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**HEARING OF PERSONNEL INCLUDED IN THE
USAF HEARING CONSERVATION PROGRAM:
JANUARY-MARCH 1975**

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Progress Report for Period January-October 1975

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USAF SCHOOL OF AEROSPACE MEDICINE
Aerospace Medical Division (AFSC)
Brooks Air Force Base, Texas 78235



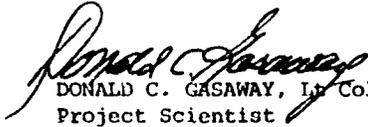
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This technical report has been reviewed and is approved for publication.


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← military personnel and 95.05% of left ears and 94.84% of right ears of civilian employees that routinely work in potentially hazardous noise showed hearing levels at 500, 1000, and 2000 Hz that averaged 30 dB or better ←

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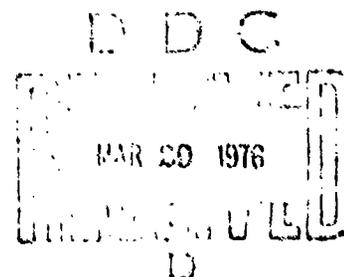
HEARING OF PERSONNEL INCLUDED IN THE
USAF HEARING CONSERVATION PROGRAM:
JANUARY-MARCH 1975

INTRODUCTION

In October 1956 the U.S. Air Force established a formal hearing conservation program that employs threshold monitoring audiometry (1). A Hearing Conservation Data Registry was also established by the Air Force to study and accumulate hearing data on military and civilian personnel who routinely work in noise. Recent revisions of this program have resulted in increased emphasis on hearing conservation studies and evaluations (2). The intent of this report is to describe the results of a survey of annual audiometric monitoring of 22,817 military and 3,629 civilian personnel who are included in the Air Force hearing conservation program.

The Air Force program requires annual audiometric monitoring of all military and civilian personnel who routinely work in potentially hazardous noise. Approximately 27,000 personnel receive audiometric monitoring each month. Of this number, about 14,000 are annual evaluations. The intent of the annual audiometric monitoring is to identify personnel who may be acquiring noise-induced hearing losses. The form used for this purpose has been carefully designed so that the current hearing of each individual can be directly and immediately compared to the hearing levels established as an individual audiometric reference, or baseline. This procedure has been in effect since October 1956, but entry of current and reference hearing levels on the same form began in 1973. Fortunately, with proper use of monitoring audiometry, most people who develop a hearing loss due to noise can be identified early enough in their careers so that a sensorineural hearing loss in the speech range can be prevented (3). Simply stated, the Air Force uses audiometric monitoring techniques and threshold shift criteria that identify "significant threshold shifts" before they progress to "significant hearing losses."

This report contains a detailed description of the hearing of personnel for whom hearing thresholds were obtained during annual audiometric evaluations reported to the USAF Hearing Conservation Data Registry during a 3-month period (January through March 1975). The authors are responsible for monitoring the effectiveness of the hearing conservation program performed at Air Force bases, and results of studies are intended to identify areas which require revision and correction. This initial study is intended to describe the hearing of personnel who routinely work in noise so that a basis for later evaluations of the effectiveness of the program can be established.



CURRENT STUDY

A duplicate copy of Air Force Form 1490 (Hearing Conservation Data), completed on each individual who receives routine audiometric monitoring, is forwarded to the Data Registry. Quality control assessment is performed on each incoming form and acceptable forms are key-punched and loaded into the computer. Each form contains information concerning the individual's noise history and other pertinent information, and a complete audiometric threshold record is reported for both the current as well as the reference audiometric test. As a result, longitudinal hearing data are available on each individual who is monitored using the AF Form 1490.

For purposes of this evaluation, military and civilians are treated separately. All audiometric data represent ANSI S3.6-1969 calibration standards. Forms containing errors or incomplete data were not included in this study.

Table 1 shows mean hearing levels at six test frequencies (500 through 6000 Hz), for each ear, obtained from hearing data recorded on 22,817 annual hearing tests performed on military personnel.

Table 2 provides details relative to the age groupings used in the study of the hearing of military personnel. The age distributions indicate that more than half the military sample were 29 years of age or younger. Although this finding was to be expected, the distribution within 5-year intervals indicates a slightly older population than is commonly found in the military.

Tables 3 and 4 provide similar information for 3,629 civilian personnel who were monitored during the same period. Table 3 shows mean hearing levels, and Table 4 provides a breakdown of the age distribution. The distribution of ages indicates an older population than that reported for the military, which is to be expected. Figure 1 illustrates the data on age groupings contained in Tables 2 and 4. The mean hearing levels contained in Table 1 are illustrated in Figure 2, and Figure 3 shows those reported in Table 3.

Study of the data reported in Tables 1 and 3 must be approached with caution since mean hearing levels are recorded. Medians are more commonly used for reporting central tendencies in hearing threshold levels because of the marked skewing of data. We believe that both statistics are of value; therefore, both means and medians are reported in this study.

Table 5 gives median hearing levels for the military personnel, and Table 6 gives data for the civilian personnel. Figures 4 and 5 illustrate the data reported in Tables 5 and 6, respectively. One additional bit of information is provided in Tables 5 and 6: the

difference between the current and reference audiogram is noted. The differences between median hearing levels at 4000 Hz tend to exhibit the most noticeable change that is commonly attributed to noise-induced hearing loss. Figure 6 serves to illustrate this phenomenon. Mean values of threshold shift noted between current and reference audiograms on 22,817 military personnel are illustrated.

Table 7 provides a comparison of mean and median data for both military and civilian personnel, using two age groups (30-34 and 40-44). Within the same age group, civilian personnel generally reflect poorer hearing acuity than do the military, especially in the higher frequencies.

Although this study is not intended to provide a comparison with other populations, it is evident that the hearing levels (medians) reflect reasonably good hearing acuity, especially for a population which routinely works in noise. Also, the hearing levels obtained during an annual audiogram (identified in this report as current) frequently reflect the results of auditory fatigue. This factor becomes even more evident when we consider that 28% of the total sample included in this study revealed current threshold audiograms that, when compared against their threshold reference, demonstrated significant threshold shift. Discovering the presence of auditory fatigue is an extremely valuable bit of information when conducting audiometric monitoring of persons who work in noise, since the presence of auditory fatigue reflects either inadequate ear protection or inappropriate encounters with excessive noise. Each base hearing conservationist is specifically instructed to provide careful counseling and stringent followup monitoring of any individual who demonstrates auditory fatigue. In any event, it is encouraging to find hearing levels of the type reported in this study.

In an attempt to provide simple descriptions of the hearing of a given population, several methods for averaging hearing threshold levels have been proposed. We selected three of these methods for purposes of comparison. The averaging technique most commonly used by audiologists and otolaryngologists is an average of hearing levels at 500, 1000, and 2000 Hz. A second method, currently proposed by a working group of CHABA (Committee on Hearing, Bioacoustics, and Biomechanics), averages hearing levels at 1000, 2000, and 3000 Hz (5). The third method, similar to a proposal by personnel at the Occupational Safety and Health Administration for computing the presence of significant amounts of hearing loss, averages hearing levels at 2000, 3000, and 4000 Hz (4).

