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NOISE MEASUREMENTS AT STOCKTON AIRPORT OBTAINED DURING ENGINEERING EVALUATION OF TWO-SEGMENT APPROACHES IN A 727-222 AIRCRAFT

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SUMMARY

A series of noise measurements were made during engineering evaluation tests of two-segment approaches in a 727-222 aircraft. The types of approaches included: 1) ILS 30° flaps, 2) ILS 40° flaps, 3) ILS delayed flaps, 4) two-segment 30° flaps, and 5) two-segment 40° flaps.

INTRODUCTION

This report presents the results of acoustic measurements made on a 727-222 aircraft during standard ILS and two-segment approaches. The aircraft was equipped with a special purpose glide slope computer to provide the capability of making two-segment noise abatement approaches. For upper segment computations, the computer used barometric-corrected pressure altitude and the slant range to a DME transmitter which was co-located with the glide slope transmitter. The computer used the ILS glide slope deviation for lower segment computations.

Additional measurements were made on 737 revenue aircraft using the Stockton Airport.

The purpose of the acoustical portion of the test was to measure and identify the noise levels during the various approaches. A total of twelve measurement sites were utilized. Six of these were located on or near the extended runway centerline from 1 to 7 nautical miles from runway threshold. The remaining six sites were located at positions sideline to the approach centerline. Three sites were placed along a perpendicular to Site 1 and three other sites were placed along a perpendicular to Site 4.

The acoustic test flights were conducted on May 14 and 15, 1973 at Stockton Metropolitan Airport.

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APPARATUS AND METHODS

Aircraft and Test Profiles

The aircraft used for the tests was a Boeing 727-222 powered by three Pratt & Whitney JT8D-7 turbofan engines. The aircraft flew two basic test profiles. The first was a standard ILS approach using conventional avionics. The second type was a two-segment approach using the two-segment glide slope computer avionics. A number of variations of the two-segment approach were flown. Table I contains a list identifying the various profiles. These profiles were flown by both the program test pilot and the airline guest pilots as well. Figure 1 illustrates the ILS and two-segment approach paths in terms of altitude versus distance. Also shown are the distances from threshold of the centerline microphone positions.

The aircraft was instrumented to record on-board a number of flight parameters. These data were time synchronized to the radar tracking and acoustic data using an IRIG B time code.

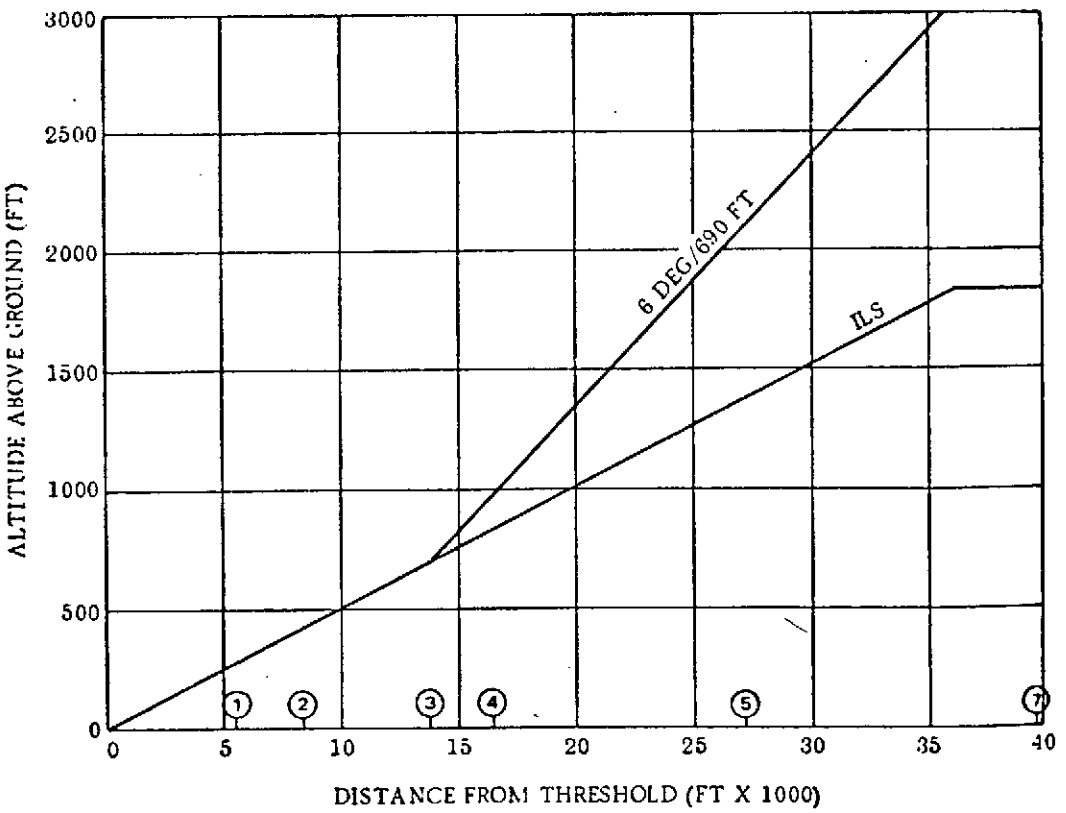

Figure 1. Approach Profiles for 727-222 Tests

Table I. Profile Identification

Profile	2.9° Glide Slope Intercept Altitude (ft)	Upper Glide Slope Intercept Altitude (ft)	Upper Glide Slope (deg)	Other
ILS, 30° Flaps	1800	NA	NA	Manual throttle
ILS, 30° Flaps	1800	NA	NA	Auto throttle
ILS, 40° Flaps	1800	NA	NA	Manual throttle
ILS, 40° Flaps	1800	NA	NA	Auto throttle
Two-Segment, 30° Flaps	690	2800	6	Manual throttle
Two-Segment, 30° Flaps	690	2800	6	Auto throttle
Two-Segment, 40° Flaps	690	2800	6	Manual throttle
Two-Segment, 40° Flaps	690	2800	6	Auto throttle
ILS Delayed Flaps	1800	NA	NA	NA

Acoustic Measurements

Acoustic data were acquired using battery-operated remote-controlled, portable acquisition systems. Figure 2 presents a block diagram of the systems. The typical system utilizes a two-channel analog tape recorder. One channel records acoustic data and the other channel records an IRIG B time signal. The time is broadcast over a radio link at 162.275 MHz (megahertz). The time signal is a 1-kHz (kilohertz) modulated carrier. The received time signal serves two functions: 1) it provides a common recorded time base for all systems and 2) the 1-kHz carrier operates a tape motion controller built by Hydrospace-Challenger, Inc. (HCI).

