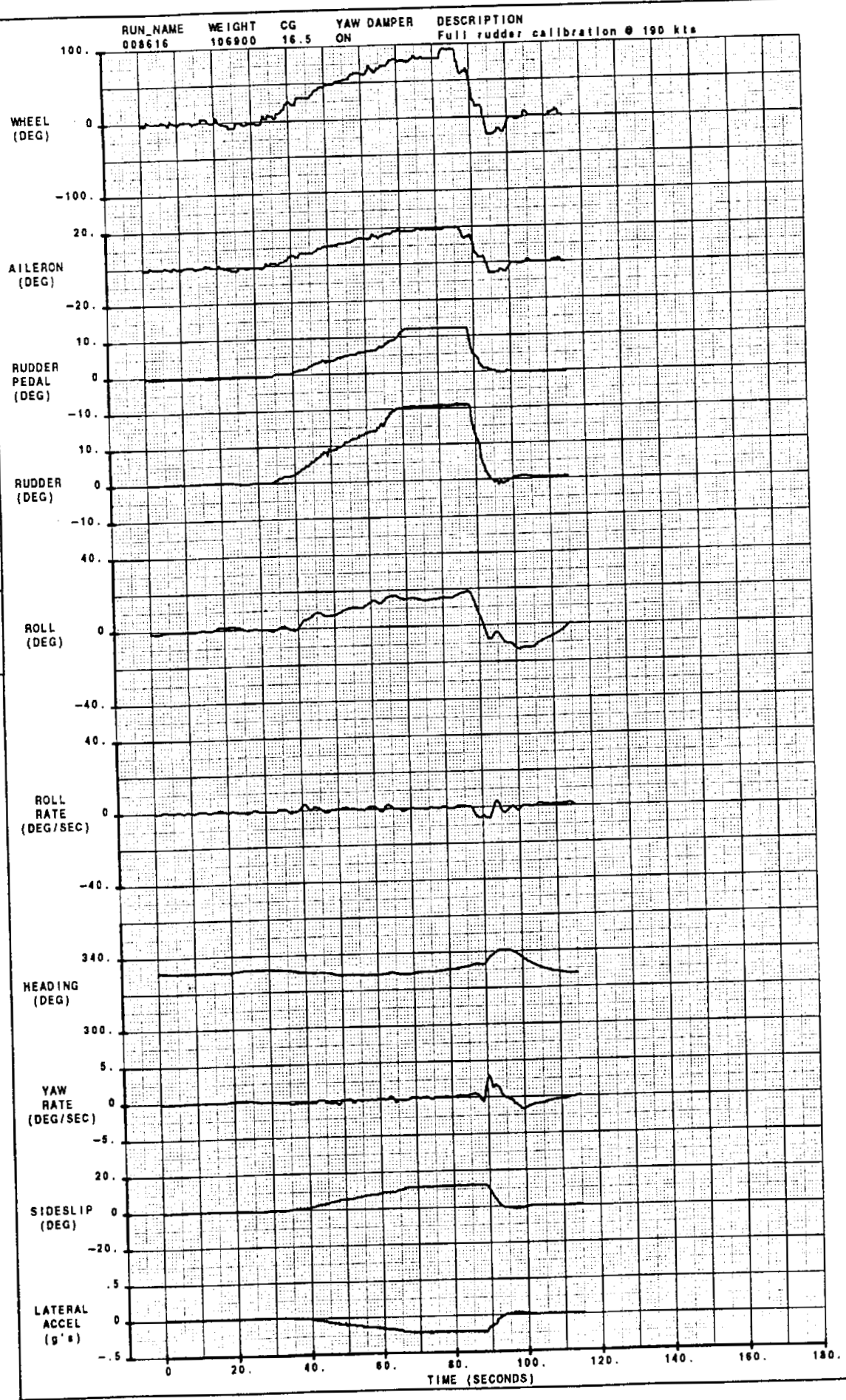
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| CHECK                                                                                                                     | APR | 1995 | 1000195 | REVIS | DATE |
| APR                                                                                                                       | APR | 1995 | 1000195 | REVIS | DATE |
| APR                                                                                                                       | APR | 1995 | 1000195 | REVIS | DATE |
| FLIGHT: 019-03<br>CONDITION NO: 81.41.0081.0030<br>TEST DATE: 09/20/95<br>THE BOEING COMPANY<br>737-300<br>PPG 53<br>PAGE |     |      |         |       |      |



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| CALC  | APPRO SEC | 2000155 | REVISIO | DATE |
| CHECK |           |         |         |      |
| APR   |           |         |         |      |
| APR   |           |         |         |      |

