DOCKET NO. **SA - 510**

EXHIBIT NO. **13X - M**

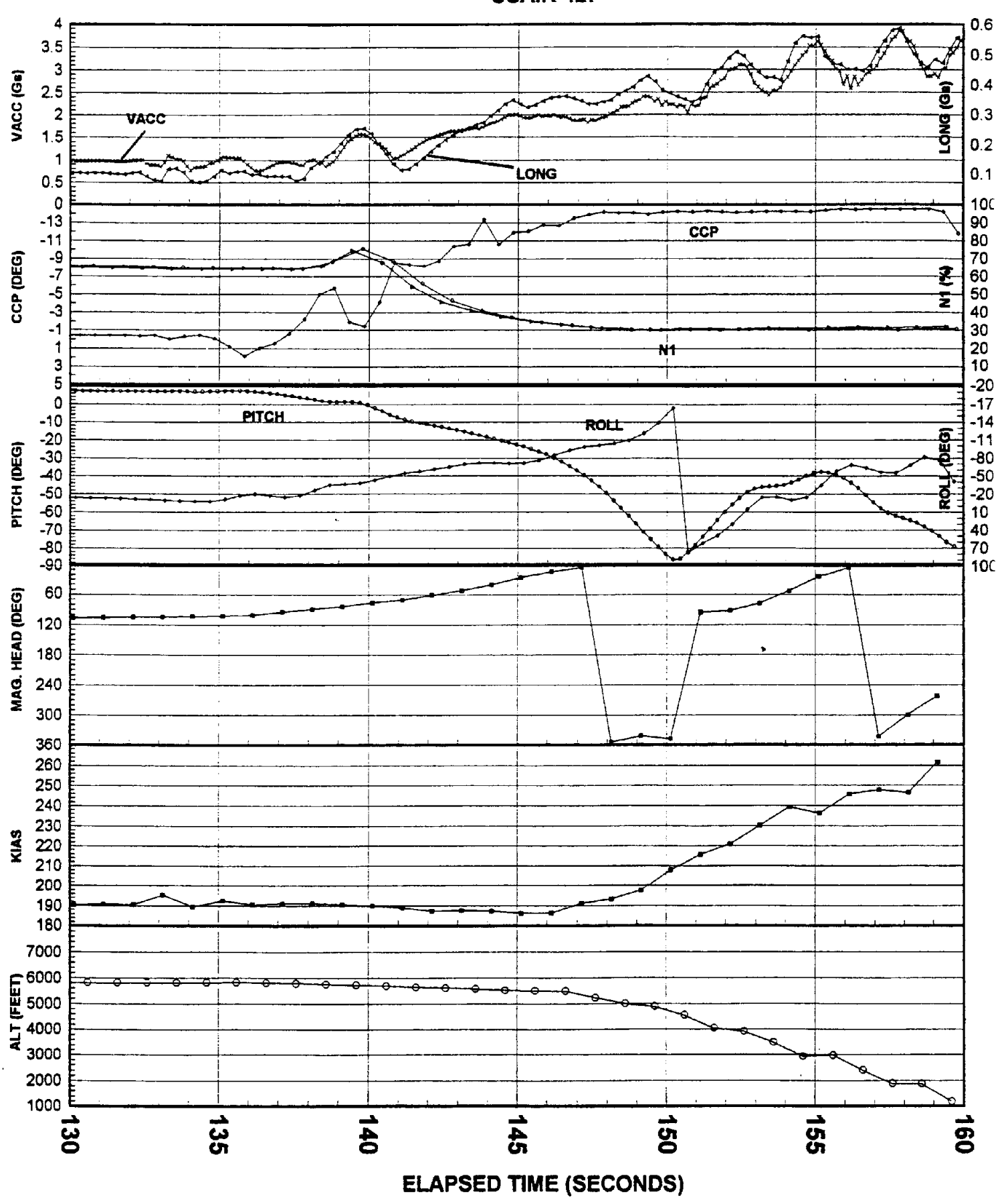
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

Excerpted Data Plots from Previous Hearing

CONTENTS OF EXHIBIT

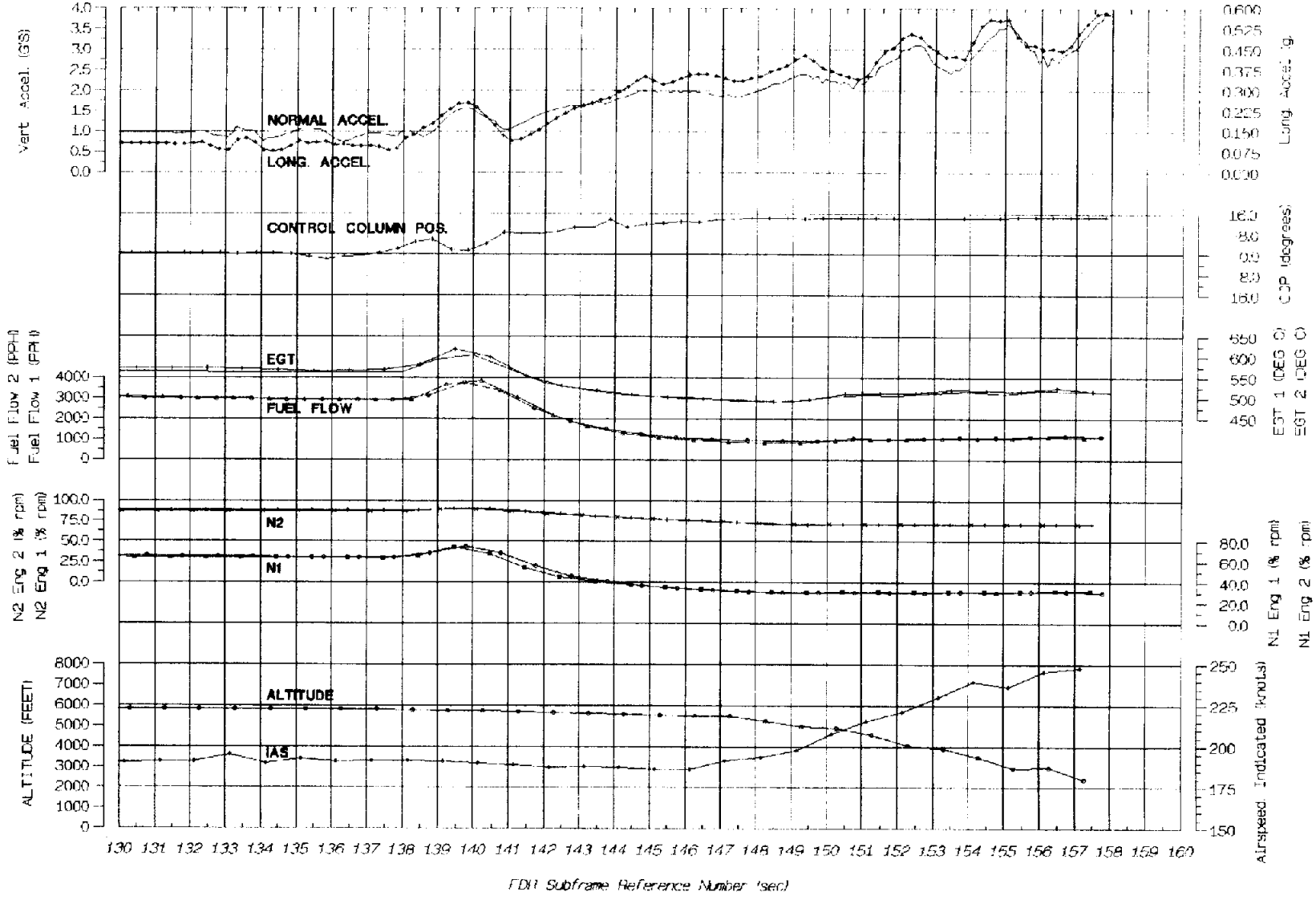
FDR Data Plots

(From Exhibit 13 K)


USAIR 427
VACC (Gs)
VACC
LONG
LONG (Gs)
CCP (DEG)
CCP
N1
N1 (%)
PITCH (DEG)
PITCH
ROLL
ROLL (DEG)
MAG. HEAD (DEG)
KIAS
ALT (FEET)
ELAPSED TIME (SECONDS)