Field technicians checked system operation and tape supply and administered a single-frequency tone calibration at least once an hour.

Each system was calibrated over a frequency range of 40 to 12 000 Hz using an electrical signal. Figure 3 is a typical total system frequency response. The high frequency pre-emphasis is removed during processing but provides a better signal for analog recording since it compensates for high-frequency sound attenuation due to the atmosphere.

Acoustical measurements were made at six locations on or near the extended runway centerline and at six sideline locations. Table II presents the positioning of the sites used during the exercise. All distances along the extended centerline are referenced to the runway threshold.

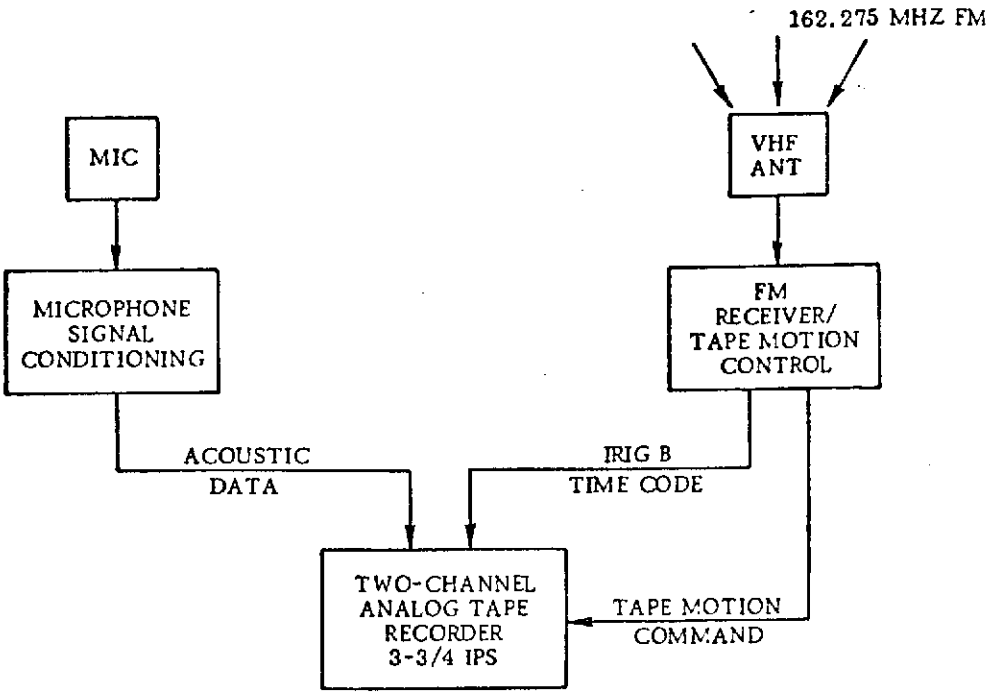

Figure 2. Acoustic Data Acquisition System

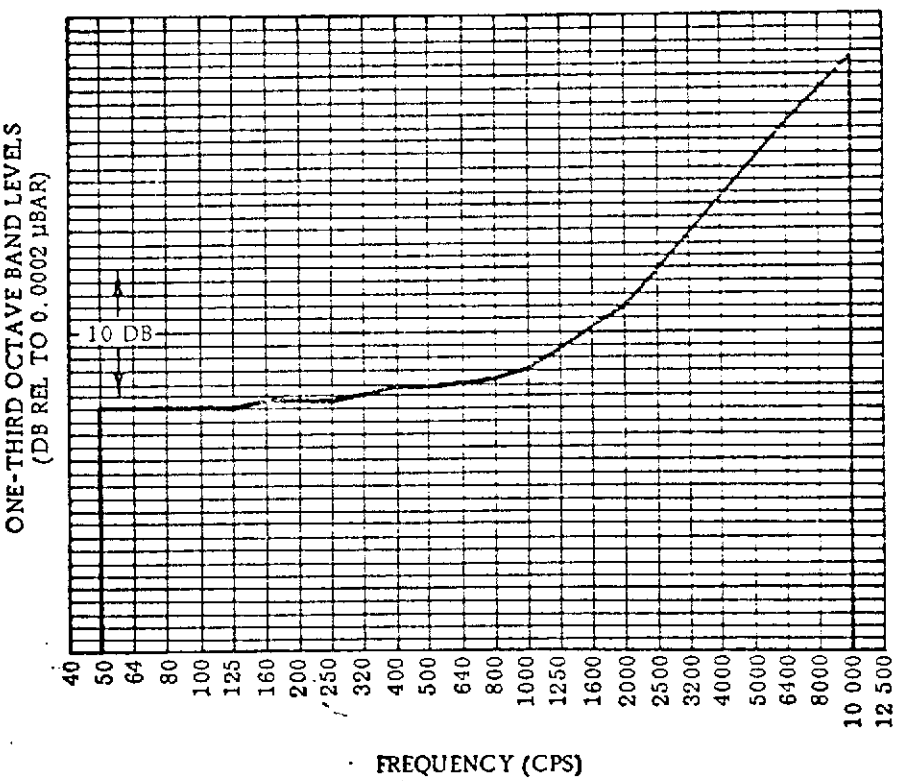

Figure 3. Typical System Response

The sites were located using an orthographic map obtained from the U.S. Geological Survey. Each site was staked and located relative to large features such as trees, roadways, etc. The orthographic photograph was then examined to locate the site. Distances were scaled from this photograph. Figure 4 shows the noise measurement site locations and major topographical features.

