inter.noise
HAMBURG 2016

Research on the effect of the air craft noise pollution on the noise environment in the school education of Okinawa due to the U.S. military Bases

Takeshi Tokashiki[1]

[1]University of the Ryukyus, Japan

ABSTRACT

At present on Okinawa, the military base facilities occupy 10.4% of the prefecture's total land area of 2274.6 Sq.km^2.
This poses a great problem in the effective urban planning of the cities, towns and villages surrounding the military bases.

Part of the problem is the aircraft noise pollution during takeoff, landing, warming up of the engines etc. which seriously affects the quality of the basic daily life of the inhabitants surrounding the base.

A survey carried out by the University of the Ryukyus indicates that the noise from the Marine Corps Air Station Futenma exceeded 100 decibels in the classrooms of the Second Futenma Elementary School,which is located next to the air base,Ginowan City, during aircraft take-off and landing.

In the Morning of October 4 when MV-22 Osprey Training began at Futenma Air Station, A team led by the author conducted a noise survey on the occurrence of low-frequency sound recorded at take-offs.

The level of sound recorded was higher than that stated in the Environmental impact Assessment Created by the Ministry of Defense for the futenma Relocation plan to Henoko.

Keywords: Okinawa,the military bases,MV-22 Osprey,low-frequency,Lden

1. INTRODUCTION

At present on Okinawa, the military base facilities occupy 10.4% of the prefecture's total land area of 2274.6 Sq.kms. This poses a great problem in the effective urban planning of the cities, towns and villages surrounding the military bases. Part of the problem is the aircraft noise pollution during takeoff, landing, warming up of the engines etc. which seriously affects the quality of the basic daily life of the inhabitants surrounding the base. The purpose of my present research is first to check the present conditions regarding the air craft noise pollution of the Kadena and Futenma air bases, second to collect the data of the human appraisal research of the areas surrounding the two air bases and third to come up with suggestions to mitigate the problem of the air craft noise pollution due to them. For the survey of the air port noise appraisal collecting only the physical data of the noise pollution such as WECPNL etc. was not complete without human appraisal of the citizens of the area. But honest expression of the citizens' appraisal could not be obtained so the writer was forced to think again. Then using the seven-grade scale, Dr. Tokashiki's study of the traffic noise pollution, the students of the university conducted a survey of the airport noise pollution with the following results. The research of the human appraisal was done using the seven-grade scale of Dr. Tokashiki's study of the traffic noise environment.

Table 1:area occupied by the military facilities on Okinawa

division	National(k㎡)		Okinawa(k㎡)		rest of Japan(k㎡)	
permanent facility	312.201	100.0%	232.987	74.6%	79.214	25.4%
tenporary facility	713.167	100.0%	3.688	0.5%	709.479	99.5%
total	1,025.368	100.0%	236.675	23.1%	788.693	76.9%

[1] tokat@tec.u-ryukyu.ac.jp

Table 2:outline of the surrounding area of Kadena and Futenma air bases

	P population	A:area (km^2)	B:base area (km^2)	(B/A)*100(%)	C:P/A population	D:P/(A-B) population	D/C
Onna village	10,144	50.83	14.95	29.4	199.6	282.8	1.4
Uruma city	116,979	86.17	6.19	7.2	1,357.5	1,462.5	1.1
Okinawa city	130,249	49.00	16.90	34.5	2,658.1	4,057.1	1.5
Yomitan village	38,200	35.17	12.59	35.8	1,086.2	1,691.8	1.6
Kadena village	13,827	15.04	12.40	82.5	919.3	5,245.4	5.7
Chatan village	27,264	13.78	7.29	52.9	1,978.5	4,200.3	2.1
Kintanakagusuku village	15,951	11.53	2.11	18.3	1,383.4	1,693.1	1.2
Ginowan City	91,928	19.70	6.38	32.4	4,666.4	6,899.4	1.5
Urasoe city	110,351	19.09	2.74	14.3	5,780.6	6,748.1	1.2
Nago city	60,231	210.37	23.35	11.1	286.3	322.1	1.1

2. THE METHOD OF MEASUREMENT OF LOW FREQUENCY

The sound level meter is set at 1/3 Octave band frequency
The covered recording mic is weatherproofed and placed on a tripod 1.5 meters in height.
The auditory sense of the environmental noise measurement device is set to A-weight , C-weight and fast
The survey is conducted watching the osprey in heli-mode , airplane-mode during takeoff and landing and the data is collected.