USAir Flight 427

Last 30 sec. of data (w/o last 2 sec.) *NTSB # : DCA-94-MA-076*



Engine Data

Revised: November 02, 1995

NTSB Flight Recorder Laboratory

4

CONFIG:737-300/400 SSFDR 542A ELEC VER. 1.2 PRINTER

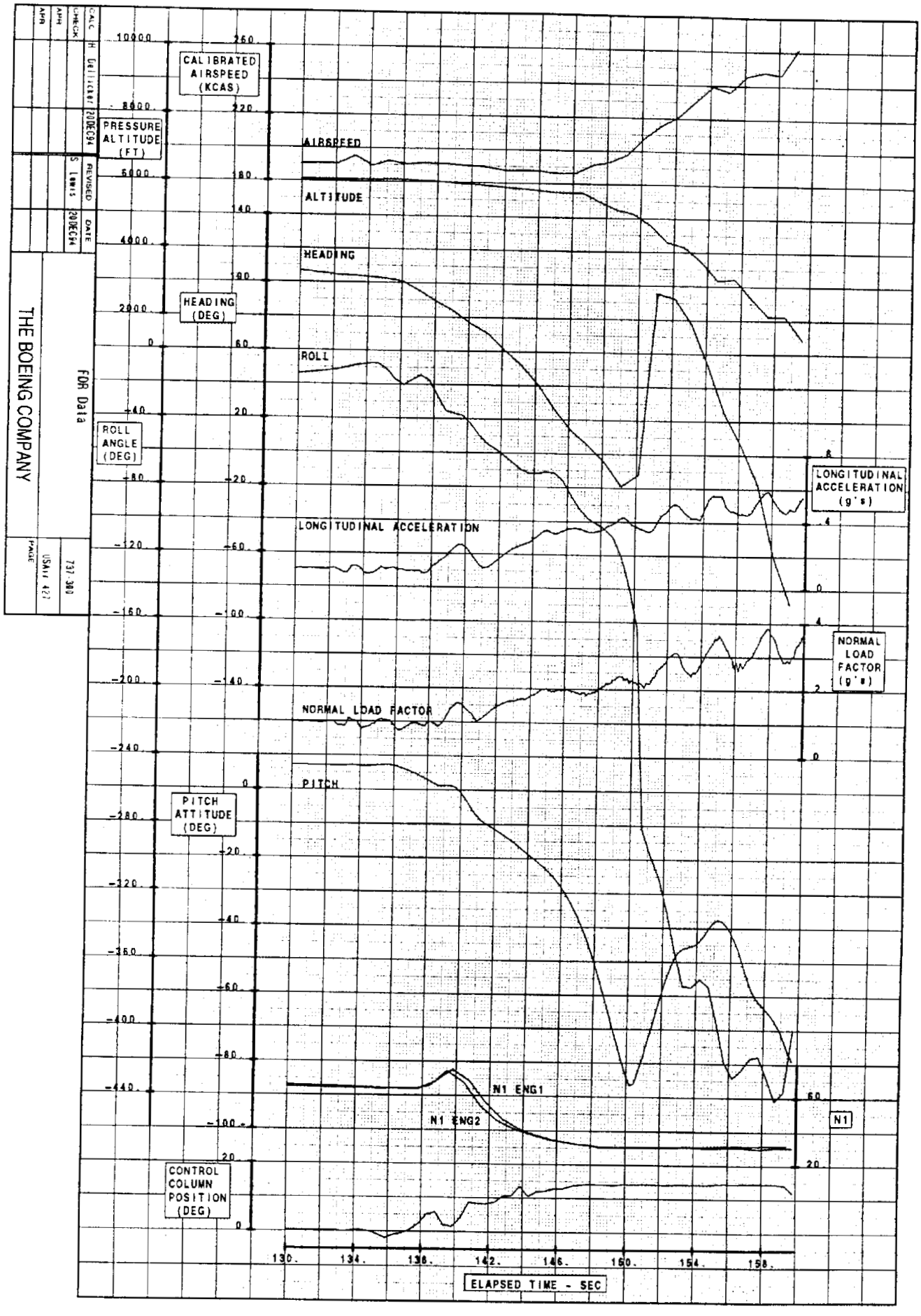
S F	TIKEAltitude HH:MM:WN=19+58	IAS WN=10	Head WN=09	Pitch Att 1 WN=13	Pitch Att 2 WN=29	Pitch Att 3 WN=45	Pitch Att 4 WN=61	Roll Att 1 WN=14	Roll att 2 WN=46	N1 Eng.1 WN=51	N1 Eng.2 WN=30	N2 Eng.1 WN=31	N2 Eng.2 WN=06	EGT Eng.1 WN=32	EGT Eng.2 WN=64	F.Flow Eng.1 WN=16	F.Flow Eng.2 WN=48	Vert Acc 1 WN=04	Vert Acc 2 WN=12	Vert Acc 3 WN=20	Vert Acc 4 WN=28	Vert Acc 5 WN=36	Vert Acc 6 WN=44	Vert Acc 7 WN=52	Vert Acc 8 WN=60	CCcont. PiPitch WNWN=55	Col. 2	Long Acc 1 WN=05	Long Acc 2 WN=21	Long Acc 3 WN=37	Long ATC Acc 4Keying WN=53WN=11
1	10:31:54	5806	189.76	126.27	7.57	7.57	7.50	7.50	-14.98	-15.07	62.8	63.0	87.0	86.2	548.8	543.5	2779	2856	1.013	1.008	1.003	1.001	0.994	0.991	0.994	0.994	-0.6	-0.8	0.107	0.108	0.107	0.107 00001
2	10:31:55	5808	189.60	124.97	7.43	7.50	7.50	7.50	-14.98	-14.82	63.3	63.6	87.2	86.4	551.1	546.5	2834	2906	0.991	0.994	0.989	0.987	0.984	0.991	1.003	1.001	-0.8	-0.8	0.107	0.108	0.107	0.110 00001
3	10:31:56	5808	189.13	123.67	7.50	7.50	7.57	7.57	-14.82	-14.82	63.8	64.2	87.4	86.5	552.6	548.8	2890	2956	0.996	0.996	0.991	0.994	0.991	0.991	0.999	0.999	-0.8	-0.7	0.110	0.110	0.107	0.111 00001
1	10:31:58	5808	189.28	121.21	7.57	7.57	7.57	7.57	-14.82	-14.73	64.1	64.5	87.5	86.8	555.7	551.9	2912	2990	0.999	1.003	1.003	1.001	1.003	0.996	0.996	0.996	-0.7	-0.7	0.112	0.112	0.112	0.112 00001
2	10:31:59	5808	188.97	119.95	7.57	7.57	7.57	7.57	-14.15	-14.07	65.1	64.7	87.9	87.0	558.8	555.7	2984	3024	1.001	1.003	1.003	1.001	1.003	1.001	0.999	1.001	-0.7	-0.6	0.114	0.114	0.115	0.115 00001
3	10:32:00	5808	189.28	118.40	7.57	7.57	7.57	7.57	-13.99	-13.99	65.6	65.2	88.0	87.1	562.7	557.3	3035	3040	1.001	0.996	1.001	1.008	1.006	1.001	1.001	1.001	-0.6	-0.6	0.115	0.114	0.116	0.115 00001
4	10:32:01	5809	189.28	117.38	7.57	7.57	7.57	7.57	-13.99	-13.99	65.9	65.6	88.1	87.3	565.8	558.8	3080	3069	1.003	0.996	0.996	0.991	0.989	0.991	0.989	0.989	-0.6	-0.6	0.115	0.114	0.114	0.114 00001
1	10:32:02	5809	189.28	116.36	7.57	7.57	7.57	7.57	-13.90	-13.99	66.0	65.5	88.1	87.3	566.6	561.1	3097	3086	0.996	0.991	0.996	0.996	0.999	0.991	0.989	0.991	-0.6	-0.6	0.114	0.115	0.114	0.114 00001
2	10:32:03	5811	189.60	115.07	7.57	7.57	7.50	7.50	-13.90	-13.90	66.1	65.6	88.2	87.3	568.9	562.7	3103	3091	0.996	0.996	0.999	0.994	1.001	1.003	0.994	0.989	-0.6	-0.6	0.114	0.115	0.115	0.115 00001
3	10:32:04	5811	189.76	113.69	7.50	7.50	7.50	7.50	-13.90	-13.82	66.1	65.8	88.2	87.4	569.1	564.2	3108	3114	0.994	0.996	0.994	0.999	1.001	0.991	0.991	0.999	-0.6	-0.8	0.114	0.115	0.114	0.114 00001
4	10:32:05	5812	190.07	112.54	7.50	7.50	7.43	7.43	-13.90	-14.07	66.1	66.0	88.2	87.5	568.9	565.8	3108	3108	1.001	1.001	0.999	0.991	0.994	0.996	0.996	0.987	-0.5	-0.5	0.115	0.114	0.113	0.114 00001
1	10:32:06	5814	190.38	111.21	7.43	7.43	7.43	7.36	-13.99	-13.99	66.1	65.9	88.3	87.5	572.0	565.8	3108	3114	0.991	0.991	0.989	0.994	0.999	0.999	1.001	0.996	-0.5	-0.5	0.114	0.112	0.113	0.113 00001
2	10:32:07	5815	190.38	110.09	7.36	7.36	7.36	7.36	-13.99	-14.07	66.2	65.9	88.3	87.6	572.8	566.6	3108	3114	0.989	0.989	0.987	0.994	0.991	0.994	0.989	0.989	-0.5	-0.5	0.112	0.112	0.112	0.112 00001
3	10:32:08	5816	190.38	108.91	7.29	7.29	7.36	7.29	-14.15	-14.15	66.1	65.4	88.3	87.6	571.2	565.8	3114	3097	0.987	0.984	0.982	0.989	0.989	0.989	0.984	0.987	-0.5	-0.5	0.111	0.110	0.110	0.110 00001
4	10:32:09	5816	190.70	107.83	7.29	7.29	7.22	7.22	-14.15	-14.07	66.1	65.0	88.3	87.5	572.0	565.0	3108	3052	0.984	0.982	0.979	0.977	0.979	0.975	0.975	0.972	-0.4	-0.4	0.109	0.108	0.107	0.106 00001
1	10:32:10	5818	190.54	106.61	7.22	7.22	7.22	7.15	-13.74	-13.33	65.7	64.8	88.3	87.4	572.0	565.0	3074	3007	0.975	0.975	0.975	0.972	0.970	0.977	0.979	0.982	-0.6	-0.4	0.106	0.107	0.105	0.107 00001
2	10:32:11	5818	190.85	105.58	7.15	7.15	7.08	7.08	-12.85	-12.29	65.4	64.6	88.1	87.3	572.0	564.2	3040	2984	0.977	0.975	0.977	0.970	0.963	0.965	0.963	0.972	-0.4	-0.4	0.107	0.105	0.104	0.102 00001
3	10:32:12	5818	190.70	104.57	7.08	7.01	7.01	7.01	-11.43	-10.66	65.2	64.4	88.0	87.3	572.8	562.7	3018	2973	0.984	0.994	0.999	1.003	0.922	0.889	0.889	0.879	-0.4	-0.4	0.107	0.105	0.096	0.084 00001
4	10:32:13	5816	195.30	103.99	7.08	7.22	7.22	7.08	-9.23	-8.43	65.0	64.3	88.0	87.3	570.4	562.7	2995	2951	0.845	0.951	1.099	1.058	1.023	1.018	0.989	0.867	-0.0	-0.3	0.081	0.119	0.123	0.110 00001
1	10:32:14	5822	189.60	103.41	6.94	6.94	7.01	7.15	-7.78	-7.78	64.7	64.2	88.0	87.2	569.7	562.7	2973	2934	0.774	0.838	0.841	0.850	0.865	0.936	0.936	1.003	-0.5	-0.1	0.080	0.076	0.081	0.096 00001
2	10:32:15	5827	192.56	102.53	7.22	7.36	7.43	7.22	-11.12	-16.95	64.6	64.1	87.8	87.2	565.0	561.4	2934	2923	1.049	1.070	1.054	1.054	1.042	1.044	0.984	0.803	0.8	1.9	0.116	0.105	0.111	0.112 00001
3	10:32:16	5812	190.70	100.58	6.87	6.46	6.05	5.58	-20.28	-17.39	64.4	64.2	87.7	87.0	567.3	562.7	2923	2917	0.834	0.767	0.752	0.771	0.817	0.850	0.889	0.934	1.0	0.5	0.101	0.102	0.095	0.097 00001
4	10:32:17	5790	191.32	94.91	4.98	4.46	3.82	3.25	-14.57	-17.30	64.1	63.9	87.7	87.1	568.1	562.7	2912	2906	0.953	0.963	0.960	0.934	0.920	0.886	0.874	0.977	-0.6	-2.2	0.096	0.095	0.081	0.088 00001
1	10:32:18	5758	191.16	88.86	2.57	1.79	1.32	1.26	-26.26	-35.08	48.2	65.7	88.0	87.0	581.2	591.3	3923	3125	0.996	1.006	0.944	0.944	0.855	0.905	0.960	1.058	-5.0	-5.7	0.124	0.138	0.161	0.177 00001
2	10:32:19	5719	190.70	83.47	1.43	1.32	0.79	-0.45	-36.71	-37.92	75.4	74.5	90.6	88.6	618.3	604.6	3670	3749	1.180	1.288	1.412	1.451	1.520	1.561	1.554	1.534	-1.9	-1.5	0.205	0.232	0.251	0.253 00001
3	10:32:20	5694	189.91	76.26	-2.09	-3.88	-5.98	-7.50	-42.93	-49.64	66.8	67.9	89.8	89.4	599.7	570.4	3834	3391	1.472	1.396	1.345	1.288	1.247	1.145	1.042	1.046	-4.1	-8.6	0.237	0.203	0.170	0.135 00001
4	10:32:21	5646	188.97	70.64	-8.79	-9.75	-10.50	-11.19	-54.60	-57.62	56.0	54.1	86.7	87.0	554.9	538.2	3040	2483	1.092	1.130	1.190	1.233	1.288	1.350	1.398	1.441	-8.3	-8.2	0.116	0.120	0.136	0.157 00001
1	10:32:22	5606	187.38	60.98	-12.05	-12.77	-13.66	-14.48	-61.40	-65.43	46.4	45.6	83.6	83.8	529.9	522.4	2150	1862	1.479	1.508	1.544	1.566	1.594	1.621	1.632	1.630	-8.7	-10.4	0.178	0.198	0.216	0.233 00001
2	10:32:23	5573	187.70	52.19	-15.41	-16.43	-17.48	-18.46	-69.44	-71.72	40.7	40.8	81.2	81.4	527.9	521.2	1607	1481	1.642	1.654	1.671	1.687	1.702	1.678	1.711	1.754	-10.6	-13.4	0.244	0.254	0.265	0.272 00001
3	10:32:24	5516	187.38	40.92	-19.54	-20.46	-21.49	-22.54	-71.72	-70.73	37.0	37.5	78.9	79.2	508.3	504.6	1282	1244	1.795	1.819	1.848	1.900	1.939	1.956	1.891	2.006	-10.5	-11.9	0.295	0.314	0.335	0.349 00001
4	10:32:25	5495	186.27	26.36	-23.69	-24.97	-26.46	-27.99	-71.36	-75.83	34.4	34.9	76.9	77.3	501.7	501.0	1076	1085	1.982	1.929	1.934	1.931	1.963	1.996	1.951	1.979	-12.1	-12.7	0.334	0.324	0.332	0.345 00001
1	10:32:26	5489	186.43	13.74	-29.95	-31.96	-34.32	-36.71	-84.69	-92.51	32.7	33.1	75.1	75.5	497.3	497.3	956	988	1.967	1.991	1.958	1.936	1.941	1.905	1.874	1.857	-12.7	-13.5	0.356	0.360	0.361	0.354 00001
2	10:32:27	5228	191.32	5.11	-39.58	-42.48	-45.95	-49.53	-98.00	-101.12	31.3	31.8	73.2	74.0	493.0	493.0	878	938	1.879	1.893	1.817	1.886	1.865	1.908	1.936	1.951	-13.9	-14.2	0.346	0.335	0.335	0.343 00000
3	10:32:28	5007	193.33	355.02	-53.62	-57.72	-62.11	-66.31	-104.15	-109.36	30.2	30.9	71.5	72.4	490.8	491.5	833	887	2.015	2.053	2.089	2.168	2.175	2.183	2.252	2.302	-14.1	-14.1	0.349	0.369	0.379	0.392 00000
4	10:32:29	4889	197.70	341.00	-70.82	-75.02	-79.34	-83.20	-120.69	-130.97	30.0	30.3	70.6	71.3	495.1	501.0	837	906	2.333	2.405	2.400	2.372	2.288	2.350	2.199	2.286	-13.9	-14.2	0.414	0.428	0.410	0.382 00000
1	10:32:30	4550	207.85	347.79	-86.50	-86.05	-82.22	-78.34	-161.74	77.63	30.4	30.8	70.9	70.9	511.2	508.3	970	1016	2.226	2.226	2.168	2.211	2.168	2.053	2.216	2.178	-14.2	-14.2	0.373	0.360	0.351	0.341 00001
2	10:32:31	4051	215.61	95.31	-73.65	-69.35	-64.44	-60.15	61.91	49.53	30.1	30.7	71.0	71.0	512.7	506.8	1002	1011	2.202	2.367	2.381	2.589	2.637	2.683	2.764	2.805	-14.3	-14.2	0.353	0.403	0.441	0.456 00000
3	10:32:32	3911	220.93	92.45	-55.79	-52.19	-48.97	-47.07	29.74	5.91	30.5	30.6	70.9	70.8	512.7	512.7	988	1020	2.986	3.006	3.037	3.106	3.104	3.061	2.905	2.699	-14.1	-14.2	0.490	0.509	0.496	0.465 00000
4	10:32:33	3492	230.22	77.71	-46.06	-45.73	-45.39	-44.83	-14.23	-15.07	30.8	31.2	71.2	70.9	521.6	515.7	1034	1095	2.616	2.539	2.498	2.427	2.532	2.525	2.592	2.730	-14.3	-14.2	0.441	0.424	0.425	0.415 00000
1	10:32:34	2929	239.32	51.07	-43.60	-42.03	-39.92	-38.36	-10.35	-14.23	30.1	31.0	71.1	71.3	518.6	511.2	1053	1081	2.833	2.951	3.096	3.199	3.316	3.383	3.532	3.522	-14.1	-14.2	0.478	0.538	0.561	0.556 00000
2	10:32:35	2972	236.19	24.57	-37.59	-37.92	-39.14	-41.03	-35.08	-58.89	30.6	31.4	70.8	71.2	517.2	518.6	1016	1122	3.625	3.537	3.415	3.273	3.195	3.020	2.967	2.471	-14.4	-14.5	0.560	0.494	0.458	0.467 00000
3	10:32:36	2397	245.72	5.44	-43.60	-46.62	-50.64	-54.36	-68.51	-63.96	30.8	31.7	71.3	71.7	524.6	515.7	1104	1160	2.852	2.585	2.845	2.663	2.773	2.901	2.939	3.001	-14.6	-14.5	0.451	0.452	0.446	0.463 00000
4	10:32:37	1880	247.86	342.78	-57.83	-60.26	-61.91	-63.13	-56.98	-55.58	30.0	31.5	71.0	71.8	515.7	514.9	1062	1136	3.087	3.250	3.357	3.503	3.661	3.723	3.852	3.852	-14.5	-14.5	0.511	0.566	0.580	0.587 00000
1	10:32:38	1874	246.50	299.38	-64.56	-65.94	-67.96	-70.20	-68.25	-81.79	30.8	31.8	70.8	71.5	521.6	518.6	1067	1183	3.675	3.628	3.525	3.317	3.118	3.008	2.850	2.885	-14.5	-14.5	0.541	0.501	0.473	0.458 00000
2	10:32:39	1188	261.70	271.00	-73.24	-76.68	-79.05	XX.XX	-76.44	-40.73	30.7	31.9	71.4	71.9	526.8	XXX.X	1150	1197	2.912	2.833	3.013	3.029	3.333	3.376	3.484	3.647	-14.2	-11.8	0.484	0.472	0.519	0.556 00000

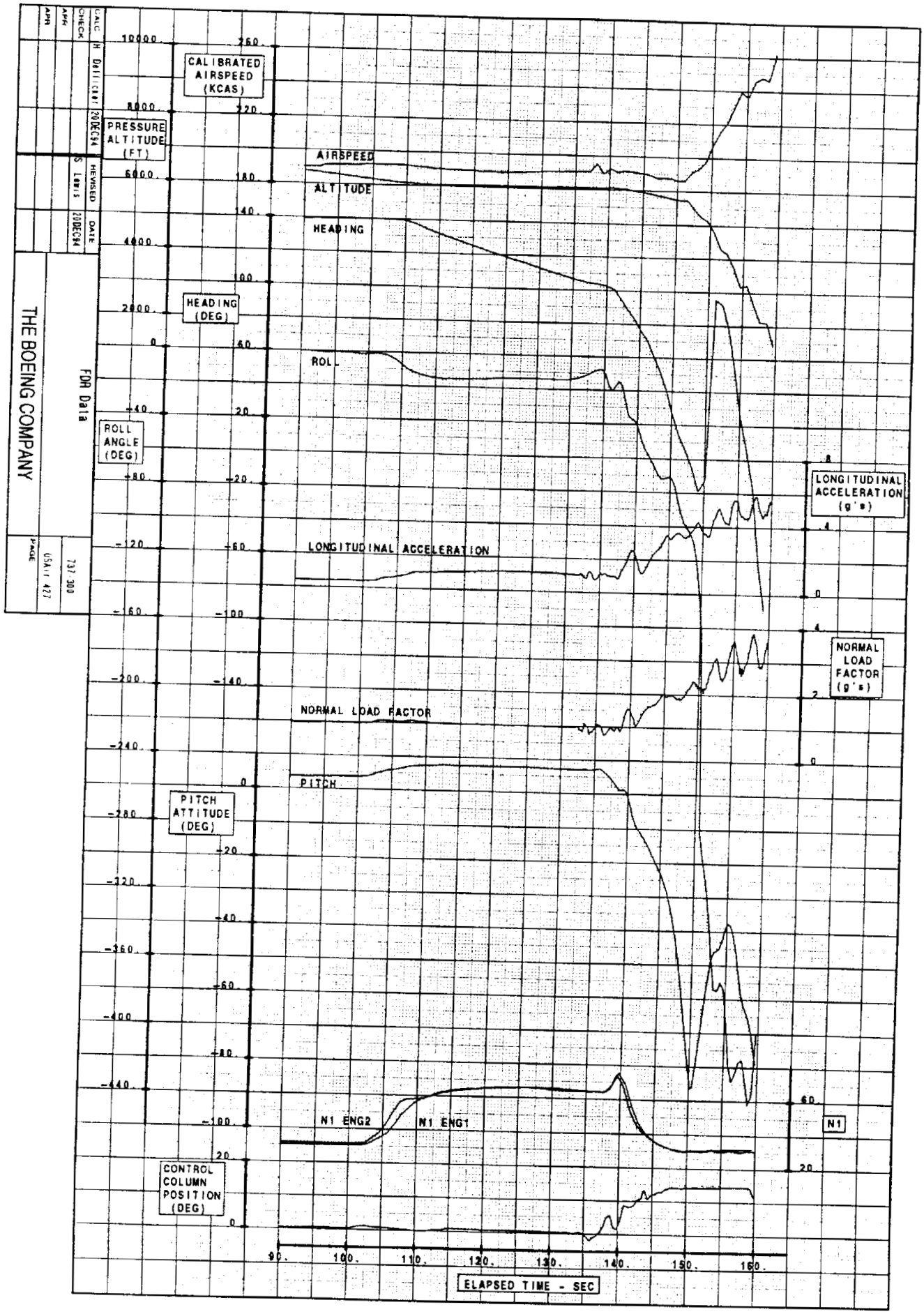
Plotted Elapsed FDR Time on Plots is elapsed from 1030:00

4A

Boeing FDR Data Plots

(From Exhibit 13 J)


THE BOEING COMPANY
FOR Data
737-300
USAir 427
PAGE
CALC
CHECK
APPR
H Gellicker 20DEC94
S Lewis 20DEC94
REVISED
DATE
CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
LONGITUDINAL ACCELERATION (g's)
NORMAL LOAD FACTOR (g's)
N1
AIRSPEED
ALTITUDE
HEADING
ROLL
LONGITUDINAL ACCELERATION
NORMAL LOAD FACTOR
PITCH
N1 ENG1
N1 ENG2
ELAPSED TIME - SEC
130.
134.
138.
142.
146.
150.
154.
158.