Table II. Noise Measurement Site Locations

Site	Distance From Runway Threshold (ft)	Distance Perpendicular to Centerline (ft)
1	5 725	0
2	8 440	70 South
3	13 910	132 North
4	16 780	0
5	27 430	100 South
7	39 175	50 North
1a	5 725	1025 South
1b	5 725	2290 South
1c	5 725	3950 South
4e	16 780	2025 South
4f	16 780	3115 South
4g	16 780	4130 South

Meteorological Measurements

Meteorological measurements of temperature, relative humidity, wind speed, and wind direction were made at the van site. The meteorological data consisted of wet and dry bulb readings using an Assman psychrometer raised to a height of 30 feet on a pole. Wind speed and direction were also measured at a height of 30 feet on the same pole as was used for the psychrometer. Table III contains a listing of the appropriate meteorological parameters.

Table III. Weather Conditions

Date	Time (LST)	Temp (°F)	Relative Humidity (%)	Wind Speed (kt)	Wind Direction (deg)
5-14-73	900	75	56	1	50
5-14-73	1000	77	42		
5-14-73	1100	80	36	3	
5-14-73	1200	82	36	5	
5-14-73	1300	82	36		
5-14-73	1400	82	36		
5-15-73	900	69	53		
5-15-73	1000	74	49	6	
5-15-73	1100	78	45	7	
5-15-73	1200	80	39		
5-15-73	1300	83	35	4	
5-15-73	1400	85	33		
5-15-73	1500	86	31	8	
5-15-73	1600	86	31		
5-15-73	1700	85	34	12	

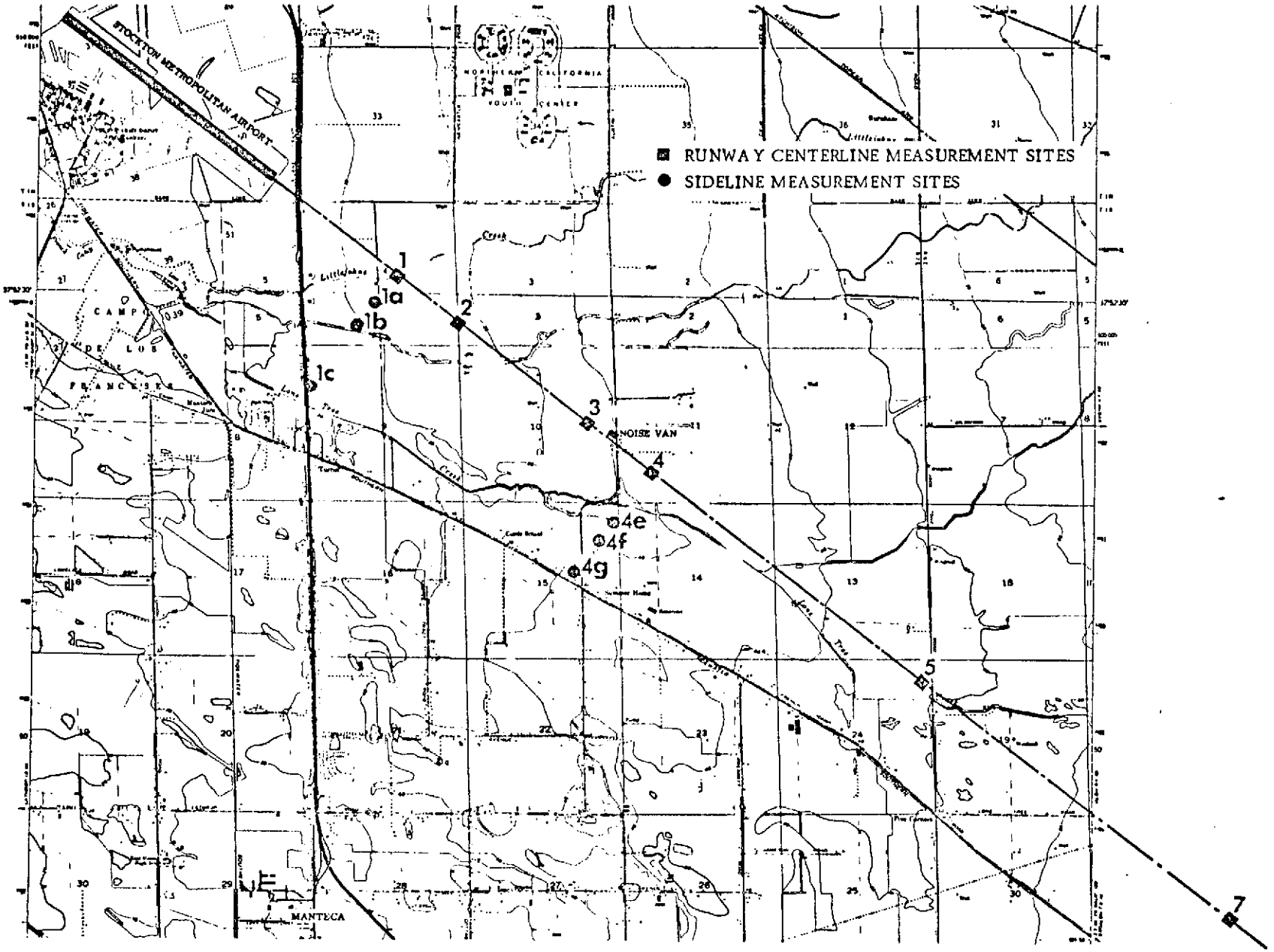

Figure 4. Measurement Site Locations

Aircraft Tracking

Radar tracking was provided by a Bell Aerospace radar unit. The radar provided both an on-line two-dimensional plot and analog three-dimensional data. Acoustic data processing was performed using both the on-line two-dimensional radar plot and the digital radar data.