3. THE METHOD OF MEASUREMENT OF LOW FREQUENCY

I felt that the noise levels inside classrooms of Futenma No. 2 Elementary School are about the same as noise levels underneath elevated railway tracks when a train passes over them and are highly likely to disrupt class.

The Education, Culture, Sports, Science and Technology Ministry's school environment and health management manual says it is "desirable" to keep noise levels inside classrooms with all windows shut or open at less than 50 decibels and 55 decibels, respectively.

According to the manual, teachers' voice levels average 65 decibels. Noise level guidelines issued by the World Health Organization in 1999 recommended a noise level differential of at least 15 decibels between a teacher's voice level and classroom noise to enable pupils and students to properly listen to class.

According to the manual, teachers' voice levels average 65 decibels. Noise level guidelines issued by the World Health Organization in 1999 recommended a noise level differential of at least 15 decibels between a teacher's voice level and classroom noise to enable pupils and students to properly listen to class.

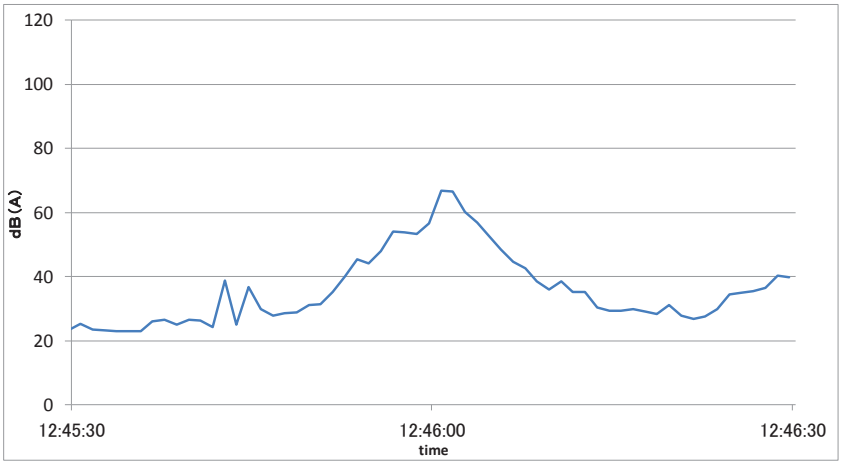


Figure 1: 66.9 dB in a shut window classroom

At around 12:45 p.m. on March 20, the author logged a noise level of 66.9 dB in a classroom with its soundproof windows shut.

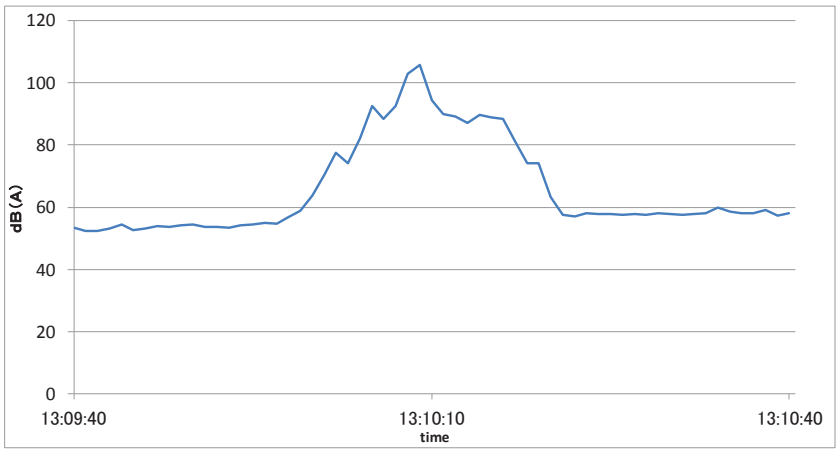


Figure 2: 105.7 dB in a open window classroom

At around 1:10 p.m. on March 23, the noise level rose to 105.7 dB in a classroom with its windows open.