Table 8 identifies the cumulative percentages of 22,817 military personnel who demonstrate average hearing levels (within 5-dB intervals) from equal to or less than 0 dB through 81 dB or more. The cumulative percentages of the sample are shown for each ear, under each of the three threshold averaging techniques. For example, 95.26% of the 22,817 persons in the sample revealed average hearing at 500, 1000, and 2000 Hz, equal to or better than 20 dB in their left ears.

The information in Table 8 allows generalizations to be made concerning the more detailed hearing data already described. For example, among Air Force military personnel who routinely work in noise, 98.90% of the left and right ears had hearing at 500, 1000, and 2000 Hz that averaged 30 dB or better. This means that 1.10% demonstrated hearing levels that averaged more than 30 dB at these three frequencies. In the same sample, 97.60% of the left and 97.98% of the right ears averaged 30 dB or better at frequencies of 1000, 2000, and 3000 Hz; with 2.40% of the left and 2.02% of the right ears revealing average hearing levels that exceeded 30 dB. For the highest of the three test frequencies studied (2000, 3000, and 4000 Hz), 92.43% of the left and 94.31% of the right ears averaged 30 dB or better; with 7.57% of left and 5.69% of right ears demonstrating average hearing levels that exceeded 30 dB. Figure 7 illustrates that data contained in Table 8. For simplicity, hearing levels (averages) of 51 dB or more are grouped into one interval.

Table 9 shows cumulative percentages of 3,629 civilian employees (tabulated in the same way as for military personnel). Using the same average hearing range (30 dB) as previously used when inspecting the hearing of military personnel, differences become evident. Among the civilians, the percentage showing average hearing of 30 dB or better was: 95.05% of left and 94.84% of right ears at 500-2000 Hz; 86.39% of left and 88.81% of right ears at 1000-3000 Hz; and 70.08% of left and 75.21% of right ears at 2000-4000 Hz. Figure 8 illustrates data contained in Table 9. As with Figure 7, the average hearing levels of 51 dB, or more, are grouped together.

The data in Table 10 (obtained by taking the remainder of the proportions reported for respective hearing levels in Tables 8 and 9) provide a comparison of the proportion of military and civilian personnel who demonstrated average hearing levels not as good as 20, 25, or 30 dB for each of the three averaging techniques. In each comparison, the average hearing of civilian personnel is consistently poorer than that of the military. Civilians represent an older population group (Tables 2 and 4), but although this would account for some of the differences in hearing levels noted in Table 9, it is doubtful if age alone can be considered as the reason for generally poorer hearing. This contention is partially based on the findings shown in Table 7. Although the civilian population reveals somewhat poorer hearing than the military for the same age range, the hearing levels are not too bad. Later research will be directed at more definitive studies of the hearing of Air Force personnel who work in noise.

DISCUSSION

This study, the first of many on the hearing of persons who work in noise, provides details and a data base against which subsequent studies can be compared. Although it is not the purpose of this study to compare the Air Force sample with other population groups, the data reported can be used for such comparisons.

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4. Occupational noise exposure. Department of Labor 29 CFR Part 1910/ Docket No. OSH-11, Federal Register, pp. 37773-37778 (Vol. 39, No. 207), Washington, D.C., 24 Oct 1974.
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TABLE 1. MEAN HEARING LEVELS (dB) FOR 22,817 MILITARY PERSONNEL

| Age (N) | Left Ear | | | | | Right Ear | | | | | | |
|-----------------|--------------------|---------------|----------------|----------------|----------------|----------------|----------------|---------------|----------------|----------------|----------------|----------------|
| | Hz: 500 | 1000 | 2000 | 3000 | 6000 | 500 | 1000 | 2000 | 3000 | 6000 | | |
| 17-19 (369) | C 10.93 R 12.25 | 7.47 7.79 | 6.82 6.50 | 8.18 7.28 | 10.14 8.98 | 14.30 14.35 | 8.82 10.08 | 6.54 6.80 | 6.14 5.70 | 7.30 6.28 | 8.48 7.81 | 11.30 10.70 |
| 20-24 (5902) | C 11.37 R 13.02 | 7.88 8.32 | 7.36 7.43 | 9.62 9.82 | 11.62 10.97 | 15.63 15.79 | 9.43 10.75 | 6.99 7.10 | 6.30 6.19 | 8.35 8.19 | 10.29 9.44 | 14.32 13.55 |
| 25-29 (6635) | C 9.10 R 11.21 | 6.45 6.95 | 6.27 6.75 | 9.56 10.31 | 12.50 11.23 | 16.75 17.54 | 7.78 10.08 | 5.74 6.36 | 5.37 5.93 | 7.97 8.71 | 10.78 9.59 | 15.18 15.66 |
| 30-34 (3580) | C 8.95 R 11.12 | 6.75 6.94 | 7.15 7.27 | 12.11 11.46 | 17.01 13.14 | 20.99 19.64 | 7.97 10.31 | 6.30 6.45 | 6.18 6.41 | 10.11 9.70 | 14.93 11.59 | 19.56 18.14 |
| 35-39 (3365) | C 9.61 R 11.69 | 7.71 7.94 | 8.46 8.52 | 15.22 13.84 | 21.89 16.37 | 25.27 21.78 | 8.98 11.58 | 7.23 7.52 | 7.40 7.78 | 13.25 12.10 | 19.44 14.52 | 23.88 20.70 |
| 40-44 (2081) | C 9.31 R 11.69 | 7.88 8.03 | 9.34 9.13 | 18.44 15.74 | 25.36 18.93 | 28.29 24.28 | 8.78 11.50 | 7.43 7.93 | 8.09 8.23 | 16.02 13.72 | 22.75 16.76 | 26.66 22.54 |
| 45-49 (572) | C 10.34 R 12.49 | 8.72 8.88 | 11.95 10.87 | 23.64 19.62 | 32.15 24.13 | 36.77 30.81 | 10.17 12.61 | 8.24 8.53 | 10.38 9.70 | 20.63 17.10 | 29.13 21.87 | 33.48 28.29 |
| ≥50 (313) | C 11.68 R 12.11 | 10.61 9.65 | 17.40 14.74 | 30.50 25.16 | 38.02 29.54 | 42.27 33.51 | 11.60 12.94 | 10.06 9.82 | 14.58 13.23 | 28.34 23.48 | 36.39 28.64 | 40.62 33.95 |

C = Current audiogram (Jan-Mar 1975 annual AF Forms 1490).