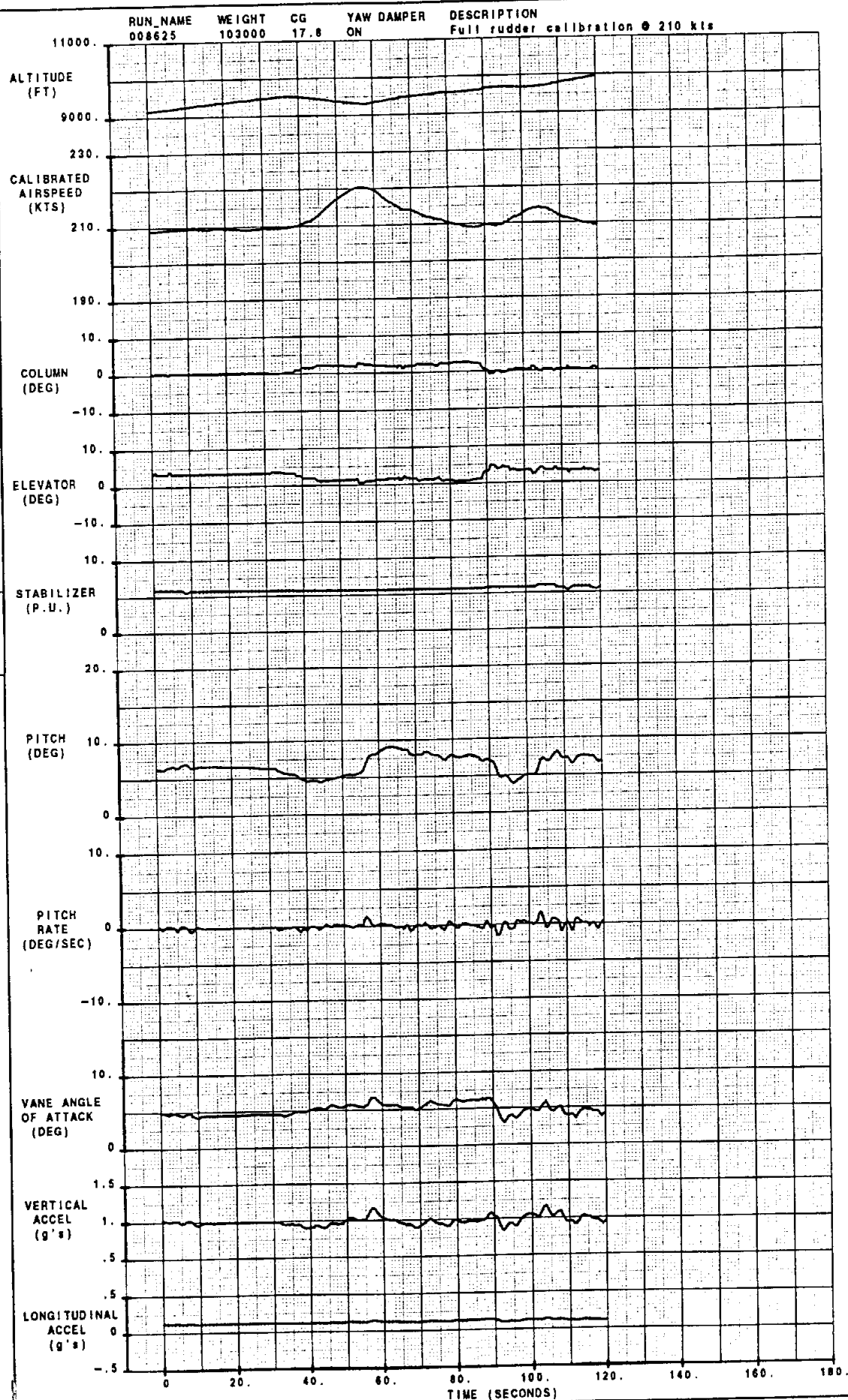
  

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| FLIGHT: 019-03                |         |
| CONDITION NO: B1.41.0081.003C |         |
| TEST DATE: 09/20/95           |         |
| THE BOEING COMPANY            |         |
| PAGE                          | 731-300 |
|                               | PR53    |



//r40/diska/wakeest/11\_database/  
11.19.03.combined.esb  
008616B - data\_pilot/wakeest.pib