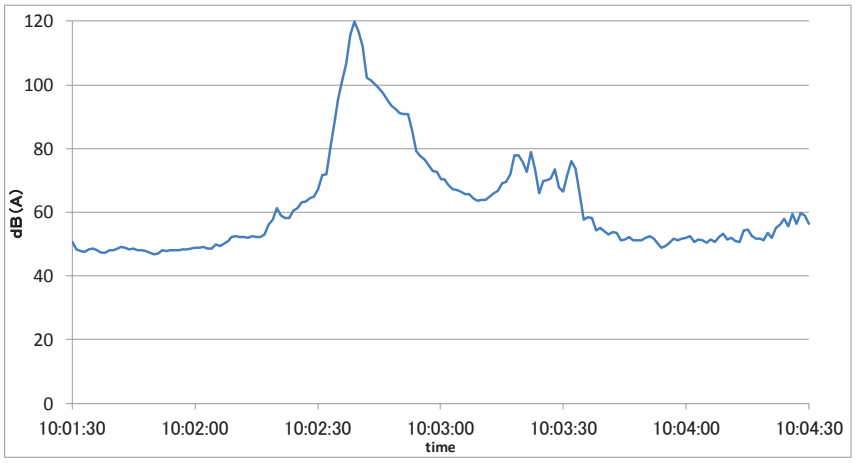


Figure 3: 119.9 dB outside the classroom

At around 10:02 a.m. on April 12,the noise level of 119 decibels was logged outside the classroom. during the whole length of the survey, this was the highest noise level logged.

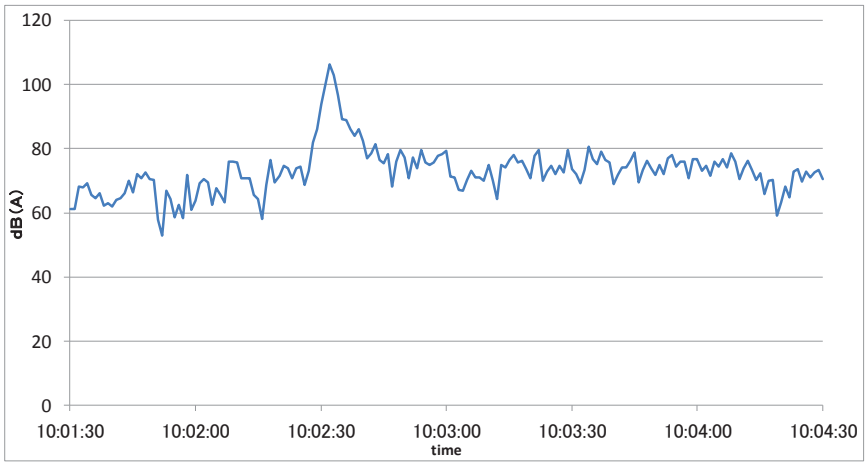


Figure 4: 106.3 dB in a partially closed classroom

At the same time the noise level inside the classroom was logged at 106.3 dB with its windows not completely closed.

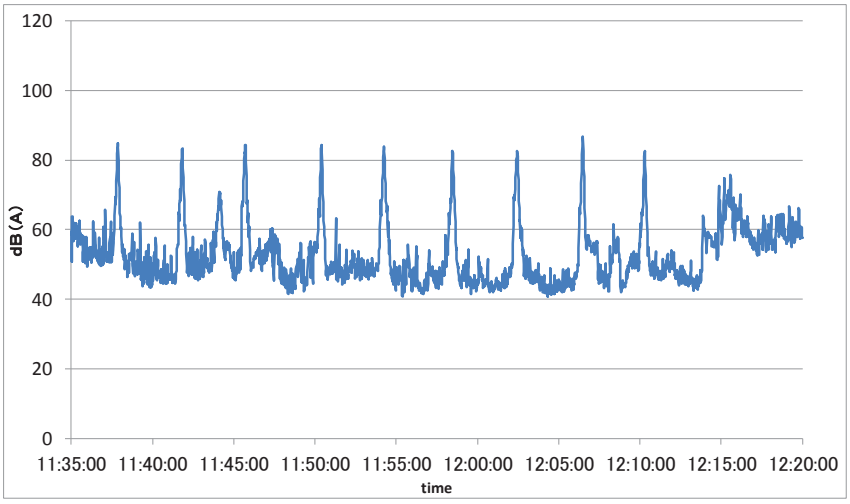


Figure 5: the touch and go training survey results

On march 1 during the touch and go training of the aircraft KC-130 we observed that the noise level during the flyover over the elementary school peaked at every 4 minutes.

4. Research results of the Low-frequency noise from MV-22 Osprey

The data on the low-frequency noise analysis from osprey is indicated on the invironment impact assessment of the henoko relocation plan.