R = Reference audiogram

TABLE 2. AGE DISTRIBUTION OF MILITARY PERSONNEL TESTED

| Age | N | Relative % | Cumulative % |
|-------|------------|------------|--------------|
| 17-19 | 359 | 1.62 | 1.62 |
| 20-24 | 5902 | 25.87 | 27.49 |
| 25-29 | 6635 | 29.08 | 56.57 |
| 30-34 | 3580 | 15.69 | 72.26 |
| 35-39 | 3365 | 14.75 | 87.01 |
| 40-44 | 2081 | 9.12 | 96.13 |
| 45-49 | 572 | 2.51 | 98.64 |
| ≥ 50 | <u>313</u> | 1.37 | 100.01 |

TOTAL MILITARY: 22,817

TABLE 3. MEAN HEARING LEVELS (dB) FOR 3,629 CIVILIAN PERSONNEL

| Age (N) | <u>Left Ear</u> | | | | | | <u>Right Ear</u> | | | | | |
|----------------|--------------------|----------------|----------------|----------------|----------------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|
| | Hz: 500 | 1000 | 2000 | 3000 | 4000 | 6000 | 500 | 1000 | 2000 | 3000 | 4000 | 6000 |
| 17-19 (9) | C 7.78 R 12.22 | 7.78 7.22 | 6.11 6.11 | 7.22 9.44 | 13.89 12.78 | 16.67 19.44 | 7.22 8.33 | 6.11 5.56 | 3.89 4.44 | 9.44 6.11 | 16.67 12.78 | 20.00 18.33 |
| 20-24 (169) | C 10.36 R 11.01 | 6.30 6.86 | 6.15 5.95 | 10.47 9.62 | 14.56 12.25 | 18.08 17.66 | 8.64 9.50 | 5.80 5.98 | 5.50 4.94 | 7.40 7.54 | 10.33 8.91 | 13.49 13.28 |
| 25-29 (528) | C 10.43 R 12.13 | 6.81 7.82 | 6.65 7.57 | 12.05 12.66 | 19.07 16.00 | 21.92 22.60 | 8.84 10.62 | 6.51 6.90 | 5.90 6.58 | 10.38 11.24 | 16.08 14.21 | 19.84 21.09 |
| 30-34 (383) | C 11.16 R 13.09 | 7.26 8.62 | 7.44 8.81 | 15.31 14.83 | 21.42 17.38 | 23.83 25.05 | 8.85 11.20 | 6.71 7.96 | 6.16 7.96 | 11.95 12.31 | 18.43 14.91 | 22.32 22.42 |
| 35-39 (351) | C 10.57 R 13.75 | 7.72 9.44 | 8.69 10.46 | 18.95 17.54 | 26.10 20.90 | 28.66 27.72 | 9.72 13.58 | 7.31 9.05 | 7.46 9.19 | 15.01 15.03 | 22.69 17.93 | 26.24 25.61 |
| 40-44 (445) | C 12.44 R 14.93 | 9.65 10.75 | 11.78 11.76 | 25.29 21.24 | 33.35 26.57 | 35.44 32.24 | 11.54 14.36 | 8.76 9.63 | 10.07 10.63 | 21.27 18.85 | 29.69 23.76 | 32.19 28.98 |
| 45-49 (523) | C 14.39 R 16.02 | 11.70 11.75 | 13.85 13.23 | 27.53 24.02 | 37.16 29.40 | 39.74 34.38 | 13.75 15.10 | 10.95 10.98 | 13.20 12.35 | 25.10 22.83 | 34.79 27.33 | 38.65 33.44 |
| 50 (1221) | C 15.73 R 17.43 | 14.27 14.02 | 20.81 18.54 | 36.48 31.17 | 44.97 36.04 | 47.93 41.39 | 15.75 17.45 | 13.76 13.26 | 18.82 16.37 | 32.80 28.19 | 41.83 33.49 | 45.23 38.74 |

C = Current audiogram (Jan-Mar 1975)

R = Reference audiogram

TABLE 4. AGE DISTRIBUTION OF CIVILIAN PERSONNEL TESTED

| Age | N | Relative % | Cumulative % |
|-------|-------------|------------|--------------|
| 17-19 | 9 | .25 | .25 |
| 20-24 | 169 | 4.66 | 4.91 |
| 25-29 | 528 | 14.55 | 19.46 |
| 30-34 | 383 | 10.55 | 30.01 |
| 35-39 | 351 | 9.67 | 39.68 |
| 40-44 | 445 | 12.26 | 51.94 |
| 45-49 | 523 | 14.41 | 66.35 |
| ≥ 50 | <u>1221</u> | 33.65 | 100.00 |

