Research on the effect of the aircraft noise pollution on the noise environment in the classrooms of Okinawa due to the U.S. Military Bases

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ABSTRACT

At present in 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.

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.

The team confirmed clearly generated low-frequency sound at the first landing of the aircraft on the base.

INTRODUCTION

At present in 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 aircraft 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 aircraft noise pollution due to them. For the survey of the airport noise appraisal collecting only the physical data of the noise pollution such as WECPNL etc. was not completed without human appraisal of the citizens of the area. But honest expression of the citizens' appraisal could not be obtained. Then using the seven-grade scale, the students of the university conducted a survey of the airport noise pollution with the following results.

Table 1: Area occupied by the military facilities in Okinawa

division	National (km²)		Okinawa (km²)		rest of Japan (km²)	
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%

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

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 and airplane-mode during takeoff and landing and the data is collected.

THE SURVEY OF NOISE ENVIRONMENT AT THE FUTENMA NO.2 ELEMENTARY SCHOOL

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 school environment and health management manual published by the Ministry of Education, Culture, Sports, Science and Technology says that it is "desirable" to keep noise levels inside classrooms with all windows shut and open 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 teachers.

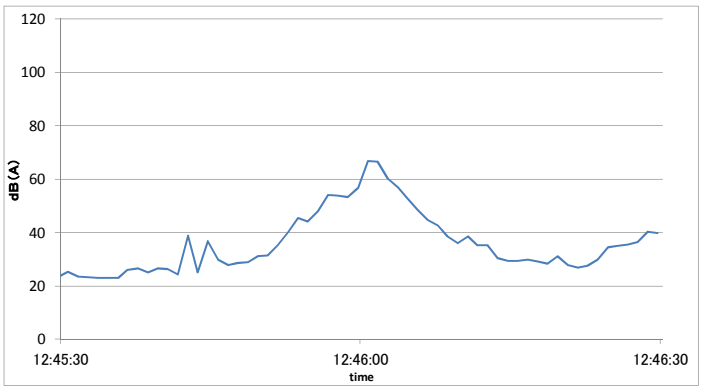

Figure 1: 66.9 dB in a shut window classroom

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.

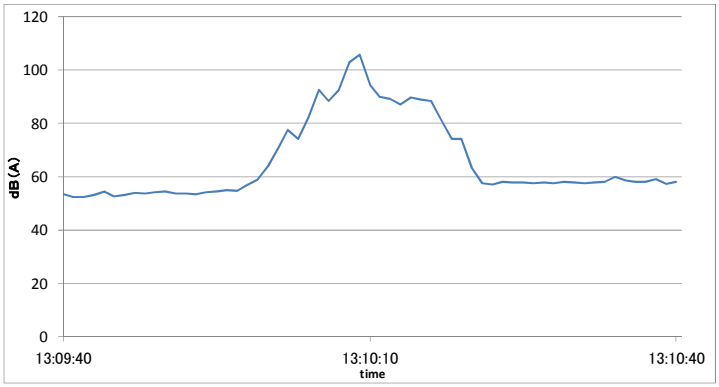

Figure 2: 105.7 dB in a open window classroom

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

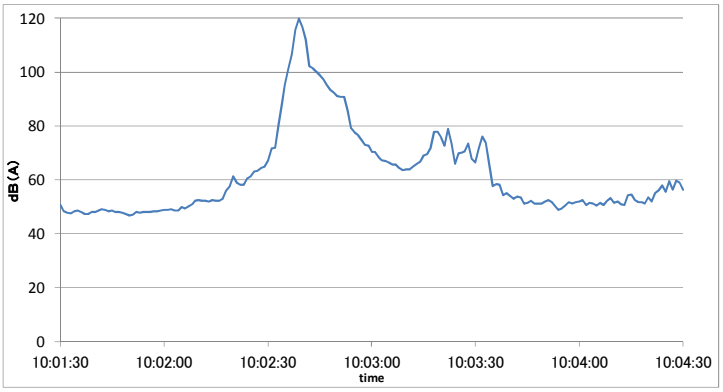

Figure 3: 119.9 dB outside the classroom

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.

