Docket No: SA - 509

Exhibit No: 10 A

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

GROUP CHAIRMAN'S FACTUAL REPORT
DIGITAL FLIGHT DATA RECORDER

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Washington, D.C.

August 30, 1994

GROUP CHAIRMAN'S FACTUAL REPORT - DIGITAL FLIGHT DATA RECORDER
DCA-94-MA-065

A. ACCIDENT

Location	:	Charlotte, North Carolina
Date	:	July 2, 1994
Time	:	Approximately 1843 Local (EDT)
Aircraft	:	USAir Inc., Flight 1016, a Douglas DC-9-30, N954VJ

B. GROUP

Chairman: Tom Jacky, National Transportation Safety Board
Member: H. Keith Hagy, Airline Pilots Association
Member: Captain Paris Michaels, USAir Inc.
Member: Frank Rock, Federal Aviation Administration
Member: Steve Lund, Douglas Aircraft Company

C. SUMMARY

On July 2, 1994, about 1843 eastern daylight time (EDT), a Douglas DC-9-31, N954VJ, owned by USAir, Inc., and operated as USAir flight 1016, touched down in a field, then collided with trees and a private residence while executing a missed-approach for the instrument landing system (ILS) approach to runway 18R at the Charlotte/Douglas International Airport in Charlotte, North Carolina. The captain and one flight attendant received minor injuries; the first officer, two flight attendants and 18 passengers sustained serious injuries; and 37 passengers received fatal injuries. The airplane was destroyed by impact forces and a post-accident fire. Instrument meteorological conditions prevailed during the final portion of the flight, and an instrument flight rules (IFR) flight plan had been filed. Flight 1016 was being conducted under 14 Code of Federal Regulation (CFR), Part 121, as a domestic, scheduled passenger service flight from Columbia, South Carolina, to Charlotte.

The digital flight data recorder (DFDR), a Loral Fairchild Data Systems model S703-1000-00 (F1000) Solid State Flight Data Recorder (SSFDR), s/n 00880, was removed from the airplane at the Charlotte/Douglas International Airport following the accident. The recorder was sent to the National Transportation Safety Board's (NTSB) flight recorder laboratory in Washington, D.C., where recorder readout and evaluation were conducted by Office of Research & Engineering

personnel.

Readout of the SSFDR was then accomplished using the laboratory's playback hardware. The quality of the recording was excellent; the transcription contained no loss of data. Transcriptions of the pertinent portion of Flight 1016 were prepared and included in this report.

Readout of the recorder indicated 24 minutes of flight from Columbia, South Carolina, until the end of the recording. The final two minutes of data revealed the following:

1) Approximately two minutes prior to end of the recording (the recording ended at a relative time of 1009:30), USAir 1016 was descending through a pressure altitude of 2000' while on a magnetic heading of about 180° magnetic and an airspeed of about 139 KIAS. USAir 1016's descent continued through a relative time of 1009:11, 19 seconds prior to the end of the recording, when a local minimum altitude of 849' was recorded. At 1009:12 relative time, the pressure altitude began increasing until 1009:20 relative time, when a local maximum pressure altitude of 1019' was recorded. Then, for the final 10 seconds of recorded data, the altitude decreased, with a final recorded pressure altitude value of 656'.

2) During the descent from 2000' to 849', the recorded indicated airspeed values varied from a minimum of 135.8 KIAS, recorded at 1007:54 relative time, to a maximum of 157.7 KIAS, recorded at 1008:54 relative time. At 1009:11 relative time, while at the local minimum altitude of 849', USAir 1016's indicated airspeed was recorded as 146.2 KIAS. For the next 11 seconds, until 1009:22 relative time, the airspeed decreased to minimum of 115.8 KIAS. During the final eight seconds of recorded data, the indicated airspeed increased to the final recorded value of 149.0 KIAS.

3) During the descent from 2000', USAir 1016's magnetic heading varied from about 177° to 185°. At 1008:56 relative time, while at an altitude of 1035' and an airspeed of 155.4 KIAS, 1016's heading was 181.7° magnetic. From 1008:56 until the end of the recording, 1016's recorded heading generally increased to a final recorded value of 214.2°.

4) During the descent from 2000', 1016's pitch values fluctuated between about -3.5° and +2.5° and roll values between about + or - 7°. At 1009:03 relative time, the pitch values increased from -1.7° AND to a maximum recorded value of 15.0° ANU at 1009:16 relative time. The roll values increased from -2.1° LWD at 1009:06 relative time, to a maximum of 17.4° RWD at 1009:16 relative time. During the final 14 seconds of recorded data, the pitch values decreased to -5.0° AND at 1009:25, increased to about 4.0° ANU, and a final recorded

value of 0.8° ANU. The roll values also decreased, to 0.2° RWD at 1009:25 relative time, and fluctuated to about 10° RWD for the remainder of the recording.

5) During the descent below 2000', 1016's EPR values were constant, at 1.28 and 1.29 for the left and right engines, respectively, until 1008:38 relative time, when both EPRs increased, over the next eight seconds, to 1.37 and 1.33, left and right engines, respectively. Both values remained constant for about 4 seconds, and then decreased until 1008:54 relative time, when the values reached constant values of 1.21 and 1.17, left and right engine, respectively. At 1009:09 the values started increasing, first to 1.81 and 1.83 at 1009:21, and then to maximum recorded values of 2.09 at 1009:28 for the left engine, and 1.99, at 1009:26, for the right engine. The final recorded left engine EPR value was 1.95, and the final recorded right engine value, after decreasing from 1.99, was 1.57.

D. DETAILS OF INVESTIGATION

1. Description of Recorded Data

This model Solid State Flight Data Recorder records Aeronautical Radio Incorporated (ARINC) 542A airplane flight information (expanded from 5 to 11 parameters) in a digital format using solid-state Flash Memory as the recording medium. The SSFDR installed in N954VJ recorded 64 12-bit words of digital information every second. Each grouping of 64 words (each second) is called a subframe. Each subframe has a unique 12-bit synchronization (sync) word identifying it as either subframe 1, 2, 3, or 4. The sync word is the first word in each subframe. The data stream is "in sync" when successive sync words appear at proper 64-word intervals. Each data parameter (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe.

If the data stream is interrupted, the sync words will not appear at the proper interval or sequence and sync will be lost along with the affected data. For example, an interruption of electrical power to the SSFDR will interrupt the serial data stream and cause a loss of sync.

The most recent 25 hours of operation are required to be retained on the recording medium. This is accomplished by erasing the oldest recorded data and replacing it with the newest. However, the SSFDR's memory compression capability enabled approximately thirty-three hours of flight data to be recorded.

A table of the parameters recorded by the SSFDR is included in Attachment 1. Included in the table are each

parameter's source, sign convention, and data word slot(s). Also included in Attachment 1 is a flight recorder component location and flight recorder functional diagram, supplied by the aircraft manufacturer. The diagram does not indicate the component locations of the engine 1 and 2 EPR, aircraft pitch and roll, longitudinal acceleration, and captain's control column parameters.

2. Examination and Readout

A. Examination

The SSFDR was removed from the accident airplane and sent to the Vehicle Performance laboratory in Washington, D.C. Upon receipt, the recorder was opened and examined for damage. The dust cover was spattered with mud and dust, but the internal electronic components, and crash-survivable storage unit exhibited no indication of damage or excessive wear.

B. Readout

A multiple floppy disk copy of the data was made using the built-in playback feature of the SSFDR and the laboratory's Loral Fairchild Read Out Center (ROC). After completion of the copying procedure, the SSFDR data was scanned for data consistent with the accident flight. Once the accident data were located, the ROC was used to create a quick-access computer file. The quick-access file was used for all further data processing.

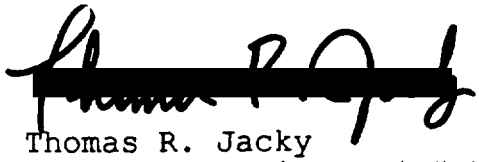
The transcribed data were reduced from the recorded binary decimal values (0 to 4095) to engineering units (e.g., feet, knots, degrees, etc.) by conversion formulas obtained from the recorder manufacturer and the airlines. The actual conversion is accomplished by an automated process that incorporates the laboratory's Loral Fairchild Read Out Center and associated software. Relative (elapsed) time, recorded by the SSFDR, from the beginning of the data transcription was used as a time base for data output.

The data frame being transcribed prior to the loss of SSFDR power was unrecoverable by the ROC. In order to retrieve the partial frame (or "purge frame", as described by the SSFDR manufacturer), a floppy disk copy of the SSFDR data was sent to the recorder manufacturer. Manufacturer's personnel were able to recover the partial frame. The size of the partial frame was 62 words, less than one subframe. The partial frame, denoted as subframe 1, was included to the end of the accident data, and is reflected in the data printouts.

