Fax -

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Boeing Air Safety Investigation
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SUBJECT: Upset During Approach

REFERENCE: Feb 95

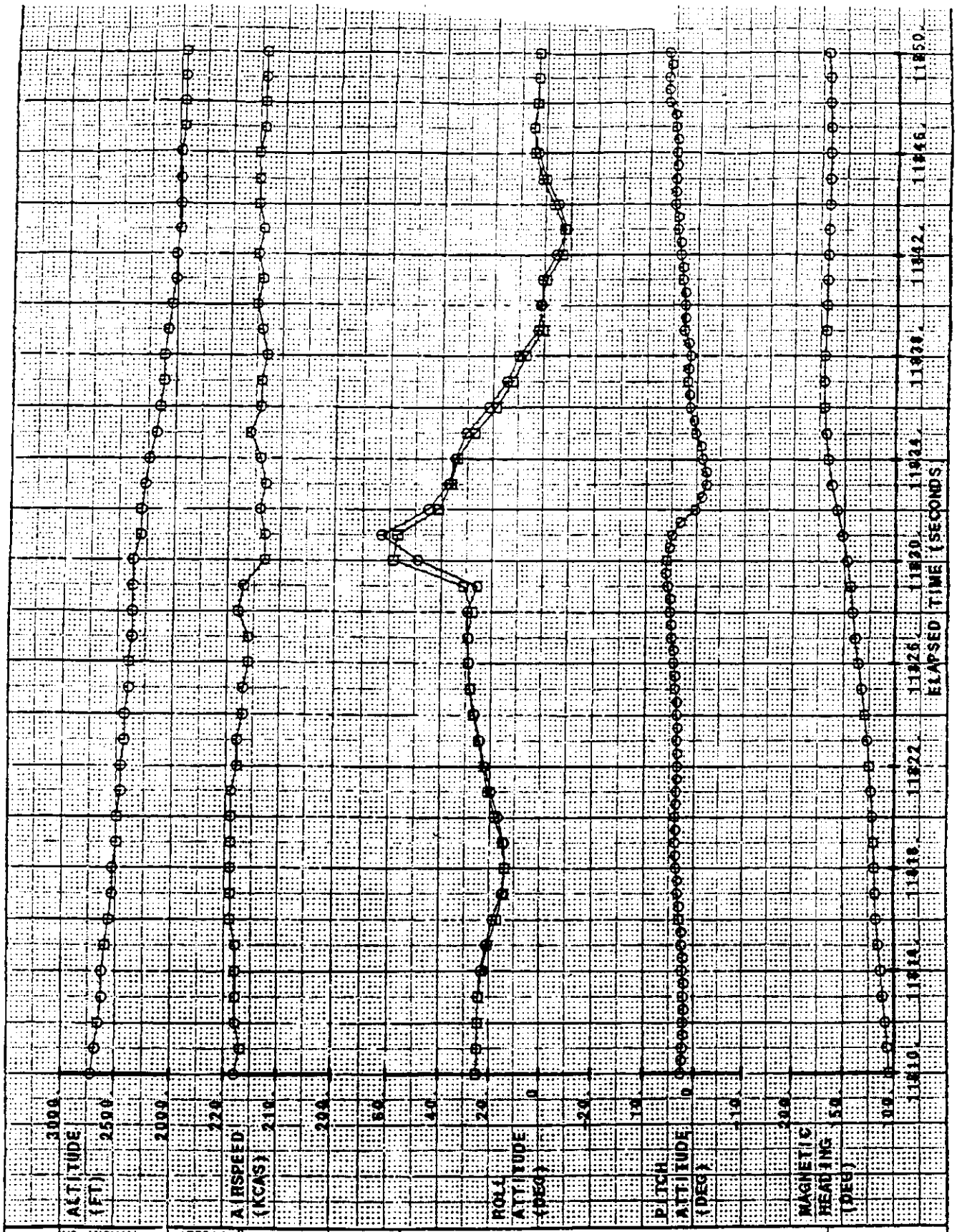
The DFDR data from the has been examined and key parameters are shown on the two attached time-history plots. 48