Looking at the results peaking at 20Hz,25Hz, the low-frequency noise was above the threshold value for physical impact and psychological impact stated in the assessment.

The results below indicate the low-frequency noise research on the osprey's flights around okinawa after it's disposition to the futenma airbase.

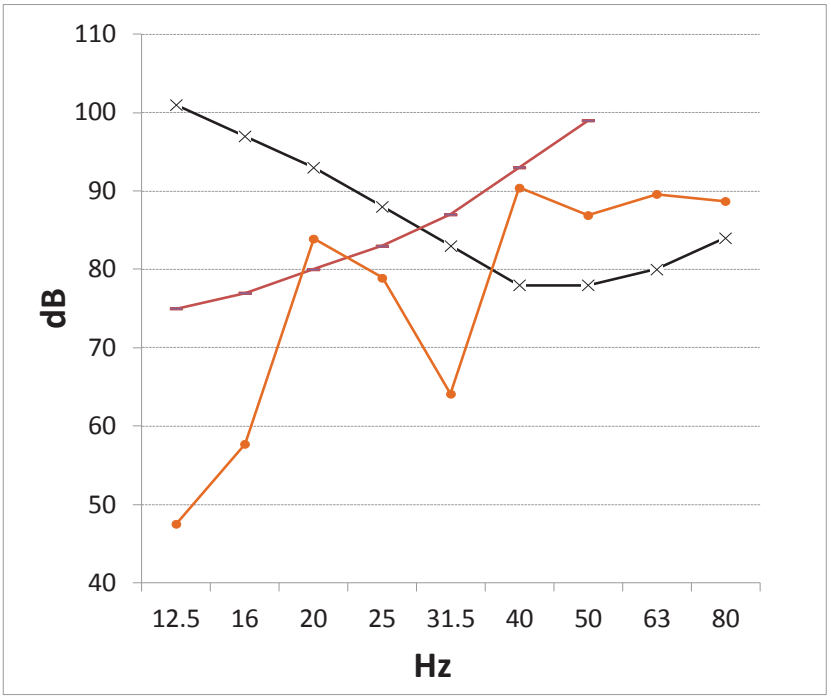


Figure 6: 2012.10.10 the resuts of the osprey's take-off in heli-mode from the top of the building in the second futenma elementary school

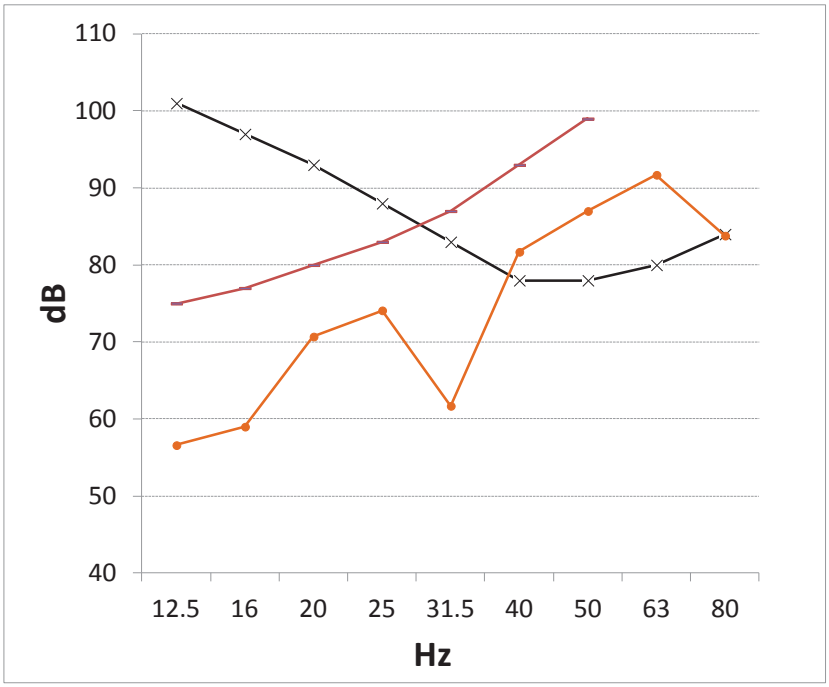


Figure 7: 2012.10.10 the resuts of the osprey's take-off in airplane-mode from the top of the building in the second futenma elementary school

