Side-By-Side Test Results

John Wayne Airport

August 2015

Aviation Planning at the Leading Edge

ANCA 1990

Exhibit 1: Noise Monitoring Locations

Aviation Planning at the Leading Edge

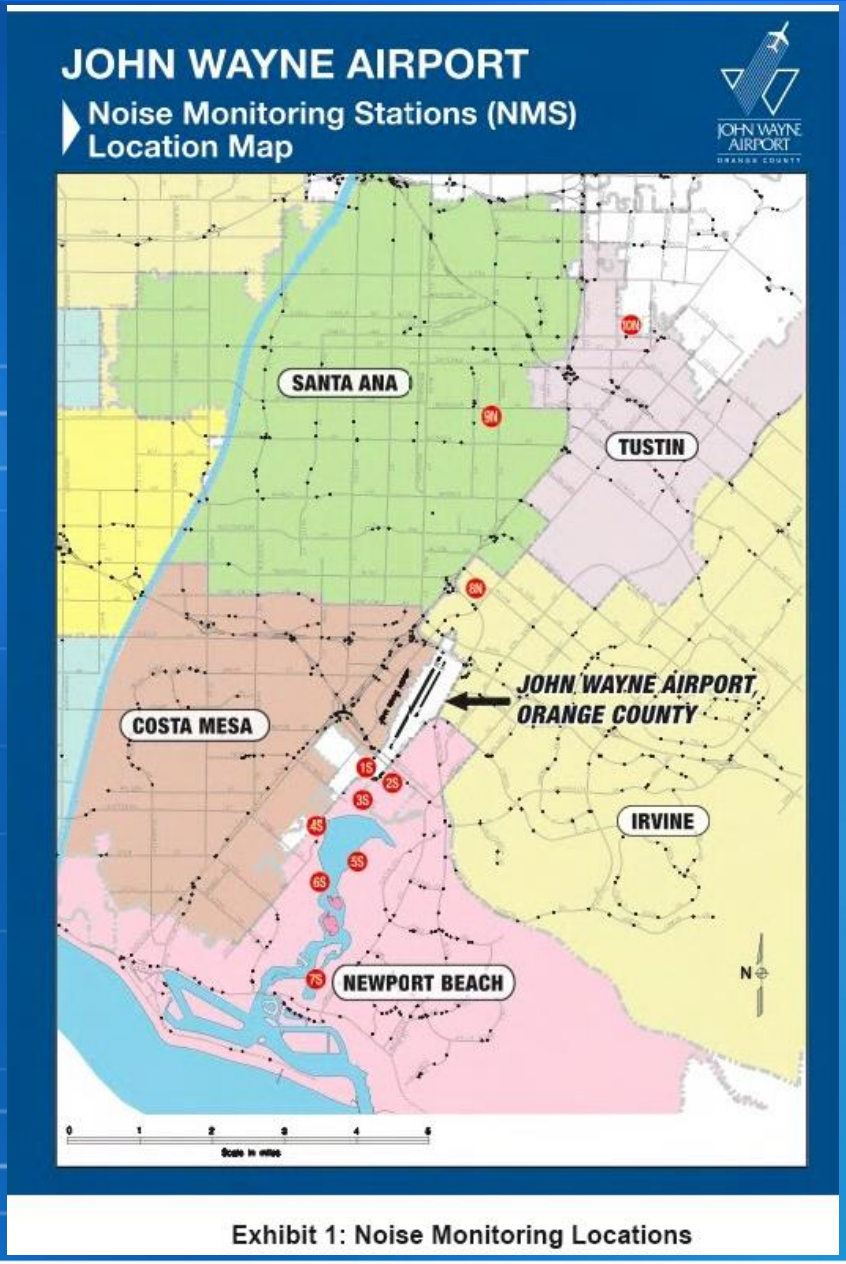


Exhibit 1: Noise Monitoring Locations

Aviation Planning at the Leading Edge

Exhibit 3: Sketch of Microphone Setup

Aviation Planning at the Leading Edge

Sec. 2-1-30.4. Commercial airline operations.