The roll upset was identified as having occurred between the elapsed times of 11829 and 11830. However, just prior to the roll upset a disturbance can be clearly seen in both vertical and lateral accelerations beginning at elapsed time of 11828. This disturbance precedes the roll upset, and is characteristic of an external disturbance (atmospheric or wake) acting on the aircraft. It is clear that these changes in acceleration and the resulting roll upset are not due to any control input from the aircraft.

While it was reported that the aircraft was on autopilot at the beginning of the upset, data show the pilot applied appropriate wheel and rudder to counter the roll beginning at an elapsed time of 11830.

The one control wheel data point at 11929 may be the autopilot attempting to maintain heading / lateral navigation, as this is within the flaps 1 autopilot wheel authority limit. This wheel input occurs after the initiation of this event, and could not have induced this roll and acceleration upset.

Based on our analysis of the DFDR data, Boeing does not request any of the parts listed in the reference be returned to Boeing for further examination.



48

CALC	MD INGHAM	FEB95	REVISED	DATE	UPSET DURING APPROACH	737-
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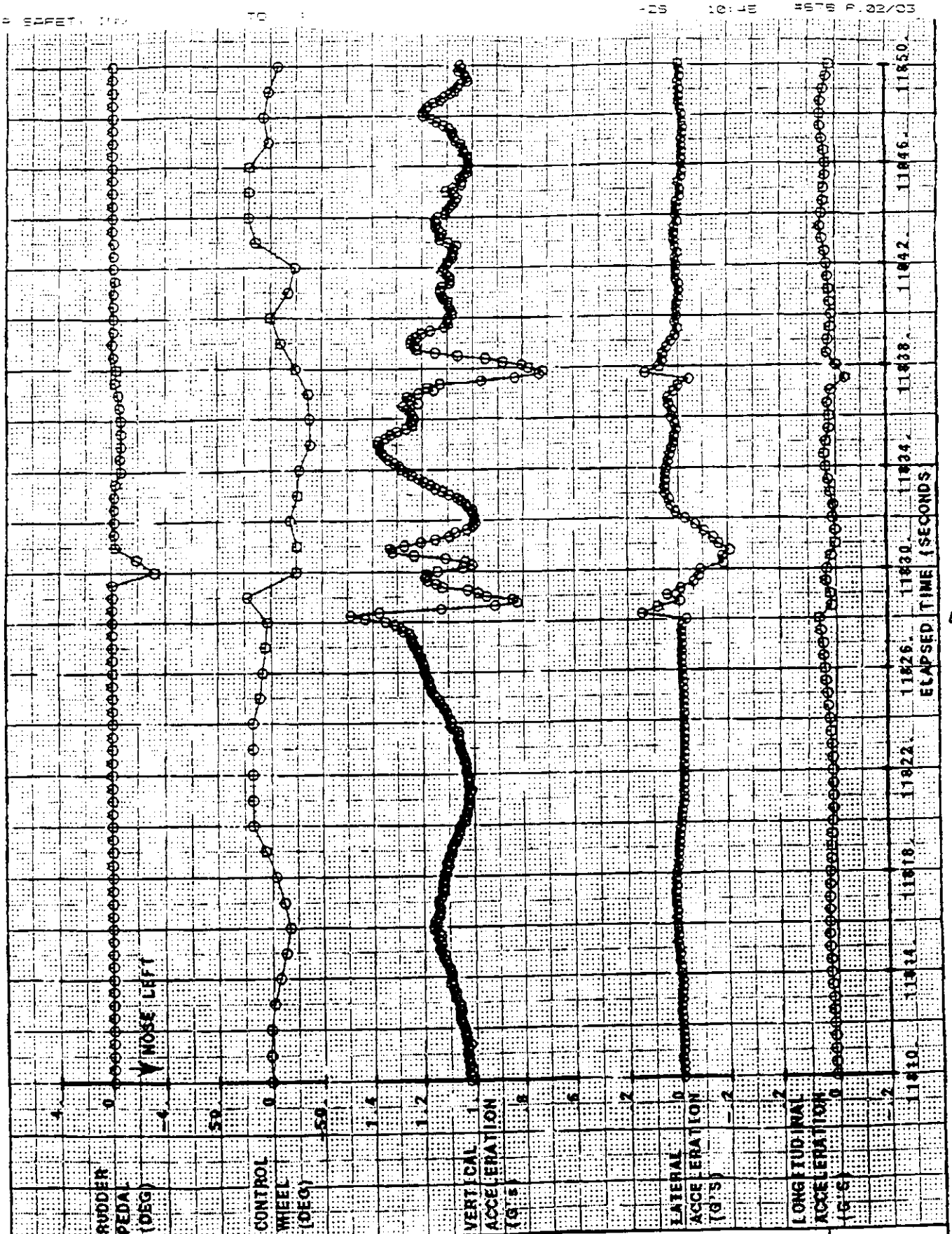
APR					THE BOEING COMPANY	PAGE Pg 3