3. Data Printouts and Graphs

Data from the entire flight from Columbia, South Carolina, through the end of the recording (0935:00 to 1009:30 relative time), were made available to each group member. For this report, however, printouts of selected parameters during the section of flight progressing through the accident, from 1008:00 to 1009:30 relative time, are included in Attachment 2. Because of a limited amount of space per page, the data are presented in three data files. However, data from different files may be aligned by use of relative time, which is consistent between data sets. The relative time of the purge frame data is 1009:30.

Two plots of selected parameters were developed for the report. Plot 1 graphs the final 60 seconds of data, plot 2 the final 30 seconds of data.



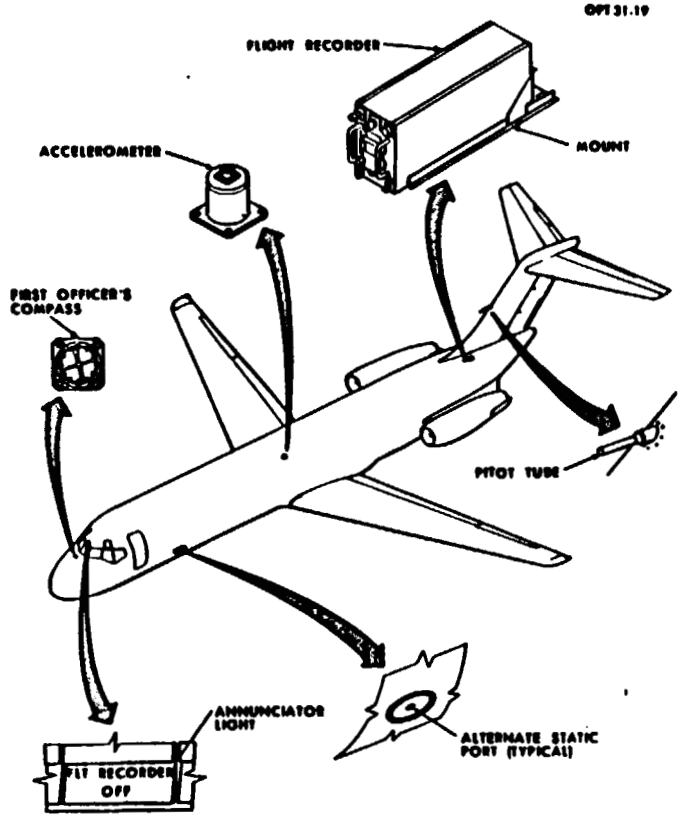
Thomas R. Jacky
Aerospace Engineer (DFDR)

Attachment
1. Table of SSFDR Parameters and Data Sources
2. USAir Flight 1016 Data Sets
3. USAir Flight 1016 Data Plot

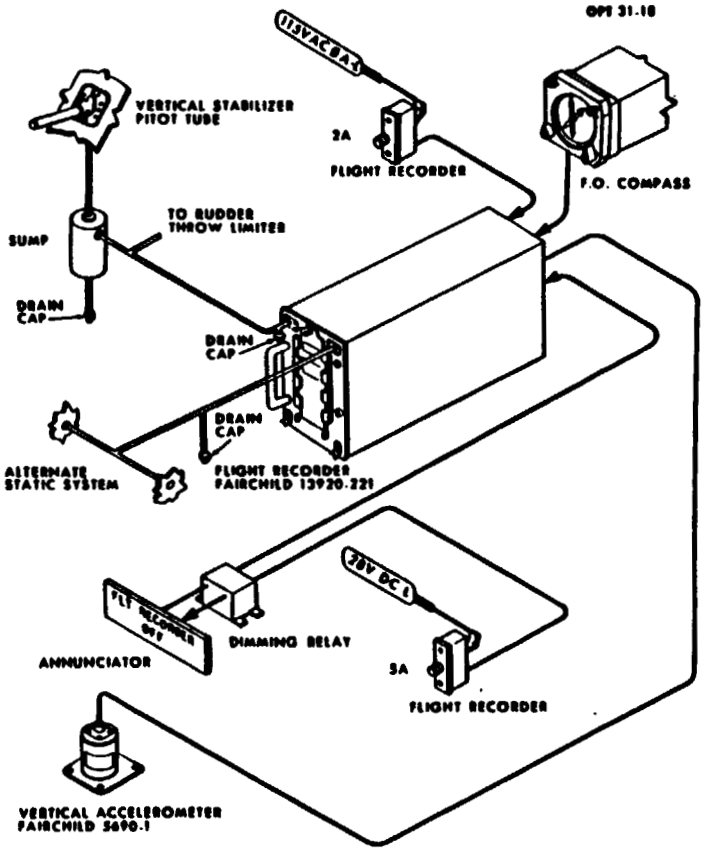
ATTACHMENT 1

Table of SSFDR Parameters and Data Sources

FDR PARAMETER	DATA SOURCE	UNITS & SIGN CONV.	WORD SLOTS Per Subframe
Relative Time	Internal Clock	seconds	N/A
Engine EPR (left & right)	EPR Transmitter	ratio	16 (left) 48 (rgt)
Aircraft Pitch Attitude	Number 1 Vertical Gyro	degrees, ANU = +	13, 29, 45, 61
Aircraft Roll Attitude	Number 1 Vertical Gyro	degrees, RWD = +	14 & 46
Magnetic Heading	Number 2 Compass System	degrees, 0°=Mag. North	9
Captain's Control Column Position	Linear Potentiometer at base of Captain's Control Column	degrees, Aft=-6.0° neutral= +13.5°, FWD= +26.0°	23, 55
Vertical Acceleration	2-Axis Accelerometer located in Right Main Wheel Well	G's, Up = +	4, 12, 20, 28, 36, 44, 52, 60
Longitudinal Acceleration	2-Axis Accelerometer located in Right Main Wheel Well	G's, FWD = +	5, 21, 37, 53
Indicated Airspeed	Alternate Static Source & Rudder Limiter Pitot System	Knots,	42
Pressure Altitude	Alternate Static Source	Feet	14 bit wd 26 (2bits) & 34 (12 bits)
ATC Keying	VHF	0=keyed 1=not keyed	11