TOTAL CIVILIAN: 3,629

TABLE 5. MEDIAN HEARING LEVELS (dB) FOR 22,817 MILITARY PERSONNEL

| Age (N) | Left Ear | | | | | Right Ear | | | | | | | |
|-----------------|------------|-------|-------|-------|-------|-----------|-------|-------|-------|-------|-------|-------|-------|
| | Hz: 500 | 1000 | 2000 | 3000 | 4000 | 6000 | 500 | 1000 | 2000 | 3000 | 4000 | 6000 | |
| 17-19 (369) | Current | 7.37 | 3.75 | 2.33 | 3.44 | 4.56 | 8.45 | 5.05 | 2.61 | 1.58 | 2.60 | 3.55 | 5.99 |
| | Reference | 9.37 | 3.93 | 2.74 | 3.57 | 3.74 | 10.26 | 6.62 | 3.12 | 2.20 | 2.46 | 3.34 | 5.62 |
| | Difference | -2.00 | -0.18 | -0.41 | -0.13 | 0.82 | -1.81 | -1.57 | -0.51 | -0.62 | 0.14 | 0.21 | 0.37 |
| 20-24 (5902) | Current | 8.14 | 3.94 | 3.01 | 4.79 | 6.14 | 9.95 | 5.74 | 2.93 | 1.87 | 3.58 | 4.67 | 8.72 |
| | Reference | 10.06 | 4.53 | 3.49 | 5.30 | 5.90 | 10.57 | 7.32 | 3.42 | 2.39 | 3.83 | 4.30 | 8.38 |
| | Difference | -1.92 | -0.59 | -0.48 | -0.51 | 0.24 | -0.62 | -1.58 | -0.49 | -0.52 | -0.25 | 0.37 | 0.34 |
| 25-29 (6635) | Current | 5.77 | 2.64 | 1.83 | 4.42 | 6.41 | 10.95 | 4.06 | 1.82 | 0.98 | 3.01 | 4.69 | 9.32 |
| | Reference | 8.14 | 3.43 | 2.95 | 6.13 | 6.00 | 10.22 | 6.87 | 2.86 | 2.06 | 4.56 | 4.44 | 10.29 |
| | Difference | -2.37 | -0.79 | -1.12 | -1.71 | 0.41 | 0.73 | -2.81 | -1.04 | -1.08 | -1.55 | 0.25 | -0.97 |
| 30-34 (3500) | Current | 5.40 | 2.76 | 2.39 | 6.07 | 9.80 | 13.86 | 4.12 | 2.36 | 1.55 | 4.42 | 7.92 | 12.27 |
| | Reference | 8.11 | 3.60 | 3.49 | 6.85 | 6.74 | 13.42 | 7.10 | 3.04 | .68 | 5.31 | 5.08 | 11.59 |
| | Difference | -2.71 | -0.84 | -1.10 | -0.78 | 3.06 | 0.44 | -2.98 | -0.68 | - | -0.89 | 2.84 | 0.68 |
| 35-39 (3365) | Current | 6.18 | 3.89 | 3.70 | 9.19 | 14.52 | 17.79 | 4.90 | 3.11 | 2.70 | 7.26 | 11.91 | 16.06 |
| | Reference | 8.89 | 4.70 | 4.98 | 8.68 | 9.41 | 15.23 | 8.22 | 3.96 | 4.04 | 7.36 | 7.53 | 13.97 |
| | Difference | -2.71 | -0.81 | -1.28 | 0.51 | 5.11 | 2.56 | -3.32 | -0.85 | -1.34 | -0.10 | 4.38 | 2.09 |
| 40-44 (2081) | Current | 5.87 | 3.92 | 4.37 | 11.86 | 18.65 | 21.19 | 4.87 | 3.49 | 3.26 | 9.57 | 15.25 | 19.22 |
| | Reference | 8.53 | 4.63 | 5.17 | 9.63 | 11.90 | 17.46 | 8.21 | 4.49 | 4.43 | 8.37 | 9.92 | 15.70 |
| | Difference | -2.66 | -0.71 | -0.80 | 2.23 | 6.75 | 3.73 | -3.34 | -1.00 | -1.17 | 1.20 | 6.33 | 3.52 |
| 45-49 (575) | Current | 6.76 | 4.39 | 5.21 | 17.35 | 26.70 | 30.11 | 6.40 | 3.74 | 5.32 | 13.15 | 27.29 | 25.22 |
| | Reference | 9.57 | 5.37 | 6.68 | 13.31 | 16.83 | 23.61 | 9.28 | 5.10 | 5.87 | 10.37 | 13.52 | 21.77 |
| | Difference | -2.81 | -0.98 | -1.47 | 4.04 | 9.87 | 6.50 | -2.88 | -1.36 | -0.55 | 2.78 | 13.77 | 3.45 |
| ≥50 (313) | Current | 12.77 | 6.18 | 11.34 | 24.92 | 33.92 | 36.31 | 7.93 | 5.53 | 8.32 | 21.55 | 32.35 | 34.33 |
| | Reference | 9.67 | 6.19 | 9.80 | 18.56 | 24.14 | 27.98 | 9.12 | 5.32 | 7.90 | 15.23 | 21.99 | 27.23 |
| | Difference | 3.08 | -0.01 | 2.54 | 6.36 | 9.78 | 8.33 | -1.19 | 0.21 | 0.42 | 6.32 | 10.36 | 7.10 |

Annual audiograms, Jan-Mar 1975

TABLE 6. MEDIAN HEARING LEVELS (dB) FOR 3,629 CIVILIAN PERSONNEL

| Age (N) | Hz: | Left Ear | | | | | Right Ear | | | | | | |
|----------------|------------|----------|-------|-------|-------|-------|-----------|-------|-------|--------|-------|-------|-------|
| | | 500 | 1000 | 2000 | 3000 | 4000 | 6000 | 500 | 1000 | 2000 | 3000 | 4000 | 6000 |
| 17-19 (9) | Current | 5.83 | 3.50 | 3.75 | 4.17 | 4.50 | 7.50 | 4.38 | 2.50 | <(0.0) | 5.83 | 3.50 | 6.25 |
| | Reference | 10.50 | 4.17 | 1.88 | 4.38 | 3.13 | 17.50 | 5.83 | 2.50 | <(0.0) | 1.25 | 6.25 | 10.25 |
| | Difference | -4.67 | -0.67 | 1.87 | -0.21 | 1.37 | -10.00 | -1.45 | 0.00 | - | 4.58 | -2.75 | -4.00 |
| 20-24 (169) | Current | 6.92 | 1.97 | 0.34 | 4.38 | 7.98 | 11.29 | 4.29 | 1.62 | <(0.0) | 2.56 | 3.67 | 8.04 |
| | Reference | 8.04 | 2.81 | 1.16 | 4.65 | 5.80 | 11.64 | 5.56 | 2.08 | 0.28 | 2.63 | 3.66 | 8.31 |
| | Difference | -2.12 | -0.84 | -0.82 | -0.27 | 2.18 | -0.35 | -1.27 | -0.46 | - | -0.07 | 0.01 | -0.27 |
| 25-29 (528) | Current | 7.12 | 3.23 | 2.13 | 5.99 | 10.74 | 14.41 | 4.64 | 2.49 | 1.15 | 4.27 | 9.03 | 12.22 |
| | Reference | 9.22 | 5.27 | 4.00 | 7.66 | 9.18 | 15.71 | 7.24 | 3.58 | 2.44 | 6.21 | 7.02 | 14.68 |
| | Difference | -2.10 | -2.04 | -1.87 | -1.67 | 1.56 | -1.30 | -2.60 | -1.09 | -1.29 | -1.94 | 2.01 | -2.46 |
| 30-34 (383) | Current | 8.19 | 3.80 | 2.62 | 8.79 | 13.20 | 15.74 | 5.24 | 3.11 | 1.64 | 4.83 | 10.05 | 13.84 |
| | Reference | 10.80 | 6.14 | 5.83 | 9.36 | 10.39 | 17.61 | 9.47 | 5.09 | 5.11 | 7.45 | 7.64 | 15.41 |
| | Difference | -2.61 | -2.34 | -3.21 | -0.57 | 2.81 | -1.87 | -4.23 | -1.98 | -3.47 | -2.62 | 3.41 | -1.57 |
| 35-39 (351) | Current | 7.35 | 4.15 | 3.78 | 11.44 | 18.31 | 21.68 | 5.78 | 3.38 | 3.05 | 7.94 | 13.75 | 18.25 |
| | Reference | 11.27 | 6.78 | 7.11 | 11.96 | 13.59 | 19.96 | 11.26 | 6.40 | 6.12 | 9.69 | 10.30 | 18.68 |
| | Difference | -3.92 | -2.63 | -3.33 | -0.52 | 4.72 | 1.72 | -5.48 | -3.02 | -3.07 | 1.75 | 3.45 | -0.43 |
| 40-44 (445) | Current | 8.76 | 5.37 | 6.18 | 16.78 | 26.80 | 27.05 | 7.26 | 4.49 | 4.35 | 12.89 | 21.60 | 23.40 |
| | Reference | 11.22 | 7.02 | 7.29 | 14.04 | 18.78 | 23.79 | 11.14 | 6.50 | 6.63 | 11.75 | 15.46 | 20.89 |
| | Difference | -2.46 | -1.65 | -1.11 | 2.74 | 8.02 | 3.26 | -3.88 | -2.01 | -2.28 | 1.14 | .14 | 2.51 |
| 45-49 (523) | Current | 10.38 | 7.56 | 8.36 | 19.28 | 32.37 | 33.36 | 9.76 | 5.90 | 6.97 | 16.82 | 27.36 | 32.12 |
| | Reference | 12.60 | 7.96 | 8.51 | 16.23 | 23.01 | 26.47 | 12.04 | 7.52 | 8.13 | 14.03 | 19.35 | 26.51 |
| | Difference | -2.22 | -0.40 | -0.15 | 3.05 | 9.36 | 6.89 | -2.28 | -1.62 | -1.16 | 2.79 | 8.01 | 5.61 |
| ≥50 (1221) | Current | 11.39 | 9.08 | 14.02 | 32.52 | 42.45 | 44.04 | 11.28 | 8.64 | 11.82 | 27.02 | 38.54 | 40.55 |
| | Reference | 13.39 | 9.23 | 12.61 | 24.81 | 31.60 | 36.05 | 13.53 | 8.80 | 13.35 | 19.91 | 26.73 | 31.84 |
| | Difference | -2.00 | -0.15 | 1.41 | 7.71 | 10.85 | 7.99 | -2.25 | -0.16 | 1.47 | 7.11 | 11.81 | 8.71 |