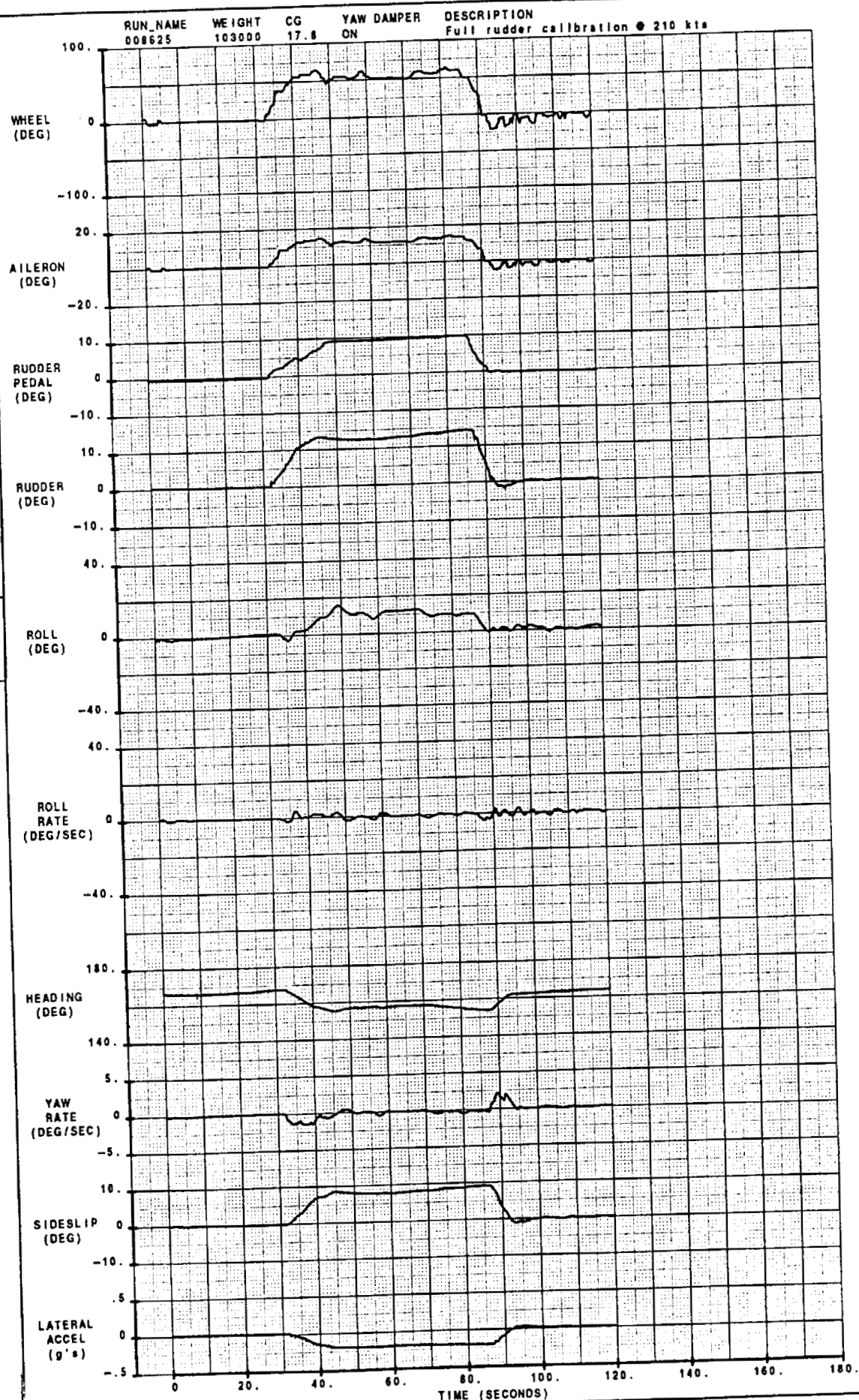
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| CALC                                                                                                 | APR 01 1995 | DATE   | 737-300 |
| CHECK                                                                                                | 2000195     | REUSED | PP53    |
| APR                                                                                                  |             |        |         |
| FLIGHT: 019-03<br>CONDITION NO: B1.41.0081.004C<br>TEST DATE: 09/20/95<br>THE BOEING COMPANY<br>PAGE |             |        |         |



