Annex C

Detailed Calculations of Operational Noise Levels

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

Date: 23 October 2009
Time: 11:43 - 13:00
Location: Seaview Commercial Building (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

						Measured Façade Noise Level at Seaview Comm. Bldg.			
Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	LAeq	LA10	LA90	LAMax
1	AW139	EW	11:48	Approach	75	73	73	72	77
		-		Hovering	21	74	74	73	76
		-		Idling	368	72	72	71	75
		EW	11:56	Take-off	63	73	73	72	79
2	AW139	EW	12:22	Approach	66	72	72	71	75
		-		Hovering	26	72	72	72	74
		-		Idling	868	71	71	71	74
		EW	12:38	Take-off	67	73	73	72	79
3	AW139	EW	12:51	Approach	67	71	71	71	75
		-		Hovering	18	71	71	71	74
		-		Idling	399	72	72	71	76
		EW	12:59	Take-off	61	73	73	72	78

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

(B). Measured Background Noise 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	71	

(C). Correction Factor for Distance Attenuation

Distance Attenuation,dB(A)
0.9

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

						Calculated Nosie Level at Ka On Bldg.
Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	LAMax @
1	AW139	EW	11:48	Approach	75	76
				Hovering	21	75
				Idling	368	74
		EW	11:56	Take-off	63	79
2	AW139	EW	12:22	Approach	66	74
				Hovering	26	72
				Idling	868	72
		EW	12:38	Take-off	67	79
3	AW139	EW	12:51	Approach	67	73
				Hovering	18	71
				Idling	399	76
		EW	12:59	Take-off	61	78
				Highest Lmax level, dB(A):		**79**

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.
@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

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

Date: 23 October 2009
Time: 19:00 - 23:00
Location: Seaview Commercial Building (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

						Measured Façade Noise Level at Seaview Comm. Bldg.		
Flight Ref. No.	Flight Model	Flight Direction *	Approx. Time	Flight Event	Duration of Flight Event, s	LAeq	LA10	LA90
1	AW139	EW	19:02	Approach	74	71	71	71
		-		Hovering	21	72	72	71
		-		Idling	392	71	71	70
		EW	19:11	Take-off	77	75	75	74
2	AW139	EW	19:23	Approach	80	70.8	71	70
		-		Hovering	23	71.1	71	71
		-		Idling	442	70.7	71	70
		EW	19:33	Take-off	59	73	73	72
3	AW139	EW	19:57	Approach	75	70.1	70	70
		-		Hovering	19	70.5	71	70
		-		Idling	228	69.9	70	69
		EW	20:03	Take-off	63	74	74	73
4	AW139	EW	20:21	Approach	66	70.4	71	70
		-		Hovering	21	70.5	71	70
		-		Idling	723	70.4	71	70
		EW	20:34	Take-off	63	72	72	71
5	AW139	EW	20:48	Approach	63	71	71	71
		-		Hovering	21	71	71	71
		-		Idling	831	71	71	70
		EW	21:04	Take-off	65	72	73	72
6	AW139	EW	21:25	Approach	80	71	71	70
		-		Hovering	27	70	70	69
		-		Idling	418	70	70	70
		EW	21:34	Take-off	62	71	71	71
7	AW139	EW	21:49	Approach	65	70	71	70
		-		Hovering	22	71	71	70
		-		Idling	853	70	70	69
		EW	22:05	Take-off	63	72	72	71
8	AW139	EW	22:22	Approach	70	71	71	70
		-		Hovering	21	71	72	71
		-		Idling	620	69	70	69
		EW	22:34	Take-off	67	73	73	72
9	AW139	EW	22:49	Approach	68	71	71	70
		-		Hovering	18	70	71	70
		-		Idling	356	70	70	70
		EW	22:56	Take-off	78	71	71	70

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

(B). Measured Background Noise 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	70	
4	70	
5	70	
6	70	
7	70	
8	70	
9	70	