Annual audiograms, Jan-Mar 1975

TABLE 7. MILITARY VS. CIVILIAN CURRENT HEARING LEVELS (dB)

| Age (N) | Left Ear | | | | | Right Ear | | | | | | |
|----------------------------------|----------|------|-------|-------|-------|-----------|-------|------|-------|-------|-------|-------|
| | Hz: 500 | 1000 | 2000 | 3000 | 6000 | 500 | 1000 | 2000 | 3000 | 4000 | 6000 | |
| Mean Data | | | | | | | | | | | | |
| 30-34 (3580 Mil) (383 Civ) | 8.95 | 6.75 | 7.15 | 12.11 | 17.01 | 20.99 | 7.97 | 6.30 | 6.18 | 10.11 | 14.92 | 19.56 |
| | 11.16 | 7.26 | 7.44 | 15.31 | 21.42 | 23.83 | 8.85 | 6.71 | 6.16 | 11.95 | 18.43 | 22.32 |
| 40-44 (2081 Mil) (445 Civ) | 9.31 | 7.88 | 9.34 | 18.44 | 25.36 | 28.29 | 8.78 | 7.43 | 8.09 | 16.02 | 22.75 | 26.66 |
| | 12.44 | 9.65 | 11.78 | 25.29 | 33.35 | 35.44 | 11.54 | 8.76 | 10.07 | 21.27 | 26.69 | 32.19 |
| Median Data | | | | | | | | | | | | |
| 30-34 (3580 Mil) (383 Civ) | 5.40 | 2.76 | 2.39 | 6.07 | 9.80 | 13.86 | 4.12 | 2.36 | 1.55 | 4.42 | 7.92 | 12.27 |
| | 8.19 | 3.80 | 2.62 | 8.79 | 13.20 | 15.74 | 5.24 | 3.11 | 1.64 | 4.83 | 10.05 | 13.84 |
| 40-44 (2081 Mil) (445 Civ) | 5.87 | 3.92 | 4.37 | 11.86 | 18.65 | 21.19 | 4.87 | 3.49 | 3.26 | 9.57 | 15.25 | 19.22 |
| | 8.76 | 5.37 | 6.18 | 16.78 | 26.80 | 27.05 | 7.26 | 4.49 | 4.35 | 12.89 | 21.60 | 23.40 |

Annual audiograms, Jan-Mar 1975:

Mil = 22,817

Civ = 3,629

TABLE 8. AVERAGE HEARING LEVELS FOR 22,817 MILITARY PERSONNEL (SHOWN BY CUMULATIVE PERCENTAGES). DATA OBTAINED FROM AF FORMS 1490 ANNUAL AUDIOGRAMS REPORTED TO THE USAF HEARING CONSERVATION DATA REGISTRY DURING JANUARY-MARCH 1975.

| Average Hearing Level (dB) | Left Ear (%) | | | Right Ear (%) | | |
|-------------------------------------|-----------------------|-------|--------|-----------------------|--------|-------|
| | Test frequencies (Hz) | | | Test frequencies (Hz) | | |
| | 500 | 1000 | 2000 | 500 | 1000 | 2000 |
| | 1000 | 2000 | 3000 | 1000 | 2000 | 3000 |
| | 2000 | 3000 | 4000 | 2000 | 3000 | 4000 |
| ≤ -0 | 9.91 | 12.88 | 11.15 | 13.66 | 15.64 | 13.02 |
| 1-5 | 42.29 | 42.67 | 35.24 | 50.63 | 50.07 | 41.35 |
| 6-10 | 72.25 | 68.41 | 57.53 | 77.94 | 74.47 | 64.67 |
| 11-15 | 88.59 | 83.64 | 73.32 | 91.09 | 87.47 | 78.90 |
| 16-20 | 95.26 | 91.52 | 82.96 | 96.10 | 93.64 | 86.76 |
| 21-25 | 97.89 | 95.51 | 88.94 | 98.05 | 96.56 | 91.49 |
| 26-30 | 98.90 | 97.60 | 92.43 | 98.90 | 97.98 | 94.31 |
| 31-35 | 99.36 | 98.67 | 95.07 | 99.28 | 98.71 | 96.14 |
| 36-40 | 99.60 | 99.22 | 96.88 | 99.53 | 99.23 | 97.46 |
| 41-45 | 99.73 | 99.50 | 98.05 | 99.69 | 99.54 | 98.39 |
| 46-50 | 99.80 | 99.68 | 98.75 | 99.77 | 99.66 | 98.96 |
| 51-55 | 99.83 | 99.78 | 99.93 | 99.83 | 99.77 | 99.44 |
| 56-60 | 99.87 | 99.85 | 99.57 | 99.87 | 99.82 | 99.60 |
| 61-65 | 99.90 | 99.90 | 99.73 | 99.90 | 99.88 | 99.75 |
| 66-70 | 99.93 | 99.93 | 99.84 | 99.94 | 99.90 | 99.82 |
| 71-75 | 99.94 | 99.95 | 99.88 | 99.95 | 99.93 | 99.87 |
| 76-80 | 99.95 | 99.95 | 99.92 | 99.97 | 99.96 | 99.91 |
| ≥ -81 | 99.97 | 99.99 | 100.00 | 100.01 | 100.00 | 99.99 |

TABLE 9. AVERAGE HEARING LEVELS FOR 3,629 CIVILIAN PERSONNEL (SHOWN BY CUMULATIVE PERCENTAGES). DATA OBTAINED FROM AF FORMS 1490 ANNUAL AUDIOGRAMS REPORTED TO THE USAF HEARING CONSERVATION DATA REGISTRY DURING JANUARY-MARCH 1975.