48

CALC	MD INGHAM	FEB 95	REVISED	DATE	UPSET DURING APPROACH
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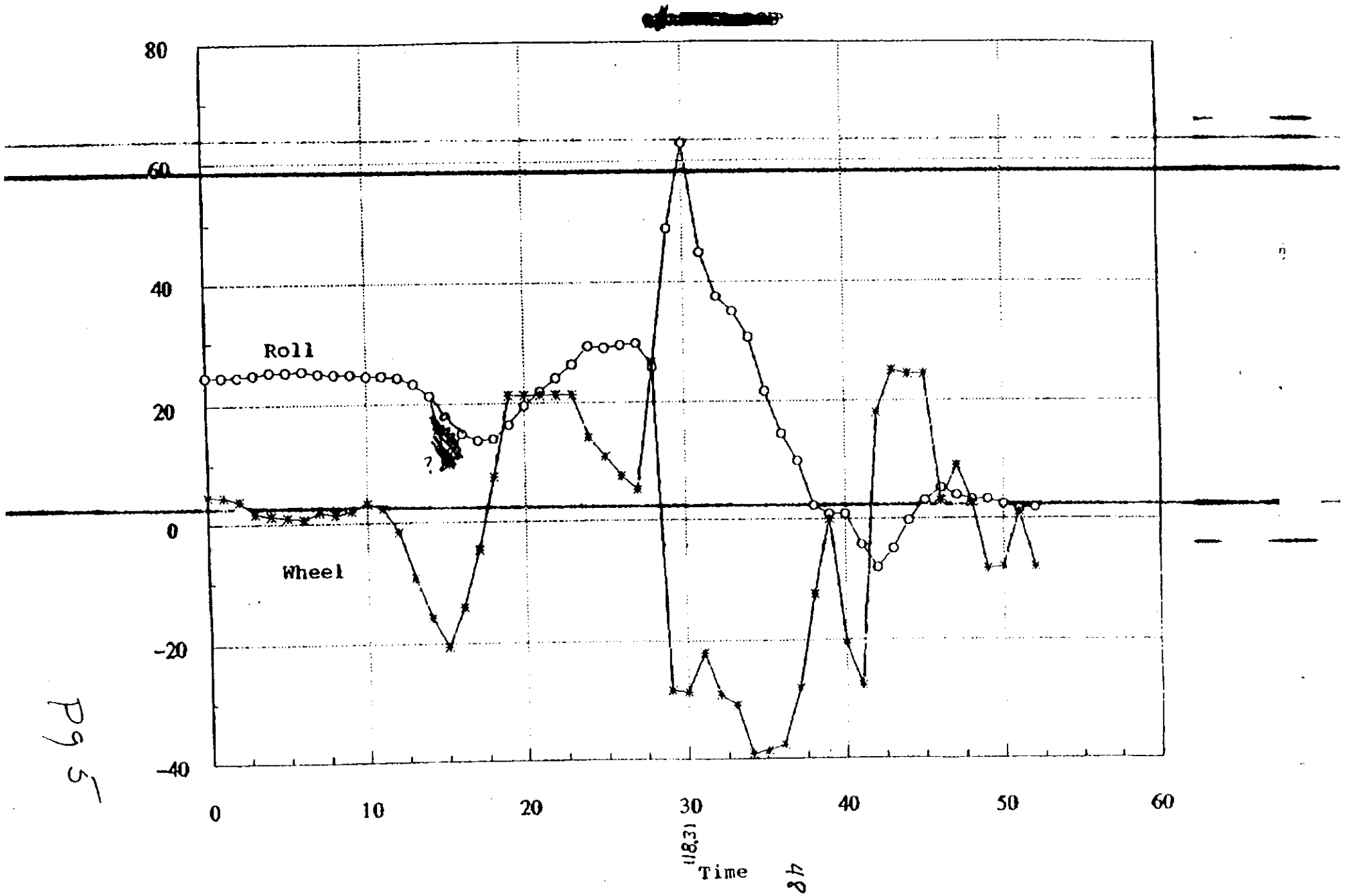
APR					
APR					THE BOEING COMPANY
					PAGE Pg 4