(a) No person may engage in commercial airline operations at John Wayne Airport if such aircraft generate a SENEL level at any of the following respective noise monitoring stations ("NMS"), averaged over each noise compliance period, which is greater than the following SENEL values for Class A aircraft when operating as a Class A operation and for Class E aircraft when operating as a Class E operation:

	Class A	Class E
NMS 1S	101.8 dB	93.5 dB
NMS 2S	101.1 dB	93.0 dB
NMS 3S	100.7 dB	89.7 dB
NMS 4S	94.1 dB	86.0 dB
NMS 5S	94.6 dB	86.6 dB
NMS 6S	96.1 dB	86.6 dB
NMS 7S	93.0 dB	86.0 dB

Sec. 2-1-30.5. General aviation operations.

(a) No person shall operate any general aviation aircraft at John Wayne Airport if it generates a SENEL level, as measured at John Wayne Airport NMS 1S, NMS 2S, or NMS 3S, on takeoff or landing, which is greater than the following SENEL values:

NMS 1S	101.8 dB
NMS 2S	101.1 dB
NMS 3S	100.7 dB

Aviation Planning at the Leading Edge

(b) *Curfew.*

(1) No person shall operate any general aviation aircraft at night at John Wayne Airport if it generates a SENEL level at any of the following respective noise monitoring stations, either on takeoff or landing, which is greater than the following SENEL values:

NMS 1S	86.8 dB
NMS 2S	86.9 dB
NMS 3S	86.0 dB
NMS 4S	86.0 dB
NMS 5S	86.0 dB
NMS 6S	86.0 dB
NMS 7S	86.0 dB
NMS 8N	86.0 dB
NMS 9N	86.0 dB
NMS 10N	86.0 dB

3 Month Test At 4 Sites

for Class A operations, the typical margin available ranges from 3 dB to 12 dB.

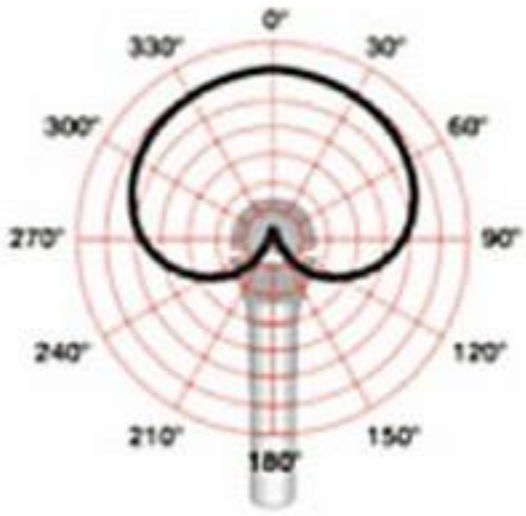
Table 1: The Margin Available Shown in dBA for Class E Noise Levels

Aircraft	1S	2S	3S	4S	5S	6S	7S
CRJ9	3.1	3.9	1.2	6.5	7.4	3.7	6.2
CRJ7	5.3	5.7	2.8	6.0	6.7	4.9	6.4
B737-700	3.3	2.9	1.0	1.8	3.3	2.2	3.7

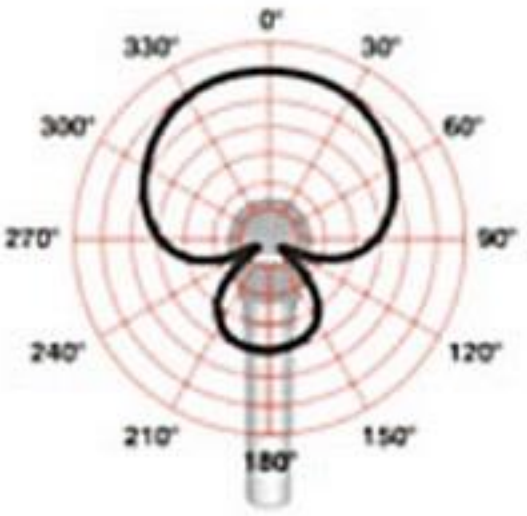
Source: Quarterly Report April 1 through June 30, 2014