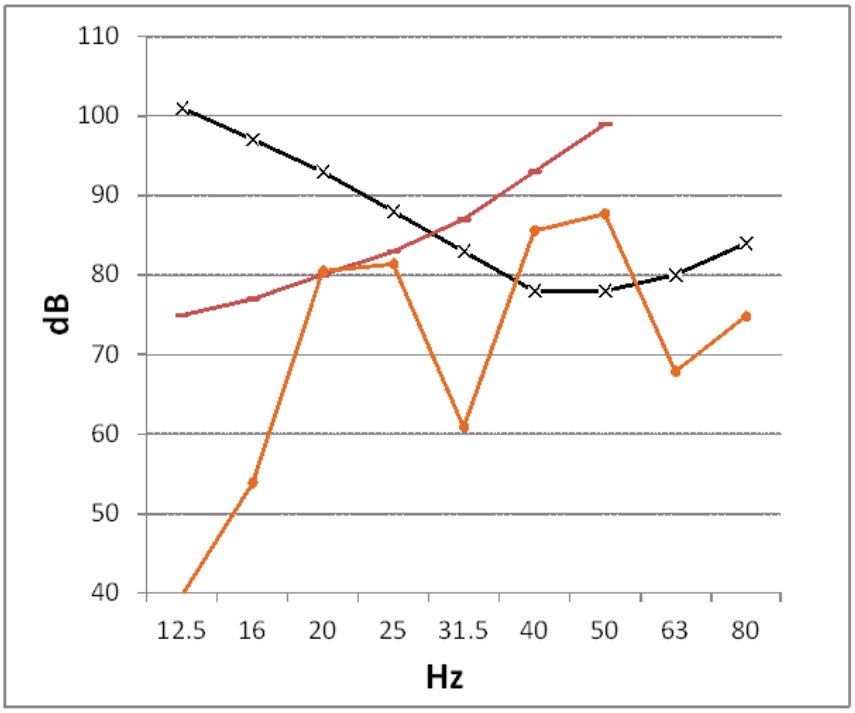


Figure 8: 2012.10.19 the resuts of the noise measurements from inside the classroom of the osprey's take-off in heli-mode from the top of the building in the second futenma elementary school

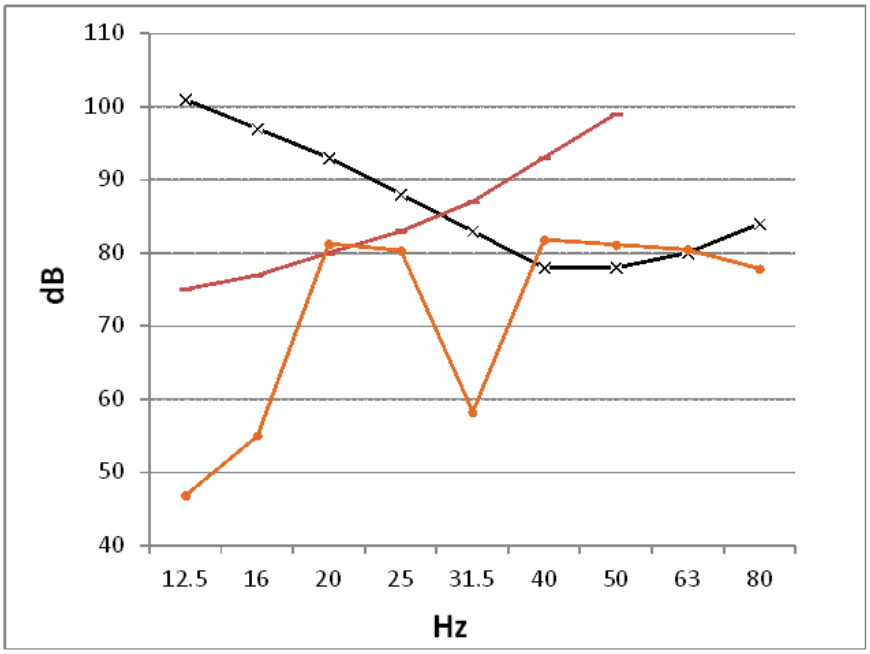


Figure 9: 2012.10.1 the results of the osprey's landing in heli-mode on the top of the building in the second futenma elementary school