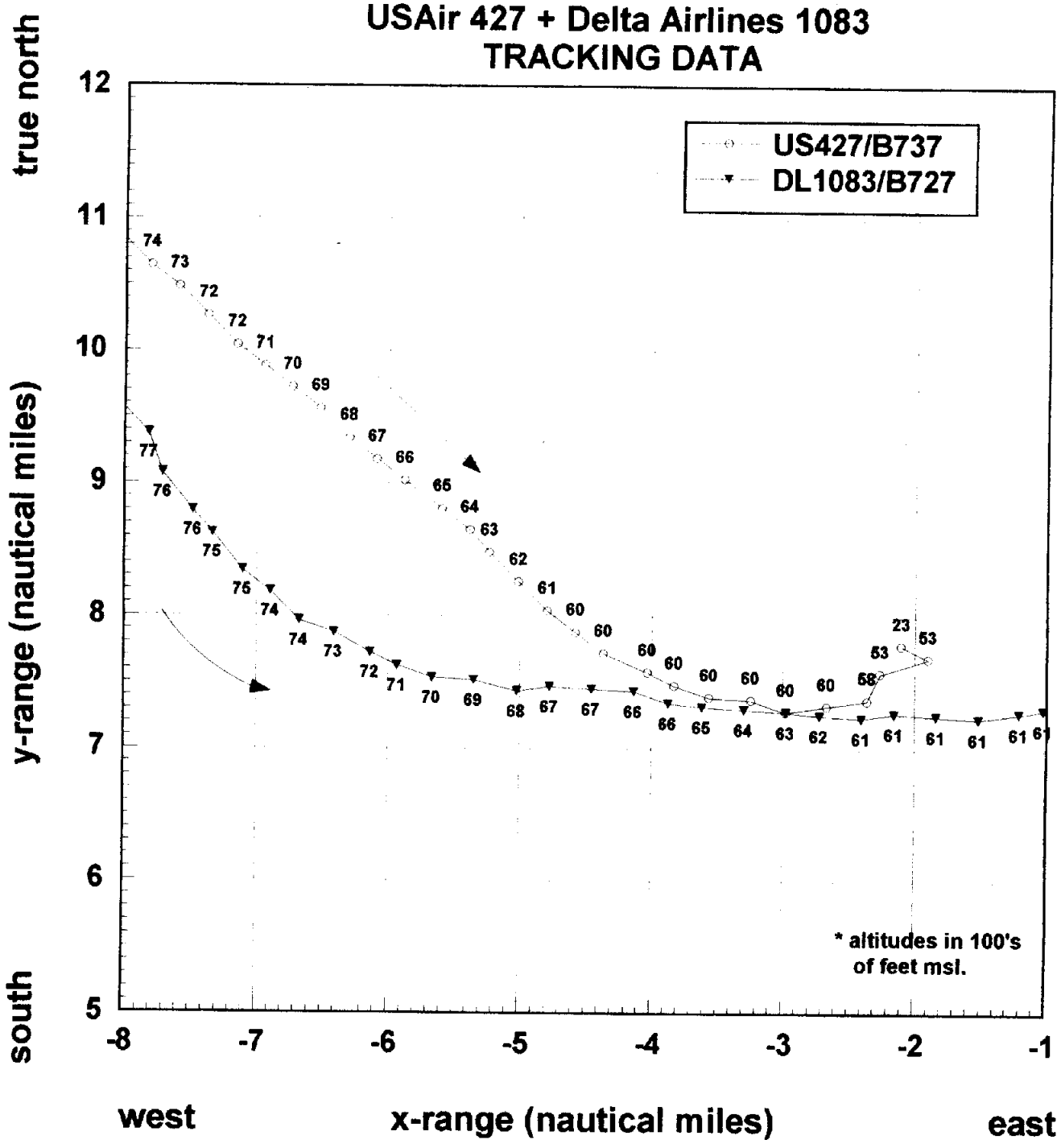

THE BOEING COMPANY
FDR Data
737-300
USAir 427
PAGE
CALC
CHECK
APP
APP
H Defilippi 20DEC94
DATE
S Lewis 20DEC94
REVISED
CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
LONGITUDINAL ACCELERATION (g's)
NORMAL LOAD FACTOR (g's)
N1
AIRSPEED
ALTITUDE
HEADING
ROLL
LONGITUDINAL ACCELERATION
NORMAL LOAD FACTOR
PITCH
N1 ENG2
N1 ENG1
ELAPSED TIME - SEC

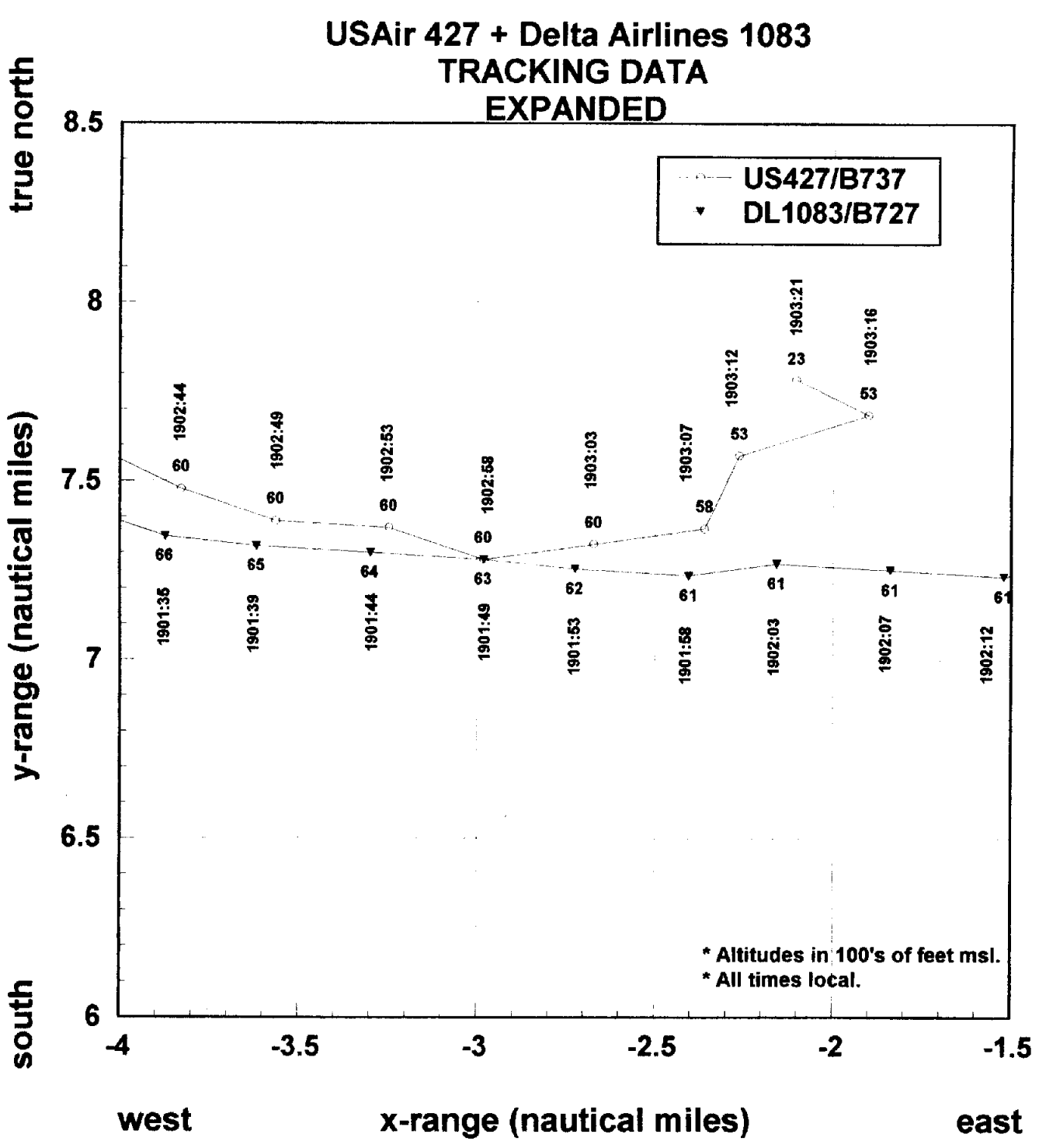
USA427 Radar Data Plots

(From Exhibit 13 H)

USAir 427 & Delta 1083 Separation Table

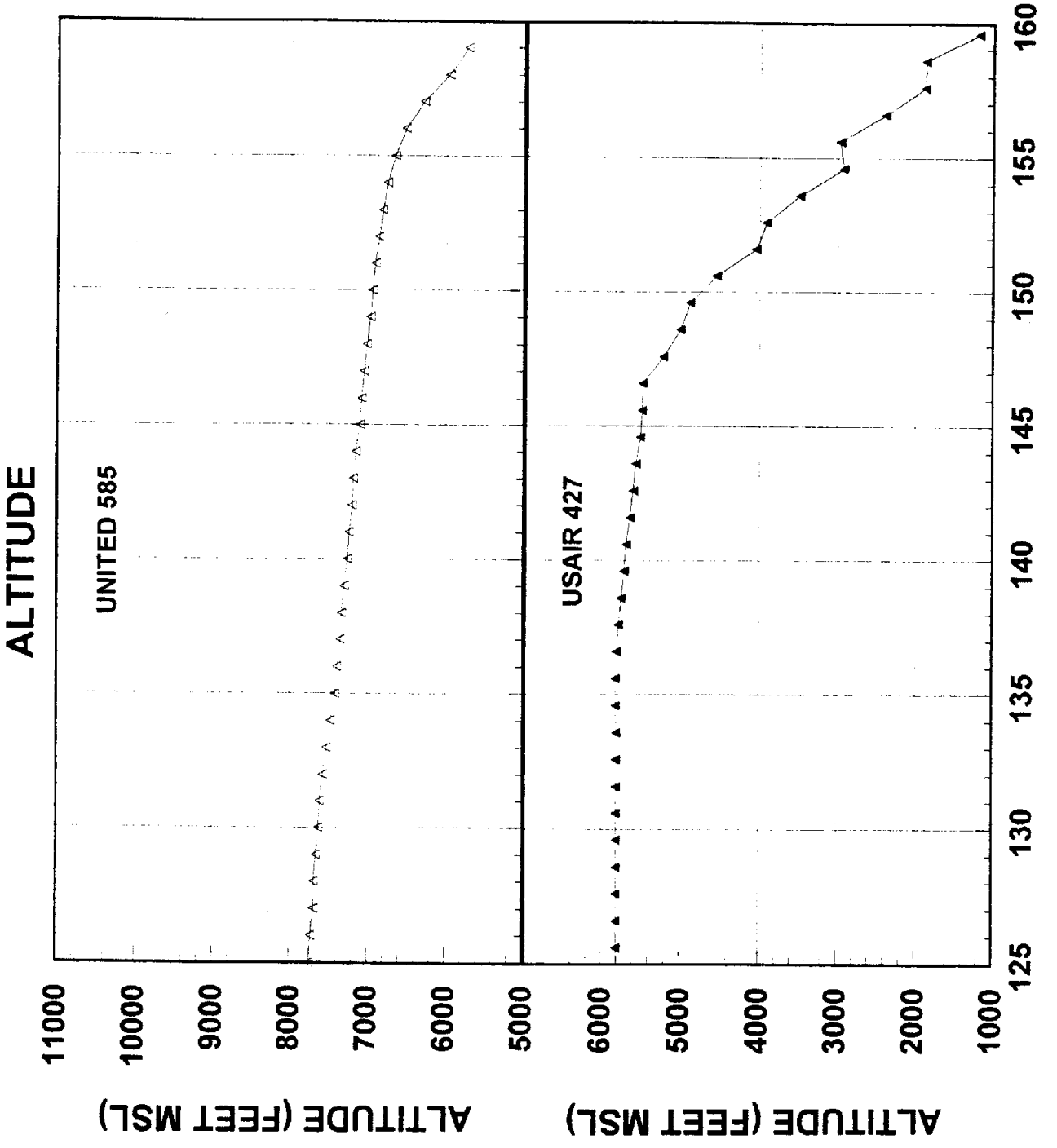
Aircraft	Radar Return UCT	X - Position (n.m.)	Y - Position (n.m.)	Mode C Alt (100s of Ft)	Vertical Separation (Feet)	Lateral Separation (n.m.)
USAir 427 Delta 1083	2301:30.01 2301:30.09	-5.875 -3.063	11.188 7.938	72 66	600	4.3
USAir 427 Delta 1083	2301:34.59 2301:34.70	-5.688 -2.813	10.938 7.813	72 66	600	4.2
USAir 427 Delta 1083	2301:39.17 2301:39.45	-5.500 -2.563	10.750 7.750	71 65	600	4.2
USAir 427 Delta 1083	2301:43.78 2301:43.95	-5.313 -2.250	10.375 7.688	70 64	600	4.2
USAir 427 Delta 1083	2301:48.45 2301:48.57	-5.125 -1.938	10.375 7.625	69 63	600	4.2
USAir 427 Delta 1083	2301:53.06 2301:53.16	-4.938 -1.688	10.125 7.563	68 62	600	4.1
USAir 427 Delta 1083	2301:57.65 2301:57.95	-4.750 -1.375	9.938 7.500	67 61	600	4.2
USAir 427 Delta 1083	2302:02.32 2302:02.54	-4.563 -1.125	9.750 7.500	66 61	500	4.1
USAir 427 Delta 1083	2302:06.95 2302:07.17	-4.313 -0.813	9.500 7.438	65 61	400	4.1
USAir 427 Delta 1083	2302:11.95 2302:11.77	-4.125 -0.500	9.313 7.375	64 61	300	4.1
USAir 427 Delta 1083	2302:16.14 2302:16.46	-4.000 -0.188	9.125 7.375	63 61	200	4.2
USAir 427 Delta 1083	2302:20.71 2302:21.14	-3.813 0.000	8.875 7.375	62 61	100	4.1
USAir 427 Delta 1083	2302:25.45 2302:25.76	-3.625 0.313	8.625 7.313	61 61	0	4.2
USAir 427 Delta 1083	2302:30.08 2302:30.45	-3.438 0.563	8.438 7.313	60 61	0	4.2
USAir 427 Delta 1083	2302:34.70 2302:35.02	-3.250 0.813	8.250 7.250	60 60	0	4.2
USAir 427 Delta 1083	2302:39.29 2302:39.64	-2.938 1.125	8.063 7.250	60 60	0	4.1
USAir 427 Delta 1083	2302:43.95 2302:44.20	-2.750 1.375	7.938 7.188	60 60	0	4.2
USAir 427 Delta 1083	2302:48.53 2302:48.96	-2.500 1.688	7.813 7.188	60 60	0	4.2
USAir 427 Delta 1083	2302:53.15 2302:53.61	-2.188 1.938	7.750 7.125	60 60	0	4.2
USAir 427 Delta 1083	2302:57.76 2302:58.16	-1.938 2.250	7.625 7.063	60 60	0	4.5
USAir 427 Delta 1083	2303:02.45 2303:02.81	-1.625 2.500	7.625 7.063	60 60	0	4.2
USAir 427 Delta 1083	2303:07.13 2303:07.46	-1.313 2.813	7.625 7.000	58 60	-200	4.2
USAir 427 Delta 1083	2303:11.77 2303:12.14	-1.188 3.063	7.813 6.938	53 60	-700	4.3

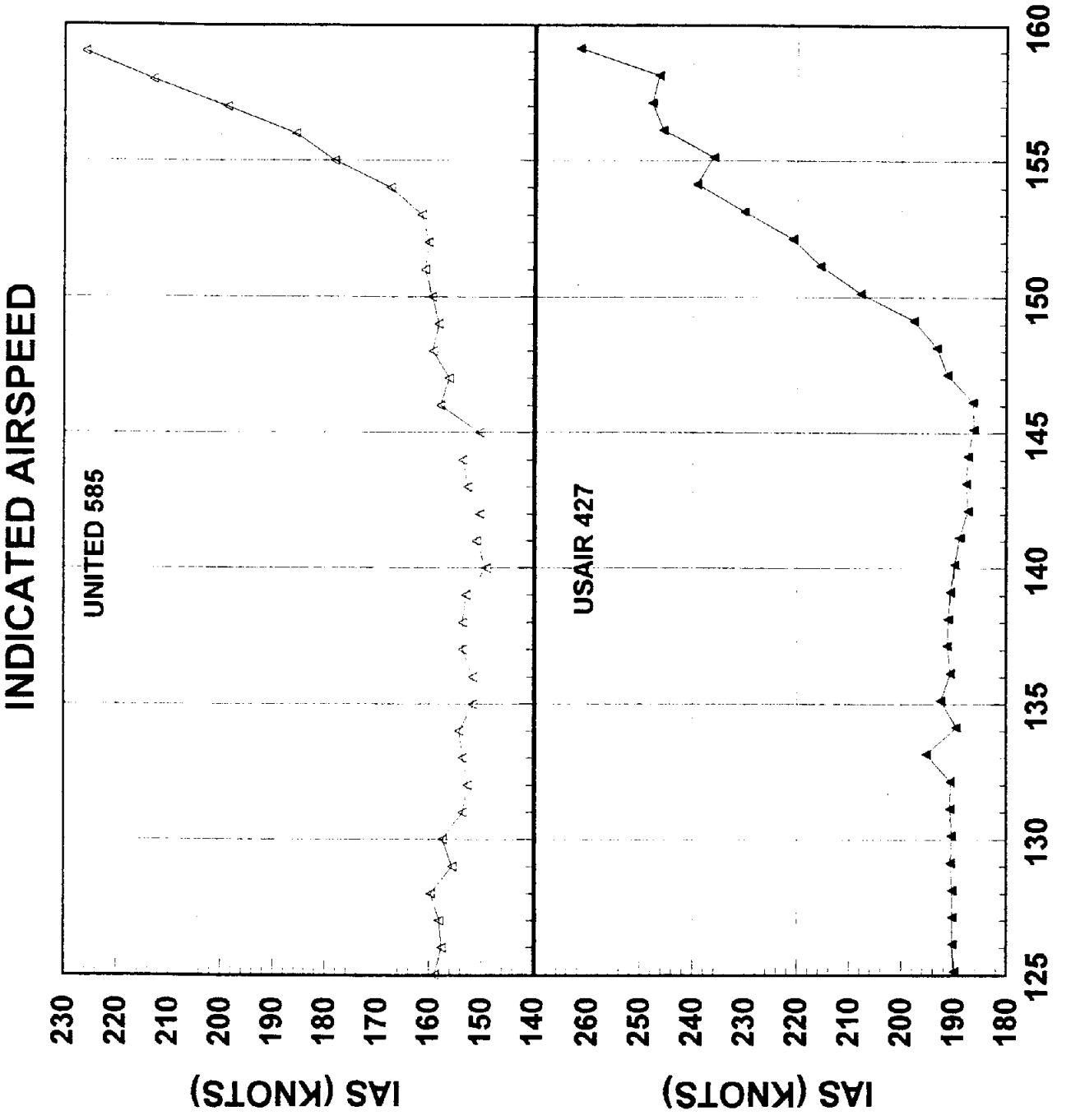

USAir 427 + Delta Airlines 1083
TRACKING DATA
US427/B737
DL1083/B727
true north
south
y-range (nautical miles)
12
11
10
9
8
7
6
5
-8
-7
-6
-5
-4
-3
-2
-1
west
x-range (nautical miles)
east
* altitudes in 100's
of feet msl.