Using the digital radar data where available, which consisted of slant range (SR) from the measurement site to the aircraft as a function of time, one could obtain the closest point of approach (CPA) range as the minimum range at the site. The range at the time of maximum tone-corrected PNLT was found by simply looking up the SR for the site at the computer-calculated time of $PNLT_{max}$.

Whenever three-dimensional digital tracking data was not available, the two-dimensional track was used. The two-dimensional track will introduce a maximum error in the acoustic results of less than ±0.25 EPNdB for the test configurations used. This figure is based on atmospheric absorption differences between the true SR at the time of maximum tone-corrected perceived noise level ($PNLT_{max}$) and vertical distance at the time of $PNLT_{max}$. The SR at CPA was obtained by scaling the altitude overhead from the radar plots and solving for the altitude height of the triangle knowing the hypotenuse and glide slope.

Acoustic Data Processing

The acoustic data were processed at HCI's San Diego Operations. The processing equipment and the computer program used conform to the requirements of FAR Part 36. The acoustic data were adjusted for system frequency response, effect of windscreen, grazing incidence, effects of temperature and humidity, and effects of background. Data were not corrected for gross weight differences.

Upon post-processing analysis, errors were found in the acoustic data for Sites 5, 7, and 4f. All the data reported in the tables for Sites 5, 7, and 4f has been corrected. A description of the errors is found in Appendixes A and B.

Aircraft Performance Data

Flight, control, and engine parameters were recorded on a digital recording system aboard the aircraft. A flight data entry panel was provided on the flight deck and a time code generator enabled synchronization of the airborne recorder with data recorded at the ground radar and noise data.

Figure 4. Measurement Site Locations

Time Synchronization

Timing was provided through the use of two time code generators (IRIG B code) which were synchronized daily to WWV. The accuracy of the synchronization was within 5 msec maximum error between the two time code generating units.

The radar and aircraft were synchronized using one generator and timing transmissions for each flight. The acoustic data acquisition used the remaining time code generator.

The Hydrospace-Challenger, Inc. time code generator digital output was found to have malfunctioned for the whole exercise. Although the recorded time signals on the acoustic data tapes looked excellent, it was discovered upon playback that some bits were constantly in one state. This resulted in a garbled bit sequence which was unreadable. The problem was solved, however, because of the transmission logs kept in the van. Each time the acoustic acquisition systems are activated and deactivated, the time is noted using the time code generator front panel readout (which functioned normally throughout the exercise). Using these transmission logs, all runs were correlated. Upon processing at HCI, a generator with the correct time was started in sync with the start of the acoustic data based on the transmission logs. Based on the time differences between CPA and time of $PNLT_{max}$ from previous exercises as well as the analog radar plots, it is felt that the maximum time error is on the order of 0.5 seconds.

RESULTS

Tables IV through XV represent the noise measurements at each site. The measurements at each site are grouped according to the specific profile flown.

Corresponding aircraft range for each noise data point was obtained from Government-furnished data. Slant range at CPA is the closest the aircraft came to the measurement site and slant range at PNLTM is the range at the time of peak noise level at the site.

Hydrospace-Challenger, Inc.
1360 Rosecrans Street,
San Diego, California, August 31, 1973

Table IV. 14-15 May, 727 Stocton Tests – Site 1

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	350	500	108.78	
	1407	280	320	109.00	
	1413	360	400	110.07	
	1501	368	393	109.44	
	1509	326	477	109.30	
ILS 40° Flaps	1417	348	386	112.82	
	1419	351	390	112.82	
	1523	347	480	111.41	
	1527	332	370	110.64	
	1528	336	423	110.26	
ILS Delayed Flaps	1409	358	474	109.16	
	1410	375	414	109.65	
	1411	366	398	110.49	
	1412	354	443	111.27	
2 Seg 30° Flaps	1402	312	423	108.10	
	1404	325	481	109.06	
	1406	355	364	109.18	
	1414	310	380	109.95	
	1416	320	370	110.51	
	1418	-	-	-	No radar
	1502	385	437	112.20	
	1504	361	403	112.39	
	1506	340	398	109.40	
	1514	-	-	-	No radar
2 Seg 40° Flaps	1403	371	377	110.76	
	1405	314	394	113.28	
	1415	310	340	111.80	
	1505	345	481	110.04	
	1513	-	-	-	No radar
	1519	328	388	110.34	
	1521	-	-	-	No radar
	1524	343	375	110.70	
737 Flights	1440	340	404	111.32	PSA 126 (7:30)
	1441	386	492	106.99	PSA 127 (8:30)
	1442	-	-	-	UA (10:24)
	1443	260	285	112.56	UA (2:04)
	1500	-	-	-	UA (7:15)
	1540	-	-	-	PSA 126 (7:30)
	1541	355	485	108.85	PSA 127 (8:30)
	1542	-	-	-	UA (10:24)
	1543	-	-	-	UA (2:04)
	1544	319	382	109.63	PSA 426 (4:45)

Table V. 14-15 May, 727 Stockton Tests – Site 2

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	481	692	104.98	
	1407	425	465	106.27	
	1413	390	425	107.41	
	1501	520	633	106.10	
	1515	486	725	105.91	
ILS 40° Flaps	1417	496	996	109.52	
	1419	491	539	106.45	
	1523	456	814	110.46	
	1527	460	646	108.31	
	1528	496	869	108.47	
ILS Delayed Flaps	1409	503	943	106.37	
	1410	500	865	106.43	
	1411	503	864	106.02	
	1412	496	934	104.48	
	1525	461	915	107.10	
	1526	458	849	105.05	
2 Seg 30° Flaps	1402	477	870	103.50	
	1404	457	986	105.92	
	1406	379	995	107.66	
	1408	500	510	108.02	
	1414	480	600	104.96	
	1416	400	525	105.41	
	1418	-	-	-	No radar
	1502	513	769	104.15	
	1504	383	762	104.82	
	1512	470	650	106.48	
	1514	-	-	-	No radar
	1516	462	959	106.09	
	1520	475	520	105.85	
	1522	465	620	107.59	
2 Seg 40° Flaps	1403	505	1021	107.18	
	1405	380	749	108.50	
	1415	480	580	105.87	
	1503	529	887	106.69	
	1505	525	784	109.98	
	1513	-	-	-	No radar
	1519	502	650	109.30	
	1521	-	-	-	No radar
	1524	487	702	109.98	
737 Flights	1440	526	746	103.99	PSA 126 (7:30)
	1441	635	1069	101.02	PSA 127 (8:30)
	1442	-	-	-	UA (10:24), no radar
	1443	-	-	-	UA (2:04), no radar
	1544	442	755	106.99	PSA 426 (4:45)