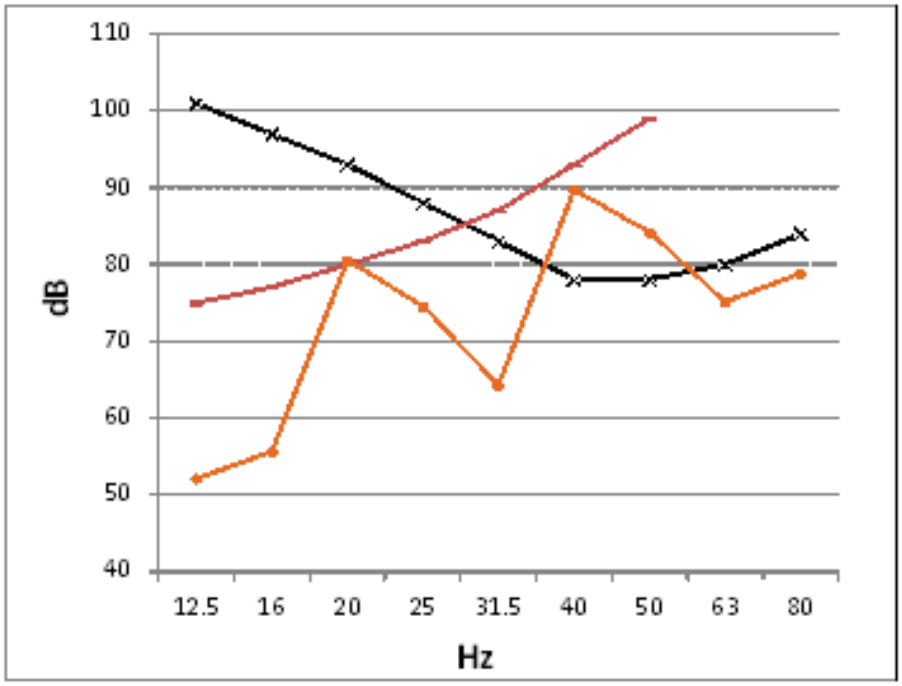
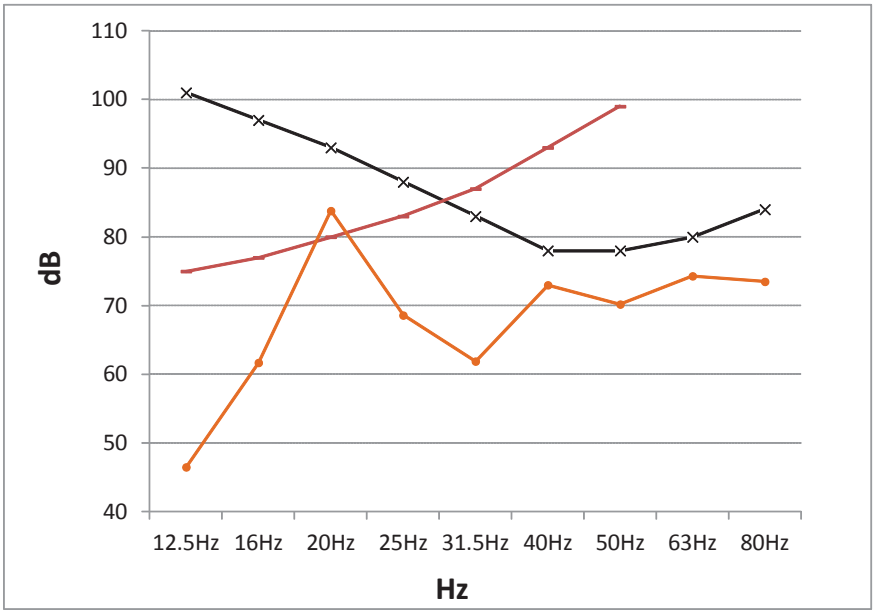
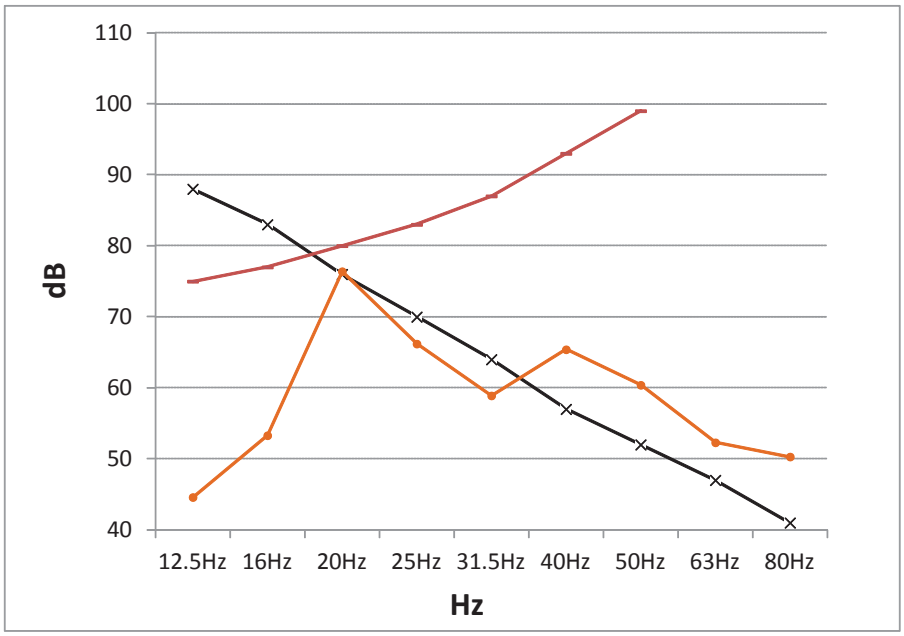