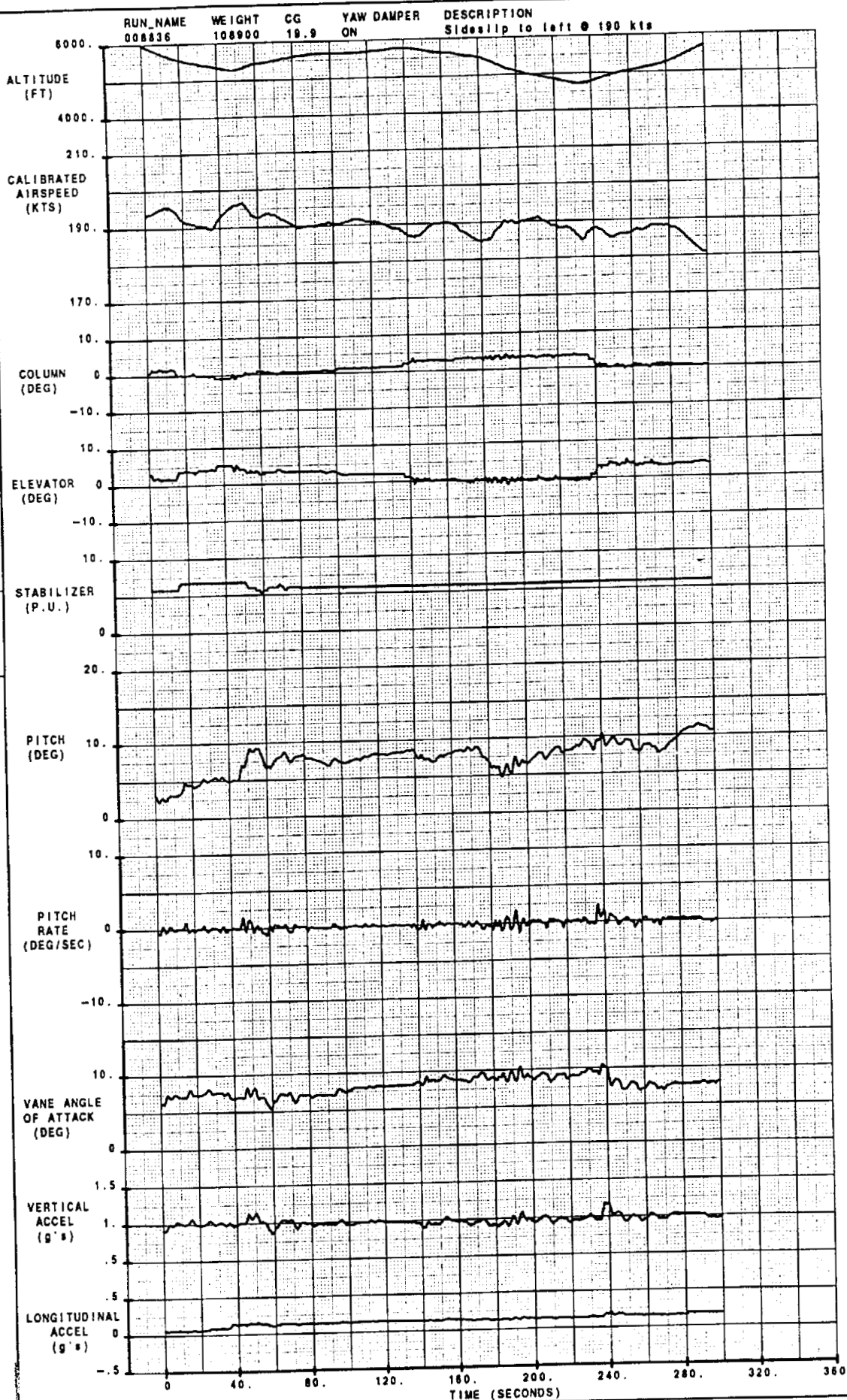
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 008625A - data\_plots/wake001.plb

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|--------|--------|------|-------------------------------|---------|
| CALC   | APPROV | DATE | FLIGHT: 019-03                | 731-341 |
| CHECK  | APPROV | DATE | CONDITION NO: 81.41.0081.00AC | PP833   |
| APPROV | APPROV | DATE | TEST DATE: 09/20/95           |         |
|        |        |      | THE BOEING COMPANY            | PAGE    |

//rad0/disk4/wakeout//11\_database/  
 11\_19\_03\_combined.asb  
 #008625B - data\_plots/wakeout.plb



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| CALC                                                                                                                | REC'D | REVISED | DATE |
| CHECK                                                                                                               |       |         |      |
| APR                                                                                                                 |       |         |      |
| APR                                                                                                                 |       |         |      |
| FLIGHT: 019-09<br>CONDITION NO: B1.41.0081.107<br>TEST DATE: 09/29/95<br>THE BOEING COMPANY<br>PAGE 737-310<br>PPS3 |       |         |      |