Table VI. 14-15 May, 727 Stockton Tests – Site 3

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	798	1206	101.24	
	1407	730	810	101.48	
	1413	755	780	101.60	
	1501	797	837	100.82	
	1507	750	819	99.76	
	1509	713	1005	100.87	
	1515	736	1044	99.37	
ILS 40° Flaps	1417	776	839	101.98	
	1419	776	866	103.98	
	1517	746	830	104.24	
	1523	745	965	107.62	
	1527	758	864	107.94	
	1528	751	794	107.48	
ILS Delayed Flaps	1409	776	784	102.38	
	1410	778	961	100.43	
	1411	772	1336	99.70	
	1412	774	1242	98.24	
	1525	748	991	104.19	
	1526	738	738	104.43	
2 Seg 30° Flaps	1402	943	963	100.58	
	1404	859	901	100.77	
	1406	917	1122	94.79	
	1408	870	930	94.88	
	1414	840	1040	95.80	
	1416	845	930	96.13	
	1418	-	-	-	No radar
	1502	928	959	93.52	
	1504	995	1117	93.53	
	1506	1024	1024	93.95	
	1508	1165	1180	90.85	
	1510	940	1040	93.58	
	1512	887	1012	94.45	
	1514	-	-	-	No radar
	1516	870	870	94.16	
	1520	945	1065	99.18	
	1522	950	1105	98.04	
2 Seg 40° Flaps	1403	874	1233	100.09	
	1405	892	1006	98.32	
	1415	910	1050	99.18	
	1503	998	1075	97.93	
	1505	960	1107	97.52	
	1511	915	1155	99.00	
	1513	-	-	-	No radar
	1519	920	1044	100.12	
	1521	-	-	-	No radar
	1524	909	949	102.59	
737 Flights	1440	912	940	92.84	PSA 126 (7:30)
	1441	1246	1560	88.77	PSA 127 (8:30)
	1442	-	-	-	UA (10:24), no radar
	1443	-	-	-	UA (2:04), no radar
	1500	-	-	-	UA (7:15), no radar
	1540	-	-	-	PSA 126 (7:30), no radar
	1541	1207	1460	88.90	PSA 127 (8:30)
	1542	-	-	-	UA (10:24), no radar
	1543	-	-	-	UA (2:04), no radar
	1544	743	1225	102.27	PSA 426 (4:45)

Table VII. 14-15 May, 727 Stockton Tests – Site 4

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	808	1194	102.79	
	1407	885	955	99.20	
	1413	800	800	99.48	
	1501	939	1205	101.41	
	1507	880	1117	100.37	
	1509	829	1133	101.42	
	1515	875	1006	100.13	
ILS 40° Flaps	1417	899	915	100.29	
	1419	902	986	103.55	
	1517	837	872	102.38	
	1523	822	927	107.18	
	1527	847	1239	106.18	
	1528	868	1075	104.60	
ILS Delayed Flaps	1409	900	961	100.04	
	1410	900	1090	100.21	
	1411	899	1065	99.63	
	1412	906	1402	99.34	
	1525	877	1174	101.44	
	1526	814	1050	99.45	
2 Seg 30° Flaps	1402	1120	1174	94.36	
	1404	1096	1282	92.54	
	1406	1156	1199	92.28	
	1408	1180	1250	91.30	
	1414	1145	1155	92.14	
	1416	1130	1240	92.91	
	1418	-	-	-	No radar
	1502	1288	1487	93.54	
	1504	1284	1389	92.76	
	1506	1304	1488	92.09	
	1508	1493	1786	91.70	
	1510	1283	1587	90.98	
	1512	1175	1516	91.75	
	1514	-	-	-	No radar
	1516	1189	1303	91.20	
	1520	1220	1250	96.30	
	1522	1235	1255	95.32	
2 Seg 40° Flaps	1403	1176	1515	98.48	
	1405	1173	1487	93.10	
	1415	1200	1305	96.34	
	1503	1299	1423	96.31	
	1505	1257	1299	94.22	
	1511	1185	1317	94.12	
	1513	-	-	-	No radar
	1519	1061	1361	97.23	
	1521	-	-	-	No radar
	1524	1187	1210	96.95	
737 Flights	1440	1306	1339	86.64	PSA 126 (7:30)
	1441	1699	1970	86.90	PSA 127 (8:30)
	1442	-	-	-	UA (10:24), no radar
	1443	-	-	-	UA (2:04), no radar
	1500	-	-	-	UA (7:15), no radar
	1540	-	-	-	PSA 126 (7:30), no radar
	1541	1337	1600	87.78	PSA 127 (8:30)
	1542	-	-	-	UA (10:24), no radar
	1543	-	-	-	UA (2:04), no radar
	1544	888	995	91.89	PSA 426 (4:45)

