

Annex C

Detailed Calculations of Operational Noise Levels

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day-time)

Date: 17 July 2009
Time: 16:41pm-18:07pm
Location: Seaview Commercial Building (roof level)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level, dB(A)				Other Noise Sources #
						LAeq	LA10	LA90	LAMax	
<i>(A). Measured Helicopter Noise Data (with background)</i>										
1	AW139	WE	16:52	Approach	84	72	72	71	75	
		-		Hovering	19	72	72	71	73	
		-		Idling	493	72	72	71	77	
		EW	17:02	Take-off	57	73	74	73	80	
2	AW139	WE	17:20	Approach	95	71	72	71	77	
		-		Hovering	18	72	72	72	74	
		-		Idling	838	71	72	71	78	
		EW	17:35	Take-off	55	73	74	73	80	
3	AW139	WE	17:58	Approach	91	72	72	71	77	
		-		Hovering	21	74	75	73	78	
		-		Idling	360	72	72	71	75	
		EW	18:05	Take-off	81	73	73	72	78	

Remark: # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
 * EW - Flight direction from East to West; WE - Flight direction from West to East.

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	71	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	71	
3	72	

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated LAMax
1	AW139	WE	16:52	Approach	84	72
		-		Hovering	19	69
		-		Idling	493	76
		EW	17:02	Take-off	57	80
2	AW139	WE	17:20	Approach	95	76
		-		Hovering	18	71
		-		Idling	838	77
		EW	17:35	Take-off	55	80
3	AW139	WE	17:58	Approach	91	76
		-		Hovering	21	77
		-		Idling	360	72
		EW	18:05	Take-off	81	76

Highest LAMax level, dB(A): 80

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Evening-time)

Date: 17 July 2009
 Time: 18:54 - 23:00
 Location: Seaview Commercial Building (roof level)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level, dB(A)			Other Noise Sources #
						LAeq	LA10	LA90	
(A). Measured Helicopter Noise Data (with background)									
1	AW139	-	19:00	Approach **					
		-		Hovering **					
		-		Idling	359	71	71	71	
		EW		Take-off	77	74	74	73	
2	AW139	WE	19:27	Approach	82	72	72	71	
		-		Hovering	13	73	74	71	
		-	19:36	Idling	460	71	71	71	
		EW		Take-off	71	72	72	71	
3	AW139	WE	19:49	Approach	89	70	71	70	
		-		Hovering	25	71	72	71	
		-	19:58	Idling	453	71	71	70	
		EW		Take-off	79	72	72	71	
4	AW139	WE	20:21	Approach	86	71	71	70	
		-		Hovering	20	71	71	70	
		-	20:33	Idling	577	70	71	70	
		EW		Take-off	76	72	72	71	
5	AW139	WE	20:49	Approach	81	71	71	70	
		-		Hovering	23	71	71	71	
		-	20:58	Idling	454	70	70	69	
		EW		Take-off	78	71	71	70	
6	AW139	WE	21:23	Approach	83	71	71	70	
		-		Hovering	15	71	71	70	
		-	21:30	Idling	330	70	70	70	
		EW		Take-off	77	71	71	70	
7	AW139	WE	21:48	Approach	88	71	71	71	
		-		Hovering	19	71	72	71	
		-	22:01	Idling	624	70	70	69	
		EW		Take-off	65	71	71	70	
8	AW139	WE	22:20	Approach	83	70	70	70	
		-		Hovering	23	71	71	71	
		-	22:32	Idling	598	71	71	70	
		EW		Take-off	76	70	71	70	
9	AW139	WE	22:49	Approach	89	70	70	70	
		-		Hovering	26	71	72	71	
		-	22:55	Idling	256	71	71	70	
		EW		Take-off	78	71	71	70	

Remark: # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
 * EW - Flight direction from East to West; WE - Flight direction from West to East.
 ** Noise measurement was commenced at 18:54. Thus, noise data before this time is not available.

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1 *	71	
2	71	
3	70	
4	70	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
5	69	
6	70	
7	70	
8	69	
9	70	

Remark: * Based on background noise level recorded before the second flight.