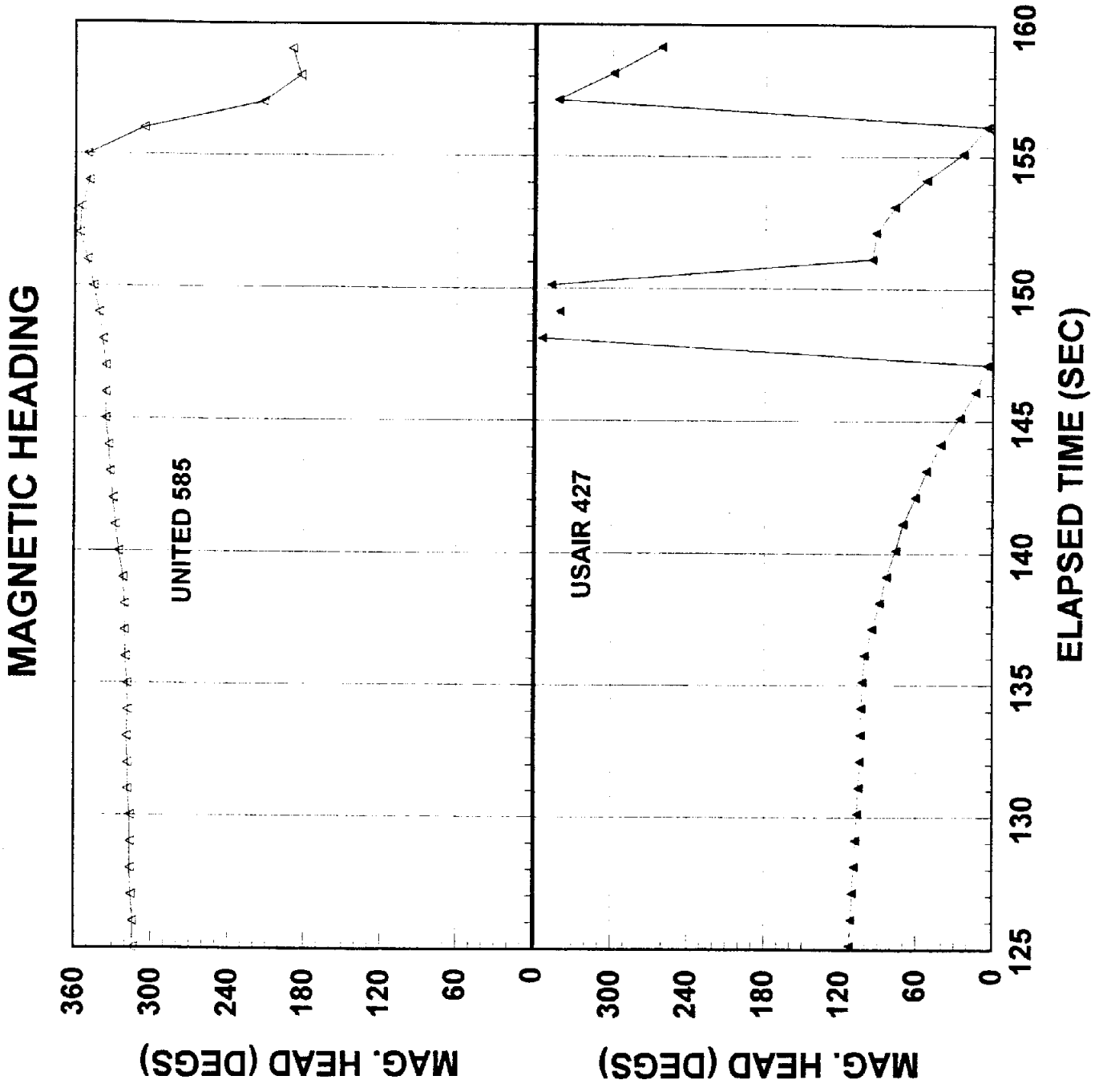

USAir 427 + Delta Airlines 1083
TRACKING DATA
EXPANDED
US427/B737
DL1083/B727
true north
south
y-range (nautical miles)
8.5
8
7.5
7
6.5
6
-4
-3.5
-3
-2.5
-2
-1.5
west
x-range (nautical miles)
east
* Altitudes in 100's of feet msl.
* All times local.
1902:44
1902:49
1902:53
1902:58
1903:03
1903:07
1903:12
1903:21
1903:16
1901:35
1901:39
1901:44
1901:49
1901:53
1901:58
1902:03
1902:07
1902:12

USA427 and UAL585 FDR Data Comparsion Plots

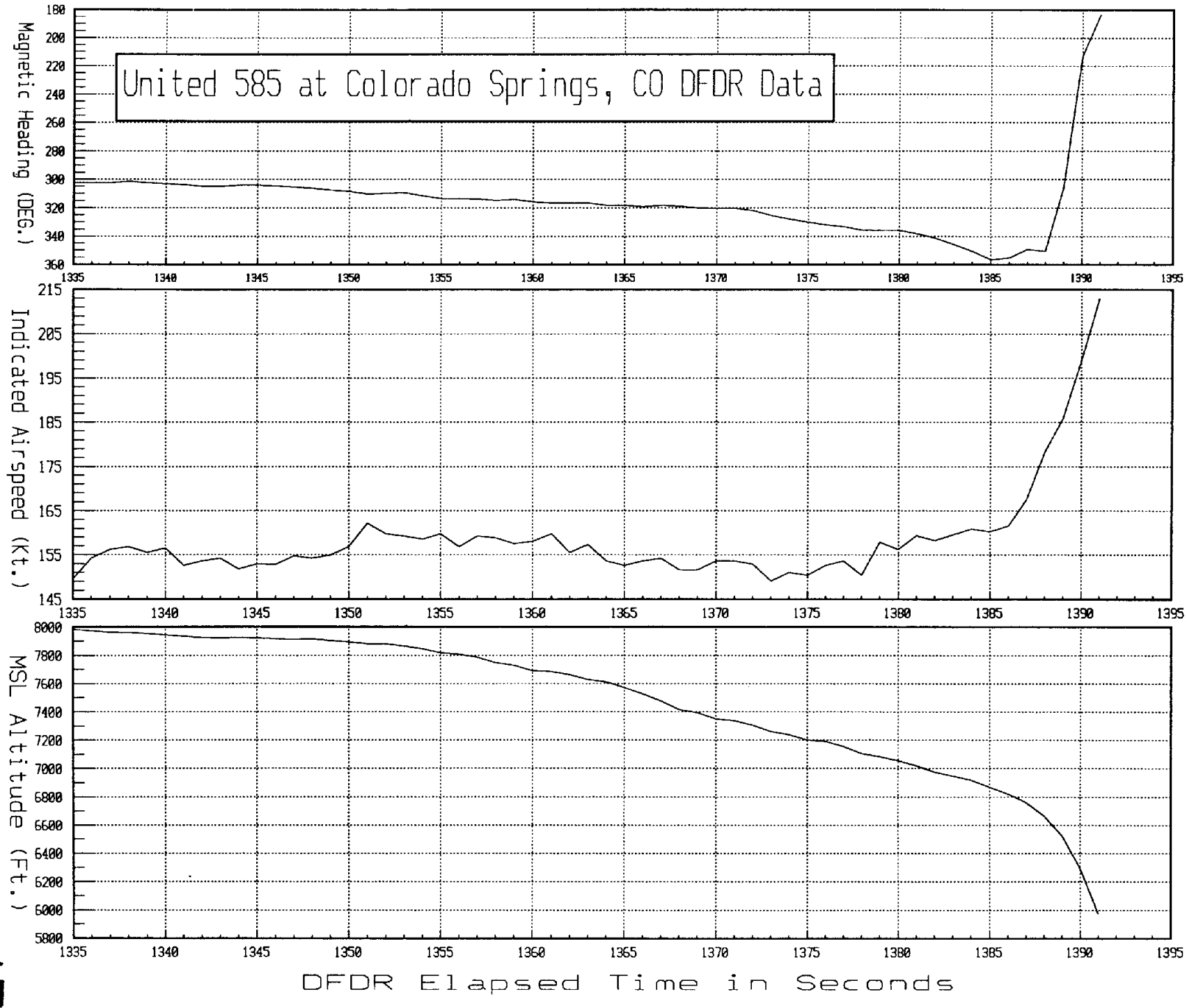
(From Exhibit 10 B)


ALTITUDE
UNITED 585
USAIR 427
ALTITUDE (FEET MSL)
ALTITUDE (FEET MSL)
11000
10000
9000
8000
7000
6000
5000
6000
5000
4000
3000
2000
1000
125
130
135
140
145
150
155
160


INDICATED AIRSPEED
UNITED 585
USAIR 427
IAS (KNOTS)
IAS (KNOTS)
230
220
210
200
190
180
170
160
150
140
260
250
240
230
220
210
200
190
180
125
130
135
140
145
150
155
160


MAGNETIC HEADING
UNITED 585
USAIR 427
MAG. HEAD (DEGS)
MAG. HEAD (DEGS)
0
60
120
180
240
300
360
125
130
135
140
145
150
155
160
ELAPSED TIME (SEC)

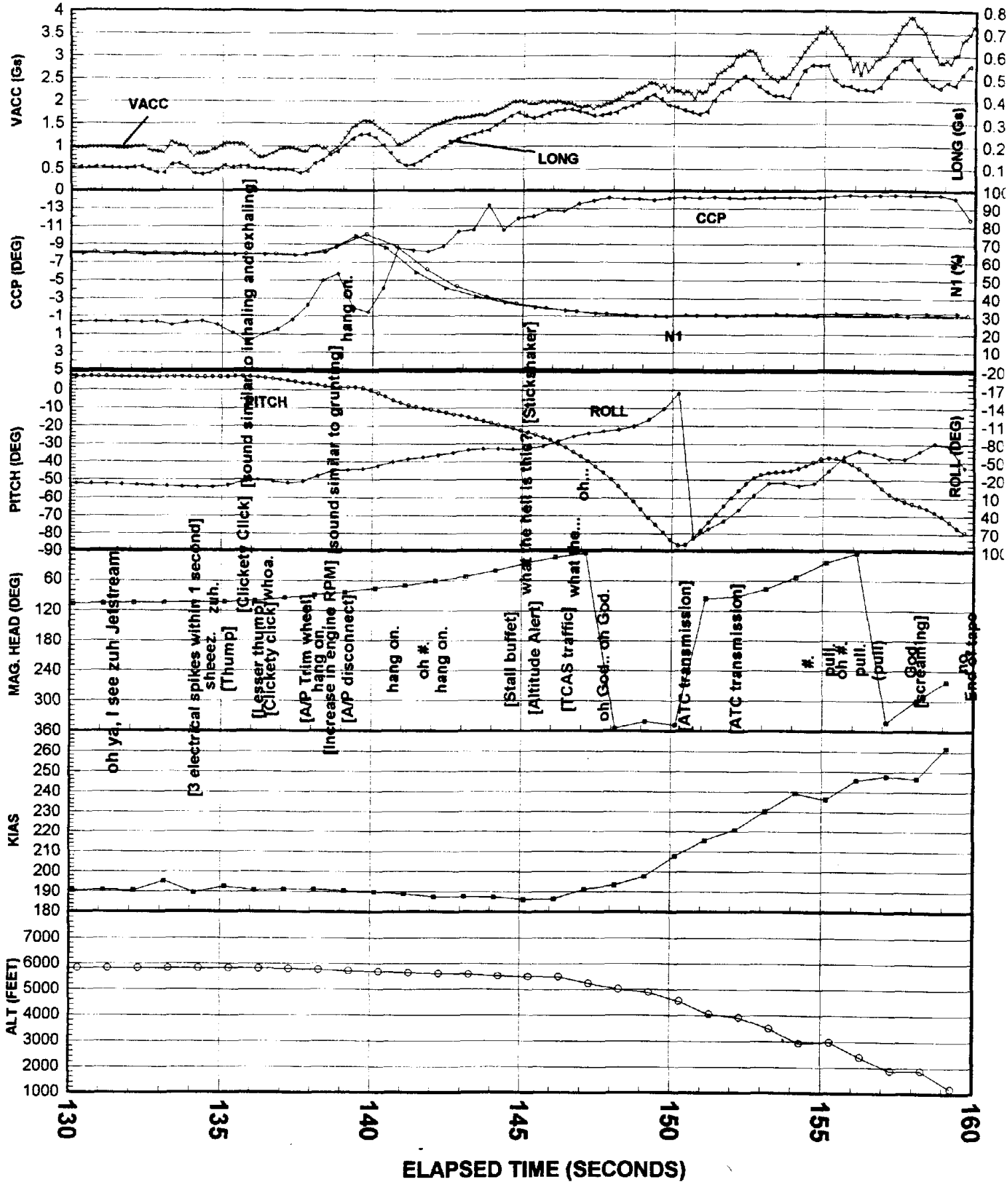
NORMAL ACCELERATION
UNITED 585
USAIR 427
NORMAL ACCEL (GS)
NORMAL ACCEL (GS)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
125
130
135
140
145
150
155
160
ELAPSED TIME (SEC)


United 585 at Colorado Springs, CO DFDR Data
Magnetic Heading (DEG.)
180
200
220
240
260
280
300
320
340
360
Indicated Airspeed (Kt.)
215
205
195
185
175
165
155
145
MSL Altitude (Ft.)
8000
7800
7600
7400
7200
7000
6800
6600
6400
6200
6000
5800
1335
1340
1345
1350
1355
1360
1365
1370
1375
1380
1385
1390
1395
DFDR Elapsed Time in Seconds

FDR / CVR Data Overlay

(From Exhibit 13 K)