Table VIII. 14-15 May, 727 Stockton Tests – Site 5

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1407	1480	1495	89.00	±2 EPNdB variability
	1413	1335	1490	93.19	
	1501	1583	1601	91.00	±2 EPNdB variability
	1507	-	-	-	No radar
	1509	1330	1502	92.00	±2 EPNdB variability
	1515	1399	1838	93.00	±2 EPNdB variability
ILS 40° Flaps	1417	1436	1664	94.50	
	1419	1439	1980	95.72	
	1517	1431	1505	85.20	
	1523	1167	1632	100.87	
	1527	1449	1743	94.77	
	1528	1427	1485	97.30	
ILS Delayed Flaps	1409	1450	1629	89.00	±2 EPNdB variability
	1410	1444	1458	88.00	±2 EPNdB variability
	1411	1448	1990	90.70	
	1412	1435	1763	89.29	
	1525	1409	1575	92.66	
	1526	1375	1523	90.43	
2 Seg 30° Flaps	1404	2398	2493	83.00	±2 EPNdB variability
	1406	2360	2387	85.00	±2 EPNdB variability
	1408	2440	2590	84.00	±2 EPNdB variability
	1414	2340	2340	85.39	
	1416	2350	2450	83.55	
	1418	-	-	-	No radar
	1502	2463	2524	87.00	±2 EPNdB variability
	1504	2493	2530	85.00	±2 EPNdB variability
	1506	2494	2494	88.00	±2 EPNdB variability
	1508	-	-	-	No radar
	1510	2343	2362	88.00	±2 EPNdB variability
	1512	2346	2546	84.00	±2 EPNdB variability
	1514	-	-	-	No radar
	1516	2303	2509	86.00	±2 EPNdB variability
	1520	2480	2495	87.95	
	1522	2440	2560	87.55	
2 Seg 40° Flaps	1403	2272	2302	86.00	±2 EPNdB variability
	1405	2374	2446	88.00	±2 EPNdB variability
	1415	2320	2355	88.01	
	1503	-	-	-	No radar
	1505	2503	2635	87.00	±2 EPNdB variability
	1511	2374	2489	89.00	±2 EPNdB variability
	1513	-	-	-	No radar
	1519	2401	2457	85.91	
	1521	-	-	-	No radar
	1524	2293	2482	90.61	
737 Flights	1442	-	-	-	UA (10:24), no radar
	1443	-	-	-	UA (2:04), no radar
	1500	-	-	-	UA (7:15), no radar

Table IX. 14-15 May, 727 Stockton Tests – Site 7

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1501	2014	2061	96.00	±2 EPNdB variability
	1507	-	-	-	No radar
	1509	1916	2151	94.00	±2 EPNdB variability
	1515	1829	2049	94.00	±2 EPNdB variability
ILS 40° Flaps	1417	2016	2316	96.02	
	1419	2015	2112	95.67	
2 Seg 30° Flaps	1414	3000	3000	90.98	
	1416	3120	3120	87.72	
	1418	-	-	-	No radar
	1502	-	-	-	No radar
	1504	3358	3633	91.00	±2 EPNdB variability
	1506	3180	3324	91.00	±2 EPNdB variability
	1508	-	-	-	No radar
	1510	3025	3155	91.00	±2 EPNdB variability
	1512	3108	3786	90.00	±2 EPNdB variability
	1514	-	-	-	No radar
	1516	3200	3250	90.00	±2 EPNdB variability
	1520	3200	3294	87.57	
2 Seg 40° Flaps	1415	-	-	-	No radar
	1503	-	-	-	No radar
	1505	3180	3325	89.00	±2 EPNdB variability
	1511	3133	3176	91.00	±2 EPNdB variability
	1519	3000	3120	86.77	
	1521	-	-	-	No radar
737 Flights	1443	-	-	-	No radar
	1541	-	-	-	No radar

Table X. 14-15 May, 727 Stockton Tests – Sideline 1a

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_C$ (EPNdB)	Comments
ILS 30° Flaps	1401	1088	1454	97.66	
	1407	1280	1283	98.30	
	1413	1086	1095	96.77	
	1501	1075	1261	97.17	
	1507	1083	1119	99.39	
	1509	1090	1141	94.81	
	1515	1124	1485	96.96	
ILS 40° Flaps	1417	1091	1533	99.29	
	1419	1072	1448	99.09	
	1523	1034	1402	100.78	
	1527	1122	1217	98.64	
	1528	1085	1110	99.66	
ILS Delayed Flaps	1409	1150	1326	94.97	
	1410	1115	1170	96.12	
	1411	1062	1280	98.70	
	1412	1093	1397	98.51	
	1525	1051	1160	98.36	
	1526	1077	1299	95.56	
2 Seg 30° Flaps	1402	1107	1181	96.74	
	1404	1035	1058	98.12	
	1406	1050	1050	98.27	
	1408	1278	1278	97.36	
	1414	1070	1105	97.98	
	1416	1076	1095	95.89	
	1418	-	-	-	No radar
	1502	1038	1139	98.72	
	1504	1124	1140	98.28	
	1506	1109	1130	98.28	
	1508	1061	1188	106.28	
	1510	1091	1277	97.15	
	1512	1054	1250	98.87	
	1514	-	-	-	No radar
	1516	1049	1049	98.57	
	1520	1170	1079	98.20	
	1522	1080	1111	97.96	
2 Seg 40° Flaps	1403	1077	1240	98.62	
	1405	1083	1235	100.06	
	1415	1068	1169	98.01	
	1503	1063	1077	101.00	
	1505	1107	1295	101.55	
	1511	1066	1259	99.06	
	1513	-	-	-	No radar
	1519	1073	1094	101.09	
	1521	-	-	-	No radar
	1524	1045	1065	100.09	
737 Flights	1440	1072	1327	109.06	PSA 126
	1441	1083	1646	106.54	PSA 127
	1442	-	-	-	UA (10:24), no radar
	1443	-	-	-	UA (2:04), no radar
	1500	-	-	-	UA (7:15), no radar
	1540	-	-	-	PSA 126, no radar
	1541	1060	1253	101.02	PSA 127
	1542	-	-	-	UA (10:24), no radar
	1543	-	-	-	UA (2:04), no radar
	1544	1073	1191	102.30	PSA 426