FLIGHT RECORDER COMPONENT LOCATIONS



FLIGHT DATA RECORDER FUNCTIONAL DIAGRAM

DC-9 FLIGHT RECORDER AND MEASUREMENTS LOCATIONS

ATTACHMENT 2

USAir Flight 1016 Data Sets

DATA SET NUMBER 1

RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	Vert Acc 1 (G's)	Vert Acc 2 (G's)	Vert Acc 3 (G's)	Vert Acc 4 (G's)	Vert Acc 5 (G's)	Vert Acc 6 (G's)	Vert Acc 7 (G's)	Vert Acc 8 (G's)
10:07:30	2025	0.9460	0.9340	0.9316	0.9364	0.9268	0.9005	0.8885	0.8766
10:07:31	2023	0.8885	0.9125	0.9460	0.9627	0.9579	0.9603	0.9579	0.9460
10:07:32	2022	0.9412	0.9244	0.8957	0.8981	0.8981	0.9125	0.9388	0.9460
10:07:33	2016	0.9603	0.9579	0.9507	0.9531	0.9771	0.9890	0.9986	1.0249
10:07:34	2006	1.0464	1.0799	1.0656	1.0871	1.0727	1.0727	1.0608	1.0392
10:07:35	2004	1.0440	1.0416	1.0345	1.0273	1.0129	1.0105	1.0392	1.0512
10:07:36	2004	1.0273	0.9890	0.9460	0.9244	0.9053	0.8981	0.8838	0.8670
10:07:37	2006	0.8622	0.8598	0.8455	0.8431	0.8431	0.8383	0.8503	0.8503
10:07:38	2006	0.8575	0.8670	0.8742	0.8718	0.8718	0.8742	0.8838	0.8838
10:07:39	2000	0.8862	0.8862	0.8933	0.8909	0.8957	0.9005	0.9101	0.9077
10:07:40	1996	0.9077	0.9077	0.9053	0.9101	0.9173	0.9220	0.9268	0.9436
10:07:41	1988	0.9627	0.9723	0.9842	0.9890	0.9890	0.9890	0.9914	1.0034
10:07:42	1979	0.9890	0.9938	0.9842	0.9699	0.9747	0.9771	0.9723	0.9699
10:07:43	1973	0.9603	0.9460	0.9436	0.9436	0.9507	0.9460	0.9316	0.9316
10:07:44	1965	0.9340	0.9316	0.9364	0.9364	0.9388	0.9388	0.9340	0.9340
10:07:45	1963	0.9388	0.9507	0.9388	0.9268	0.9364	0.9364	0.9388	0.9388
10:07:46	1951	0.9388	0.9436	0.9651	0.9723	0.9842	0.9890	0.9842	0.9842
10:07:47	1940	0.9842	0.9771	0.9723	0.9818	0.9842	0.9890	0.9890	0.9890
10:07:48	1932	0.9842	0.9866	0.9890	1.0034	1.0129	1.0129	1.0201	1.0082
10:07:49	1922	0.9890	0.9794	0.9771	0.9818	0.9890	0.9842	0.9771	0.9627
10:07:50	1920	0.9627	0.9531	0.9555	0.9507	0.9364	0.9101	0.8957	0.8933
10:07:51	1922	0.8790	0.8670	0.8790	0.8694	0.8670	0.8551	0.8359	0.8383
10:07:52	1916	0.8431	0.8455	0.8527	0.8598	0.8646	0.8670	0.8885	0.8885
10:07:53	1901	0.8885	0.8862	0.8885	0.8909	0.8933	0.9029	0.9077	0.9149
10:07:54	1889	0.9196	0.9125	0.9220	0.9220	0.9173	0.9077	0.9005	0.9053
10:07:55	1877	0.9125	0.9196	0.9460	0.9579	0.9555	0.9460	0.9436	0.9460
10:07:56	1866	0.9484	0.9603	0.9627	0.9603	0.9579	0.9340	0.9364	0.9340
10:07:57	1852	0.9340	0.9484	0.9507	0.9460	0.9340	0.9220	0.9053	0.8957
10:07:58	1840	0.9053	0.9077	0.9125	0.9196	0.9077	0.9053	0.9125	0.9244
10:07:59	1823	0.9507	0.9627	0.9627	0.9699	0.9627	0.9747	0.9723	0.9962
10:08:00	1804	1.0082	1.0129	1.0129	1.0105	1.0201	1.0082	0.9962	0.9842
10:08:01	1788	0.9627	0.9651	0.9555	0.9531	0.9484	0.9340	0.9244	0.9220
10:08:02	1776	0.9005	0.8885	0.8885	0.8862	0.9005	0.9173	0.9388	0.9723
10:08:03	1761	0.9747	0.9986	0.9842	0.9484	0.9268	0.9196	0.9125	0.9196
10:08:04	1744	0.9125	0.9220	0.9268	0.9388	0.9388	0.9507	0.9699	0.9675
10:08:05	1726	0.9651	0.9603	0.9890	1.0345	1.0536	1.0608	1.0751	1.0919
10:08:06	1705	1.1182	1.1541	1.1517	1.1684	1.1684	1.1278	1.0871	1.0512
10:08:07	1697	1.0082	0.9723	0.9507	0.9053	0.8957	0.9005	0.8933	0.8766
10:08:08	1684	0.9005	0.9125	0.9077	0.8957	0.9268	0.9220	0.9196	0.9077
10:08:09	1680	0.8885	0.8192	0.7929	0.7857	0.7713	0.7737	0.7977	0.8383
10:08:10	1662	0.8670	0.8957	0.9125	0.9507	0.9340	0.9531	0.9962	1.0129
10:08:11	1639	1.0225	1.0034	0.9747	0.9651	0.9747	0.9651	0.9747	0.9603
10:08:12	1629	0.9603	0.9699	0.9507	0.9603	0.9579	0.9531	0.9364	0.9268
10:08:13	1614	0.9316	0.9268	0.9340	0.9268	0.9388	0.9531	0.9818	0.9962
10:08:14	1593	0.9890	0.9866	1.0010	0.9962	1.0010	1.0010	1.0010	0.9818
10:08:15	1579	0.9675	0.9627	0.9699	0.9699	0.9747	0.9507	0.9340	0.9627
10:08:16	1566	1.0034	0.9914	0.9723	0.9627	0.9699	0.9723	0.9794	1.0105
10:08:17	1549	1.0034	0.9890	1.0201	1.0392	1.0464	1.0345	1.0082	1.0010
10:08:18	1537	0.9914	1.0034	1.0010	1.0105	0.9986	0.9938	0.9890	0.9818
10:08:19	1524	0.9603	0.9555	0.9579	0.9436	0.9460	0.9460	0.9268	0.9268
10:08:20	1514	0.9268	0.9292	0.9220	0.9149	0.9101	0.9005	0.9053	0.8957
10:08:21	1508	0.8838	0.8790	0.8646	0.8742	0.8862	0.9196	0.9220	0.9149
10:08:22	1489	0.9268	0.9364	0.9555	0.9699	1.0010	1.0153	1.0369	1.0464
10:08:23	1470	1.0608	1.0488	1.0345	1.0345	1.0273	1.0105	1.0058	0.9962

RELATIVE

TIME HH:MM:SS	Altitude Pneum. (feet)	Vert Acc 1 (G's)	Vert Acc 2 (G's)	Vert Acc 3 (G's)	Vert Acc 4 (G's)	Vert Acc 5 (G's)	Vert Acc 6 (G's)	Vert Acc 7 (G's)	Vert Acc 8 (G's)
10:08:24	1456	1.0010	1.0058	0.9842	0.9699	0.9531	0.9531	0.9507	0.9460
10:08:25	1447	0.9364	0.9340	0.9436	0.9555	0.9507	0.9651	0.9723	0.9794
10:08:26	1439	0.9651	0.9818	0.9771	0.9627	0.9555	0.9555	0.9436	0.9340
10:08:27	1427	0.9149	0.9053	0.8766	0.8646	0.8527	0.8455	0.8240	0.8287
10:08:28	1416	0.8359	0.8479	0.8598	0.8407	0.8240	0.8287	0.8311	0.8287
10:08:29	1397	0.8359	0.8431	0.8622	0.8742	0.8814	0.8909	0.8981	0.9005
10:08:30	1385	0.8957	0.9005	0.8981	0.9005	0.9077	0.9173	0.8981	0.9005
10:08:31	1358	0.8885	0.8766	0.8766	0.8766	0.8766	0.8885	0.9053	0.9125
10:08:32	1336	0.9244	0.9460	0.9484	0.9627	0.9771	0.9986	1.0010	1.0225
10:08:33	1314	1.0201	1.0297	1.0416	1.0392	1.0512	1.0392	1.0225	1.0153
10:08:34	1286	1.0225	1.0201	1.0321	1.0225	1.0201	1.0225	1.0201	1.0177
10:08:35	1267	1.0153	1.0225	1.0416	1.0512	1.0345	1.0201	1.0225	0.9986
10:08:36	1248	0.9842	0.9603	0.9555	0.9268	0.8957	0.8790	0.8694	0.8622
10:08:37	1232	0.8694	0.8933	0.9125	0.9244	0.9484	0.9723	1.0010	1.0225
10:08:38	1219	1.0703	1.0775	1.0967	1.0727	1.0680	1.0727	1.0608	1.0608
10:08:39	1192	1.0584	1.0392	1.0321	1.0225	0.9842	0.9603	0.9316	0.9364
10:08:40	1187	0.9699	0.9986	0.9986	1.0010	1.0153	0.9866	0.9460	0.9316
10:08:41	1168	0.9388	0.9364	0.9388	0.9364	0.9388	0.9316	0.9244	0.9292
10:08:42	1154	0.9651	0.9651	0.9747	0.9723	0.9890	0.9938	1.0010	1.0249
10:08:43	1141	1.0656	1.0799	1.1014	1.1038	1.1062	1.1086	1.1086	1.0775
10:08:44	1133	1.0488	1.0584	1.0512	1.0369	1.0369	1.0392	1.0201	0.9771
10:08:45	1122	0.9388	0.9196	0.9220	0.9244	0.9507	0.9436	0.8766	0.7953
10:08:46	1124	0.7570	0.7378	0.7737	0.8096	0.9316	0.9842	0.9890	0.9627
10:08:47	1116	0.9818	1.0105	1.0225	1.0082	1.0225	0.9890	0.9842	0.9603
10:08:48	1107	0.9316	0.8957	0.9005	0.8885	0.8957	0.9053	0.9627	0.9866
10:08:49	1101	1.0345	0.9962	0.9890	0.9555	0.9579	0.9005	0.9196	0.9244
10:08:50	1082	0.9388	0.9436	0.9675	0.9771	0.9627	0.9484	0.9531	0.9771
10:08:51	1073	1.0392	1.1110	1.1373	1.0656	0.9675	0.8885	0.8790	0.8503
10:08:52	1065	0.8431	0.8287	0.8311	0.8933	0.9771	0.9268	0.9196	0.9005
10:08:53	1069	0.9101	0.9244	0.9268	0.9125	0.9340	0.9340	0.9316	0.9460
10:08:54	1050	0.9842	1.0010	1.0153	1.0345	1.0201	1.0464	1.0512	1.0608
10:08:55	1042	1.0632	1.0584	1.0536	1.0345	1.0153	0.9771	0.9627	0.9460
10:08:56	1035	0.9077	0.8766	0.8311	0.8000	0.7594	0.7546	0.7474	0.7522
10:08:57	1023	0.7522	0.7785	0.8072	0.8072	0.7833	0.7737	0.7666	0.8000
10:08:58	1012	0.8742	0.9005	0.9220	0.9220	0.9460	0.9531	0.9627	0.9986
10:08:59	989	1.0225	1.0584	1.0823	1.0727	1.0488	1.0105	1.0058	1.0153
10:09:00	974	1.0273	1.0249	1.0273	1.0416	1.0464	1.0416	1.0153	1.0369
10:09:01	959	1.0416	1.0584	1.0345	1.0345	1.0225	0.9914	0.9723	0.9890
10:09:02	951	1.0010	0.9842	0.9460	0.8981	0.8670	0.8838	0.8622	0.8431
10:09:03	936	0.8359	0.8240	0.8216	0.7905	0.8120	0.8311	0.8287	0.8168
10:09:04	927	0.8431	0.8790	0.9316	0.9507	0.9579	0.9818	1.0608	1.0703
10:09:05	902	1.0847	1.1110	1.1780	1.1923	1.2163	1.1923	1.1278	1.0536
10:09:06	885	1.0273	1.0584	1.0775	1.0871	1.0727	1.0560	1.0249	0.9938
10:09:07	878	1.0034	1.0273	1.0082	1.0082	1.0105	1.0034	1.0010	1.0105
10:09:08	874	1.0345	1.0799	1.1612	1.2713	1.3072	1.1995	1.1780	1.1230
10:09:09	861	1.1278	1.1421	1.1182	1.0727	1.0895	1.0632	1.0105	1.0249
10:09:10	864	1.0656	1.0751	1.0847	1.1301	1.1349	1.1397	1.1565	1.1899
10:09:11	849	1.2019	1.1923	1.1828	1.1852	1.1780	1.2043	1.2115	1.1852
10:09:12	864	1.1899	1.1636	1.1158	1.1278	1.1230	1.1876	1.1947	1.2402
10:09:13	881	1.1684	1.1493	1.1397	1.1565	1.1612	1.1493	1.1421	1.1158
10:09:14	900	1.0775	1.0249	0.9866	0.9842	0.9603	0.9196	0.9507	0.9938
10:09:15	930	0.9866	0.9842	0.9484	0.8933	0.8742	0.8981	0.8981	0.8766
10:09:16	953	0.8622	0.8766	0.8479	0.8598	0.8216	0.8096	0.7761	0.7929
10:09:17	982	0.7689	0.7402	0.7163	0.7020	0.6541	0.6517	0.6780	0.6924

RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	Vert Acc 1 (G's)	Vert Acc 2 (G's)	Vert Acc 3 (G's)	Vert Acc 4 (G's)	Vert Acc 5 (G's)	Vert Acc 6 (G's)	Vert Acc 7 (G's)	Vert Acc 8 (G's)
10:09:18	1002	0.6900	0.6948	0.6948	0.6685	0.6709	0.6493	0.6398	0.6278
10:09:19	1016	0.6159	0.5895	0.6015	0.5895	0.5776	0.5800	0.6135	0.5991
10:09:20	1019	0.5704	0.5417	0.5154	0.4747	0.4867	0.4484	0.4675	0.4484
10:09:21	1018	0.4747	0.4675	0.5034	0.5154	0.5417	0.5537	0.5752	0.5824
10:09:22	993	0.6015	0.6087	0.6422	0.6637	0.6828	0.6757	0.6709	0.6326
10:09:23	965	0.6685	0.6661	0.7355	0.8072	0.9651	1.0416	1.0608	1.0082
10:09:24	921	0.9699	0.8790	0.7474	0.6780	0.6900	0.6709	0.5369	0.4293
10:09:25	885	0.4484	0.4675	0.4843	0.5369	0.6182	0.7259	0.8335	0.9005
10:09:26	825	1.0416	1.1397	1.2402	1.3454	1.3239	1.2761	1.3574	1.3717
10:09:27	731	1.4244	1.4363	1.3933	1.2856	1.2713	1.2378	1.1995	1.2474
10:09:28	691	1.2282	1.1804	1.1062	1.0919	1.0703	1.0847	1.0751	1.0369
10:09:29	665	1.0273	1.0512	1.1134	1.1923	1.2952	1.4483	1.9028	3.1299
10:09:30	656	2.2688	2.4219	2.3812	0.6254	0.4915	1.0943	2.8046	0.7187

DATA SET NUMBER 2

S F	RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	IAS Pneum (KIAS)	Head (deg)	Pitch Att 1 (deg)	Pitch Att 2 (deg)	Pitch Att 3 (deg)	Pitch Att 4 (deg)	Roll Att 1 (deg)	Roll Att 2 (deg)	CCP Pitch DEGS	CCP Pitch DEGS
1	10:07:30	2025	137.8	183.4	1.4	1.4	1.3	1.1	-3.4	-2.6	16.36	16.11
2	10:07:31	2023	138.7	182.9	1.1	1.1	1.0	0.9	-1.4	-0.1	16.11	16.08
3	10:07:32	2022	138.2	182.1	0.8	0.7	0.7	0.8	0.4	-1.1	15.80	15.48
4	10:07:33	2016	141.1	180.8	0.9	1.1	1.3	1.6	-2.5	-3.3	15.25	15.36
1	10:07:34	2006	140.2	180.2	1.9	2.1	2.3	2.3	-2.9	-1.4	16.11	16.78
2	10:07:35	2004	140.2	180.1	2.2	2.0	1.7	1.4	-0.3	0.8	17.27	17.07
3	10:07:36	2004	141.1	180.3	1.0	0.6	0.2	-0.3	1.2	0.9	16.87	16.50
4	10:07:37	2006	142.2	180.6	-0.6	-0.8	-0.9	-1.0	0.8	0.6	16.42	16.40
1	10:07:38	2006	140.9	180.9	-1.0	-1.0	-1.0	-1.0	0.5	-0.2	16.42	16.61
2	10:07:39	2000	140.0	181.1	-1.0	-1.0	-1.0	-1.0	-1.3	-2.1	16.36	15.89
3	10:07:40	1996	139.3	181.2	-0.9	-0.8	-0.6	-0.3	-2.3	-2.0	15.14	16.17
4	10:07:41	1988	138.7	181.2	-0.1	0.3	0.5	0.5	-1.0	0.2	15.94	16.40
1	10:07:42	1979	138.7	180.9	0.6	0.5	0.5	0.4	0.9	0.9	16.34	16.33
2	10:07:43	1973	138.7	180.6	0.3	0.2	0.1	-0.1	-0.1	-0.6	15.99	15.88
3	10:07:44	1965	138.7	180.5	-0.1	-0.1	-0.1	0.1	-0.7	-0.7	15.97	15.86
4	10:07:45	1963	138.2	180.4	0.2	0.3	0.4	0.5	-1.3	-1.6	15.58	15.42
1	10:07:46	1951	137.4	180.3	0.7	0.8	0.9	1.0	-1.1	-0.3	16.06	15.75
2	10:07:47	1940	136.5	180.4	1.1	1.1	1.2	1.3	0.3	0.5	15.50	15.53
3	10:07:48	1932	136.7	180.4	1.4	1.4	1.5	1.5	0.7	0.5	15.94	15.81
4	10:07:49	1922	137.1	180.2	1.5	1.5	1.4	1.2	0.3	-0.3	16.58	16.61
1	10:07:50	1920	137.1	180.2	1.1	0.8	0.6	0.3	-0.7	-1.0	16.87	16.74
2	10:07:51	1922	137.8	180.2	-0.2	-0.5	-0.6	-0.9	-1.0	-1.0	16.40	16.45
3	10:07:52	1916	137.8	180.2	-0.9	-1.0	-1.1	-1.1	-1.1	-1.7	16.42	16.19
4	10:07:53	1901	136.5	179.6	-1.1	-1.2	-1.3	-1.3	-2.2	-2.5	16.34	16.65
1	10:07:54	1889	135.8	179.6	-1.4	-1.6	-1.7	-1.8	-2.3	-2.0	16.62	16.54
2	10:07:55	1877	136.9	179.7	-2.0	-2.1	-2.3	-2.5	-1.3	-0.7	16.51	16.61
3	10:07:56	1866	138.0	179.8	-2.6	-2.8	-3.0	-3.2	-0.9	-1.4	16.36	16.20
4	10:07:57	1852	140.6	179.4	-3.3	-3.3	-3.4	-3.3	-2.2	-3.3	15.78	15.92
1	10:07:58	1840	142.4	179.1	-3.3	-3.1	-2.9	-2.6	-3.6	-3.4	15.66	16.09
2	10:07:59	1823	142.8	178.6	-2.3	-2.1	-1.9	-1.7	-2.9	-2.8	16.50	16.96
3	10:08:00	1804	142.2	178.2	-1.6	-1.6	-1.7	-1.8	-2.6	-2.0	17.07	16.91
4	10:08:01	1788	142.8	178.0	-2.0	-2.2	-2.4	-2.6	-0.6	1.0	16.65	16.81
1	10:08:02	1776	143.0	177.7	-2.7	-2.9	-3.0	-3.0	2.4	3.2	16.70	16.42
2	10:08:03	1761	144.9	177.4	-3.0	-2.9	-2.9	-2.8	2.7	2.1	16.03	15.53
3	10:08:04	1744	144.9	177.1	-2.7	-2.4	-2.1	-1.8	1.7	1.6	15.48	15.69
4	10:08:05	1726	144.1	177.2	-1.4	-1.0	-0.7	-0.6	2.0	1.7	16.47	16.81
1	10:08:06	1705	146.0	177.4	-0.3	-0.3	-0.3	-0.6	1.0	1.0	16.82	16.40
2	10:08:07	1697	147.8	178.2	-0.8	-1.1	-1.3	-1.5	2.1	2.5	16.76	16.23
3	10:08:08	1684	145.1	179.3	-1.6	-1.7	-2.0	-2.3	3.5	4.0	17.46	17.72
4	10:08:09	1680	142.6	180.5	-2.6	-3.0	-3.1	-3.1	3.7	3.5	16.08	15.72
1	10:08:10	1662	144.1	180.7	-2.9	-2.7	-2.5	-2.3	4.1	4.3	16.20	17.07
2	10:08:11	1639	143.6	181.1	-2.2	-2.2	-2.3	-2.3	3.1	1.4	16.76	16.20
3	10:08:12	1629	144.5	181.2	-2.3	-2.3	-2.5	-2.5	0.3	-0.3	17.25	16.08
4	10:08:13	1614	146.6	181.8	-2.5	-2.4	-2.2	-2.1	-0.4	0.3	15.88	16.98
1	10:08:14	1593	146.8	182.1	-2.0	-1.9	-1.9	-1.8	0.6	1.3	16.90	16.09
2	10:08:15	1579	146.6	182.3	-1.8	-1.7	-1.6	-1.5	2.2	3.1	16.16	16.50
3	10:08:16	1566	146.6	182.6	-1.4	-1.2	-1.0	-0.8	3.6	3.0	16.03	16.06
4	10:08:17	1549	146.4	182.7	-0.6	-0.4	-0.3	-0.3	2.0	1.3	16.74	16.74
1	10:08:18	1537	146.2	183.1	-0.2	-0.3	-0.4	-0.6	0.3	-0.3	16.78	16.34
2	10:08:19	1524	145.5	183.5	-0.8	-0.9	-1.1	-1.3	0.5	1.3	16.16	16.09
3	10:08:20	1514	145.3	183.7	-1.4	-1.5	-1.6	-1.6	2.0	2.9	15.14	16.00
4	10:08:21	1508	144.7	183.9	-1.6	-1.6	-1.4	-1.3	3.4	2.4	15.33	15.34
1	10:08:22	1489	145.5	184.1	-1.1	-0.9	-0.6	-0.3	1.1	0.7	14.98	15.72
2	10:08:23	1470	145.7	184.7	-0.1	0.2	0.3	0.3	0.4	-1.3	15.92	15.48