Aviation Planning at the Leading Edge

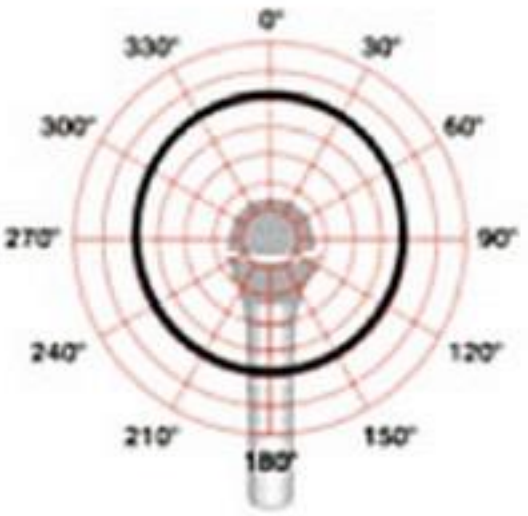
Microphone Directionality



Cardioid



Hyper-Cardioid



Omni-Directional

Aviation Planning at the Leading Edge

Exhibit 2: Pistonphone and Coupler Used to Calibrate Hydrophone (top: calibrator and coupler, bottom: coupler disassembled)

Table 2: Comparison of SENEL Values From Old and New Systems

Site	Aircraft	Aircraft Class	Existing SENEL (energy averge)	New SENEL (energy averge)	Count	Change*
1S	A306	A	96.2	96.8	42	0.6
1S	A30B	A	97.9	98.6	16	**0.7**
1S	A319	A	94.0	94.5	773	0.4
1S	A320	A	93.6	94.0	504	0.4
1S	A321	A	97.3	97.9	128	0.6
1S	B734	A	97.0	97.5	10	0.5
1S	B737	A & E	92.1	92.5	4916	0.5
1S	B738	A	97.7	98.2	1989	0.5
1S	B752	A	95.4	95.8	317	0.4
1S	CRJ7	E	87.5	88.1	402	**0.6**
1S	CRJ9	E	90.3	90.7	242	0.3
2S	A306	A	95.5	96.2	45	**0.7**
2S	A30B	A	97.2	97.9	16	**0.7**
2S	A319	A	93.2	93.7	761	0.5
2S	A320	A	92.7	93.2	526	0.5
2S	A321	A	96.4	97.0	128	0.6
2S	B734	A	95.3	95.9	10	0.6
2S	B737	A & E	91.2	91.7	5032	**0.5**
2S	B738	A	96.2	96.7	2021	0.6
2S	B752	A	94.5	95.0	317	0.5
2S	CRJ7	E	87.2	87.6	411	**0.5**
2S	CRJ9	E	88.7	89.2	244	**0.5**
3S	A306	A	93.9	94.1	42	0.3
3S	A30B	A	95.2	95.6	16	**0.4**
3S	A319	A	92.7	93.1	789	0.3
3S	A320	A	91.4	91.7	519	0.3
3S	A321	A	95.3	95.6	125	**0.4**
3S	B734	A	96.8	97.2	11	**0.4**
3S	B737	A & E	90.8	91.1	5184	0.3
3S	B738	A	96.3	96.6	2036	0.3
3S	B752	A	93.8	94.1	319	0.3
3S	CRJ7	E	86.4	87.0	428	**0.6**
3S	CRJ9	E	88.5	89.0	243	0.4
8N	A306	A	95.5	96.4	26	0.8
8N	A30B	A	96.6	97.4	8	**0.9**
8N	A319	A	91.6	92.3	379	0.7
8N	A320	A	91.3	92.1	335	0.7
8N	A321	A	92.5	93.3	53	0.8
8N	B734	A	95.5	96.2	5	0.8
8N	B737	A & E	92.6	93.3	2641	**0.7**
8N	B738	A	93.6	94.3	1077	0.7
8N	B752	A	94.2	95.0	170	0.8
8N	CRJ7	E	88.5	88.8	227	0.3
8N	CRJ9	E	88.8	89.3	115	0.5