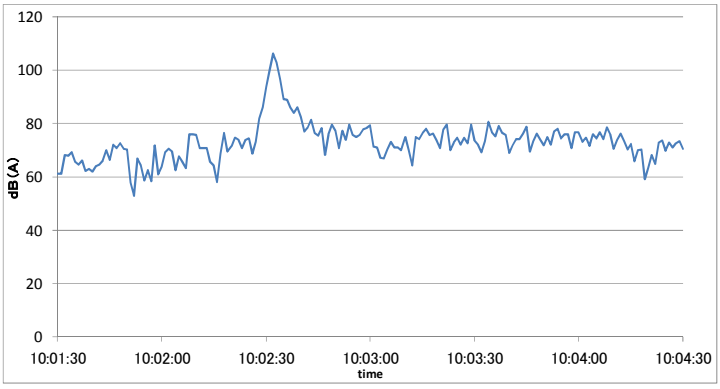

Figure 4: 106.3 dB in a partially closed classroom

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

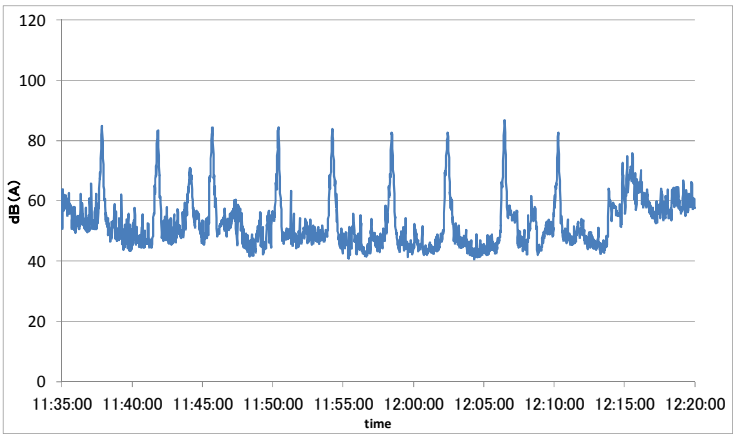

Figure 5: the touch and go training survey results

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.

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

The data on the low-frequency noise analysis from Osprey is indicated in the environment 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.

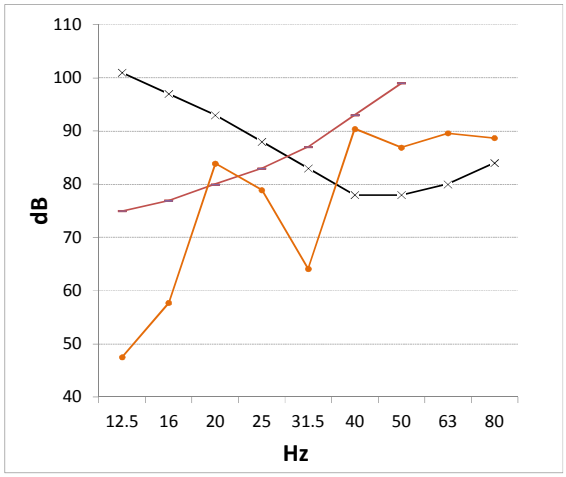

Figure 6: 2012.10.10 the resuts of the osprey's take-off in heli-mode from the top of the building in the second Futenma Elementary School

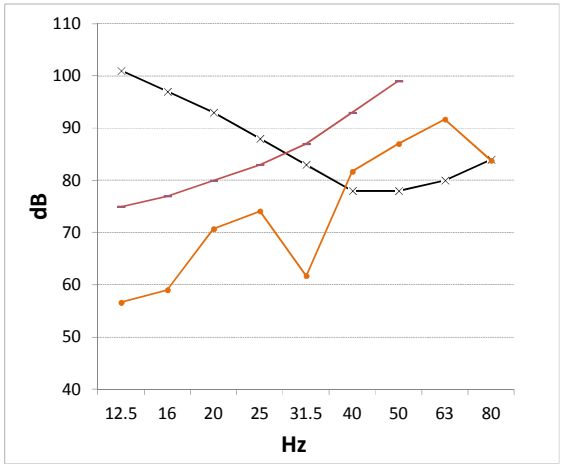

Figure 7: 2012.10.10 the resuts of the Osprey's take-off in airplane-mode from the top of the building in the second Futenma Elementary School