S F	RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	IAS Pneum (KIAS)	Head (deg)	Pitch Att 1 (deg)	Pitch Att 2 (deg)	Pitch Att 3 (deg)	Pitch Att 4 (deg)	Roll Att 1 (deg)	Roll Att 2 (deg)	CCP Pitch DEGS	CCP Pitch DEGS
3	10:08:24	1456	145.5	185.0	0.3	0.3	0.4	0.4	-2.9	-3.5	15.25	15.59
4	10:08:25	1447	144.5	185.2	0.4	0.5	0.6	0.6	-3.4	-2.5	15.34	16.16
1	10:08:26	1439	143.6	185.0	0.6	0.5	0.2	-0.3	-1.4	-0.7	16.74	17.11
2	10:08:27	1427	143.0	184.3	-0.7	-1.1	-1.6	-1.8	-0.6	-0.6	16.16	15.94
3	10:08:28	1416	143.0	183.6	-2.1	-2.3	-2.5	-2.6	-0.9	-1.6	16.25	15.80
4	10:08:29	1397	142.4	183.1	-2.7	-2.7	-2.7	-2.7	-2.6	-2.9	15.59	16.36
1	10:08:30	1385	141.7	182.9	-2.8	-2.8	-2.9	-2.9	-2.4	-2.0	15.94	15.55
2	10:08:31	1358	141.7	182.9	-2.9	-2.9	-2.8	-2.6	-2.3	-4.5	14.77	14.77
3	10:08:32	1336	141.1	182.8	-2.3	-2.0	-1.7	-1.4	-6.8	-7.2	14.74	14.74
4	10:08:33	1314	141.1	182.5	-1.0	-0.7	-0.6	-0.4	-6.7	-6.8	15.55	14.79
1	10:08:34	1286	141.1	181.6	-0.2	-0.1	0.2	0.4	-7.1	-6.3	14.73	14.68
2	10:08:35	1267	140.6	180.7	0.6	0.6	0.6	0.4	-4.0	-2.1	16.27	16.13
3	10:08:36	1248	140.0	179.5	0.2	-0.2	-0.3	-0.3	-1.5	-1.7	14.58	14.44
4	10:08:37	1232	139.3	178.7	-0.2	0.2	0.5	0.6	-1.7	0.5	14.71	15.91
1	10:08:38	1219	140.0	178.6	0.8	0.9	0.9	0.9	2.0	1.6	15.31	15.50
2	10:08:39	1192	140.9	178.4	0.8	0.6	0.3	-0.1	1.3	0.4	16.53	14.92
3	10:08:40	1187	139.1	178.7	-0.3	-0.5	-0.6	-0.7	-0.9	-1.3	15.92	14.41
4	10:08:41	1168	141.7	179.8	-0.6	-0.5	-0.2	0.3	-1.6	-1.4	14.33	14.76
1	10:08:42	1154	141.5	181.2	0.7	1.0	1.3	1.4	-0.8	-0.2	15.44	15.59
2	10:08:43	1141	139.1	181.6	1.6	1.6	1.7	1.7	-0.3	-0.7	14.68	16.20
3	10:08:44	1133	140.9	181.3	1.7	1.5	1.3	1.1	-0.5	0.1	15.50	16.22
4	10:08:45	1122	142.8	181.1	0.7	0.5	0.2	-0.5	1.2	2.9	17.07	15.97
1	10:08:46	1124	142.6	181.1	-0.7	-0.8	-0.7	-0.5	3.5	1.0	14.42	15.70
2	10:08:47	1116	143.9	181.5	-0.4	-0.5	-0.7	-0.9	-0.3	-0.7	16.79	16.28
3	10:08:48	1107	147.6	182.0	-1.1	-1.3	-1.3	-1.2	-0.7	-0.8	14.65	15.45
4	10:08:49	1101	145.7	182.6	-1.0	-0.9	-0.9	-0.9	0.6	1.2	16.87	15.97
1	10:08:50	1082	148.4	182.4	-0.9	-0.9	-1.0	-1.1	2.6	3.5	16.87	16.03
2	10:08:51	1073	145.1	182.1	-1.3	-1.6	-1.9	-2.3	2.6	1.0	16.47	15.94
3	10:08:52	1065	148.2	182.1	-2.7	-2.9	-2.9	-2.8	-0.6	-0.7	15.80	16.44
4	10:08:53	1069	156.8	182.1	-2.7	-2.5	-2.3	-2.0	-0.2	-0.1	15.91	15.61
1	10:08:54	1050	157.7	182.0	-1.7	-1.4	-1.0	-0.7	0.6	1.0	15.41	17.02
2	10:08:55	1042	157.0	181.7	-0.5	-0.6	-0.9	-1.3	1.4	2.1	18.06	17.83
3	10:08:56	1035	155.4	181.7	-1.8	-2.3	-2.7	-3.0	3.8	5.5	16.65	16.45
4	10:08:57	1023	153.1	182.5	-3.2	-3.3	-3.3	-2.9	6.3	6.0	15.07	15.01
1	10:08:58	1012	150.7	183.5	-2.6	-2.1	-1.7	-1.3	4.6	1.9	14.98	16.17
2	10:08:59	989	149.7	184.5	-0.9	-0.9	-0.9	-0.7	0.5	0.2	15.63	15.03
3	10:09:00	974	149.9	185.4	-0.6	-0.5	-0.4	-0.2	0.2	0.3	15.47	15.48
4	10:09:01	959	148.4	185.8	-0.1	-0.1	-0.2	-0.5	0.3	0.7	17.19	16.42
1	10:09:02	951	148.8	186.3	-0.7	-1.0	-1.3	-1.5	1.4	2.4	16.13	16.31
2	10:09:03	936	149.2	186.3	-1.6	-1.7	-1.6	-1.3	3.6	1.9	14.57	14.71
3	10:09:04	927	147.0	186.2	-1.0	-0.6	-0.1	0.6	-1.1	-1.3	14.41	14.90
4	10:09:05	902	145.1	186.2	0.9	1.3	1.5	1.6	-0.4	-0.6	15.41	14.87
1	10:09:06	885	144.9	186.2	1.6	1.6	1.7	1.7	-2.1	-2.1	14.76	14.74
2	10:09:07	878	145.5	186.7	1.8	2.0	2.2	2.5	0.2	2.0	14.18	14.17
3	10:09:08	874	145.5	187.1	2.9	3.4	3.9	4.2	2.8	2.7	14.09	14.39
4	10:09:09	861	148.4	187.4	4.6	5.0	5.2	5.6	2.3	3.4	14.73	13.97
1	10:09:10	864	147.8	188.4	6.0	6.6	7.2	7.9	5.2	6.3	13.49	13.55
2	10:09:11	849	146.2	189.1	8.7	9.5	10.0	10.6	4.8	3.7	14.60	14.55
3	10:09:12	864	144.1	190.0	11.0	11.4	11.8	12.1	4.0	6.7	14.47	14.55
4	10:09:13	881	143.4	191.3	12.5	12.8	13.1	13.2	9.8	11.8	14.79	16.99
1	10:09:14	900	140.6	191.9	13.1	13.0	13.0	13.2	12.1	13.7	14.47	14.45
2	10:09:15	930	140.0	192.7	13.5	13.7	14.0	14.2	15.5	16.9	14.66	14.90
3	10:09:16	953	135.8	193.7	14.5	14.7	14.9	15.0	17.4	16.9	15.80	17.69
4	10:09:17	982	131.7	195.4	14.7	14.5	14.1	13.6	16.3	16.9	16.47	18.54