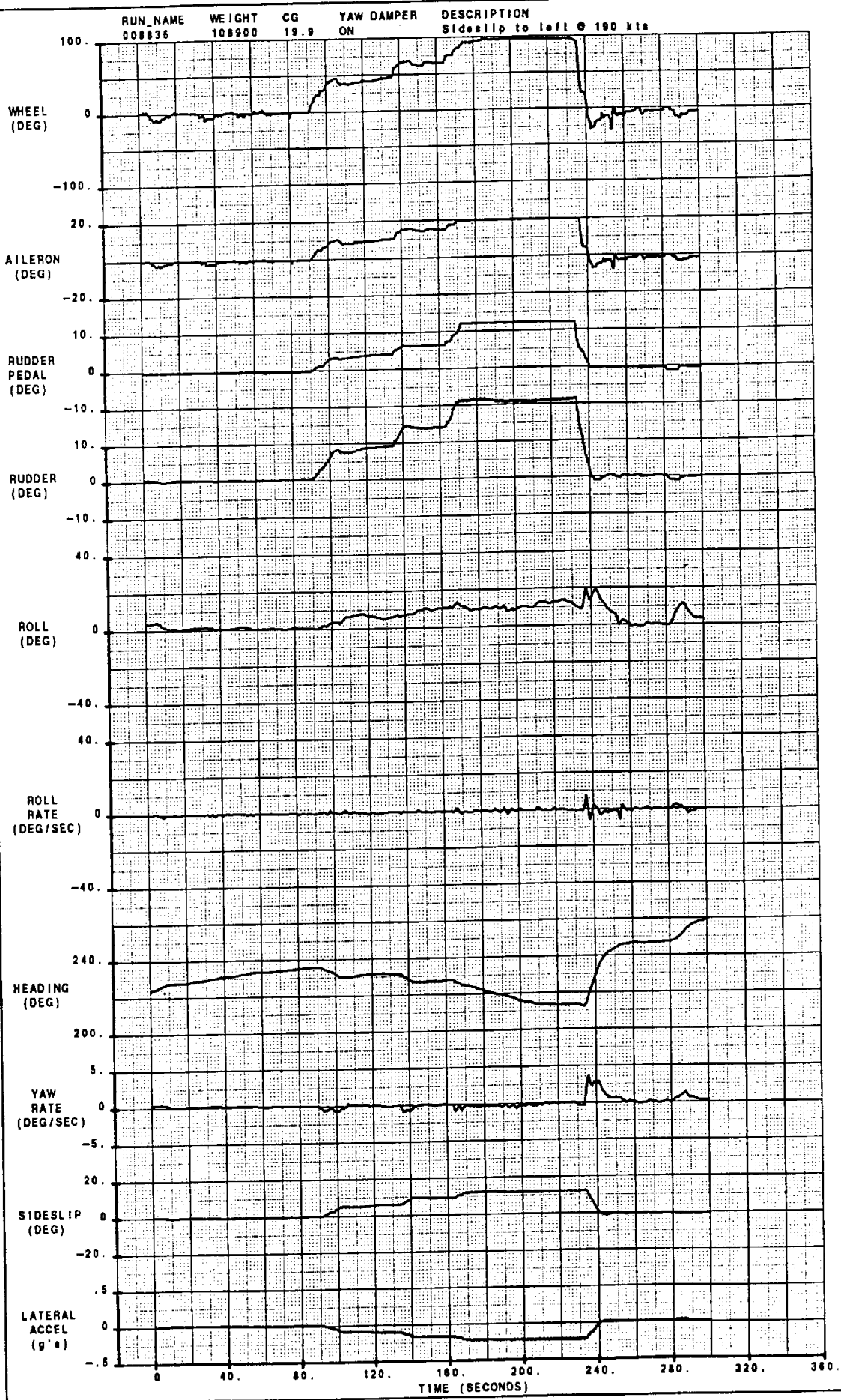


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 1008836A - data.plots/wakeest.plt



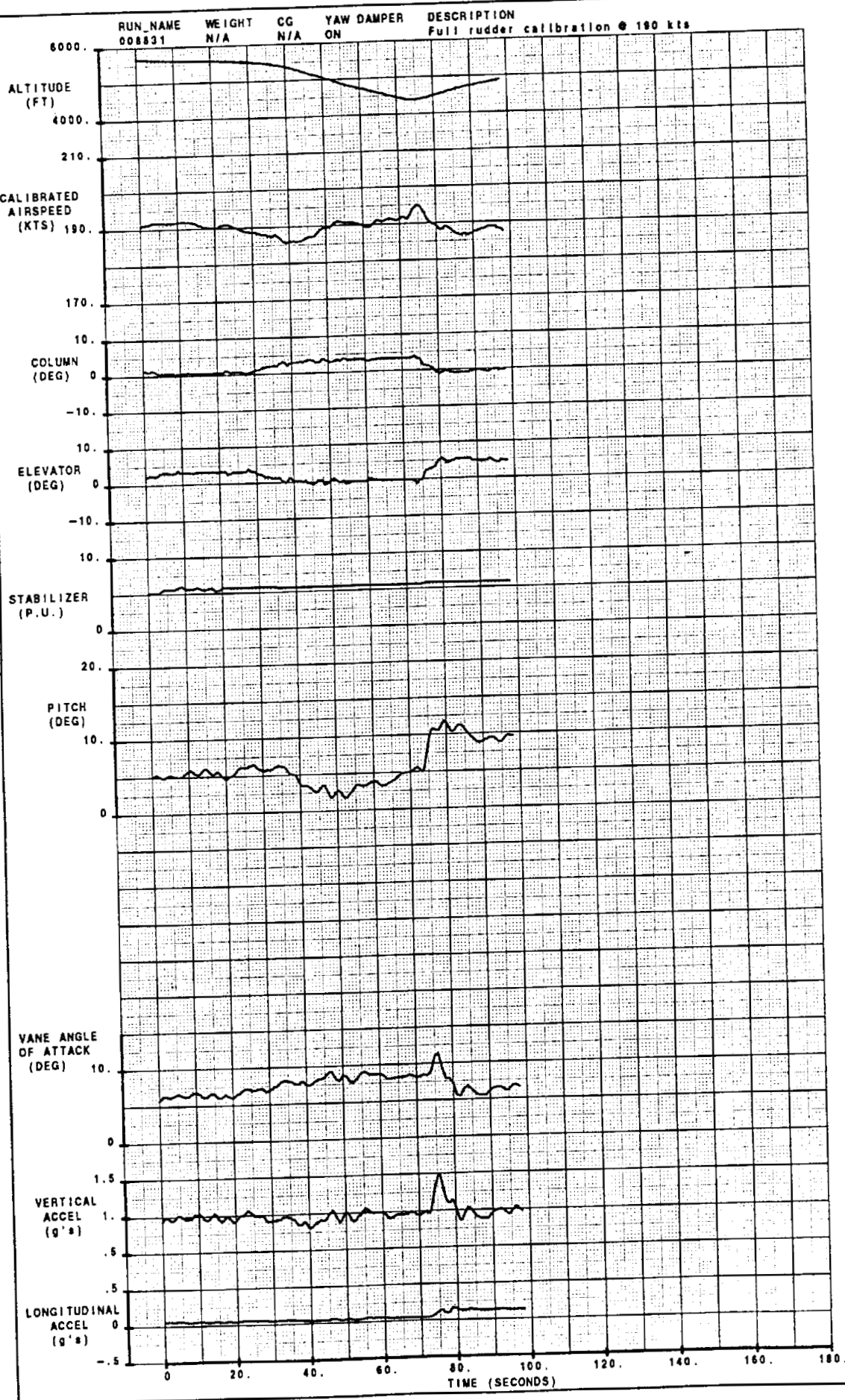
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| DATE                                                                                                                | 09/29/95 | REVISION | 1 |
| CHECK                                                                                                               | APR      | DATE     |   |
| APR                                                                                                                 |          |          |   |
| APR                                                                                                                 |          |          |   |
| FLIGHT: 019-09<br>CONDITION NO: 81.41.0081.107<br>TEST DATE: 09/29/95<br>THE BOEING COMPANY<br>PAGE 737-300<br>PROS |          |          |   |