| Average Hearing Level (dB) | Left Ear (%) | | | Right Ear (%) | | |
|----------------------------|-----------------------|--------|--------|-----------------------|-------|--------|
| | Test frequencies (Hz) | | | Test frequencies (Hz) | | |
| | 500 | 1000 | 2000 | 500 | 1000 | 2000 |
| | 1000 | 2000 | 3000 | 1000 | 2000 | 3000 |
| | 2000 | 3000 | 4000 | 2000 | 3000 | 4000 |
| ≤ 0 | 3.17 | 4.99 | 3.31 | 5.40 | 6.45 | 4.63 |
| 1-5 | 27.01 | 22.76 | 13.97 | 33.89 | 28.63 | 18.55 |
| 6-10 | 53.22 | 42.52 | 28.33 | 59.96 | 49.43 | 34.89 |
| 11-15 | 74.47 | 58.94 | 42.11 | 77.87 | 65.00 | 49.25 |
| 16-20 | 85.49 | 70.68 | 52.50 | 87.27 | 76.99 | 59.64 |
| 21-25 | 91.80 | 79.83 | 61.79 | 92.06 | 83.55 | 68.02 |
| 26-30 | 95.05 | 86.39 | 70.08 | 94.84 | 88.81 | 75.21 |
| 31-35 | 96.70 | 91.38 | 76.56 | 96.58 | 92.36 | 80.80 |
| 36-40 | 97.86 | 94.58 | 81.99 | 97.52 | 94.95 | 85.48 |
| 41-45 | 98.55 | 96.23 | 86.92 | 98.32 | 96.55 | 89.26 |
| 46-50 | 98.85 | 97.64 | 90.81 | 98.79 | 97.62 | 92.62 |
| 51-55 | 99.21 | 98.58 | 94.12 | 99.29 | 98.50 | 94.71 |
| 56-60 | 99.54 | 99.05 | 96.41 | 99.59 | 99.05 | 96.86 |
| 61-65 | 99.79 | 99.41 | 97.87 | 99.76 | 99.33 | 98.02 |
| 66-70 | 99.93 | 99.63 | 98.56 | 99.82 | 99.72 | 98.68 |
| 71-75 | 99.96 | 99.82 | 99.11 | 99.90 | 99.80 | 99.15 |
| 76-80 | 99.99 | 99.90 | 99.55 | 99.90 | 99.88 | 99.48 |
| ≥ 81 | 100.02 | 100.01 | 100.02 | 100.01 | 99.99 | 100.00 |

TABLE 10. COMPARISONS OF AVERAGE HEARING LEVELS FOR MILITARY AND CIVILIAN PERSONNEL WHO WORK IN NOISE (PERCENT OF SAMPLE OF 22,817 MILITARY AND 3,629 CIVILIAN PERSONNEL)

| | Left Ear | | | Right Ear | | |
|---------------|-----------------------|-------|-------|-----------------------|-------|-------|
| | Test frequencies (Hz) | | | Test frequencies (Hz) | | |
| Average | 500 | 1000 | 2000 | 500 | 1000 | 2000 |
| Hearing | 1000 | 2000 | 3000 | 1000 | 2000 | 3000 |
| Level | 2000 | 3000 | 4000 | 2000 | 3000 | 4000 |
| <u>20 dB+</u> | | | | | | |
| Mil | 4.74 | 8.48 | 17.04 | 3.90 | 6.36 | 13.24 |
| Civ | 14.51 | 29.32 | 47.50 | 12.73 | 23.01 | 40.36 |
| <u>25 dB+</u> | | | | | | |
| Mil | 2.11 | 4.49 | 11.06 | 1.95 | 3.44 | 8.51 |
| Civ | 8.20 | 20.17 | 38.21 | 7.94 | 16.45 | 31.98 |
| <u>30 dB+</u> | | | | | | |
| Mil | 1.10 | 2.40 | 7.57 | 1.10 | 2.02 | 5.69 |
| Civ | 4.95 | 13.61 | 29.92 | 5.16 | 11.19 | 24.79 |

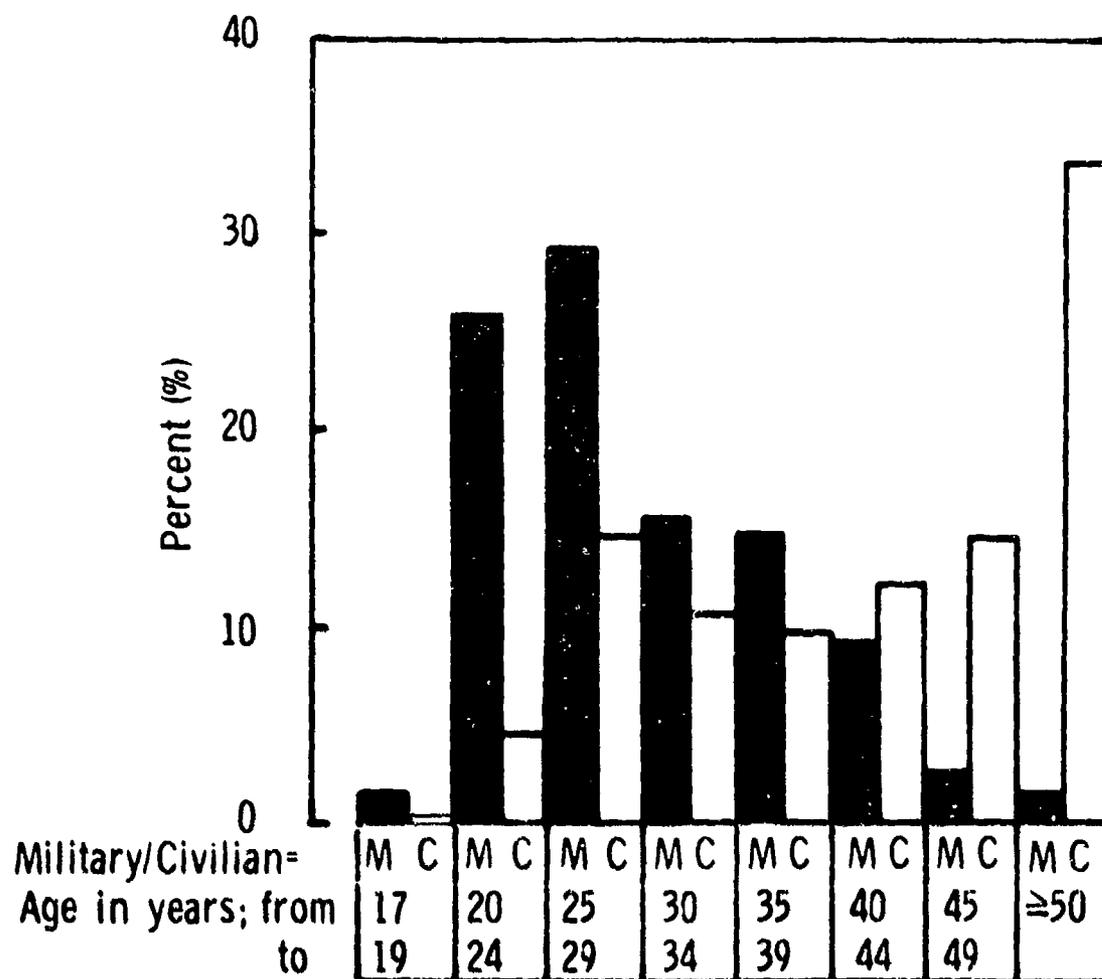


Figure 1. Percentages of 22,817 military (M) and 3,629 civilian (C) personnel included in 8 age groups.