80
60
40
20
0
-20
-40
Roll
Wheel
0
10
20
30
40
50
60
Time

The attached plot is of wheel position and roll from the original faxed data. Subsequent to this another set of roll data was sent which included a column identical to the original and another column which was taken to be offset from the first by one half second but was not added to this plot.

The time at 30 seconds on this plot is equivalent to 118.31 on the aero plots. All further references to time will be with respect to this plot.

In response to LOC capture the autopilot banked the airplane up to 30 degrees while the flaps were still up. This is indicated by the wheel limiting at 21 degrees between 19 and 23 seconds. As the bank angle approached 30 degrees (24 to 27 seconds) the autopilot brought the wheel back to approx. 5 degrees. During this time the flaps were lowered to 1 degree.

Between 27 and 28 seconds a sharp lateral accel was felt by the airplane and the bank angle was driven off the 30 degree limit to approx. 25 degrees. This change in bank command from the desired bank angle of 30 degrees resulted in an autopilot wheel command of approx 26 degrees which is the flaps 1 autopilot limit. Between 28 and 29 seconds the airplane banked to 50 degrees and the wheel responded by reversing direction to the approx autopilot flaps down limit in the other direction, which it held for one more data frame as the airplane continued to roll to 60 degrees. Somewhere between 28 and 30 seconds the autopilot dropped to Roll CWS and disconnect occurred between 38 and 40 seconds. 48

The autopilot can move the wheel at approx 60 deg/sec within the limits of the aileron force limiter. The wheel rates and wheel directions which occur between 27 and 29 seconds are those to be expected from the autopilot responding to the externally induced roll rates.

CALC	MD INGHAM	FEB95	REVISED	DATE	UPSET DURING APPROACH
CHECK			S LEWIS	FEB95	737
APR					
APR					THE BOEING COMPANY
					PAGE 8