Table XI. 14-15 May, 727 Stockton Tests – Sideline 1b

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	2322	2509	86.02	
	1407	2312	2490	85.73	
	1413	2318	2350	86.57	
	1501	2305	2399	90.46	
	1507	2314	2499	89.84	
	1509	2328	2460	89.58	
	1515	2358	2484	89.73	
ILS 40° Flaps	1417	2325	2496	87.90	
	1419	2305	2477	87.79	
	1523	2267	2276	91.67	
	1527	2361	2422	91.12	
	1528	2321	2392	90.43	
ILS Delayed Flaps	1409	2386	2517	85.59	
	1410	2344	2345	84.87	
	1411	2291	2419	87.18	
	1412	2324	2478	87.67	
	1525	2288	2337	91.20	
	1526	2315	2563	89.73	
2 Seg 30° Flaps	1402	2349	2360	86.30	
	1404	2272	2382	85.88	
	1406	2278	2397	88.06	
	1408	2313	2350	85.03	
	1414	2310	2415	87.21	
	1416	2312	2610	86.24	
	1418	-	-	-	No radar
	1502	2262	2369	90.79	
	1504	2357	2520	89.45	
	1506	2345	2356	89.72	
	1508	2277	2528	101.12	
	1510	2326	2518	89.10	
	1512	2287	2445	89.43	
	1514	-	-	-	No radar
	1516	2286	2339	90.13	
	1520	2316	2358	90.13	
	1522	2316	2328	92.34	
2 Seg 40° Flaps	1403	2306	2464	87.52	
	1405	2323	2472	88.45	
	1415	2311	2326	88.12	
	1503	2292	2449	91.46	
	1505	2342	2342	91.58	
	1511	2298	2392	90.47	
	1513	-	-	-	No radar
	1519	2310	2479	93.56	
	1521	-	-	-	No radar
	1524	2276	2446	92.43	
737 Flights	1440	2312	2444	78.25	
	1441	2310	2458	74.76	
	1442	-	-	-	No radar
	1443	-	-	-	No radar
	1500	-	-	-	No radar
	1540	-	-	-	No radar
	1541	2291	2580	90.09	
	1542	-	-	-	No radar
	1544	2311	2484	94.56	

Table XII. 14-15 May, 727 Stockton Tests – Sideline 1c

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	3970	4015	80.52	
	1407	3960	4210	75.60	
	1413	3966	3966	-	
	1501	3952	4350	80.84	
	1507	3962	3962	-	
	1509	3987	4111	76.78	
	1515	4007	4267	78.45	
ILS 40° Flaps	1417	3974	4176	-	
	1523	3916	4357	-	
	1527	4012	4121	-	
ILS Delayed Flaps	1410	3990	4469	86.05	
	1411	3939	4173	-	
	1412	3972	4412	-	
	1525	3938	4147	-	
2 Seg 30° Flaps	1402	4000	4000	80.27	
	1404	3922	3926	78.47	
	1406	3922	4259	85.40	
	1408	3965	4410	-	
	1414	3961	4310	-	
	1416	3962	4410	-	
	1502	3908	3937	81.41	
	1504	4006	4461	-	
	1506	3994	4283	-	
	1508	3920	4491	88.62	
	1510	3975	4125	83.90	
	1512	3936	4206	-	
	1516	3936	4295	78.61	
	1520	3965	4084	79.13	
2 Seg 40° Flaps	1403	3954	4332	81.55	
	1405	3974	4026	80.82	
	1415	3962	4110	-	
	1503	3939	3998	-	
	1505	3992	4049	81.66	
	1519	3960	4252	78.76	
	1521	-	-	-	No radar
	1524	3922	4340	-	
737 Flights	1442	-	-	-	No radar
	1541	3940	3995	81.04	

Table XIII. 14-15 May, 727 Stockton Tests – Sideline 4e

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_c$ (EPNdB)	Comments
ILS 30° Flaps	1401	2194	2549	89.56	
	1407	2207	2225	89.73	
	1413	2177	2274	88.75	
	1501	2175	2253	89.51	
	1507	2185	2384	90.08	
	1509	2237	2237	88.39	
	1515	2219	2640	89.41	
ILS 40° Flaps	1417	2212	2271	92.51	
	1419	2170	2512	92.32	
	1517	2204	2476	89.80	
	1523	2192	2532	94.74	
	1527	2245	2505	93.93	
	1528	2150	2226	93.23	
ILS Delayed Flaps	1409	2215	2384	89.84	
	1410	2177	2253	90.34	
	1412	2131	2545	-	
	1525	2185	2605	90.81	
	1526	2212	2216	88.38	
2 Seg 30° Flaps	1402	2236	2507	86.94	
	1404	2458	2488	84.09	
	1406	2225	2575	88.41	
	1408	2379	2510	84.03	
	1414	2328	2449	84.15	
	1416	2326	2380	85.38	
	1418	-	-	-	No radar
	1502	2395	2900	85.84	
	1504	2400	2445	83.14	
	1506	2321	2367	83.99	
	1508	2506	2510	82.72	
	1512	2399	2554	83.67	
	1514	-	-	-	No radar
	1516	2395	2486	84.35	
	1518	-	-	-	
	1520	2364	2384	89.83	
	1522	2362	2374	88.23	
2 Seg 40° Flaps	1403	2475	2824	89.68	
	1405	2433	2440	86.09	
	1415	2353	2367	88.15	
	1503	2387	2598	89.33	
	1505	2397	2682	87.01	
	1511	2233	2381	88.74	
	1513	-	-	-	No radar
	1519	2302	2538	89.73	
	1521	-	-	-	No radar
	1524	2336	2347	90.34	
737 Flights	1442	-	-	-	No radar
	1443	-	-	-	No radar
	1540	-	-	-	No radar
	1541	2904	2953	81.98	
	1542	-	-	-	No radar
	1543	-	-	-	No radar