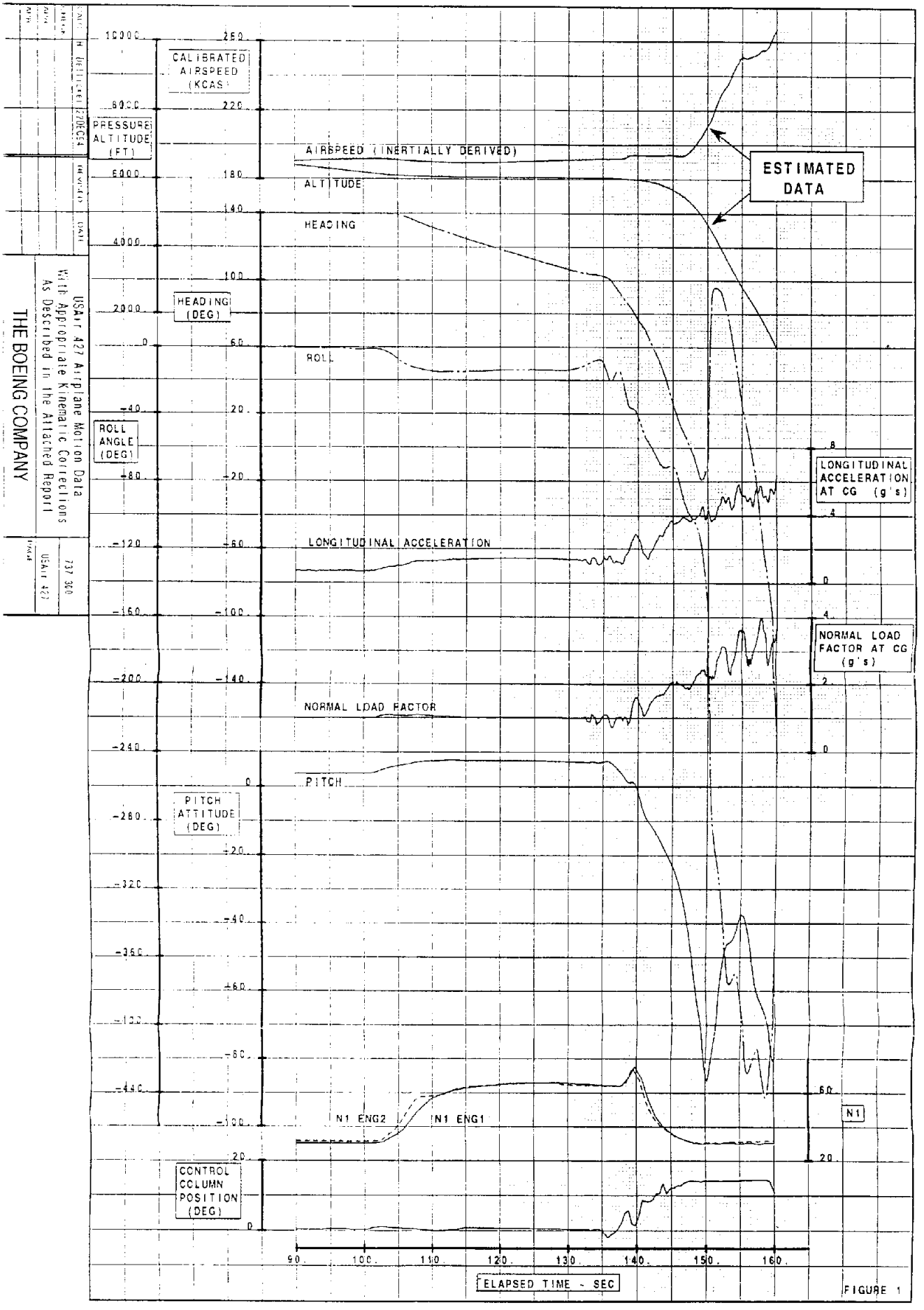
USAIR 427


VACC (Gs)
VACC
LONG
LONG (Gs)
CCP (DEG)
CCP
N1
N1 (%)
PITCH (DEG)
PITCH
ROLL
ROLL (DEG)
MAG. HEAD (DEG)
KIAS
ALT (FEET)
oh ya, I see zuh Jetstream
[3 electrical spikes within 1 second]
sheez. zuh.
[Thump]
[Clickety Click] [Sound similar to inhaling and exhaling]
[Lesser thump]
[Clickety click] whoa.
[A/P Trim wheel]
hang on.
[Increase in engine RPM] [sound similar to grunting] hang on.
[A/P disconnect]
hang on.
oh #.
hang on.
[Stall buffet]
what the hell is this? [Stickshaker]
[Altitude Alert]
[TCAS traffic] what the...
oh...
oh God... oh God.
[ATC transmission]
[ATC transmission]
#.
pull.
oh #.
pull.
(pull)
God
[screaming]
130
135
140
145
150
155
160
ELAPSED TIME (SECONDS)

Kinematic Study and Backdrive Plots

(From Exhibit 13 K)

KINEMATIC MODEL


THE BOEING COMPANY
USAir 427 Airplane Motion Data
With Appropriate Kinematic Corrections
As Described in the Attached Report
737 300
USAir 427
CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
AIRSPEED (INERTIALLY DERIVED)
ALTITUDE
HEADING
ROLL
LONGITUDINAL ACCELERATION
NORMAL LOAD FACTOR
PITCH
N1 ENG2
N1 ENG1
ESTIMATED DATA
LONGITUDINAL ACCELERATION AT CG (g's)
NORMAL LOAD FACTOR AT CG (g's)
N1
ELAPSED TIME - SEC
FIGURE 1

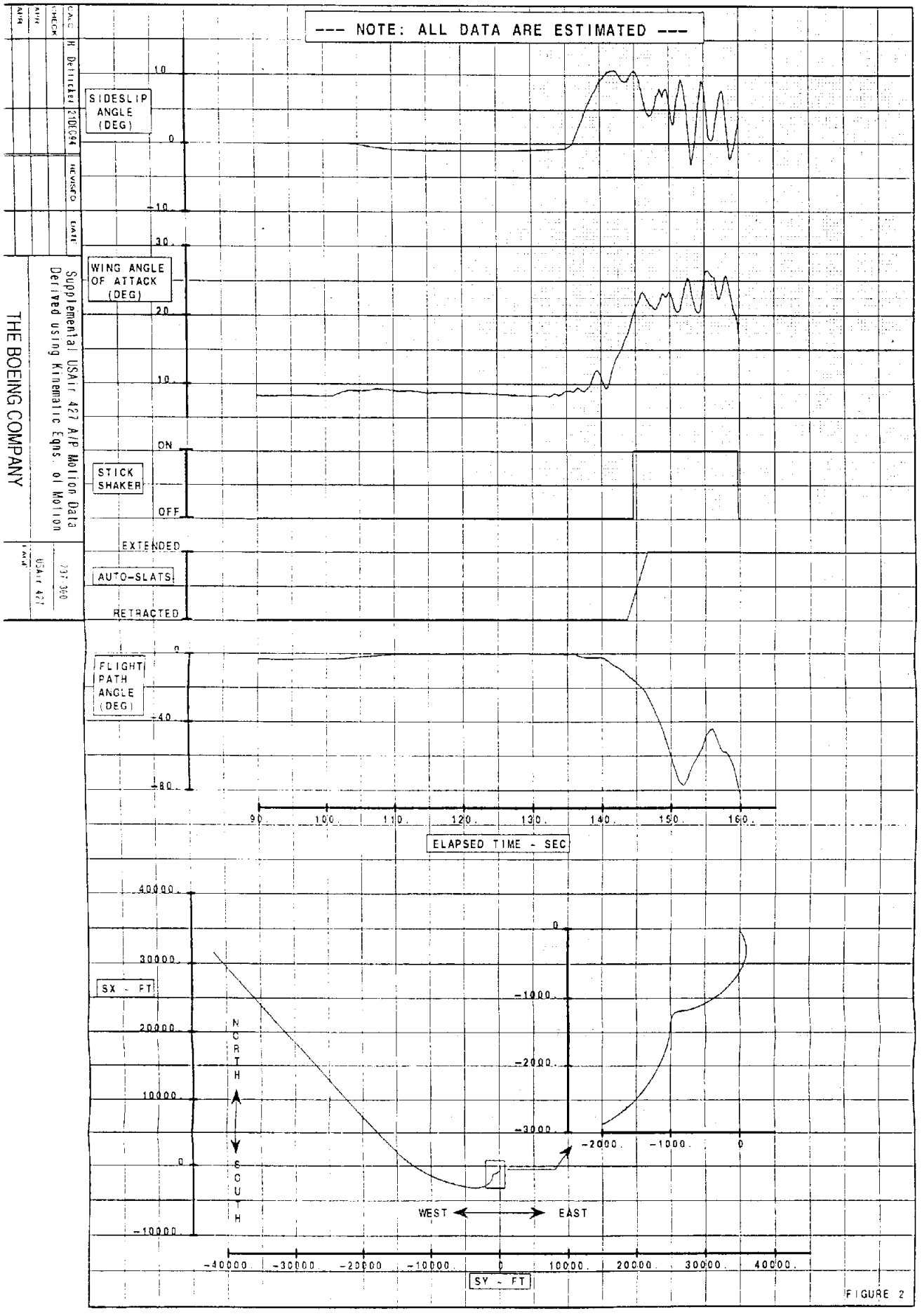
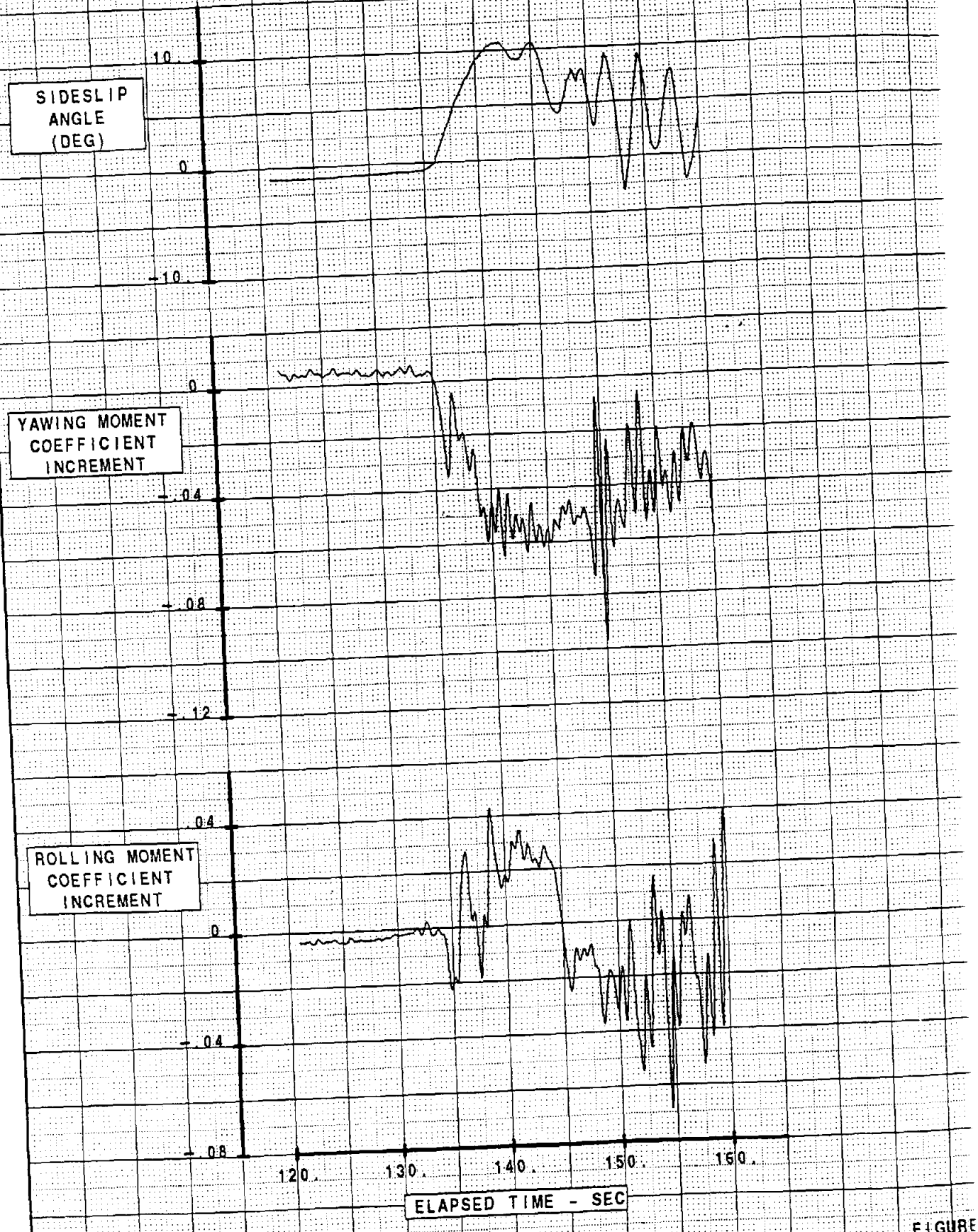


FIGURE 2

Supplemental USAir 427 A/P Motion Data
Derived using Kinematic Eqns. of Motion

THE BOEING COMPANY

--- NOTE: ALL DATA ARE ESTIMATED ---



FIGURE

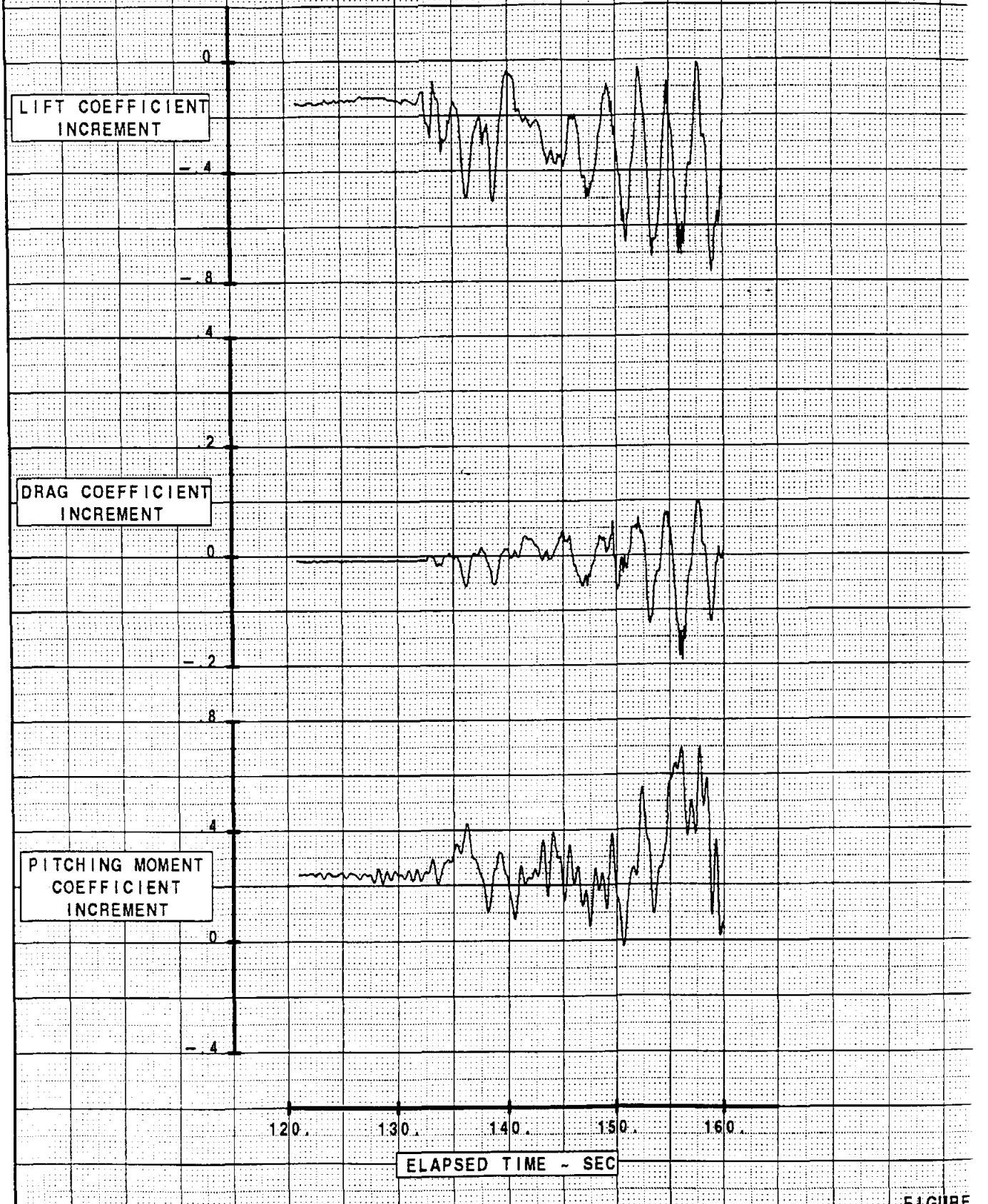
CALC	H. Dellicker	21DEC94	REVISED	DATE	USAir 427 Aerodynamic Coefficient Data -- Lateral/Directional -- (Rudder, Wheel and Stab set to Zero)
CHECK					
APR					
~~APR~~					