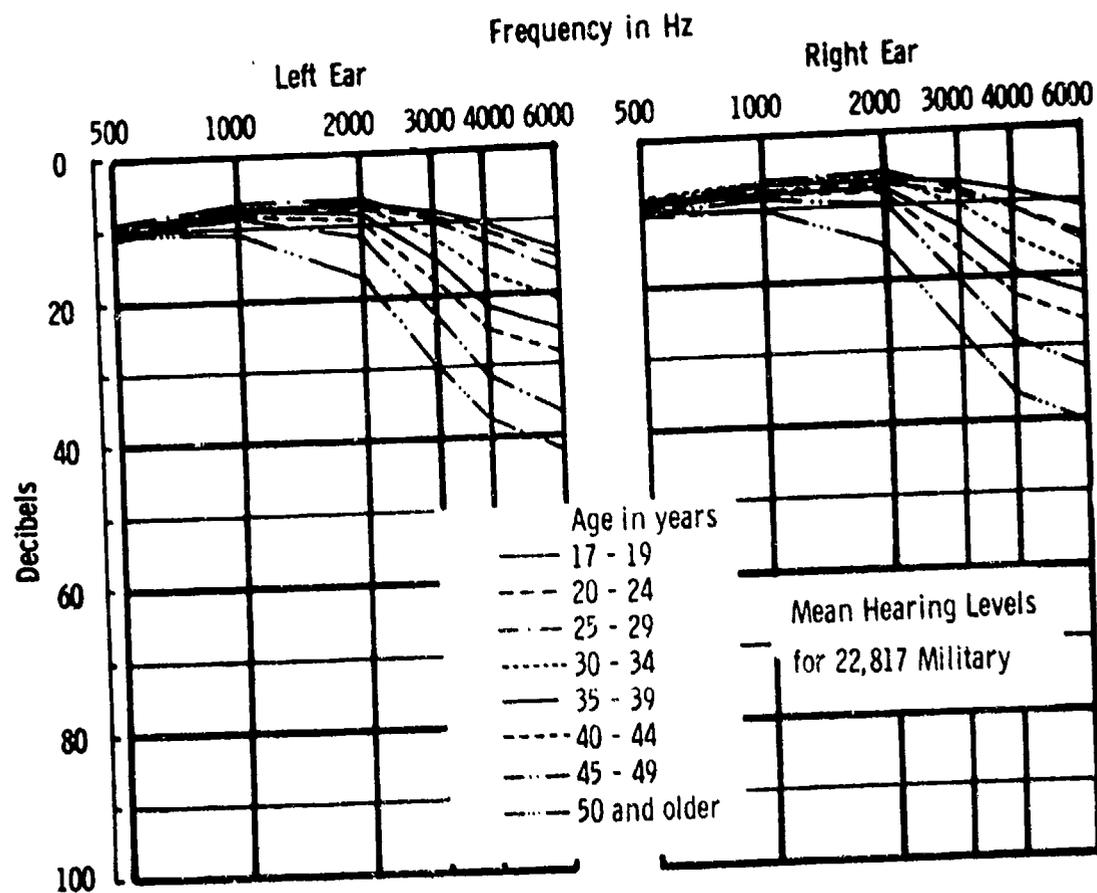


Figure 2. Mean hearing levels of 22,817 current (annual) audiograms obtained on military personnel.

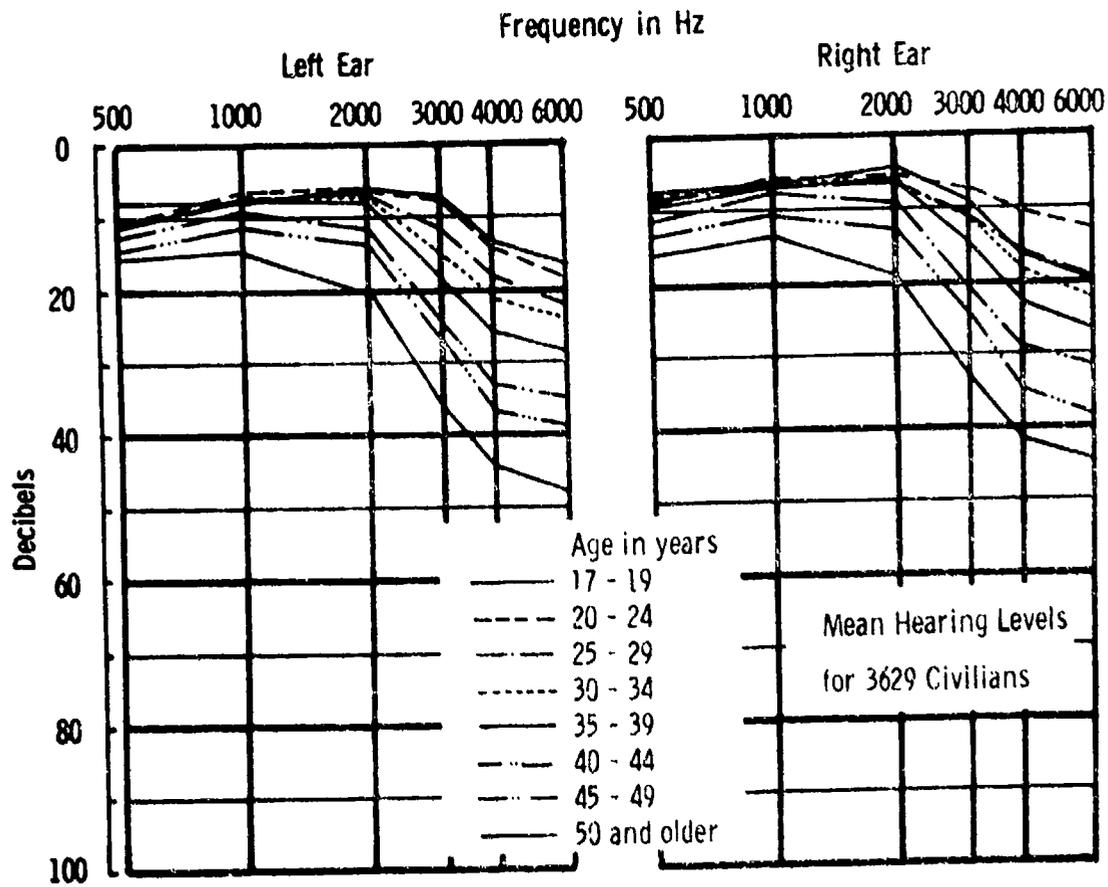


Figure 3. Mean hearing levels of 3,629 current (annual) audiograms obtained on civilian personnel.

