

MILITARY AIRCRAFT NOISE EFFECTS ON CREW'S COGNITIVE CONDITIONS

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ABSTRACT

The purpose of this research is to establish a relationship between subjects exposed to noise generated by military aircraft, with potential changes observed in cognitive abilities. The sample of 65 subjects in two layers pilots and maintenance personnel. Data were collected between 2006 and 2009. For the study of noise, were considered FAA Standards and ISO, and the evaluation psychoacoustics, the technical survey results indicate that in the work area of low frequency noise between 16 and 250 Hz, is higher than 100 dB, at all stages of the airplane. The launch represents the phase at higher pressure. Ground operations, reached values of 125 dB. No significant changes were observed in attention and memory. In conclusion, it is assumed that noise is transformed into an electrical signal the brain by altering the Beta and Delta brain waves, giving responses of irritability, fatigue, malaise and drowsiness.

INTRODUCTION

According to aeronautic psychology, pilots' cognitive processes are based on learning predictors. In this respect, theory has explained information processing such as perception, concentration, and memory [1]. In the case of army, pilots are demanded a very high performance [2] that produces distress. Consequently, this distress becomes an activator of neurons and hormones, leaving noise aside just a disrupter of communication.

PROBLEM DEFINITION

The selection of the crew and aircraft maintenance personnel involves a professional modeling broadly cover three important elements: a) the ability to fly, including spatial relationships, orientation, and visualization; b) the attention of both selective as shared, closely related to the memory of short and long term c) personality, in terms of control of anxiety, temperament and achievement motivation and their subsequent evaluation in the maintenance of such powers [3].

The pathologies in the psychological are associated with the derivation of each of the elements identified as cognitive indicators, recently increased the studies where the noise is related to changes psychophysiological interference as a factor for the memories, memory being one of the ways to process information cognitively. It has been reported the effect of exposure to aircraft noise and road traffic with the decline in episodic memory, working memory and sustained attention [4] In the case of pilots has been suggested that this deviation can be overcome by ongoing training.

Other studies relate the psychological load during the work of flight and the reactions of stress, generating an activation neuroendocrina [2] and that can contribute with changes in the nervous system.

Similarly the environmental noise has been studied in air military zones, emphasizing that the noise produced by aircraft and military helicopters, it affects the population, with a prevalence of anxiety and primary insomnia. The results drive to relate that the noise generated by military aircraft has adverse effects in the auditory function, the cardiovascular health and the mental health [5].

In this context, the purpose is to study whether exposure to noise from military aircraft can cause cognitive changes associated with memory and attention, regardless of the process of training pilots and maintenance personnel in three groups of subjects covered: Hunting 12 airplane flight VF5, Hunting 16, F16 flight and Core 4 aircraft flying sky M28 truck and Bell 206 helicopters and 412.

OBJECTIVES

General:

To assess the effects of noise generated by military aircraft and equipment maintenance, about the group of crew and maintenance personnel, Air Force Military Venezuelan and psychoacoustic effects during the development of work activities.

Specifics:

- Determine the perception of noise as the working groups of subjects.
- Assess the dose-effects in exposed subjects.
- Relate the change in memory and attention with possible stress generated by noise from military aircraft.

METHODOLOGY

The selection of the sample of 65 subjects was intentional, differentiated three groups by ship and these into two groups: pilots and maintenance personnel with the previous criteria to be suitable in the medical evidence according to JAR FCL 3215 [6]. Sound characterization subscribed to international standards of FAA [7] and ISO 1990 [8] and 9612 [9]. By using a survey was established cognitive response patterns associated with cognitive processes of attention and memory. Measurement technique for noise: There were two procedures: one for sampling and other measurements of the day. With the noise was first characterized in the hangar and on track for the engine heating operations, takeoff and landing, and finally inside cabin. For the second procedure was determined the total perception of noise, since subjects are mobilized throughout the area of work.

Equipment and instruments The sound level meters was registered CEL Series 593, Type 1, averaging integrator, using a calibrator CEL 282. And the dosimeter Series CEL 460 and CEL-284 Calibrator / 2. By applying an exchange rate of 3 dBA to a criterion of 85 dBA for 8 hours of work, in 1998 NIOSH recommended criteria [10]. The valuation was estimated with the following descriptors: noise level equivalent (Leq), (SPL), peak values, the analysis of octave frequency band is expressed in decibels (dB) and weighted fast and slow time [7]. The survey was divided into 21 dichotomous choice questions, divided into six questions to correlate sleep quality with noise and fatigue, 7 questions to relate noise and attention, and 8 questions to relate sound and memory, using a pilot test for reliability of the instrument, and trial expert and construct validity for the same.