737-300

USAir 42

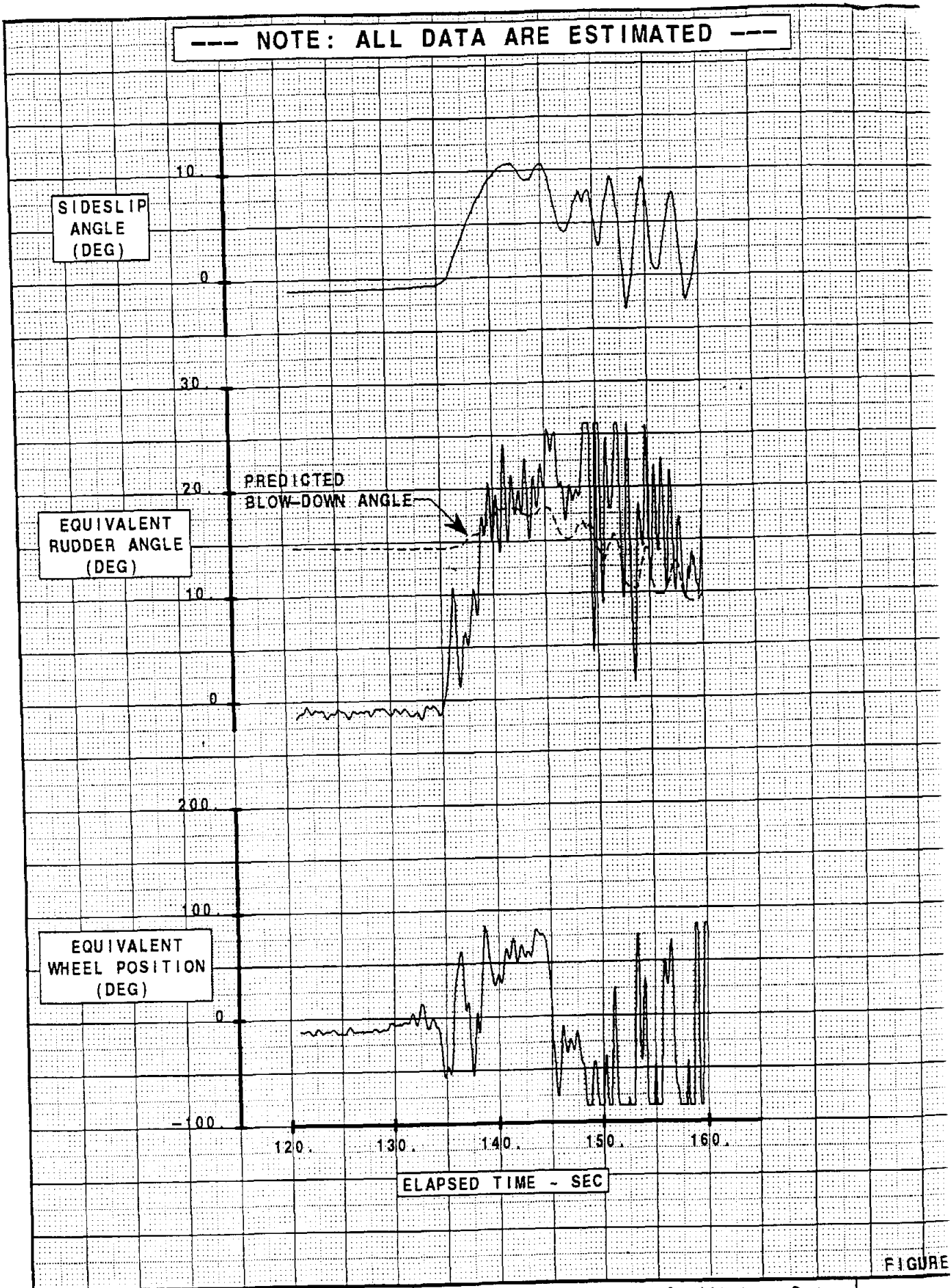
THE BOEING COMPANY

--- NOTE: ALL DATA ARE ESTIMATED ---



FIGURE

CALC	H. Dellicker	06JAN95	REVISED	DATE	USAir 427 Aerodynamic Coefficient Data -- Longitudinal -- (Rudder, Wheel and Stab set to Zero)	737-300
CHECK				-		USAir 427
APR						
APR					THE BOEING COMPANY	PAGE 25



FIGURE

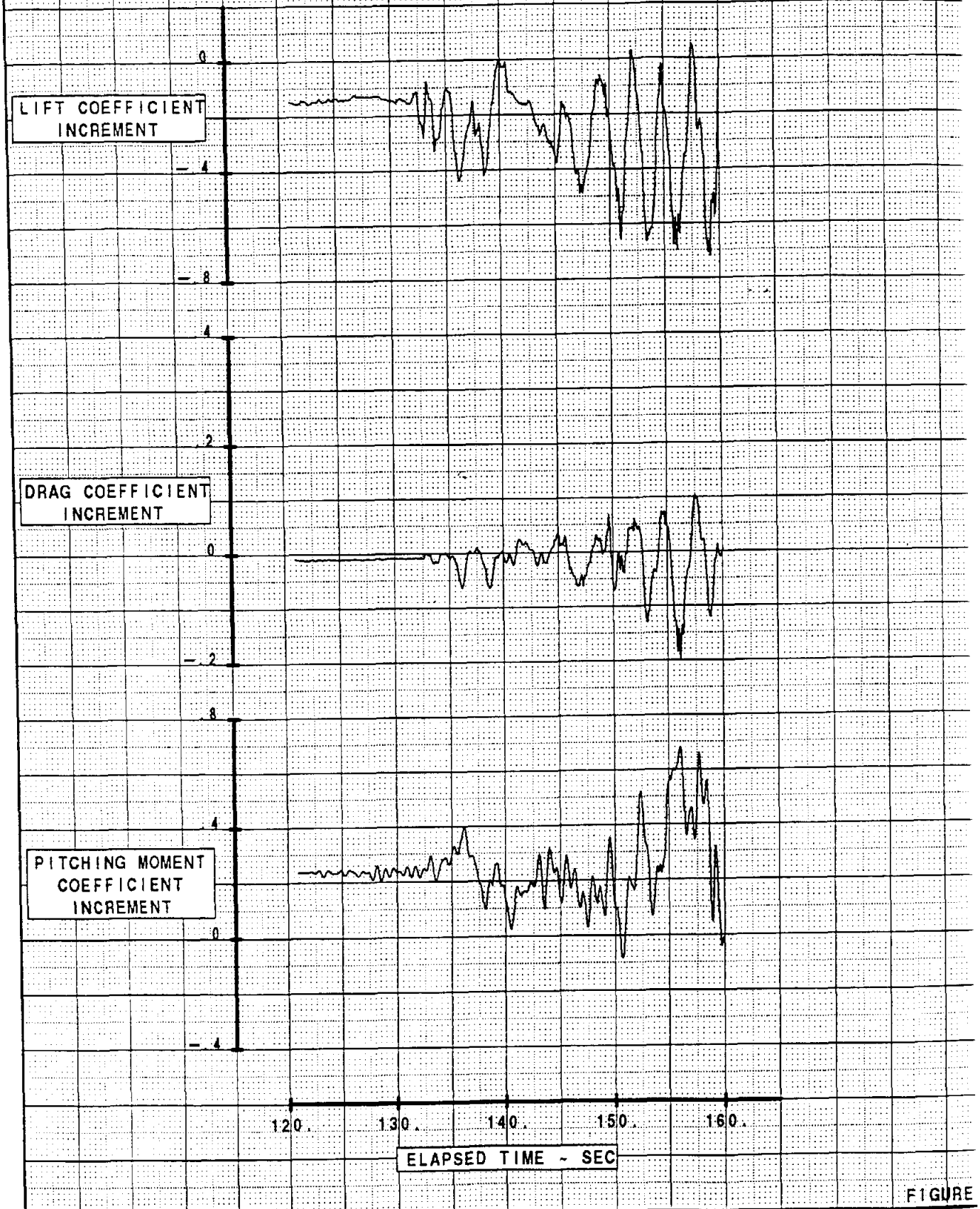
CALC	H. Dellicker	21DEC94	REVISED	DATE	USAir 427 Aerodynamic Coefficient Data -- Lateral/Directional -- (Yaw & Roll Trimmed with Rudder & Wheel
CHECK					
APR					
APR					

737-300

USAir 427

THE BOEING COMPANY

--- NOTE: ALL DATA ARE ESTIMATED ---



FIGURE

CALC	R. Dellicker	21DEC94	REVISED	DATE	USAir 427 Aerodynamic Coefficient Data -- Longitudinal -- (Yaw & Roll Trimmed with Rudder & Wheel)
CHECK				-	
APR					
APR					

737-300

USAir 427

THE BOEING COMPANY

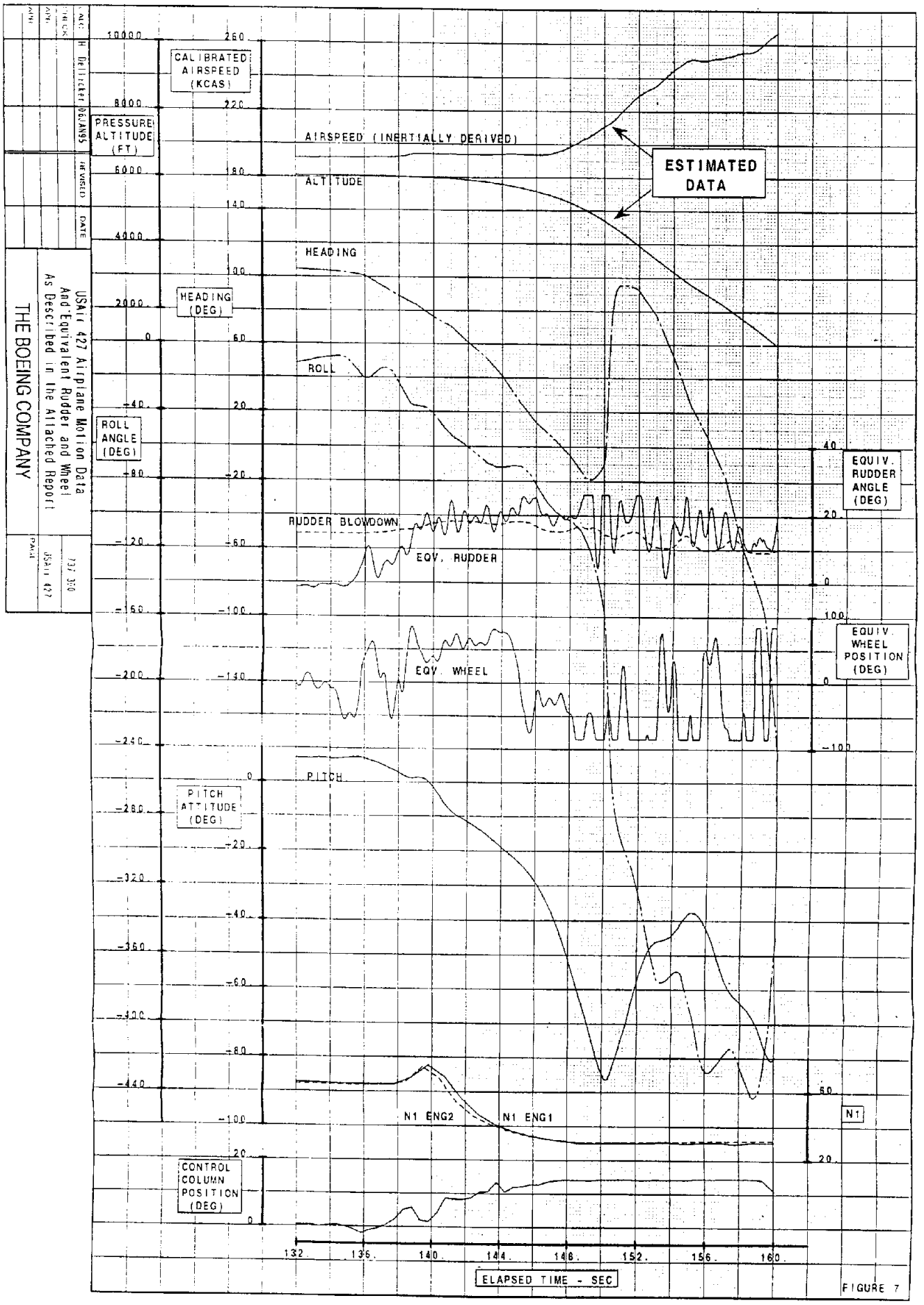
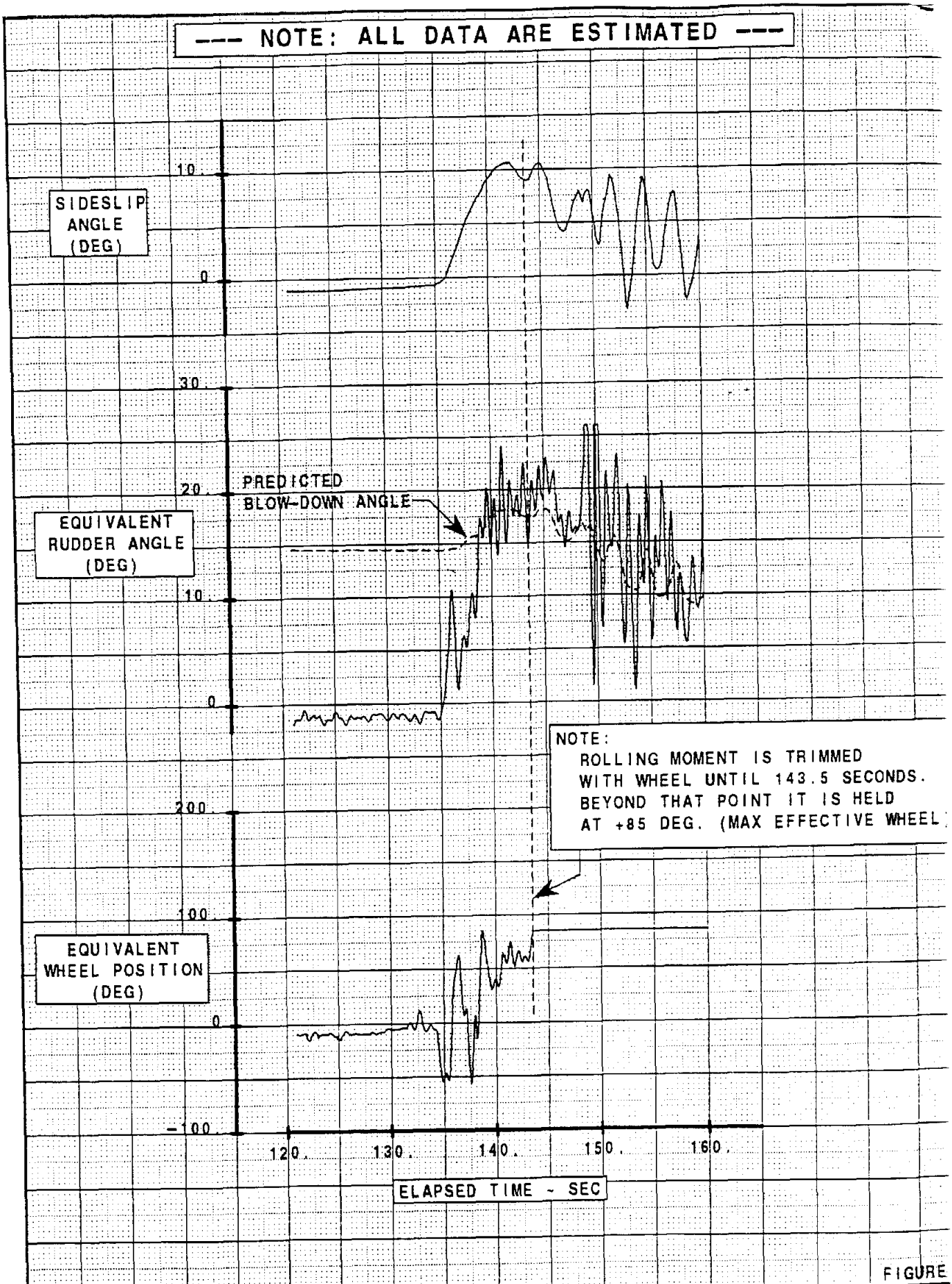

CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
EQUIV. RUDDER ANGLE (DEG)
EQUIV. WHEEL POSITION (DEG)
N1
AIRSPEED (INERTIALLY DERIVED)
ALTITUDE
HEADING
ROLL
RUDDER BLOWDOWN
EQV. RUDDER
EQV. WHEEL
PITCH
N1 ENG2
N1 ENG1
ESTIMATED DATA
ELAPSED TIME - SEC
132
136
140
144
148
152
156
160
THE BOEING COMPANY
USAir 427 Airplane Motion Data
And Equivalent Rudder and Wheel
As Described in the Attached Report