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 11-19-09-2combined.sdb  
 #0088368 - data.plots/wakelet1.plt



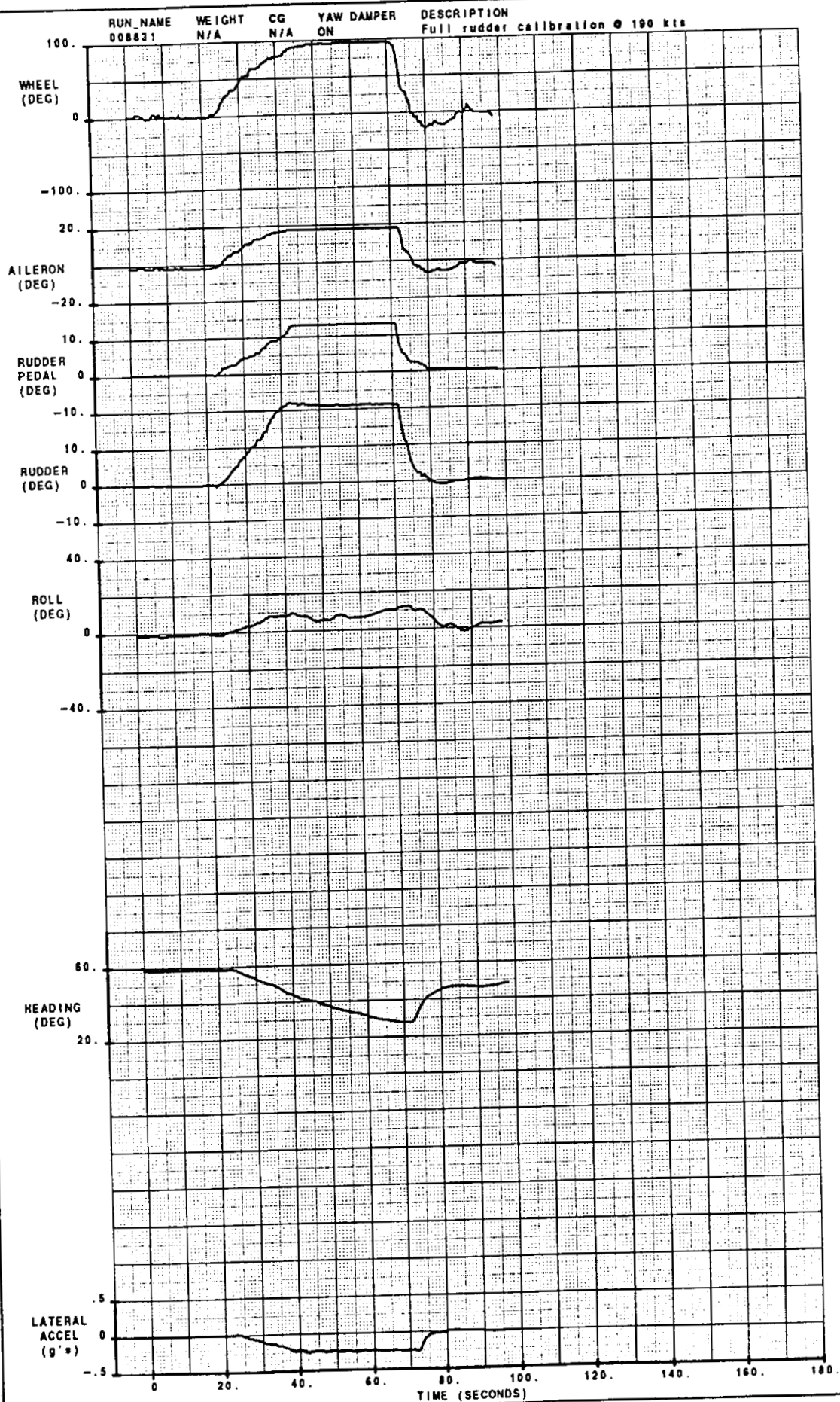
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| CALC                                                                                                 | RECD SIG | 200195 | REMOVED | DATE |
| CHECK                                                                                                |          |        |         |      |
| APR                                                                                                  |          |        |         |      |
| APR                                                                                                  |          |        |         |      |
| FLIGHT: 019-09<br>CONDITION NO: 81410081.100<br>TEST DATE: 09/29/95<br>THE BOEING COMPANY<br>PAGE 33 |          |        |         |      |