CALC	MD INGHAM	FEB95	REVISED	DATE	UPSET DURING APPROACH
CHECK			S LEWIS	FEB95	737
APR					
APR					
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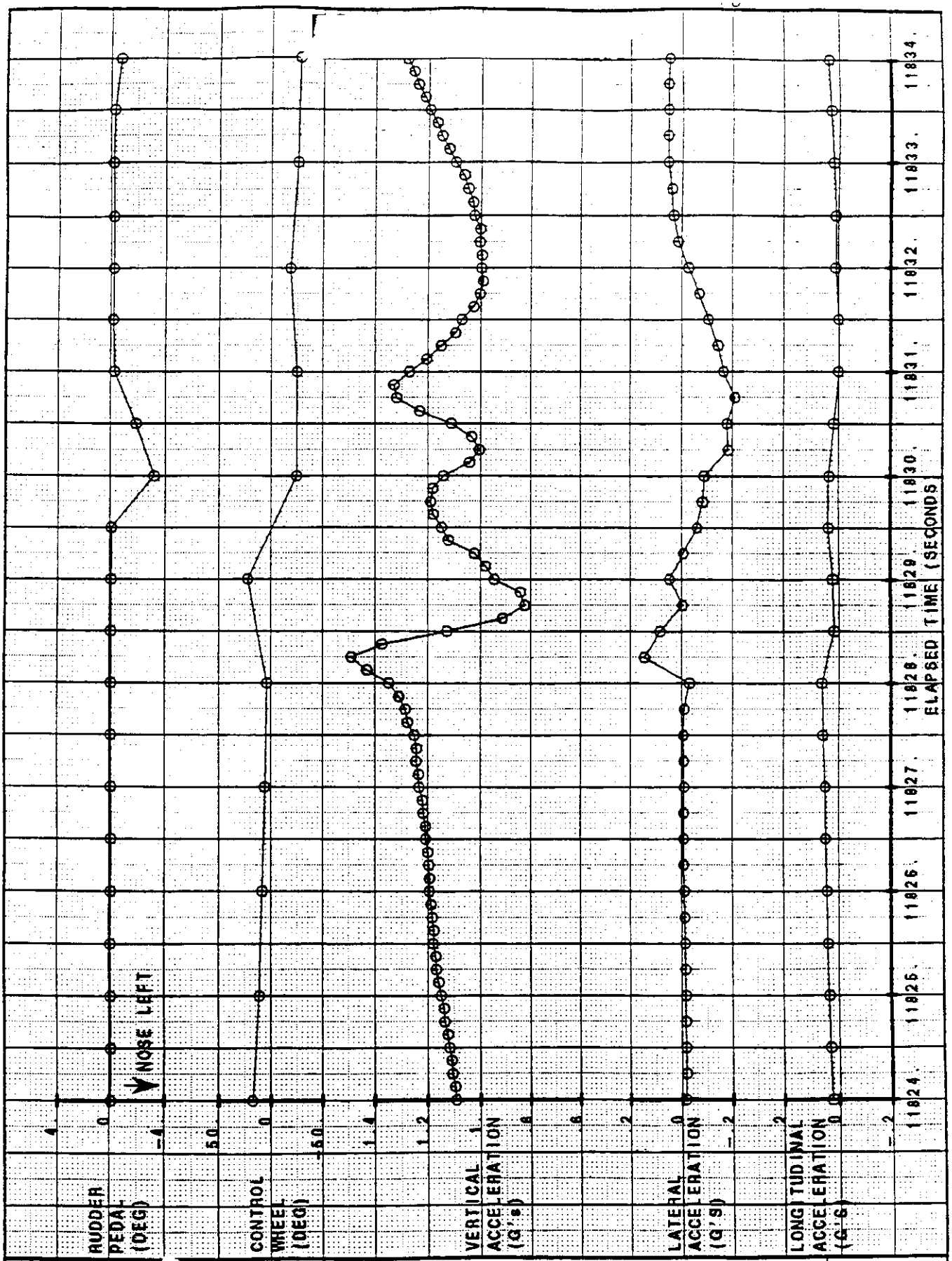
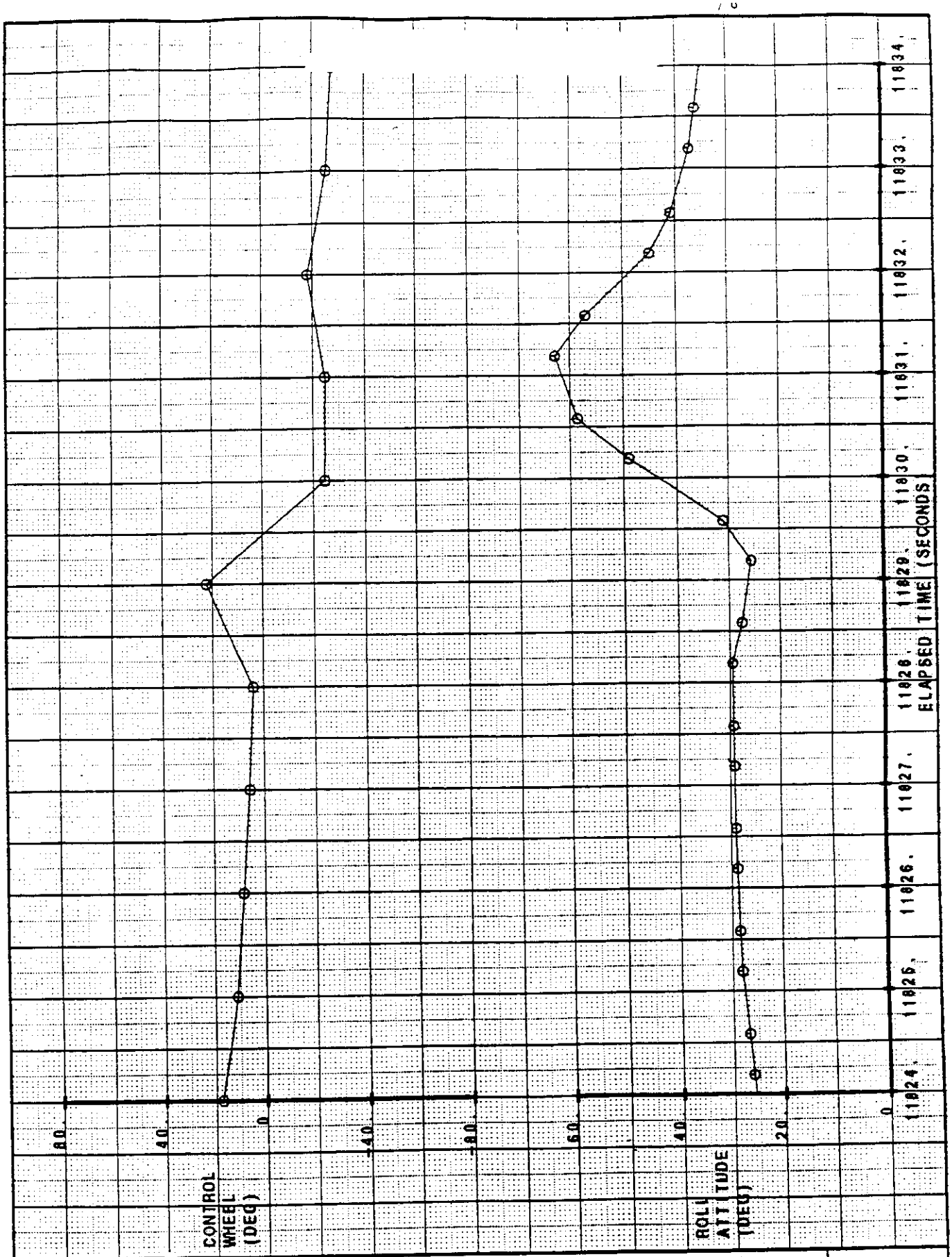


CALC	MD INGHAM	FEB95	REVISED	DATE	UPSET DURING APPROACH
CHECK			S LEWIS	FEB95	737
APR					
APR					THE BOEING COMPANY
					PAGE 10



CALC	MD INGHAM	FEB95	REVISED	DATE	UPSET DURING APPROACH
CHECK			S LEWIS	FEB95	737
APR					
APR					THE BOEING COMPANY
					PAGE 11