RESULTS

Assessment of noise

Hangar Noise The noise emission by equipment for daily maintenance of the aircraft depend on three factors, 1) the power of each, 2) the engine speed with which they work and 3) the location of this site. The first two are inherent to the team and the third as a result of wave propagation within the individual construction work hangar. The pattern of distribution of frequencies of octave band featured a greater similarity to the teams that feed the turbo-prop aircraft such as the M28. Finding higher values for the required equipment for turbine aircraft such as hunting. In fig. 1 shows that negative values are recorded at low frequencies, between 16 and 250 Hz to reach between 135 and 75 dB.

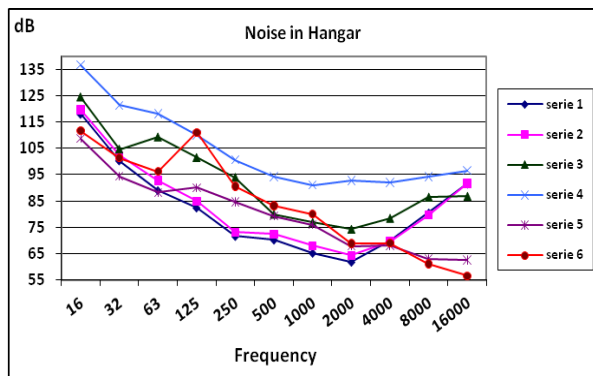


Figure 1. Hangar Core 4: Series 1 compressor. Series 2: 1 compressor and machine. Series 3: power plant, a compressor and machine Hunting Hangar 12: Series 4: VF-5 turbine. Series 5: power plant. Series 6: ground water.

Descriptors noise during ground operations Comparative analysis between the ships and the various noise descriptors showed overlapping facts as: 1) all recorded values are above 100 dB, 2) ground operations during the peak values are above 120 dB, 3) Equivalent noise level corresponds to higher emissions from the helicopters, this being perceived as more annoying, coinciding with the subjects of the M28 aircraft, related studies show that brain waves acoustic signal to be perceived as brain, it transforms it into electrical signal, with the fluctuating noise generator more discomfort [11]. [figure 2].

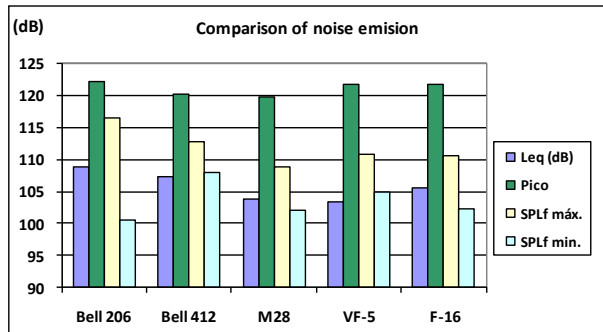


Figure 2. Comparison of equivalent noise level (Leq), peak values and level of sonic pressure characterized as fast (SPLf), among military aircrafts.

The projection of standardized doses, can express the value measured during the whole day exceeds 100% is permissible. It is stressed that the pilot of the M28 made the projection of higher energy. In relation to this situation arises: if the flight hours were as homogeneous for all the drivers (two hours on average), it follows that the pressurized cabin of the fighters act as a protective enclosure, but also exceed the values 100% of the allowable reference, in contrast with the values for the subjects of M28, which reached 450% projection. Only the person who does not perform flight operations recorded a value of 72.8%, from within the command where there is shelter to the noise. [Figure 3].

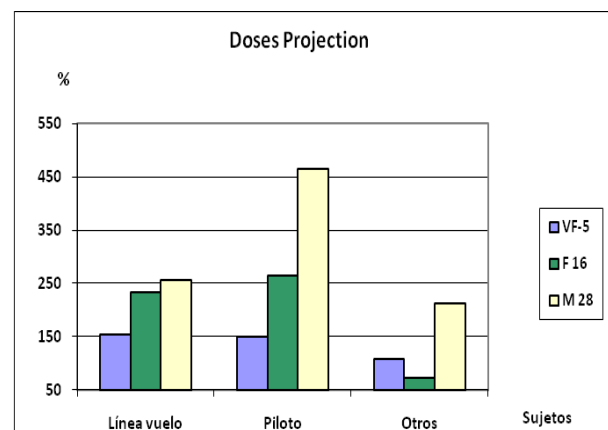


Figure 3. Normalized projection for subjects exposed to military aircraft noise on a working day.

Valuation psicoacústica

The experimental results of the present investigation reveal that the subjects of study give his major attention to the labors indistinctly from the noise in which they are unrolled and which, in conditions of extreme time, they support such an activity to consist of the fatigue that the same one could produce. In the figure 4, the relation observes noise - attention, where the subjects express that obvian the external noises, to the dominant being the internal noise in the environ-

ment where they work. The demand of the task together with the responsibility that it implies induces to support the attention in spite of the noises [12].