//rao/disk4/wakeos/11\_database/  
 11\_19\_09\_combined.asb  
 8008831C - data\_plots/wakeos1\_1dr.pib



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|--------------------|----------|--------|---------|------|------------------------------|---------|
| CALC               | 1500 SAC | 230015 | REMOVED | DATE | FLIGHT: 019-09               | 137-380 |
| CHECK              |          |        |         |      | CONDITION NO: 81.41.0081.100 |         |
| APR                |          |        |         |      | TEST DATE: 09/29/95          | P953    |
| APR                |          |        |         |      |                              |         |
| THE BOEING COMPANY |          |        |         |      |                              |         |
|                    |          |        |         |      | PAGE                         |         |

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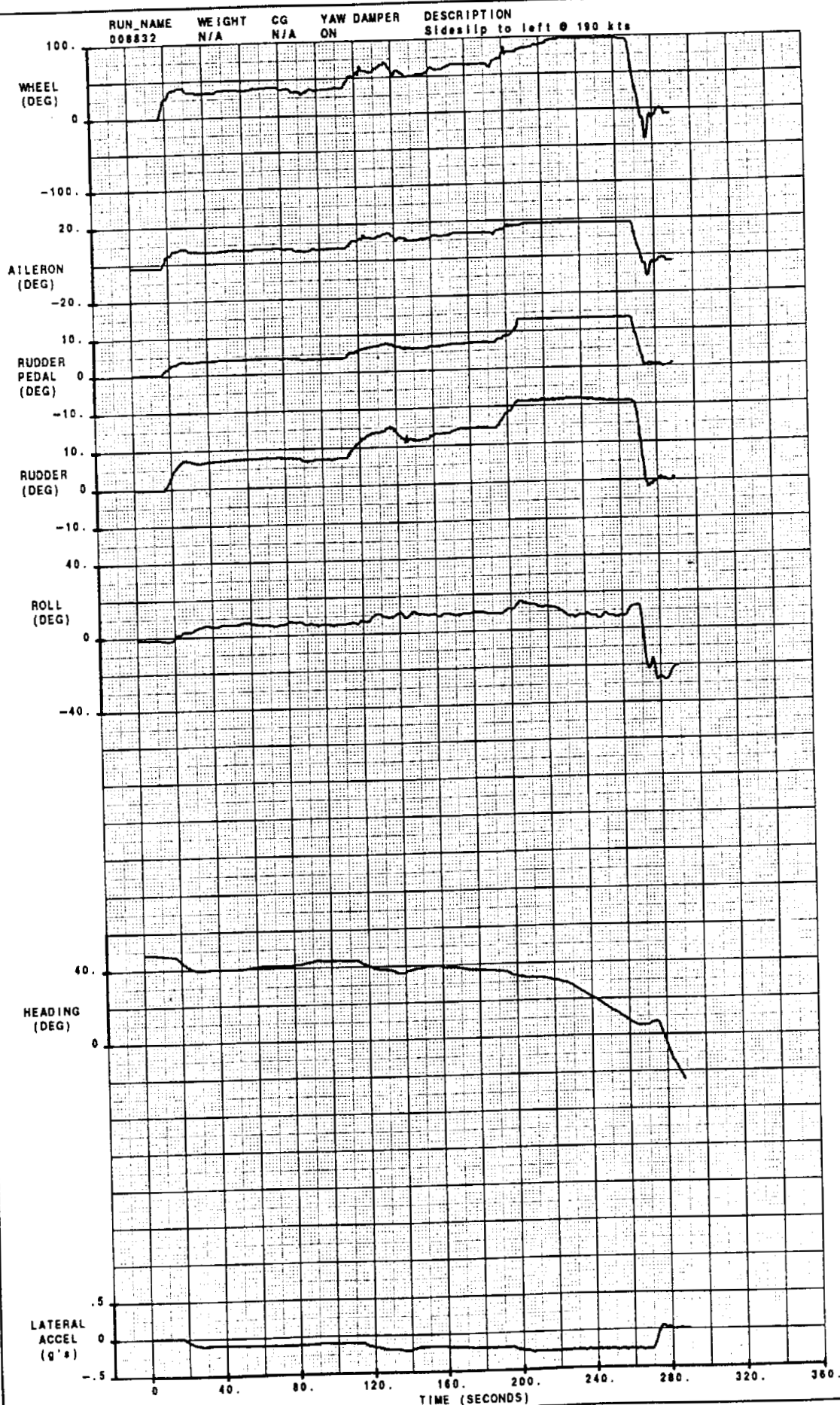