FIGURE 7



FIGURE

CALC	H. Dellicker	06JAN95	REVISED	DATE
CHECK				
APR				
APR				

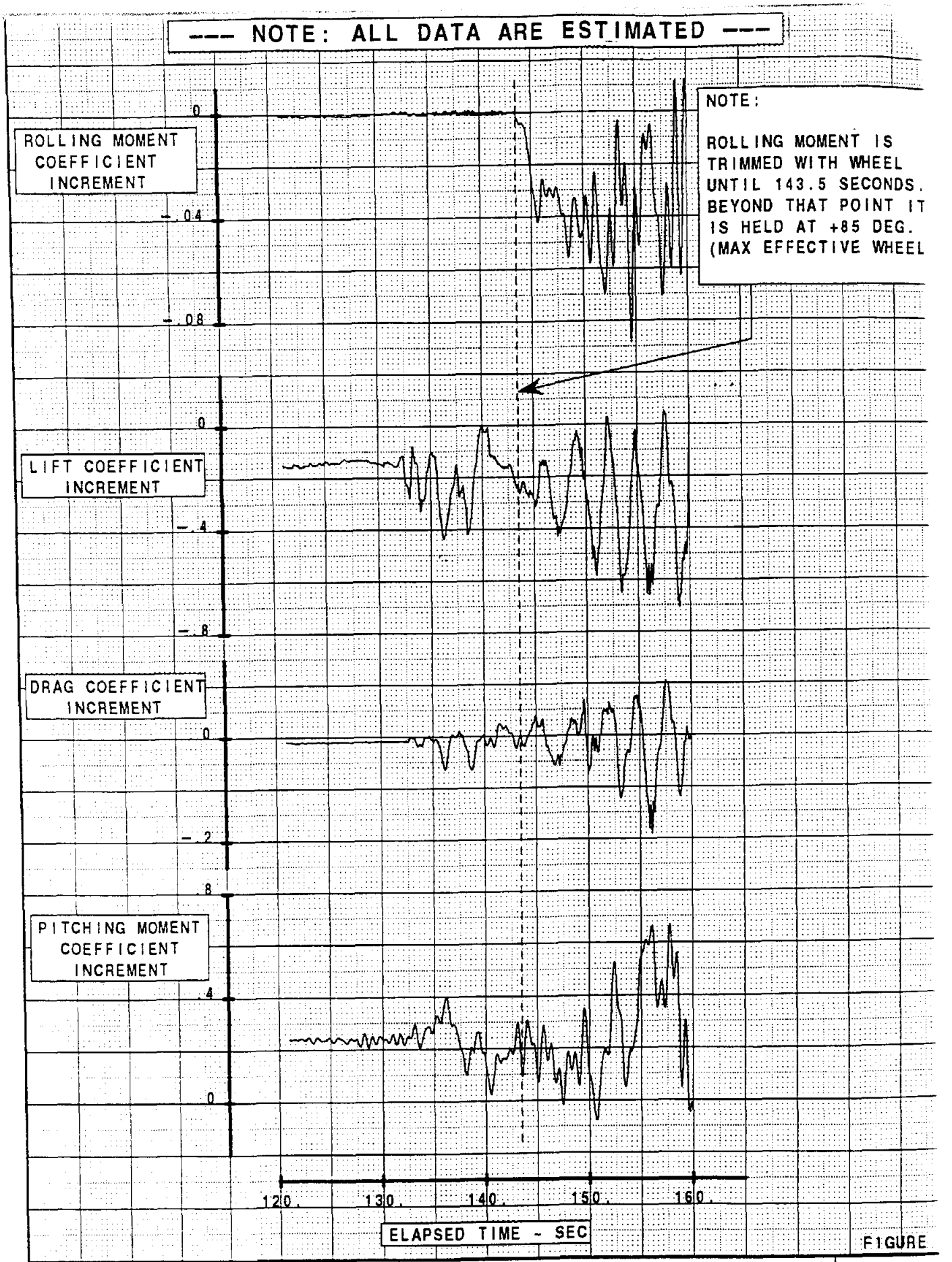
USAir 427 Aerodynamic Coefficient Data
-- Lateral/Directional --
(Yaw Trimmed w/Rudder: Roll, see Note)

737-300

USAir 427

THE BOEING COMPANY

--- NOTE: ALL DATA ARE ESTIMATED ---



FIGURE

CALC	H. Dellicker	06JAN95	REVISED	DATE	USAir 427 Aerodynamic Coefficient Data -- Lateral/Directional & Longitudinal -- (Yaw Trimmed w/Rudder)
CHECK				-	
APR					
APR					

737-300

USAir 427

THE BOEING COMPANY

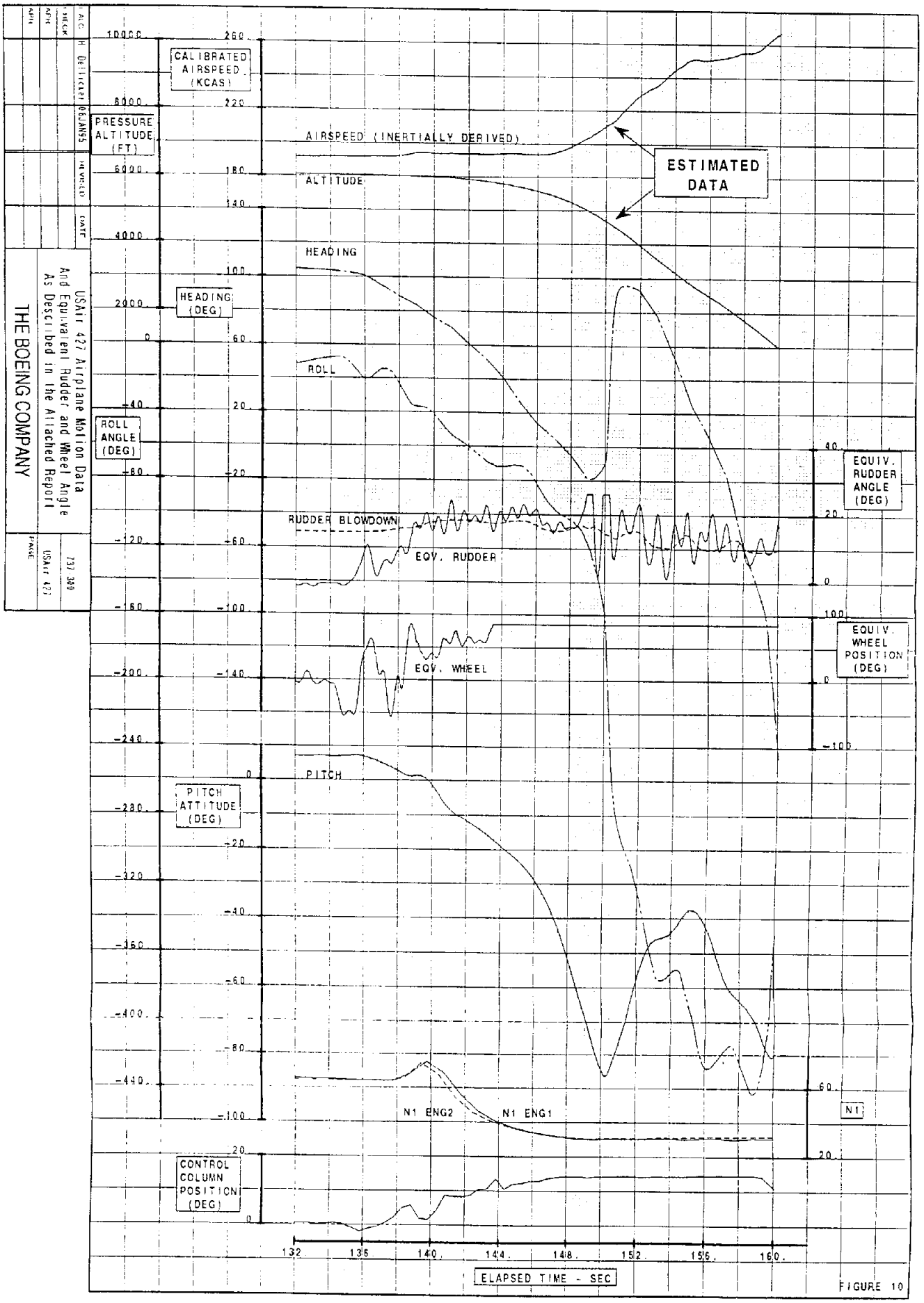
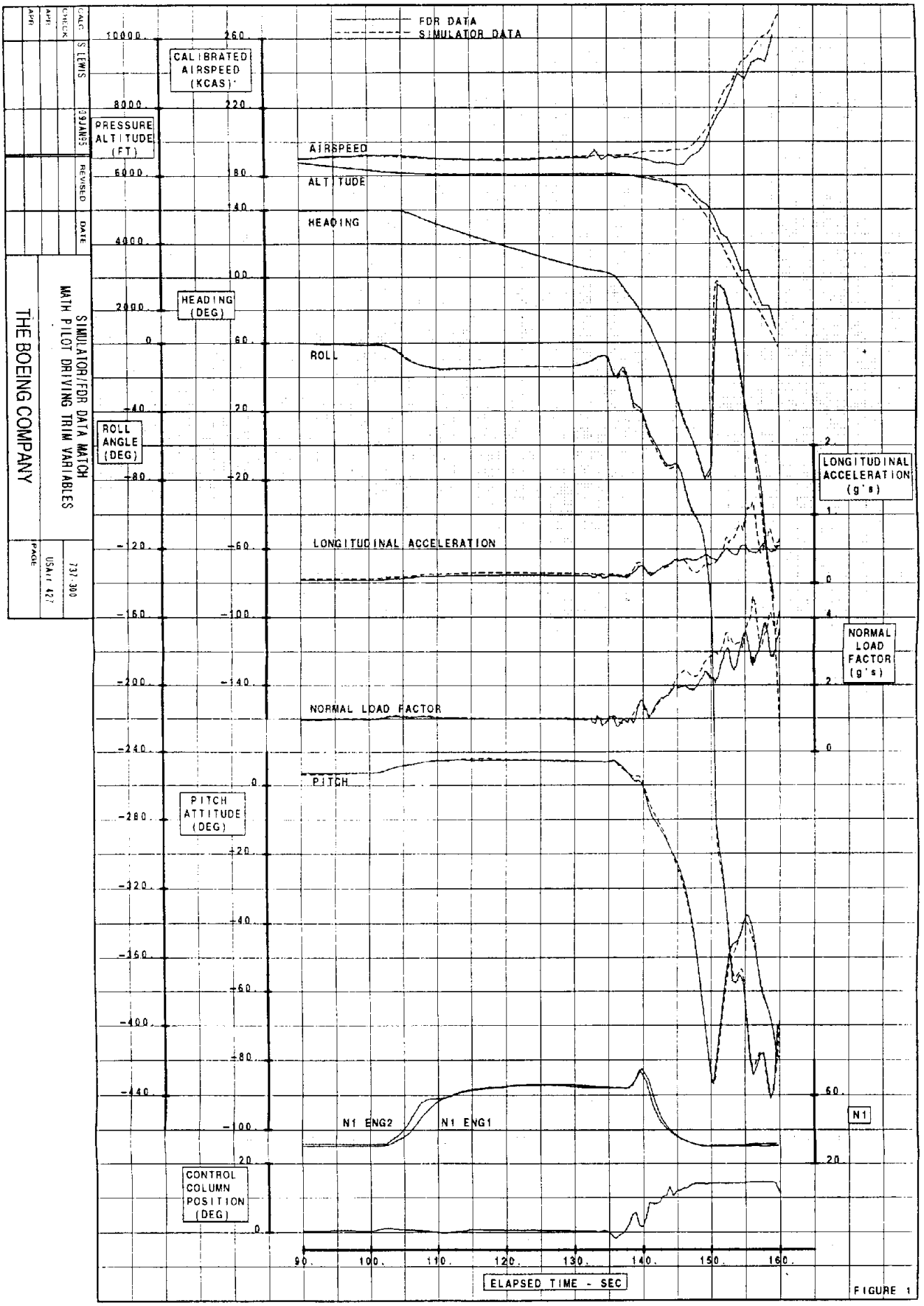
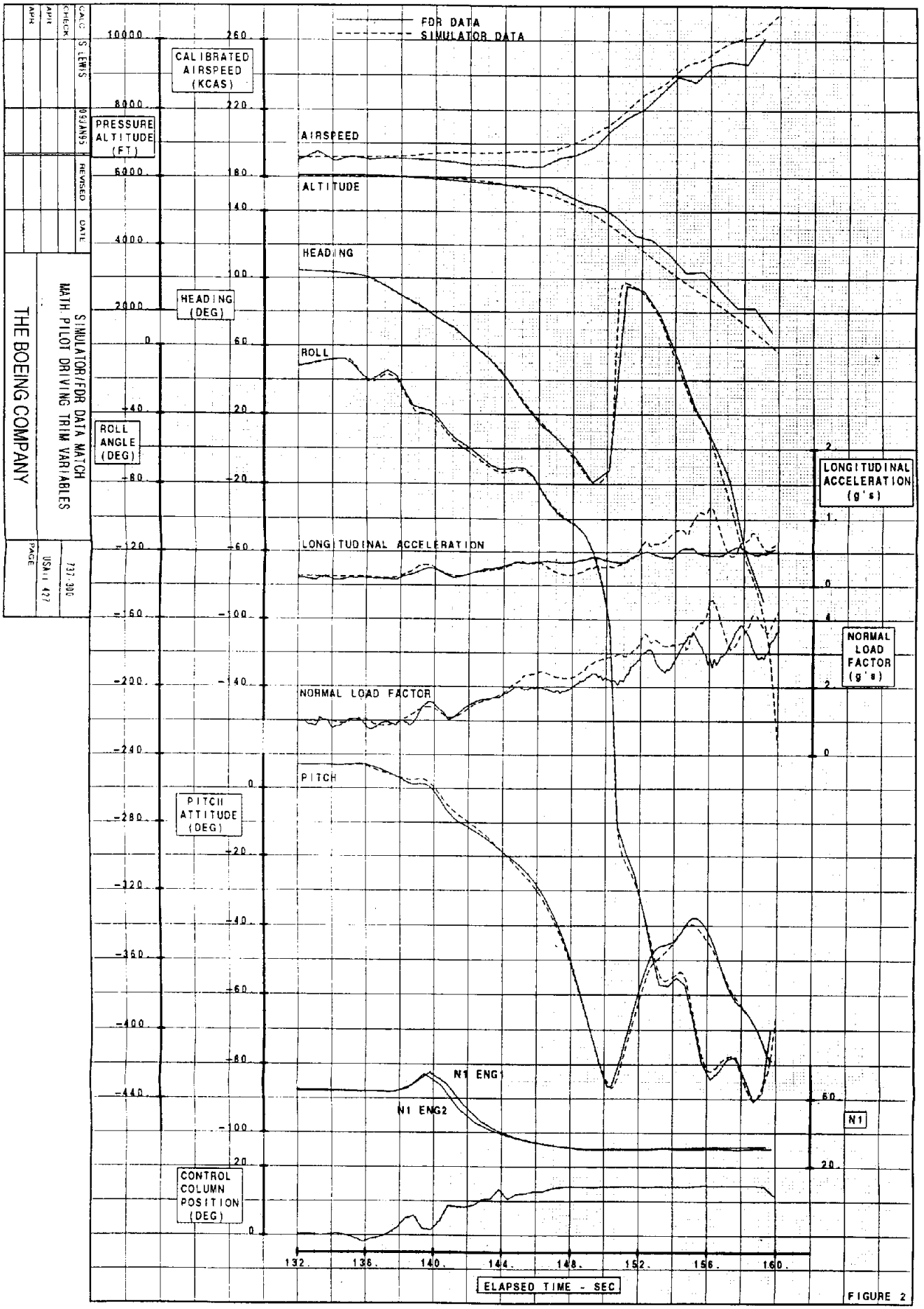

CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
EQUIV. RUDDER ANGLE (DEG)
EQUIV. WHEEL POSITION (DEG)
N1
AIRSPEED (INERTIALLY DERIVED)
ALTITUDE
ESTIMATED DATA
HEADING
ROLL
RUDDER BLOWDOWN
EQV. RUDDER
EQV. WHEEL
PITCH
N1 ENG2
N1 ENG1
ELAPSED TIME - SEC
THE BOEING COMPANY
USAir 427 Airplane Motion Data And Equivalent Rudder and Wheel Angle As Described in the Attached Report
737-300
USAir 427

FIGURE 10

BACKDRIVE MODEL


FDR DATA
SIMULATOR DATA
CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
LONGITUDINAL ACCELERATION (g's)
NORMAL LOAD FACTOR (g's)
N1
AIRSPEED
ALTITUDE
HEADING
ROLL
LONGITUDINAL ACCELERATION
NORMAL LOAD FACTOR
PITCH
N1 ENG2
N1 ENG1
ELAPSED TIME - SEC
SIMULATOR/FDR DATA MATCH
MATH PILOT DRIVING TRIM VARIABLES
THE BOEING COMPANY
737-300
USAir 427
FIGURE 1


FDR DATA
SIMULATOR DATA
CALIBRATED AIRSPEED (KCAS)
PRESSURE ALTITUDE (FT)
HEADING (DEG)
ROLL ANGLE (DEG)
PITCH ATTITUDE (DEG)
CONTROL COLUMN POSITION (DEG)
AIRSPEED
ALTITUDE
HEADING
ROLL
LONGITUDINAL ACCELERATION
NORMAL LOAD FACTOR
PITCH
N1 ENG1
N1 ENG2
LONGITUDINAL ACCELERATION (g's)
NORMAL LOAD FACTOR (g's)
N1
ELAPSED TIME - SEC
FIGURE 2
THE BOEING COMPANY
SIMULATOR/FDR DATA MATCH
MATH PILOT DRIVING TRIM VARIABLES
737-300
USA-11427
PAGE