Figure 10: 2012.11.16 the results of the osprey's flight in heli-mode from the 2nd floor of a building in the kin town Ryukyu rehabilitation institute



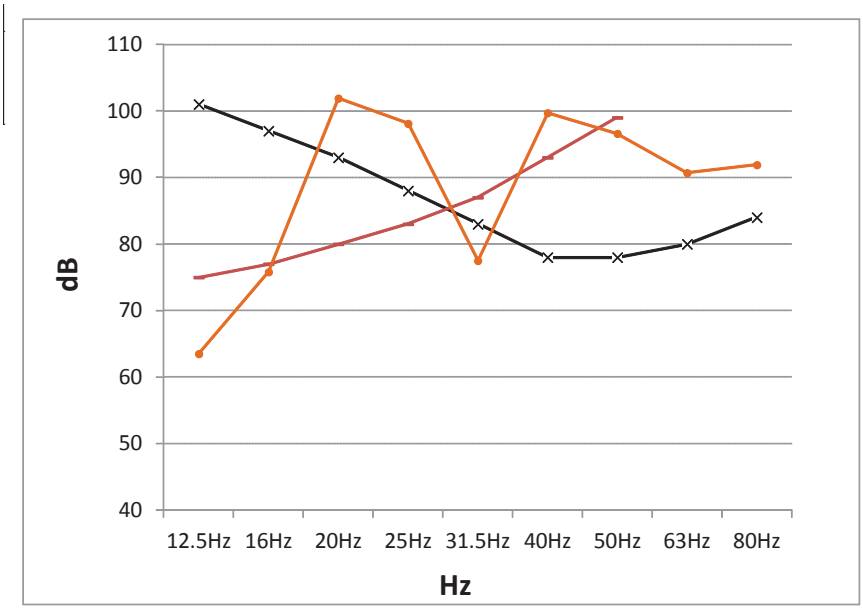
	12.5	16	20	25	31.5	40	50	63	80	騒音レベル L(A)
心理的影響（アセス）	101.0	97.0	93.0	88.0	83.0	78.0	78.0	80.0	84.0	
物的影響	75.0	77.0	80.0	83.0	87.0	93.0	99.0			82.5
2015/12/15 16:14:51	46.5	61.7	83.8	68.6	61.9	73.0	70.2	74.3	73.5	

Figure 11: 2015.12.15 the results of the CH-53 helicopter from the top of a building in the Okinawa National College of Technology



	12.5	16	20	25	31.5	40	50	63	80	騒音レベル L(A)
心理的影響（環境省）	88.0	83.0	76.0	70.0	64.0	57.0	52.0	47.0	41.0	
物的影響（環境省）	75.0	77.0	80.0	83.0	87.0	93.0	99.0			53.5
2015/12/15 16:18:07	44.6	53.3	76.4	66.2	58.9	65.4	60.4	52.3	50.3	

Figure 12: 2015.12.15 the results of the CH-53 helicopter from the top of the 4th floor in the Okinawa National College of Technology