Table XIV. 14-15 May, 727 Stockton Tests – Sideline 4f

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_C$ (EPNdB)	Comments
ILS 30° Flaps	1401	3262	3624	85.38	
	1407	3234	3268	85.86	
	1413	3214	3312	84.92	
	1501	3221	3299	87.46	
	1507	3213	3306	85.94	
	1509	3275	3384	85.10	
	1515	3250	3252	84.50	
ILS 40° Flaps	1417	3310	3451	84.91	
	1419	3194	3538	86.16	
	1517	3253	3390	83.00	Calibration error
	1523	3228	3635	86.90	Calibration error
	1527	3281	3570	86.03	Calibration error
	1528	3178	3657	86.10	Calibration error
ILS Delayed Flaps	1409	3241	3655	86.62	
	1410	3202	3608	84.59	
	1411	3207	3483	85.48	
	1412	3153	3764	84.13	
	1525	3214	3317	82.14	Calibration error
	1526	3250	3314	83.00	Calibration error
2 Seg 30° Flaps	1402	3226	3537	84.77	
	1404	3470	3799	83.41	
	1408	3354	3410	83.20	
	1414	3318	3541	81.64	
	1416	3316	3610	82.89	
	1418	-	-	-	No radar
	1502	3363	3661	84.70	
	1504	3372	3796	82.72	
	1506	3281	3282	83.37	
	1508	3443	3443	82.10	
	1510	3287	3566	83.28	
	1512	3391	3616	83.47	
	1514	-	-	-	No track
	1516	3385	3636	-	
	1520	3343	3350	82.18	Calibration error
	1522	3350	3355	83.68	Calibration error
2 Seg 40° Flaps	1403	3473	3971	85.52	
	1405	3429	3604	82.66	
	1415	3332	3465	85.71	
	1503	3354	3416	85.92	
	1505	3374	3504	84.63	
	1511	3211	3608	83.95	
	1513	-	-	-	No track
	1519	3307	3472	82.79	Calibration error
	1521	-	-	-	No track
	1524	3333	3884	83.72	Calibration error
737 Flights	1441	3517	3589	82.18	
	1442	-	-	-	No radar
	1443	-	-	-	No radar
	1540	-	-	-	No track
	1541	3455	3510	82.15	
	1542	-	-	-	No track
	1543	-	-	-	No track
	1544	3183	3461	80.79	Calibration error

Table XV. 14-15 May, 727 Stockton Tests – Sideline 4g

Type Run	Run No.	Slant Range at CPA (ft)	Slant Range at PNLTM (ft)	$EPNL_C$ (EPNdB)	Comments
ILS 30° Flaps	1413	4206	4301	80.98	
	1507	4198	4434	76.22	
	1509	4264	4292	76.03	
	1515	4236	4641	75.37	
ILS 40° Flaps	1417	4223	4809	86.77	
	1419	4178	4571	-	
	1517	4226	4490	82.01	
	1523	4217	4587	86.26	
ILS Delayed Flaps	1409	4225	4655	81.11	
	1410	4185	4423	80.13	
	1411	4191	4587	79.23	
	1412	4136	4528	80.37	
	1525	4199	4675	81.55	
2 Seg 30° Flaps	1402	-	-	-	No track
	1404	-	-	-	No track
	1406	-	-	-	No track
	1408	4315	4335	83.89	
	1414	4287	4461	79.39	
	1416	4285	4320	78.62	
	1418	-	-	-	No track
	1502	4318	4398	74.07	
	1504	4327	4785	75.66	
	1506	4232	4717	75.41	
	1508	4380	4595	75.85	
	1510	4242	4303	78.41	
	1512	4355	4576	74.70	
	1514	-	-	-	No track
	1516	4351	4600	75.38	
	1518	-	-	-	No track
	1520	4306	4314	81.52	
	1522	4312	4330	-	
2 Seg 40° Flaps	1415	4300	4485	80.55	
	1503	4308	4318	76.30	
	1505	4332	4333	76.12	
	1511	4172	4253	75.22	
	1513	-	-	-	No track
	1519	4321	4614	82.18	
	1521	-	-	-	No track
	1524	4341	4420	83.45	
737 Flights	1542	-	-	-	No track
	1543	-	-	-	No track
	1544	4167	4550	82.06	

Appendix A

REVISED DATA FOR SITES 5 AND 7 FROM THE STOCKTON EXERCISE, 14 AND 15 MAY 1973

Because of a large data scatter at Sites 5 and 7 for the exercise at Stockton on May 14 and 15, 1973, a further analysis was undertaken. An error was discovered that correlated with the suspect data points. The error in all cases was due to a data acquisition operator error.

The HCI data acquisition systems contain two data acquisition gain adjustments. One is a constant 10-dB gain step adjustment used during data acquisition; the other is a continuously variable tape recorder gain used only at the start of each acquisition period in order to optimize the S/N ratio of the acoustic data on the tape recorder. Once a calibration signal has been placed on the data tape, the continuously variable gain may not be changed without nullifying the calibration. During the course of system checkout in the field on the mornings of May 14 and 15, the continuously variable tape recorder gain was changed for both Sites 5 and 7. The change occurred immediately after the calibration.

Data was recovered, however, within ±2 EPNdB for those faulty data points by observing the quiet background following both good data points and bad data points. Then, noting the constant difference in ambient level for tapes with faulty data and those with good data points, an average constant was subtracted from the faulty data points to yield estimates of the level for the site and a given run. The average constant is correct within ±2 EPNdB. These data are accompanied by a comment notation in Tables VIII and IX.

Appendix B

REVISED DATA FOR SITE 4f FROM THE STOCKTON EXERCISE, 14 AND 15 MAY 1973

Upon examining the acoustic data at Site 4f for the measurement period of 14 and 15 May 1973, a problem arises for Runs 1517 through 1526, including the 737 flight 1544. The data for the runs appears low.

After examining the data processing logs and the actual analog tape calibration signals, it was found that the last reel of tape used on May 15, 1973, which contained Runs 1517 through 1526 including 1544, exclusively, was calibrated incorrectly in the field. The error was due to a pistonphone calibration at a gain of 40 dB instead of 30 dB as announced. This results immediately in a 10-dB gain error. However, in calibrating at 40 dB gain the acoustic calibration signal was overdriven on tape. The problem was duplicated in the labroatory and the error determined.

With these findings, a correction of +8.2 EPNdB was made to the EPNL values reported for Runs 1517 through 1526 including 1544. The corrected values and appropriate comments are contained in Table XIV of the report.