(C). Distance Attenuation

Distance Attenuation,dB(A)
0.9

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

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Nosie Level at Ka On Bldg. LAeq @
1	AW139	EW	19:02	Approach	74	55
				Hovering	21	65
				Idling	392	55
		EW	19:11	Take-off	77	73
2	AW139	EW	19:23	Approach	80	58
				Hovering	23	62
				Idling	442	55
		EW	19:33	Take-off	59	69
3	AW139	EW	19:57	Approach	75	58
				Hovering	19	63
				Idling	228	61
		EW	20:03	Take-off	63	72
4	AW139	EW	20:21	Approach	66	61
				Hovering	21	55
				Idling	723	61
		EW	20:34	Take-off	63	66
5	AW139	EW	20:48	Approach	63	66
				Hovering	21	66
				Idling	831	63
		EW	21:04	Take-off	65	69
6	AW139	EW	21:25	Approach	80	64
				Hovering	27	54
				Idling	418	62
		EW	21:34	Take-off	62	67
7	AW139	EW	21:49	Approach	65	62
				Hovering	22	64
				Idling	853	61
		EW	22:05	Take-off	63	68
8	AW139	EW	22:22	Approach	70	65
				Hovering	21	67
				Idling	620	60
		EW	22:34	Take-off	67	70
9	AW139	EW	22:49	Approach	68	65
				Hovering	18	63
				Idling	356	62
		EW	22:56	Take-off	78	67
				Leq(4-hrs), dB(A):		**60**

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

@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

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

Date: 22 October 2009
Time: 16:15 - 17:34
Location: Wayson Commercial Building (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

						Measured Façade Noise Level at Wayson Comm. Bldg. (with Correction for Shielding Effect at Talon Tower)			
Flight Ref. No.	**Flight Model**	**Flight Direction ***	**Approx. Time**	**Flight Event**	**Duration of Flight Event, s**	**LAeq**	**LA10**	**LA90**	**LAMax**
1	AW139	WE	16:18	Approach	51	75	75	75	77
		-		Hovering	22	74	74	73	76
		-		Idling	867	72	73	72	80
		EW	16:34	Take-off	64	74	75	74	80
2	AW139	EW	16:50	Approach	87	74	75	74	83
		-		Hovering	24	74	74	73	76
		-		Idling	440	72	73	72	77
		EW	16:59	Take-off	64	75	75	75	79
3	AW139	EW	17:18	Approach	88	74	74	73	80
		-		Hovering	23	73	74	73	76
		-		Idling	810	72	73	72	79
		EW	17:33	Take-off	64	74	75	74	81

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

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

Correspon-ding 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	72	

(C). Correction Factor for Distance Attenuation

Distance Attenuation,dB(A)
-0.6

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

						Calculated Nosie Level at Talon Tower
Flight Ref. No.	**Flight Model**	**Flight Direction ##**	**Approx. Time**	**Flight Event**	**Duration of Flight Event, s**	**LAMax @**
1	AW139	WE	16:18	Approach	51	75
				Hovering	22	73
				Idling	867	78
		EW	16:34	Take-off	64	78
2	AW139	EW	16:50	Approach	87	81
				Hovering	24	73
				Idling	440	74
		EW	16:59	Take-off	64	77
3	AW139	EW	17:18	Approach	88	78
				Hovering	23	73
				Idling	810	77
		EW	17:33	Take-off	64	79
					Highest Lmax level, dB(A):	**81**

Remark: ## EW - Flight direction from East to West; WE - Flight direction from West to East.
@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

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

Date: 22 October 2009
Time: 19:00 - 23:00
Location: Wayson Commercial Building (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

						Measured Façade Noise Level at Wayson Comm. Bldg. (with Correction for Shielding Effect at Talon Tower)		
Flight Ref. No.	**Flight Model**	**Flight Direction ***	**Approx. Time**	**Flight Event**	**Duration of Flight Event, s**	**LAeq**	**LA10**	**LA90**
1	AW139	WE	19:33	Approach	60	75	75	74
		-		Hovering	22	75	75	75
		-		Idling	371	72	72	71
		EW	19:40	Take-off	66	74	75	74
2	AW139	EW	19:51	Approach	70	72	73	72
		-		Hovering	23	72	72	71
		-		Idling	398	72	72	71
		EW	20:00	Take-off	64	72	73	72
3	AW139	EW	20:27	Approach	88	73	74	72
		-		Hovering	26	73	74	73
		-		Idling	247	73	73	72
		EW	20:33	Take-off	70	75	75	74
4	AW139	EW	20:52	Approach	84	73	73	72
		-		Hovering	21	74	74	73
		-		Idling	571	72	72	71
		EW	21:03	Take-off	68	74	75	73
5	AW139	WE	21:50	Approach	66	76	77	75
		-		Hovering	27	75	76	74
		-		Idling	660	72	72	71
		EW	22:03	Take-off	68	75	75	74
6	AW139	WE	22:18	Approach	74	73	74	73
		-		Hovering	23	72	73	72
		-		Idling	419	71	72	71
		EW	22:27	Take-off	65	74	75	73
7	AW139	WE	22:49	Approach	66	75	76	75
		-		Hovering	23	76	76	75
		-		Idling	400	72	72	71
		EW	22:57	Take-off	76	72	72	71