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated LAeq
1	AW139		19:00	Approach **		
				Hovering **		
				Idling	359	59
				Take-off	77	70
2	AW139	WE	19:27	Approach	82	65
				Hovering	13	68
				Idling	460	59
			19:36	Take-off	71	65
3	AW139	WE	19:49	Approach	89	60
				Hovering	25	65
				Idling	453	59
			19:58	Take-off	79	67
4	AW139	WE	20:21	Approach	86	63
				Hovering	20	63
				Idling	577	54
			20:33	Take-off	76	67
5	AW139	WE	20:49	Approach	81	65
				Hovering	23	67
				Idling	454	59
			20:58	Take-off	78	66
6	AW139	WE	21:23	Approach	83	62
				Hovering	15	61
				Idling	330	60
			21:30	Take-off	77	60
7	AW139	WE	21:48	Approach	88	65
				Hovering	19	66
				Idling	624	57
			22:01	Take-off	65	64
8	AW139	WE	22:20	Approach	83	62
				Hovering	23	66
				Idling	598	64
			22:32	Take-off	76	63
9	AW139	WE	22:49	Approach	89	60
				Hovering	26	65
				Idling	256	60
			22:55	Take-off	78	63

Average Noise Level (4 hrs), dB(A): 58

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.

** Noise measurement was commenced at 18:54. Thus, noise data before this time is not available.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day-time)

Date: 20 July 2009
 Time: 16:16pm-17:02pm
 Location: Wayson Commercial Building (roof level)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level, dB(A)				Other Noise Sources #
						LAeq	LA10	LA90	LAMax	
(A). Measured Helicopter Noise Data (with background)										
1	AW139	WE	16:24	Approach	68	77	77	76	81	
		-		Hovering	16	76	76	75	78	
		-	16:35	Idling	573	74	75	74	81	
		EW		Take-off	72	74	75	74	77	
2	AW139	WE	16:51	Approach	56	77	78	76	82	
		-		Hovering	17	78	79	77	82	
		-	17:01	Idling	517	74	75	74	80	
		EW		Take-off	74	74	75	74	76	

Remark: # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
 * EW - Flight direction from East to West; WE - Flight direction from West to East.

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	74	Road traffic noise, and noise due to airplane passing-by, and Turbojet arrival/ departure at HK-Macau Ferry Terminal
2	74	

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated LAMax
1	AW139	WE	16:24	Approach	68	80
		-		Hovering	16	76
		-	16:35	Idling	573	80
		EW		Take-off	72	74
2	AW139	WE	16:51	Approach	56	81
		-		Hovering	17	82
		-	17:01	Idling	517	79
		EW		Take-off	74	72

Highest Lmax level, dB(A): 82

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Evening-time)

Date: 20 July 2009
 Time: 18:59 - 23:00
 Location: Wayson Commercial Building (roof level)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level, dB(A)			Other Noise Sources #
						LAeq	LA10	LA90	
(A). Measured Helicopter Noise Data (with background)									
1	AW139	WE	18:59	Approach	95	75	75	74	
		-		Hovering	29	74	74	73	
		-	19:06	Idling	336	73	74	73	
		EW		Take-off	76	73	73	72	
2	AW139	WE	19:18	Approach	63	74	75	74	
		-		Hovering	12	77	77	76	
		-	19:28	Idling	474	73	73	73	
		EW		Take-off	87	74	74	73	
3	AW139	WE	19:56	Approach	63	75	75	74	
		-		Hovering	19	75	75	74	
		-	20:04	Idling	321	73	73	72	
		EW		Take-off	71	73	73	72	
4	AW139	WE	20:51	Approach	71	74	75	74	
		-		Hovering	18	75	75	73	
		-	21:02	Idling	522	71	72	71	
		EW		Take-off	74	72	72	71	
5	AW139	WE	21:30	Approach	79	74	74	73	
		-		Hovering	19	77	78	75	
		-	21:37	Idling	330	72	72	71	
		EW		Take-off	86	72	72	71	
6	AW139	WE	21:55	Approach	73	75	76	74	
		-		Hovering	18	75	76	74	
		-	22:03	Idling	351	72	72	71	
		EW		Take-off	71	74	74	73	
7	AW139	WE	22:23	Approach	74	73	74	73	
		-		Hovering	21	73	74	73	
		-	22:31	Idling	354	71	71	70	
		EW		Take-off	80	72	73	71	
8	AW139	WE	22:52	Approach	75	74	75	74	
		-		Hovering	27	76	76	75	
		-	22:59	Idling	304	71	71	70	
		EW		Take-off	61	73	74	72	

Remark: # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
 * EW - Flight direction from East to West; WE - Flight direction from West to East.

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1 *	72	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	72	
3	71	
4	70	
5	71	
6	71	
7	70	
8	70	

Remark: * Based on background noise level recorded before the second flight.