S F	RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	IAS Pneum (KIAS)	Head (deg)	Pitch Att 1 (deg)	Pitch Att 2 (deg)	Pitch Att 3 (deg)	Pitch Att 4 (deg)	Roll Att 1 (deg)	Roll Att 2 (deg)	CCP Pitch DEGS	CCP Pitch DEGS
1	10:09:18	1002	125.5	197.4	13.0	12.3	11.4	10.7	16.9	17.0	17.42	16.90
2	10:09:19	1016	121.0	198.4	9.7	8.9	8.0	7.1	15.7	14.1	16.47	17.34
3	10:09:20	1019	118.2	199.1	6.2	5.2	4.6	3.9	12.3	11.6	14.39	14.96
4	10:09:21	1018	117.2	200.1	3.4	2.9	2.6	2.3	10.9	10.7	14.80	14.37
1	10:09:22	993	115.8	202.1	2.1	1.9	1.7	1.4	11.0	12.3	14.80	14.98
2	10:09:23	965	118.2	203.9	1.1	0.7	0.3	-0.7	13.1	13.0	16.16	17.54
3	10:09:24	921	123.3	204.3	-1.8	-3.1	-4.1	-4.9	11.0	5.4	13.80	8.78
4	10:09:25	885	131.0	204.2	-5.0	-4.5	-3.6	-2.1	1.2	0.2	9.46	11.03
1	10:09:26	825	131.2	206.2	-0.6	1.0	2.2	2.9	1.7	5.8	13.52	14.77
2	10:09:27	731	133.1	208.6	3.3	3.2	2.8	2.4	9.2	9.6	14.68	13.88
3	10:09:28	691	135.1	210.4	1.9	1.5	1.3	1.4	9.6	8.6	11.93	8.63
4	10:09:29	665	142.2	212.0	1.9	3.0	4.7	46.5	6.9	4.7	5.23	6.00
1	10:09:30	656	149.0	214.2	3.7	4.0	3.5	0.8	2.9	-178.8	10.44	-7.32

DATA SET NUMBER 3

RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	EPR Eng1 Range1	EPR Eng1 Range2	EPR Eng2 Range1	EPR Eng2 Range2	Long Acc 1 (G's)	Long Acc 2 (G's)	Long Acc 3 (G's)	Long Acc 4 (G's)	ATC Keying (0=key)
10:07:30	2025	1.35	1.33			0.0385	0.0353	0.0310	0.0256	1
10:07:31	2023	1.35	1.33			0.0256	0.0342	0.0406	0.0369	1
10:07:32	2022	1.35	1.33			0.0288	0.0144	0.0128	0.0198	1
10:07:33	2016	1.35	1.33			0.0251	0.0246	0.0262	0.0379	1
10:07:34	2006	1.35	1.33			0.0438	0.0513	0.0497	0.0427	1
10:07:35	2004	1.35	1.33			0.0358	0.0369	0.0353	0.0379	1
10:07:36	2004	1.33	1.32			0.0310	0.0128	0.0037	-0.0032	1
10:07:37	2006	1.31	1.31			-0.0059	-0.0064	-0.0101	-0.0118	1
10:07:38	2006	1.29	1.30			-0.0112	-0.0112	-0.0080	-0.0053	1
10:07:39	2000	1.28	1.29			-0.0091	-0.0053	-0.0048	-0.0021	1
10:07:40	1996	1.28	1.29			0.0000	0.0032	0.0027	0.0053	1
10:07:41	1988	1.28	1.29			0.0080	0.0150	0.0139	0.0171	1
10:07:42	1979	1.28	1.29			0.0171	0.0171	0.0155	0.0139	0
10:07:43	1973	1.28	1.29			0.0101	0.0096	0.0096	0.0096	0
10:07:44	1965	1.28	1.29			0.0080	0.0069	0.0069	0.0080	1
10:07:45	1963	1.28	1.29			0.0080	0.0107	0.0112	0.0150	1
10:07:46	1951	1.28	1.29			0.0155	0.0171	0.0182	0.0256	1
10:07:47	1940	1.28	1.29			0.0224	0.0224	0.0230	0.0278	1
10:07:48	1932	1.28	1.29			0.0256	0.0256	0.0262	0.0294	1
10:07:49	1922	1.28	1.29			0.0262	0.0230	0.0214	0.0208	0
10:07:50	1920	1.28	1.29			0.0203	0.0139	0.0085	0.0032	1
10:07:51	1922	1.28	1.29			0.0000	-0.0021	-0.0048	-0.0043	1
10:07:52	1916	1.28	1.29			-0.0069	-0.0016	0.0021	0.0043	1
10:07:53	1901	1.28	1.29			0.0064	0.0069	0.0080	0.0085	1
10:07:54	1889	1.28	1.29			0.0080	0.0096	0.0080	0.0069	1
10:07:55	1877	1.28	1.29			0.0043	0.0107	0.0096	0.0096	1
10:07:56	1866	1.28	1.29			0.0112	0.0101	0.0037	0.0005	1
10:07:57	1852	1.28	1.29			0.0011	0.0000	-0.0053	-0.0134	1
10:07:58	1840	1.28	1.29			-0.0144	-0.0144	-0.0107	-0.0128	0
10:07:59	1823	1.28	1.29			-0.0118	-0.0053	-0.0032	-0.0032	1
10:08:00	1804	1.28	1.29			0.0032	0.0027	0.0037	0.0037	1
10:08:01	1788	1.28	1.29			-0.0005	-0.0043	-0.0069	-0.0101	1
10:08:02	1776	1.28	1.29			-0.0187	-0.0230	-0.0251	-0.0166	1
10:08:03	1761	1.28	1.29			-0.0080	-0.0075	-0.0171	-0.0171	1
10:08:04	1744	1.28	1.29			-0.0171	-0.0155	-0.0144	-0.0118	1
10:08:05	1726	1.28	1.29			-0.0107	-0.0107	-0.0091	-0.0053	1
10:08:06	1705	1.28	1.29			0.0096	0.0182	0.0272	0.0182	1
10:08:07	1697	1.28	1.29			0.0064	-0.0069	-0.0176	-0.0128	1
10:08:08	1684	1.28	1.29			-0.0107	-0.0101	-0.0085	-0.0112	1
10:08:09	1680	1.28	1.29			-0.0203	-0.0363	-0.0390	-0.0299	1
10:08:10	1662	1.28	1.29			-0.0198	-0.0166	-0.0118	-0.0021	1
10:08:11	1639	1.28	1.29			0.0011	-0.0101	-0.0107	-0.0085	1
10:08:12	1629	1.28	1.29			-0.0118	-0.0192	-0.0230	-0.0192	1
10:08:13	1614	1.28	1.29			-0.0214	-0.0240	-0.0240	-0.0240	1
10:08:14	1593	1.28	1.29			-0.0166	-0.0118	-0.0118	-0.0112	1
10:08:15	1579	1.28	1.29			-0.0134	-0.0166	-0.0155	-0.0160	1
10:08:16	1566	1.28	1.29			-0.0160	-0.0160	-0.0160	-0.0112	1
10:08:17	1549	1.28	1.29			-0.0075	-0.0043	-0.0032	-0.0053	1
10:08:18	1537	1.28	1.29			-0.0075	-0.0032	-0.0032	-0.0085	1
10:08:19	1524	1.28	1.29			-0.0085	-0.0118	-0.0155	-0.0166	1
10:08:20	1514	1.28	1.29			-0.0171	-0.0171	-0.0187	-0.0240	1
10:08:21	1508	1.28	1.29			-0.0288	-0.0256	-0.0240	-0.0203	1
10:08:22	1489	1.28	1.29			-0.0214	-0.0171	-0.0134	-0.0032	1
10:08:23	1470	1.28	1.29			0.0069	0.0059	0.0053	0.0027	1

RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	EPR Eng1 Range1	EPR Eng1 Range2	EPR Eng2 Range1	EPR Eng2 Range2	Long Acc 1 (G's)	Long Acc 2 (G's)	Long Acc 3 (G's)	Long Acc 4 (G's)	ATC Keying (0=key)
10:08:24	1456	1.28		1.29		0.0011	0.0000	-0.0048	-0.0064	1
10:08:25	1447	1.28		1.29		-0.0101	-0.0053	-0.0016	-0.0027	1
10:08:26	1439	1.28		1.29		-0.0016	0.0032	0.0000	-0.0048	1
10:08:27	1427	1.28		1.29		-0.0080	-0.0160	-0.0176	-0.0187	1
10:08:28	1416	1.28		1.29		-0.0214	-0.0219	-0.0240	-0.0230	1
10:08:29	1397	1.28		1.29		-0.0214	-0.0198	-0.0144	-0.0166	1
10:08:30	1385	1.28		1.29		-0.0160	-0.0134	-0.0101	-0.0101	1
10:08:31	1358	1.28		1.29		-0.0085	-0.0053	-0.0032	-0.0032	1
10:08:32	1336	1.28		1.29		-0.0027	0.0027	0.0080	0.0139	1
10:08:33	1314	1.28		1.29		0.0208	0.0208	0.0240	0.0235	1
10:08:34	1286	1.28		1.29		0.0235	0.0278	0.0288	0.0278	1
10:08:35	1267	1.28		1.29		0.0251	0.0272	0.0272	0.0240	1
10:08:36	1248	1.28		1.29		0.0176	0.0139	0.0085	0.0000	1
10:08:37	1232	1.28		1.29		-0.0016	0.0027	0.0123	0.0203	1
10:08:38	1219	1.32		1.31		0.0315	0.0449	0.0449	0.0465	1
10:08:39	1192	1.34		1.31		0.0481	0.0470	0.0379	0.0230	1
10:08:40	1187	1.34		1.31		0.0256	0.0299	0.0288	0.0198	1
10:08:41	1168	1.34		1.31		0.0144	0.0139	0.0155	0.0182	1
10:08:42	1154	1.34		1.31		0.0235	0.0294	0.0342	0.0395	1
10:08:43	1141	1.35		1.32		0.0491	0.0545	0.0540	0.0556	1
10:08:44	1133	1.36		1.33		0.0481	0.0406	0.0353	0.0315	1
10:08:45	1122	1.37		1.33		0.0198	0.0171	0.0171	0.0080	1
10:08:46	1124	1.37		1.32		-0.0134	-0.0069	-0.0021	0.0064	1
10:08:47	1116	1.37		1.33		0.0011	0.0027	-0.0016	0.0005	1
10:08:48	1107	1.37		1.33		0.0053	0.0059	0.0037	-0.0027	1
10:08:49	1101	1.37		1.33		0.0123	0.0069	-0.0112	-0.0064	1
10:08:50	1082	1.37		1.32		0.0053	0.0144	0.0096	0.0037	1
10:08:51	1073	1.33		1.28		0.0144	0.0198	-0.0016	-0.0518	1
10:08:52	1065	1.28		1.22		-0.0646	-0.0700	-0.0700	-0.0775	1
10:08:53	1069	1.22		1.18		-0.0817	-0.0828	-0.0823	-0.0849	1
10:08:54	1050	1.21		1.17		-0.0828	-0.0732	-0.0684	-0.0657	1
10:08:55	1042	1.21		1.17		-0.0646	-0.0646	-0.0673	-0.0684	1
10:08:56	1035	1.21		1.17		-0.0775	-0.0817	-0.0849	-0.0823	1
10:08:57	1023	1.21		1.17		-0.0801	-0.0769	-0.0775	-0.0732	1
10:08:58	1012	1.21		1.17		-0.0673	-0.0598	-0.0529	-0.0459	1
10:08:59	989	1.21		1.17		-0.0443	-0.0390	-0.0363	-0.0347	1
10:09:00	974	1.21		1.17		-0.0342	-0.0347	-0.0326	-0.0310	1
10:09:01	959	1.21		1.17		-0.0315	-0.0321	-0.0422	-0.0470	1
10:09:02	951	1.21		1.16		-0.0395	-0.0443	-0.0598	-0.0646	1
10:09:03	936	1.19		1.14		-0.0678	-0.0646	-0.0700	-0.0673	1
10:09:04	927	1.18		1.13		-0.0646	-0.0513	-0.0454	-0.0315	1
10:09:05	902	1.18		1.13		-0.0192	-0.0032	0.0123	0.0064	1
10:09:06	885	1.18		1.13		-0.0272	-0.0214	-0.0139	-0.0198	1
10:09:07	878	1.18		1.13		-0.0272	-0.0256	-0.0374	-0.0395	1
10:09:08	874	1.18		1.13		-0.0390	-0.0166	0.0171	-0.0112	1
10:09:09	861	1.33		1.35		-0.0005	0.0272	0.0406	0.0577	1
10:09:10	864	1.58		1.46		0.0769	0.0946	0.1154	0.1223	0
10:09:11	849	1.61		1.50		0.1368	0.1378	0.1405	0.1496	0
10:09:12	864		1.71	1.55		0.1469	0.1538	0.1538	0.1736	1
10:09:13	881		1.79		1.72	0.1891	0.1848	0.1891	0.1950	1
10:09:14	900		1.80		1.78	0.1811	0.1677	0.1603	0.1608	1
10:09:15	930		1.77		1.80	0.1811	0.1912	0.1795	0.1875	1
10:09:16	953		1.79		1.81	0.2019	0.2051	0.2035	0.2062	1
10:09:17	982		1.80		1.83	0.2035	0.2046	0.2051	0.2089	1

RELATIVE TIME HH:MM:SS	Altitude Pneum. (feet)	EPR Eng1 Range1	EPR Eng1 Range2	EPR Eng2 Range1	EPR Eng2 Range2	Long Acc 1 (G's)	Long Acc 2 (G's)	Long Acc 3 (G's)	Long Acc 4 (G's)	ATC Keying (0=key)
10:09:18	1002		1.82		1.85	0.2190	0.2222	0.2302	0.2334	1
10:09:19	1016		1.81		1.83	0.2276	0.2217	0.2286	0.2308	1
10:09:20	1019		1.81		1.84	0.2276	0.2206	0.2206	0.2174	0
10:09:21	1018		1.81		1.83	0.2163	0.2222	0.2350	0.2425	0
10:09:22	993		1.81		1.83	0.2463	0.2537	0.2655	0.2623	1
10:09:23	965		1.79		1.83	0.2575	0.2591	0.3243	0.3595	1
10:09:24	921		1.79		1.84	0.3275	0.2853	0.2703	0.2495	1
10:09:25	885		1.81		1.85	0.2244	0.2361	0.2452	0.2879	1
10:09:26	825		1.97		1.99	0.3616	0.4765	0.5732	0.5491	1
10:09:27	731		2.05		1.97	0.5625	0.5561	0.5112	0.4893	1
10:09:28	691		2.09		1.96	0.4829	0.4402	0.4167	0.4081	1
10:09:29	665		2.09		1.96	0.3910	0.4060	0.4364	0.4738	1
10:09:30	656		1.95	1.57		-0.7399	-0.9920	-0.1944	-0.7484	1