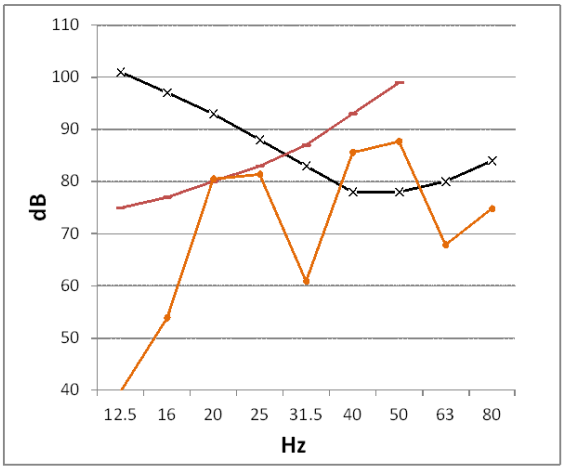

Figure 8: 2012.10.19 the resuts of the noise measurements from inside the classroom of the Osprey's take-off in heli-mode from the top of the building in the second Futenma Elementary School

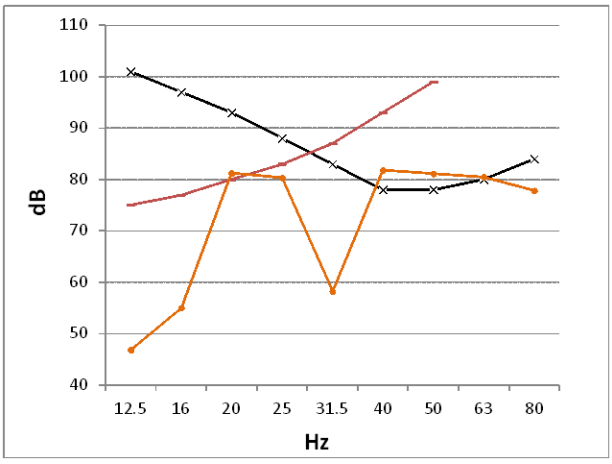

Figure 9: 2012.10.10 the results of the Osprey's landing in heli-mode on the top of the building in the second Futenma Elementary School

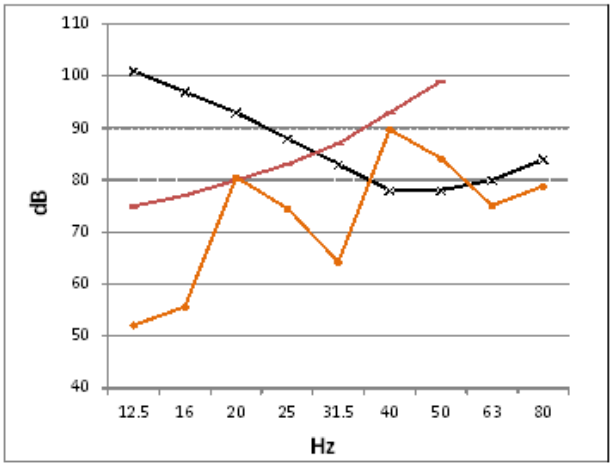

Figure 10: 2012.11.16 the results of the Osprey's flight in heli-mode from the 2nd floor of a building in the Kin town Ryukyu rehabilitation institute

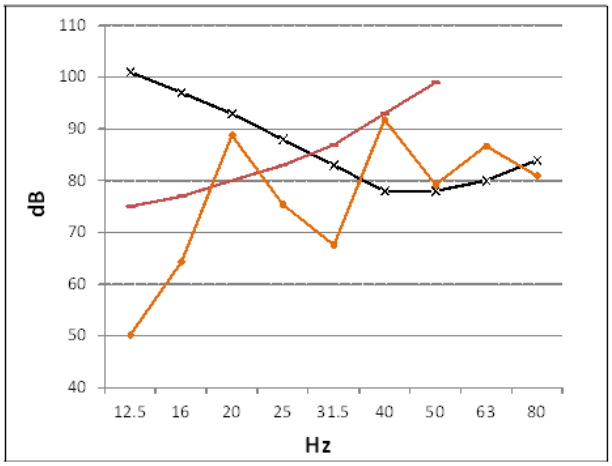

Figure 11: 2012.10.12 the results of the Osprey's flight in heli-mode from the top of a building in the Okinawa National College of Technology

Figs.6 to 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 Osprey's first flight from 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 concrete-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 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.

CONCLUSIONS

According to school environment and health management manual recommended by the Ministry of Education, Culture, Sports, Science and Technology, the noise levels in the classrooms of 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 was confirmed that the noise environment of the school was destroyed.

It was 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 surveyed 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. Moreover a survey of its effects on the psychological and physical health should be conducted and basic data should be documented.

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