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated LAeq
1	AW139	WE	18:59	Approach	95	71
				Hovering	29	69
				Idling	336	67
		EW	19:06	Take-off	76	65
2	AW139	WE	19:18	Approach	63	71
				Hovering	12	75
				Idling	474	66
		EW	19:28	Take-off	87	69
3	AW139	WE	19:56	Approach	63	72
				Hovering	19	72
				Idling	321	67
		EW	20:04	Take-off	71	66
4	AW139	WE	20:51	Approach	71	73
				Hovering	18	73
				Idling	522	66
		EW	21:02	Take-off	74	67
5	AW139	WE	21:30	Approach	79	70
				Hovering	19	75
				Idling	330	65
		EW	21:37	Take-off	86	66
6	AW139	WE	21:55	Approach	73	73
				Hovering	18	74
				Idling	351	64
		EW	22:03	Take-off	71	70
7	AW139	WE	22:23	Approach	74	71
				Hovering	21	71
				Idling	354	64
		EW	22:31	Take-off	80	68
8	AW139	WE	22:52	Approach	75	72
				Hovering	27	74
				Idling	304	64
		EW	22:59	Take-off	61	70
Average Noise Level (4 hrs), dB(A):						63

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day Time)

Date: 20 July 2009
 Time Period: 18:11-18:43
 Location: Wing On Centre (roof-top)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Façade Noise Level (with background), dB(A)				Other Noise Sources #
						LAeq	LA10	LA90	LAMax	
(A). Measured Helicopter Noise Data (with background)										
1	AW139	EW	18:11	Approach ##						-
				Hovering ##						-
				Idling ##						-
				Take-off **	69	71	74	66	80	-
2	AW139	WE	18:23	Approach ##	52	70	73	68	75	-
				Hovering **						-
				Idling ##	345	68	70	67	76	-
				Take-off **						-

Remark:

- # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
- * EW - Flight direction from East to West; WE - Flight direction from West to East.
- ** During the measurement, Lmax level was measured by manually start and stop the SLM during each flight event. Thus, only two flight events were measured in each flight (i.e. either "Approach" and "Idling", or "Hovering" and "Take-off").
- ### Noise measurement was commenced at 18:11. Thus, noise data before this time is not available.

On 20th July 2009, noise measurement was conducted between 18:11pm and 18:43pm. As "Hovering" mode of flight was not captured in the above measurement period, additional noise measurement was conducted on 23rd July 2009 in order to capture all flight modes (i.e. Approach, Hovering, Idling and Take Off).

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	68	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	67	

(C). Calculated Helicopter Noise Levels (without background)

Flight Ref. No.	Flight Model	Flight Direction #	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Lmax, dB(A) *
1	AW139	EW	18:11	Approach ##		
				Hovering ##		
				Idling ##		
				Take-off **	69	80
2	AW139	WE	18:23	Approach ##	52	74
				Hovering **		
				Idling ##	345	75
				Take-off **		

Highest Lmax level, dB(A): 80

Remark:

- * Corrected noise level without background.
- ** During the measurement, Lmax level was measured by manually start and stop the SLM during each flight event. Thus, only two flight events were measured in each flight (i.e. either "Approach" and "Idling", or "Hovering" and "Take-off").
- # EW - Flight direction from East to West; WE - Flight direction from West to East.
- ### Noise measurement was commenced at 18:11. Thus, noise data before this time is not available.

On 20th July 2009, noise measurement was conducted between 18:11pm and 18:43pm. As "Hovering" mode of flight was not captured in the above measurement period, additional noise measurement was conducted on 23rd July 2009 in order to capture all flight modes (i.e. Approach, Hovering, Idling and Take Off).

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Day-time)

Date: 23 July 2009
Time: 17:18- 17:31
Location: Wing On Centre (roof level)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level, dB(A)				Other Noise Sources #
						LAeq	LA10	LA90	LAMax	
(A). Measured Helicopter Noise Data (with background)										
1	AW139	WE	17:18	Approach	64	69	69	68	77	
		-		Hovering	17	72	72	71	75	
		-	17:30	Idling	626	68	68	67	74	
		EW		Take-off	76	72	72	71	83	

Remark: # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
 * EW - Flight direction from East to West; WE - Flight direction from West to East.
 As "Hovering" mode of flight was not captured during the noise measurement on 20th July 2009, additional noise measurement was conducted on 23rd July 2009 in order to capture all flight modes (i.e. Approach, Hovering, Idling and Take Off).