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| CALC  | HERO SAC | 200/95 | REVISED | DATE |
| CHECK |          |        |         |      |
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| FLIGHT: 019-09               |  | 127-008 |
| CONDITION NO: B1 41.0081.101 |  |         |
| TEST DATE: 09/29/95          |  | PAGE 3  |
| THE BOEING COMPANY           |  |         |



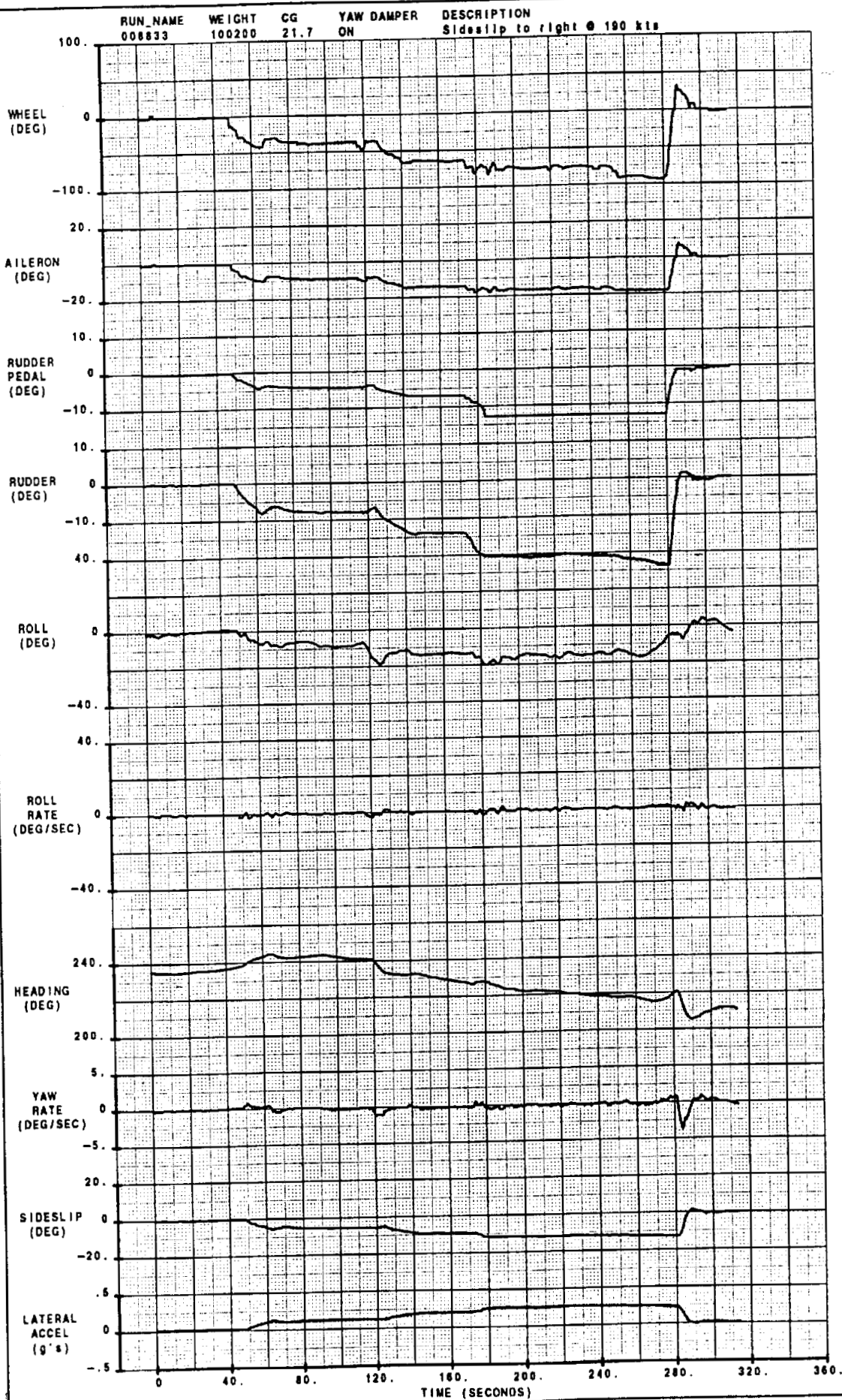
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| CAC   | HERO SAC | 2800135 | REVISID | DATE |
| CHECK |          |         |         |      |
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| FLIGHT: 019-09               |         |
| CONDITION NO: B1.41.0081.104 |         |
| TEST DATE: 09/29/95          |         |
| THE BOEING COMPANY           |         |
| 737-380                      | 737-380 |
| PAGE                         | PAGE    |



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008833B - data\_plots\maketest.plb