* A positive change means new SENEL measurement is louder than the existing measurement

.x	Largest difference for Class A aircraft for sites 1S, 2S, and 3S
.y	Largest difference for Class E aircraft for sites 1S, 2S, and 3S

General Aviation Aircraft

Note that the general aviation recommended changes were based on an analysis similar to the air carrier analysis described earlier. The results showed that for the general aviation aircraft the differences for the new monitors were 0.3, 0.7, 0.3, and 0.4 for sites 1S, 2S, 3S, and 8N respectively. These numbers are very similar to the air carrier numbers. There may be some bias in the general aviation results as only a small fraction of general aviation operations trigger a noise event at the monitors. Thus the measurements reflect the results only for the

* Calibration Considerations
* Microphone Considerations
* Electronic System Considerations

Aviation Planning at the Leading Edge

It is important to remember that these increases do not represent an increase in the noise levels that will occur in the community. Rather, these increases in the noise limits are necessary to account for new microphones that are more sensitive than the old microphones. As discussed in detail above, these modifications are therefore necessary to maintain parity with the existing noise compliance limits at the Airport.

Table 3: Recommended Adjustments, in dB, To The Phase 2 Access Plan SENEL Noise Limits

Site	Increase in Class A Limit	New Class A Limit	Increase in Class E Limit	New Class E Limit
1S	0.7	102.5	0.6	94.1
2S	0.7	101.8	0.5	93.5
3S	0.4	101.1	0.6	90.3
4S	0.7	94.8	0.6	86.6
5S	0.7	95.3	0.6	87.2
6S	0.7	96.8	0.6	87.2
7S	0.7	93.7	0.6	86.6

Table 4: Recommended Adjustments, in dB, to the General Aviation Noise Ordinance

Site	Increase in Daytime Limit	New Daytime Limit	Increase in Curfew Hours Limit	New Curfew Hours Limit
1S	0.7	102.5	0.7	87.5
2S	0.7	101.8	0.7	87.6
3S	0.4	101.1	0.7	86.7
4S	NA	NA	0.7	86.7
5S	NA	NA	0.7	86.7
6S	NA	NA	0.7	86.7
7S	NA	NA	0.7	86.7
8N	NA	NA	0.9	86.9
9N	NA	NA	0.9	86.9
10N	NA	NA	0.9	86.9