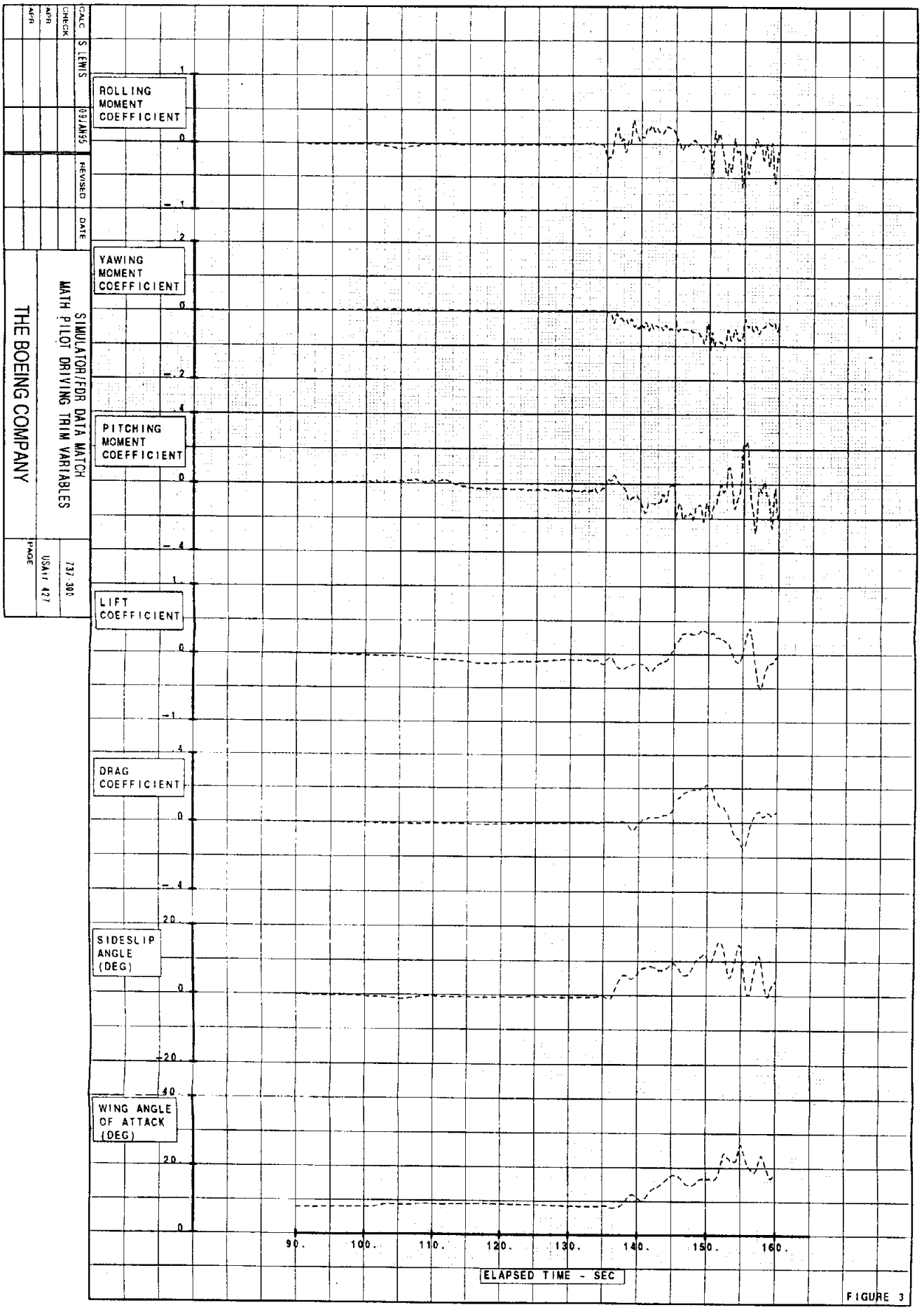

ROLLING MOMENT COEFFICIENT
YAWING MOMENT COEFFICIENT
PITCHING MOMENT COEFFICIENT
LIFT COEFFICIENT
DRAG COEFFICIENT
SIDESLIP ANGLE (DEG)
WING ANGLE OF ATTACK (DEG)
90.
100.
110.
120.
130.
140.
150.
160.
ELAPSED TIME - SEC
CALC S LEWIS 09JAN95
CHECK
APR
APR
REVISED
DATE
THE BOEING COMPANY
SIMULATOR/FDR DATA MATCH
MATH PILOT DRIVING TRIM VARIABLES
737-300
USA11 427
PAGE

FIGURE 3

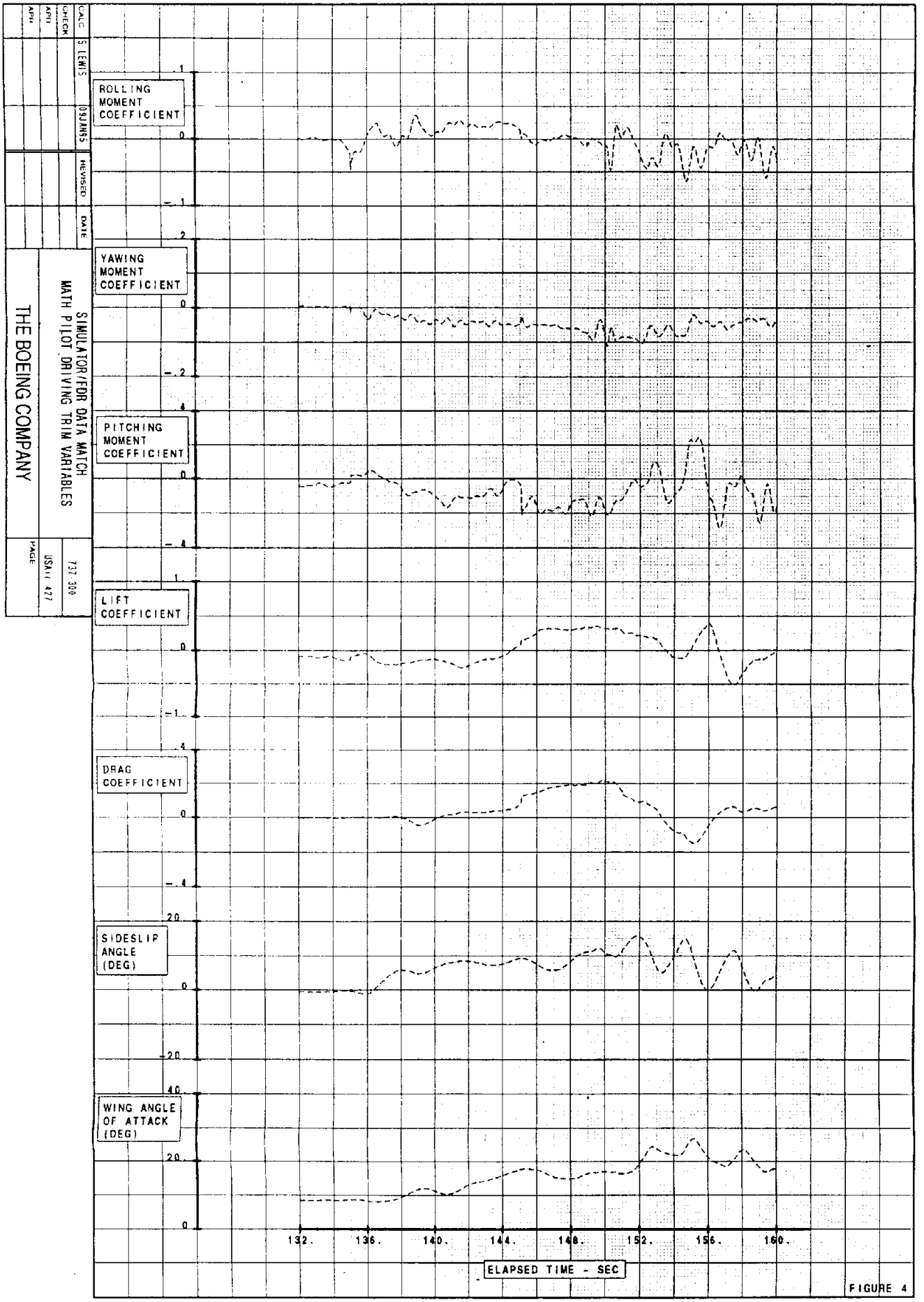
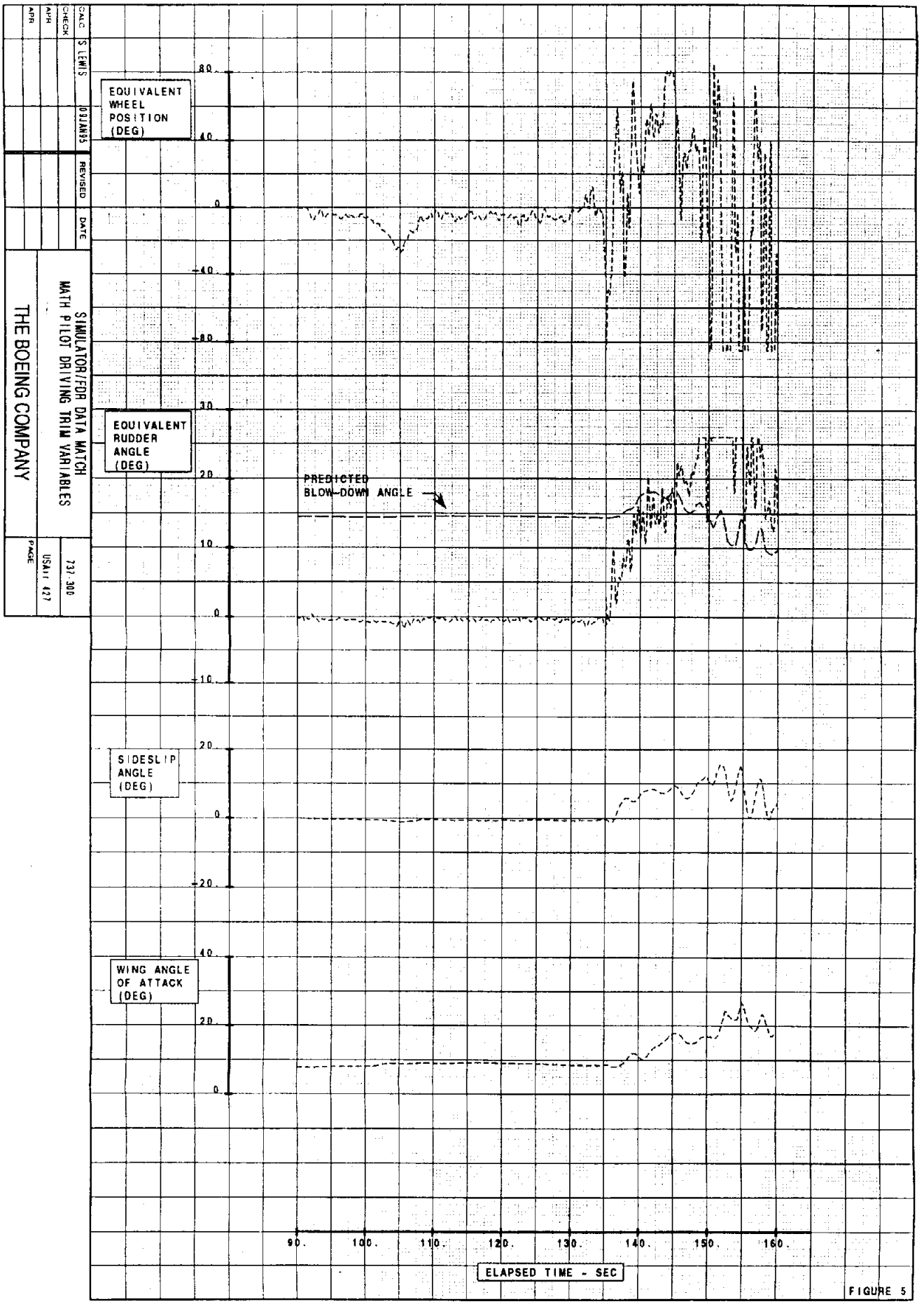
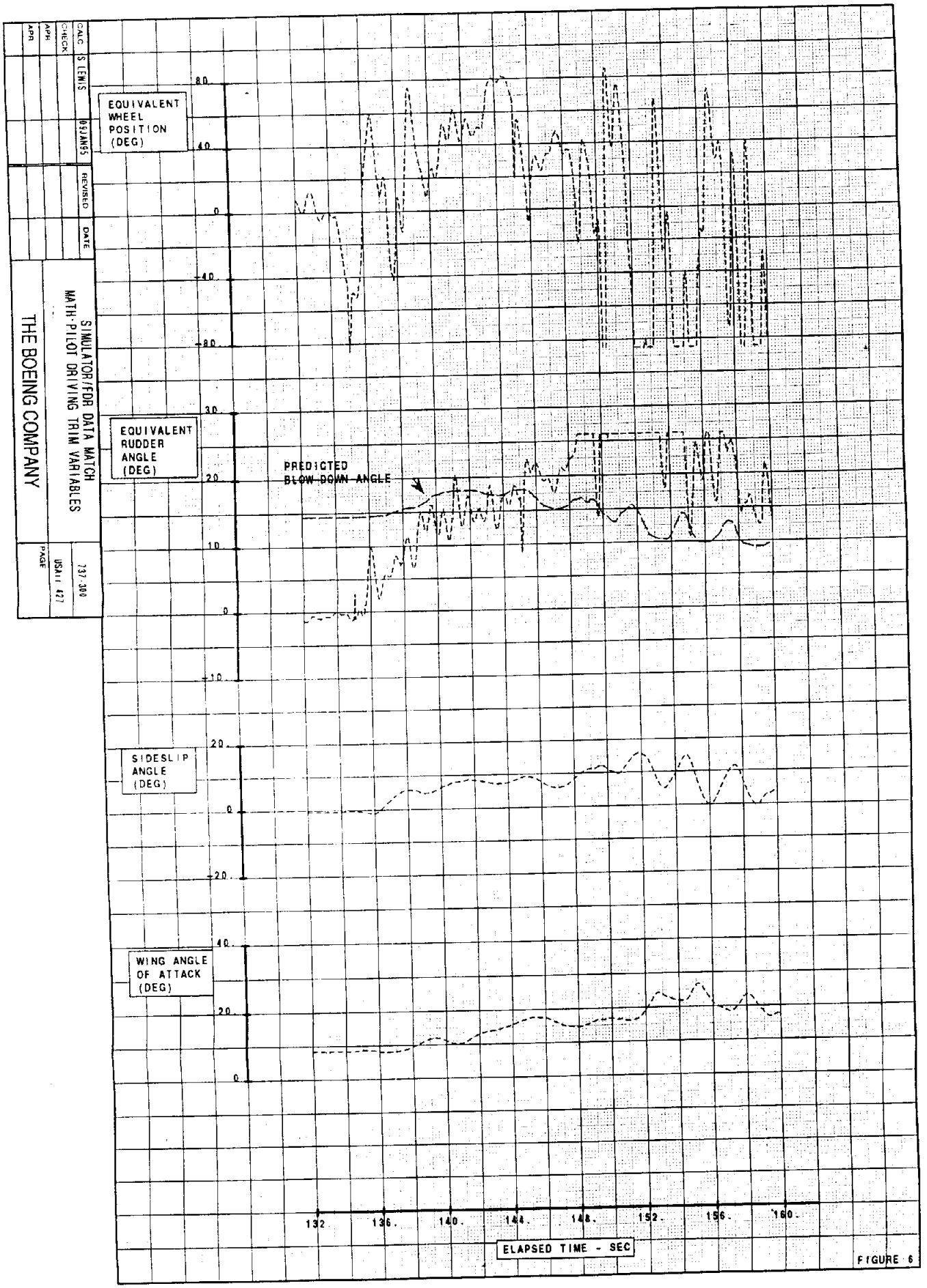

CALC
S LEWIS
CHECK
APPI
APPI
REVISED
DATE
THE BOEING COMPANY
SIMULATOR/FDR DATA MATCH
MATH PILOT DRIVING TRIM VARIABLES
737 300
USA11 427
PAGE
ROLLING MOMENT COEFFICIENT
1
0
-1
YAWING MOMENT COEFFICIENT
.2
0
-.2
PITCHING MOMENT COEFFICIENT
.4
0
-.4
LIFT COEFFICIENT
1
0
-1
DRAG COEFFICIENT
.4
0
-.4
SIDESLIP ANGLE (DEG)
20
0
-20
WING ANGLE OF ATTACK (DEG)
40
20
0
132.
136.
140.
144.
148.
152.
156.
160.
ELAPSED TIME - SEC

FIGURE 4


EQUIVALENT WHEEL POSITION (DEG)
80
40
0
-40
-80
EQUIVALENT RUDDER ANGLE (DEG)
30
20
10
0
-10
PREDICTED BLOW-DOWN ANGLE
SIDESLIP ANGLE (DEG)
20
0
-20
WING ANGLE OF ATTACK (DEG)
40
20
0
90.
100.
110.
120.
130.
140.
150.
160.
ELAPSED TIME - SEC
FIGURE 5
CALC
S LEWIS
CHECK
APP
APP
09JAN95
REVISED
DATE
THE BOEING COMPANY
SIMULATOR/FDR DATA MATCH
MATH PILOT DRIVING TRIM VARIABLES
737-300
USAir 427
PAGE


EQUIVALENT WHEEL POSITION (DEG)
80
40
0
-40
-80
EQUIVALENT RUDDER ANGLE (DEG)
30
20
10
0
-10
PREDICTED BLOW-DOWN ANGLE
SIDESLIP ANGLE (DEG)
20
0
-20
WING ANGLE OF ATTACK (DEG)
40
20
0
132.
136.
140.
144.
148.
152.
156.
160.
ELAPSED TIME - SEC
FIGURE 6
CALC S LEWIS 05JAN95
CHECK
APPR
REVISED
DATE
THE BOEING COMPANY
SIMULATOR/FDR DATA MATCH
MATH-PILOT DRIVING TRIM VARIABLES
737-300
USAir 427
PAGE