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

(B). Measured Background Noise 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	70	
4	70	
5	70	
6	69	
7	70	

(C). Correction Factor for Distance Attenuation

Distance Attenuation,dB(A)
-0.6

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

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Nosie Level at Talon Tower LAeq @
1	AW139	WE	19:33	Approach	60	71
				Hovering	22	72
				Idling	371	63
		EW	19:40	Take-off	66	70
2	AW139	EW	19:51	Approach	70	66
				Hovering	23	64
				Idling	398	63
		EW	20:00	Take-off	64	66
3	AW139	EW	20:27	Approach	88	69
				Hovering	26	69
				Idling	247	68
		EW	20:33	Take-off	70	72
4	AW139	EW	20:52	Approach	84	68
				Hovering	21	70
				Idling	571	66
		EW	21:03	Take-off	68	70
5	AW139	WE	21:50	Approach	66	74
				Hovering	27	72
				Idling	660	65
		EW	22:03	Take-off	68	72
6	AW139	WE	22:18	Approach	74	70
				Hovering	23	68
				Idling	419	66
		EW	22:27	Take-off	65	71
7	AW139	WE	22:49	Approach	66	73
				Hovering	23	73
				Idling	400	66
		EW	22:57	Take-off	76	66
					Leq(4-hrs), dB(A):	**63**

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

@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

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

Date: 23 October 2009
Time: 14:14 - 16:34
Location: Wing On Centre (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

						Measured Façade Noise Level at Wing On Centre			
Flight Ref. No.	**Flight Model**	**Flight Direction ***	**Approx. Time**	**Flight Event**	**Duration of Flight Event, s**	**LAeq**	**LA10**	**LA90**	**LAMax**
1	AW139	EW	14:19	Approach	74	77	77	76	84
		-		Hovering	26	72	72	71	80
		-		Idling	670	69	69	68	78
		EW	14:32	Take-off	65	71	71	70	80
2	AW139	EW	14:48	Approach	70	78	79	77	86
		-		Hovering	26	74	75	74	80
		-		Idling	577	68	69	68	74
		EW	15:00	Take-off	68	71	71	70	76
3	AW139	EW	15:20	Approach	71	78	79	77	87
		-		Hovering	24	75	75	74	83
		-		Idling	656	69	70	69	79
		EW	15:32	Take-off	65	70	70	69	75
4	AW139	WE	15:46	Approach	57	69	69	68	73
		-		Hovering	24	71	71	70	74
		-		Idling	726	69	69	69	79
		EW	15:59	Take-off	68	69	70	68	77
5	AW139	EW	16:20	Approach	68	76	76	75	86
		-		Hovering	20	74	75	73	83
		-		Idling	678	68	69	68	80
		EW	16:33	Take-off	64	70	70	69	73

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

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

Correspon-ding Flight Ref. No.	**Background Level, LAeq, dB(A)**	**Major Noise Sources**
1	69	Road traffic noise, and noise due to airplane passing-by,and TurboJet arrival/ departure at HK-Macau Ferry Terminal
2	67	
3	68	
4	67	
5	69	

(C). Correction Factor for Distance Attenuation and Shielding Effect

Distance Attenuation,dB(A)	**Shielding Effect, dB(A) ***
0.4	-5dB(A) **

Remark: * The correction factor is applied the measured Lmax and Leq levels during the **Approach** and **Take-off** modes when flights approach from/ depart to the East.

** A negative value indicates a negative correction to the measured noise level; a positive correction indicates that the value is added to the measured noise level.