	12.5	16	20	25	31.5	40	50	63	80	騒音レベル L(A)
心理的影響（アセス）	101.0	97.0	93.0	88.0	83.0	78.0	78.0	80.0	84.0	
物的影響	75.0	77.0	80.0	83.0	87.0	93.0	99.0			95.2
2016/5/10 9:42:46	63.5	75.8	101.9	98.1	77.5	99.7	96.6	90.7	91.9	

Figure 13: 2016.5.10 the results of the osprey's flight in heli-mode from the top of a building in the Okinawa National College of Technology

Figs.6 to Fig.9 show the resuts of the low frequency noise assessment in the second futenma elementary school.
Fig.9 shows the results of the low-frequency noise assessment of the ospreys first flight on futenma airbase.

At 20Hz the low-frequency noise crossed the threshold value for physical impact and at 40Hz and 63Hz it crossed the psychological impact.

Fig.8 shows the resuts of the low frequency noise assessment inside a sound-proofed windowed classroom.

I confirmed that the low-frequency noise penetrates even a concret-walled classroom through sound proofed windows.

Fig.10 show the results of the osprey's flight in heli-mode from the 2nd floor of a building in the kin town Ryukyu rehabilitation institute. The frequency noise at 40Hz the neared the threshold for physical impact

Fig.11 shows the low-frequency noise assessment results of the CH-53 helicopter from the top of a building in the Okinawa National College of Technology situated at the mountainside behind Camp Schwab located on the east coast of Nago city. at 20Hz and 40Hz it neared the threshold level for physical impact and psychological impact respectivily.The touch down point of the helicoptor is located 400m away from the classroom and take-off and landing activities of the CH-53 disturbs the classroom procedures.

Fig.12 shows the low-frequency noise assessment results of the CH-53 helicopter from the 4th floor of a building in the Okinawa National College of Technology situated at the mountainside behind Camp Schwab located on the east coast of Nago city. at 20Hz and 40Hz it neared the threshold level for physical impact and psychological impact respectivily.The touch down point of the helicoptor is located 400m away from the classroom and take-off and landing activities of the CH-53 disturbs the classroom procedures.

Fig.13 shows the low-frequency noise assessment results of the osprey's flight in heli-mode from the top of a building in the Okinawa National College of Technology situated at the mountainside behind Camp Schwab located on the east coast of Nago city. at 20Hz and 40Hz it neared the threshold level for physical impact and psychological impact respectivily.The touch down point of the helicoptor is located 400m away from the classroom and take-off and landing activities of the osprey disturbs the classroom procedures.

5. CONCLUSIONS

According to the Education, Culture, Sports, Science and Technology Ministry's school environment and health management manual the noise levels in classrooms at the Futenma No. 2 Elementary School have far surpassed the ministry's recommended noise levels.

In the classroom an assessment on the low-frecency noise from the osprey was done. Moreover it confirmed that the noise environment of the school was destroyed.

It also confirmed that the low-frequency noise emitted from the Osprey during the research conducted at four different locations around Okinawa surpassed the threshold level of the physical impact and the psychological impact.
Inside the four surbeyed locations

The result of the survey conducted at Okinawa National College of Technology situated at the mountainside behind Camp Schwab located on the east coast of Nago city confirmed that the low-frequency noise from the osprey surpassed the thressold level of the physical impact and psycholical impact stated in the Environmental impact Assessment Created by the Ministry of Defense for the futenma Relocation plan to Henoko.

Therefore a survey conducted during a actual demonstration flight of the Osprey is essential.

From now on training of MV-22 Osprey is expected to be severe at all locations and hopefully the low-frequency noise assessment should be continued and moreover a survey on it effects on the psychological and physical health be conducted and basic data be documented.

REFERENCES

1. The Okinawa Times (morning edition), May 17,2006
2. Hideki Tachibana, Hiroo Yano; *Measurement Methods for Environmental Noise and Building Acoustics*, CORONA PUBLISHING CO., LTD, 2004, pp 60-77.
3. Environment Preservation Division Okinawa Prefecture; The results of the research of the aircraft noise, 2000-2005.
4. Takeshi T., Naoki T., Yamashita Y. & Dai M.;(2002),Study on the correlation between audible environmental noise and annoyance in the Naha city areas, J.Archit. Plann. Environ.,AIJ,,No.562,9-13
5. Mainichi News paper Japan, April 2, 2012