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1	66	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/ departure at HK-Macau Ferry Terminal

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated LAMax
1	AW139	WE	17:18	Approach	64	76
		-		Hovering	17	74
		-	17:30	Idling	626	74
		EW		Take-off	76	82
Highest Lmax level, dB(A):						82

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.
 As "Hovering" mode of flight was not captured during the noise measurement on 20th July 2009, additional noise measurement was conducted on 23rd July 2009 in order to capture all flight modes (i.e. Approach, Hovering, Idling and Take Off).

Expansion of Heliport Facilities at Macau Ferry Terminal - Operational Phase Noise Monitoring (Evening-time)

Date: 20 July 2009
 Time: 18:59 - 23:00
 Location: Wing On Centre (roof level)

Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	Measured Façade Noise Level, dB(A)			Other Noise Sources #
						LAeq	LA10	LA90	
(A). Measured Helicopter Noise Data (with background)									
1	AW139	WE	18:59	Approach	95	70	70	69	
		-		Hovering	29	71	71	70	
		-		Idling	336	68	68	68	
		EW	19:06	Take-off	76	70	70	69	
2	AW139	WE	19:18	Approach	63	70	71	70	
		-		Hovering	12	75	76	74	
		-		Idling	474	68	69	68	
		EW	19:28	Take-off	87	70	70	69	
3	AW139	WE	19:56	Approach	63	68	69	68	
		-		Hovering	19	71	71	71	
		-		Idling	321	68	69	68	
		EW	20:04	Take-off	71	71	71	70	
4	AW139	WE	20:51	Approach	71	68	69	68	
		-		Hovering	18	72	72	71	
		-		Idling	522	67	67	67	
		EW	21:02	Take-off	74	71	72	71	
5	AW139	WE	21:30	Approach	79	67	68	66	
		-		Hovering	19	70	71	70	
		-		Idling	330	68	68	68	
		EW	21:37	Take-off	86	70	70	69	
6	AW139	WE	21:55	Approach	73	68	68	67	
		-		Hovering	18	72	72	71	
		-		Idling	351	68	68	67	
		EW	22:03	Take-off	71	70	70	69	
7	AW139	WE	22:23	Approach	74	67	67	66	
		-		Hovering	21	70	70	69	
		-		Idling	354	67	68	67	
		EW	22:31	Take-off	80	70	71	70	
8	AW139	WE	22:52	Approach	75	68	68	67	
		-		Hovering	27	70	71	70	
		-		Idling	304	66.2	66	66	
		EW	22:59	Take-off	61	68	68	67	

Remark: # Non-project related noise sources, those peak noise levels significantly mask that recorded due to operation of the new helipad.
 * EW - Flight direction from East to West; WE - Flight direction from West to East.

(B). Measured Background level, dB(A)

Corresponding Flight Ref. No.	Background Level, LAeq, dB(A)	Major Noise Sources
1 *	67	
2	67	
3	67	
4	65	Road traffic noise, and noise due to airplane passing-by, and TurboJet arrival/
5	65	departure at HK-Macau Ferry Terminal
6	66	
7	65	
8	66	

Remark: * Based on background noise level recorded before the second flight.

(C). Calculated Helicopter Noise Level (without background)

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated LAeq
1	AW139	WE	18:59	Approach	95	66
				Hovering	29	68
			19:06	Idling	336	62
		EW		Take-off	76	67
2	AW139	WE	19:18	Approach	63	68
				Hovering	12	75
			19:28	Idling	474	63
		EW		Take-off	87	67
3	AW139	WE	19:56	Approach	63	63
				Hovering	19	69
			20:04	Idling	321	63
		EW		Take-off	71	69
4	AW139	WE	20:51	Approach	71	65
				Hovering	18	70
			21:02	Idling	522	62
		EW		Take-off	74	70
5	AW139	WE	21:30	Approach	79	62
				Hovering	19	69
			21:37	Idling	330	65
		EW		Take-off	86	68
6	AW139	WE	21:55	Approach	73	63
				Hovering	18	70
			22:03	Idling	351	63
		EW		Take-off	71	68
7	AW139	WE	22:23	Approach	74	61
				Hovering	21	68
			22:31	Idling	354	63
		EW		Take-off	80	69
8	AW139	WE	22:52	Approach	75	64
				Hovering	27	69
			22:59	Idling	304	57
		EW		Take-off	61	63
Average Noise Level (4 hrs), dB(A):						59

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.