Likewise, 70 % of the polled subjects expressed that they can support the attention in two tasks simultaneously, interpreting that his shared attention is functionally useful in the labor executions. Whereas for 80 %, they suppose that the noise improves not even his visual final touch not auditory, in spite of that they manage to support the conscious condition of attention.

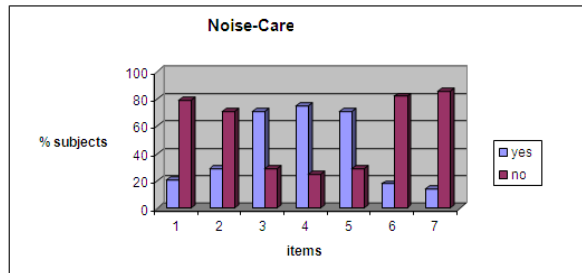


Figure 4. Noise-concentration relationship: (1) diminish conscious concentration (2) during working hours, concentration is not disrupted, (3) no matter how much noise there is, concentration remains, (4) tasks are executed fast and precisely, (5) perform simultaneous tasks during work time, (6) eyesight improves with noise, (7) listening improves with noise

Relation noise – memory. The experimental information emphasizes the following answers analyzed in the set of the subjects: the items 1 and 2, recounted to if they remember all the procedures, it is valued affirmatively by more than 80 %. These answers correlate with the article 3 it means that the memory of short term is very active and that of long term is stimulated by the constant study and review of the manuals of procedures.

The spatial vision so much for the pilots that it is fundamental during the flight, since in the arrangement of pieces on the part of the subjects of maintenance, does not meet affected by the noise. The response was forceful for 100 %. The answers of the article 8 differ, being more important for the subjects of maintenance, where the noise typical of the engines forms a part of the information that they receive of the condition of the engine. The response of 60 % represents to these subjects. A particular condition is the article 4, where 80 % of the subjects expressed that, in spite of the high levels of noises, his mind does not stay in white, though they sit in cases of fatigue a stun. The above mentioned can assume to the permanency in the time opposite to the low frequencies of noise [11] [figure 5].

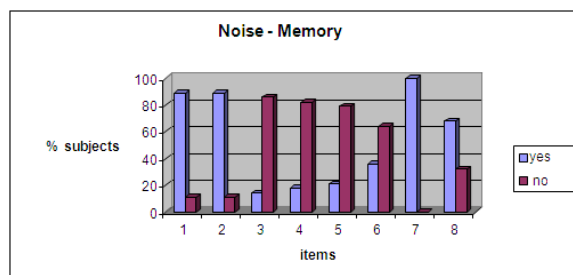


Figure 5. Noise-memory relationship: (1) remember procedures before checking manual, (2) consult manual constantly, (3) make an effort to recall procedures, (4) mind is blank during activities, (5) consult manual only at the end, (6) repetitive activities are affected, (7) look at flight instruments or actions before executing them, (8) noise allows the recognition of engine operational state.

CONCLUSIONS

Inside the hangar so much for the group He Hunts 12, since for the group Core 4, indistinctly of the equipments and the operations of maintenance, the boss represented in the analysis of frequencies presented similarity. The values understood between 16 and 125 Hz, ranged between 115 and 95 dB, respectively. The difference resides when they realize tests with turbine dismantled of the plane VF-5, which values range between 135 and 115 dB, for the same frequencies.

Opposite to the differences of cabin pressurized in F16, and not pressurized in plane M28, there existed a notable difference between the pilots and the dose that they accumulate, being 200 % for the first ones and 450 % of dose projected for the second ones.

The generation of noise in diverse environments aeromilitares has been characterized by the predominance of low frequencies in values that overcome the 100 dB, as all the indicators of analysis of noise. For what decides that the sonorous pressure of the frequencies understood between 16 and 250 Hz can be harmful on having affected the human body.

In presence of noise, the subjects support the aptitude to attend to two or more tasks, this facet is fundamental in the pilots of helicopters and of the plane M 28, which answered that during the activity of flight, the generated noise indicates operative condition of the ship to them.

The maintenance of attention at the expense of the noises around you means a greater effort than they notice increasing fatigue.

The pilots and personnel of maintenance, exposed to noises of planes already are of type turbocharger, I disturb propeller and his equipments of maintenance, it did not affect them in his processes of spatial, visual memory, and long term. Nevertheless, they stick fast to the protocol of checking the respective manuals for each of the tasks that corresponds to them to realize.

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