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

						Calculated Nosie Level at The Bauhinia
Flight Ref. No.	**Flight Model**	**Flight Direction ##**	**Approx. Time**	**Flight Event**	**Duration of Flight Event, s**	**LAMax (W/O Bkg.) @**
1	AW139	EW	14:19	Approach	74	79
				Hovering	26	79
				Idling	670	77
		EW	14:32	Take-off	65	74
2	AW139	EW	14:48	Approach	70	81
				Hovering	26	80
				Idling	577	73
		EW	15:00	Take-off	68	70
3	AW139	EW	15:20	Approach	71	82
				Hovering	24	83
				Idling	656	78
		EW	15:32	Take-off	65	69
4	AW139	WE	15:46	Approach	57	72
				Hovering	24	73
				Idling	726	78
		EW	15:59	Take-off	68	71
5	AW139	EW	16:20	Approach	68	81
				Hovering	20	82
				Idling	678	80
		EW	16:33	Take-off	64	66
					Highest Lmax level, dB(A):	**83**

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

@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.

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

Date: 22 October 2009
Time: 19:00 - 23:00
Location: Wing On Centre (roof level)
Weather Condition: Fine

(A). Measured Helicopter Noise Data (with background)

						Measured Façade Noise Level at Wing On Centre		
Flight Ref. No.	**Flight Model**	**Flight Direction ***	**Approx. Time**	**Flight Event**	**Duration of Flight Event, s**	**LAeq**	**LA10**	**LA90**
1	AW139	WE	19:33	Approach	60	69	70	69
		-		Hovering	22	71	72	71
		-		Idling	359	68	68	68
		EW	19:40	Take-off	66	69	70	69
2	AW139	EW	19:51	Approach	70	74	75	73
		-		Hovering	23	80	80	79
		-		Idling	353	68	68	67
		EW	19:59	Take-off	65	70	70	69
3	AW139	EW	20:27	Approach	88	77	77	76
		-		Hovering	26	68	68	68
		-		Idling	247	67	68	67
		EW	20:33	Take-off	70	71	71	71
4	AW139	EW	20:52	Approach	84	71	71	70
		-		Hovering	21	81	81	80
		-		Idling	571	68	68	67
		EW	21:03	Take-off	68	72	72	71
5	AW139	WE	21:50	Approach	66	68	68	67
		-		Hovering	27	71	72	71
		-		Idling	660	67	67	66
		EW	22:03	Take-off	68	72	73	72
6	AW139	WE	22:18	Approach	74	67	67	66
		-		Hovering	23	70	71	70
		-		Idling	419	67	67	67
		EW	22:27	Take-off	65	71	72	70
7	AW139	WE	22:49	Approach	66	68	68	67
		-		Hovering	23	71	71	70
		-		Idling	400	68	68	67
		EW	22:57	Take-off	76	70	70	69

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

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

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

(C). Correction Factor for Distance Attenuation and Shielding Effect

Distance Attenuation,dB(A)	**Shielding Effect, dB(A) ***
0.4	-5dB(A) **

Remark: * The correction factor is applied the measured Lmax and Leq levels during the **Approach** and **Take-off** modes when flights approach from/ depart to the East.

** A negative value indicates a negative correction to the measured noise level; a positive correction indicates that the value is added to the measured noise level.

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

Flight Ref. No.	Flight Model	Flight Direction ##	Approx. Time	Flight Event	Duration of Flight Event, s	Calculated Nosie Level at The Bauhinia LAeq (W/O Bkg.) @
1	AW139	WE	19:33	Approach	60	65
				Hovering	22	69
				Idling	359	61
		EW	19:40	Take-off	66	61
2	AW139	EW	19:51	Approach	70	68
				Hovering	23	79
				Idling	353	59
		EW	19:59	Take-off	65	62
3	AW139	EW	20:27	Approach	88	71
				Hovering	26	64
				Idling	247	61
		EW	20:33	Take-off	70	65
4	AW139	EW	20:52	Approach	84	64
				Hovering	21	81
				Idling	571	64
		EW	21:03	Take-off	68	66
5	AW139	WE	21:50	Approach	66	62
				Hovering	27	70
				Idling	660	58
		EW	22:03	Take-off	68	66
6	AW139	WE	22:18	Approach	74	61
				Hovering	23	68
				Idling	419	61
		EW	22:27	Take-off	65	65
7	AW139	WE	22:49	Approach	66	64
				Hovering	23	69
				Idling	400	63
		EW	22:57	Take-off	76	63
					Leq(4-hrs), dB(A):	**60**

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

@ Calculated noise level (without background) with noise correction for shielding effect and distance attenuation.