ATTACHMENT 3

USAir Flight 1016 Data Plot

Data Plot Time/Subframe Convention:

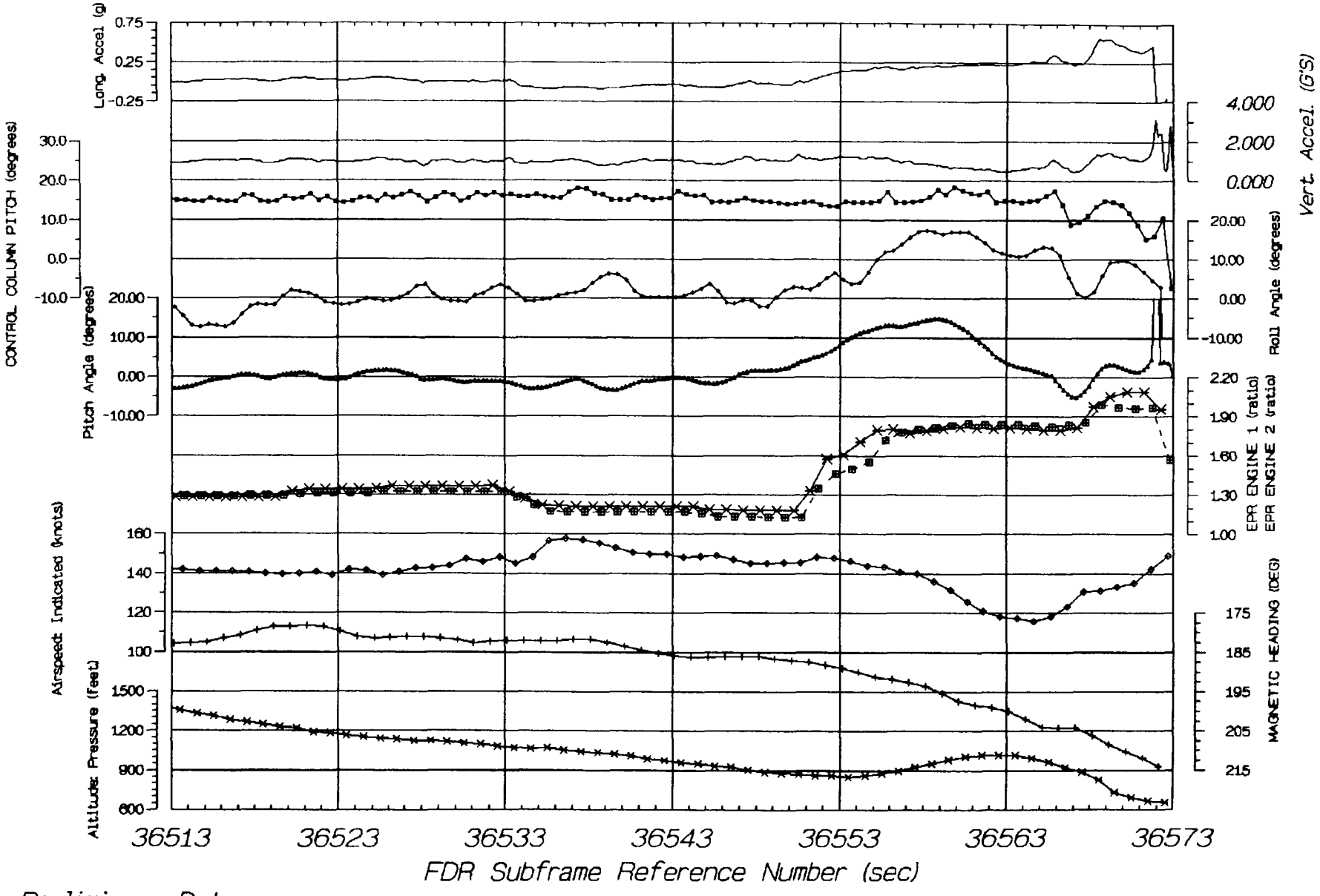
Relative Time 1009:30 = Data Plot Subframe 36572

DATA PLOT NUMBER 1

Final 60 Seconds of Data

USAir Flight 1016 - N954VJ - Final 60 Seconds

Landing at Charlotte, N.C. 7/2/94 *NTSB # : DCA-94-MA-065*



Preliminary Data

Revised: August 1994

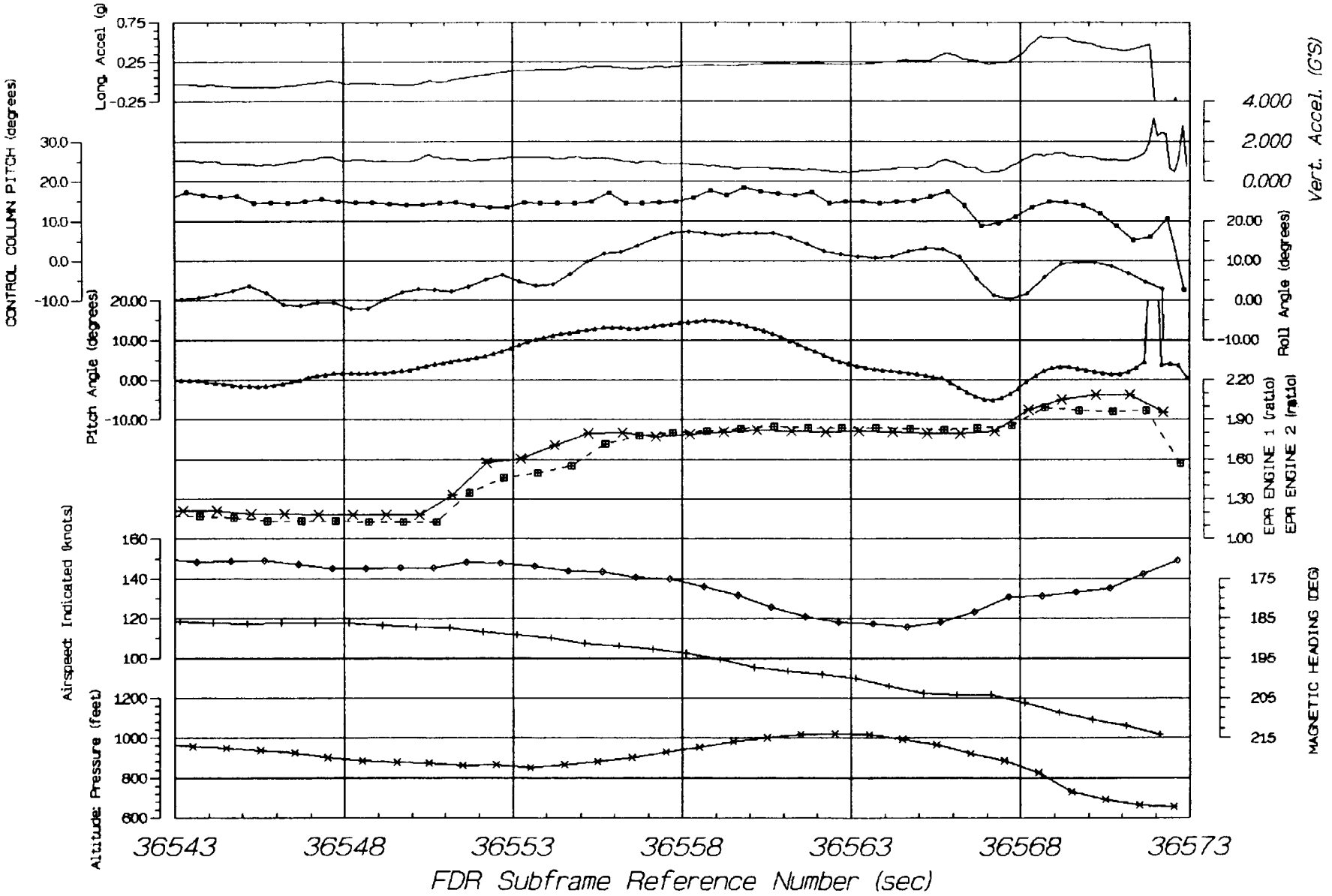
NTSB Flight Recorder Laboratory

DATA PLOT NUMBER 2

Final 30 Seconds of Data

USAir Flight 1016 - N954VJ - Final 30 Seconds

Landing at Charlotte, N.C. 7/2/94 *NTSB # : DCA-94-MA-065*



Preliminary Data

Revised: August 1994

NTSB Flight Recorder Laboratory