Table 5: Summary of Estimations of Measurement Uncertainty

Site	Aircraft	Old Average SENEL	Old Std Dev	+-Uncertainty	New Average SENEL	New Std Dev	+-Uncertainty	Count	Average Difference	Std Dev	+-Uncertainty
101	A306	95.9	1.8	0.5	96.4	1.8	0.6	42	0.5	0.1	0.04
101	A30B	97.7	1.2	0.6	98.4	1.3	0.6	16	0.7	0.2	0.08
101	A319	93.5	2.7	0.2	93.9	2.7	0.2	773	0.4	0.2	0.02
101	A320	93.2	2.2	0.2	93.6	2.3	0.2	504	0.4	0.2	0.02
101	A321	95.6	5.3	0.9	96.2	5.3	0.9	128	0.6	0.2	0.04
101	B734	96.9	0.6	0.4	97.4	0.8	0.5	10	0.5	0.2	0.15
101	B737	91.1	3.1	0.1	91.6	3.0	0.1	4916	0.5	0.3	0.01
101	B738	96.8	3.7	0.2	97.3	3.7	0.2	1989	0.5	0.3	0.01
101	B752	94.9	3.0	0.3	95.2	3.1	0.3	317	0.4	0.3	0.03
101	CRJ7	86.8	2.4	0.2	87.4	2.3	0.2	402	0.7	0.3	0.03
101	CRJ9	89.8	2.4	0.3	90.2	2.3	0.3	242	0.4	0.3	0.04
102	A306	94.0	5.2	1.5	94.7	5.1	1.5	46	0.7	0.3	0.09
102	A30B	97.0	1.2	0.6	97.7	1.3	0.7	15	0.7	0.2	0.08
102	A319	92.6	3.0	0.2	93.1	2.9	0.2	761	0.5	0.4	0.03
102	A320	92.0	3.5	0.3	92.5	3.4	0.3	526	0.5	0.4	0.04
102	A321	94.2	6.0	1.1	94.9	6.0	1.1	128	0.7	0.3	0.05
102	B734	95.3	0.3	0.2	95.9	0.3	0.2	10	0.6	0.1	0.07
102	B737	90.3	3.4	0.1	90.8	3.2	0.1	5032	0.6	0.4	0.01
102	B738	95.1	4.3	0.2	95.7	4.2	0.2	2021	0.6	0.5	0.02
102	B752	93.8	3.5	0.4	94.3	3.4	0.4	317	0.5	0.3	0.04
102	CRJ7	86.3	2.7	0.3	87.1	2.4	0.2	411	0.7	0.7	0.07
102	CRJ9	88.1	2.7	0.3	88.7	2.5	0.3	244	0.6	0.3	0.04
103	A306	93.6	1.6	0.5	93.8	1.7	0.5	42	0.3	0.2	0.07
103	A30B	95.1	0.8	0.4	95.5	0.9	0.5	16	0.3	0.3	0.13
103	A319	92.3	2.0	0.1	92.6	2.1	0.1	789	0.3	0.3	0.02
103	A320	91.2	1.5	0.1	91.4	1.6	0.1	519	0.2	0.4	0.04
103	A321	94.1	3.9	0.7	94.4	4.0	0.7	125	0.3	0.3	0.05
103	B734	96.8	0.7	0.4	97.1	0.9	0.5	11	0.4	0.3	0.17
103	B737	89.8	2.7	0.1	90.0	2.8	0.1	5184	0.2	0.3	0.01
103	B738	95.6	3.0	0.1	95.8	3.1	0.1	2036	0.2	0.3	0.02
103	B752	93.4	2.0	0.2	93.7	2.1	0.2	319	0.2	0.3	0.04
103	CRJ7	86.1	1.7	0.2	86.7	1.6	0.2	428	0.6	0.3	0.03
103	CRJ9	88.0	2.0	0.3	88.5	2.0	0.3	243	0.5	0.3	0.04
108	A306	93.8	5.6	2.2	94.6	5.8	2.3	26	0.8	0.3	0.12
108	A30B	96.4	1.3	0.9	97.2	1.3	1.0	8	0.8	0.1	0.06
108	A319	91.5	1.0	0.1	92.2	1.0	0.1	379	0.7	0.2	0.02
108	A320	90.8	3.1	0.3	91.5	3.1	0.3	335	0.7	0.5	0.05
108	A321	92.4	1.1	0.3	93.1	1.1	0.3	53	0.8	0.1	0.03
108	B734	95.4	0.5	0.5	96.2	0.6	0.6	5	0.8	0.2	0.20
108	B737	92.4	1.5	0.1	93.1	1.4	0.1	2641	0.7	0.4	0.02
108	B738	93.4	1.4	0.1	94.1	1.4	0.1	1077	0.7	0.3	0.02
108	B752	93.9	1.7	0.3	94.7	1.7	0.3	170	0.8	0.3	0.04
108	CRJ7	88.1	1.7	0.2	88.6	1.5	0.2	227	0.5	0.7	0.10
108	CRJ9	88.7	0.9	0.2	89.3	0.9	0.2	115	0.5	0.3	0.06

Questions?

Aviation Planning at the Leading Edge