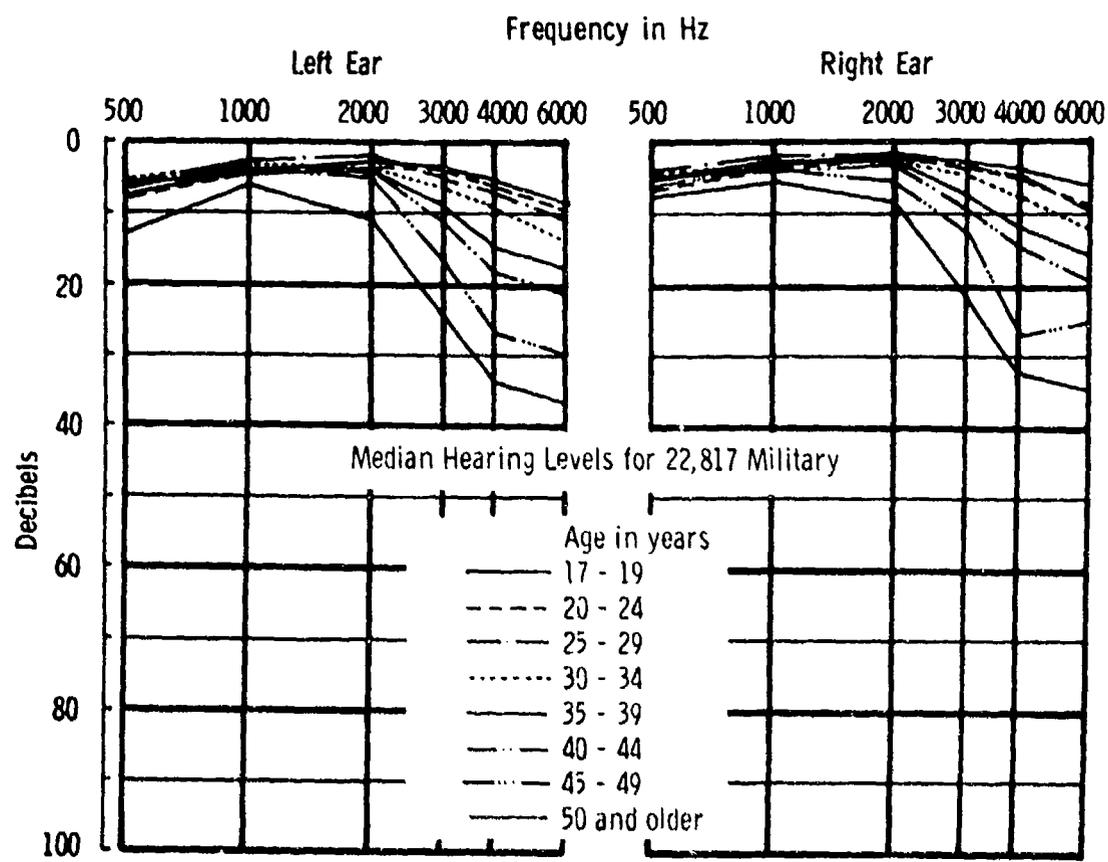


Figure 4. Median hearing levels of 22,817 current (annual) audiograms obtained on military personnel.

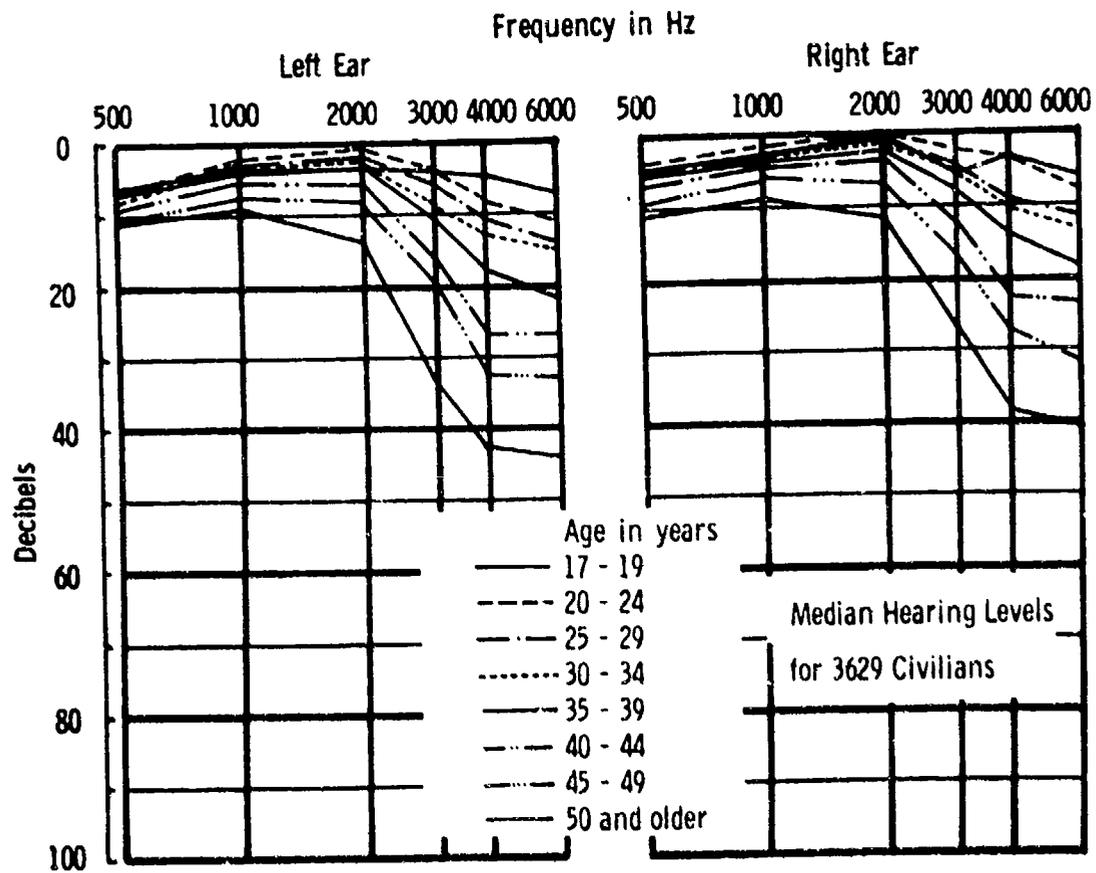


Figure 5. Median hearing levels of 3,629 current (annual) audiograms obtained on civilian personnel.

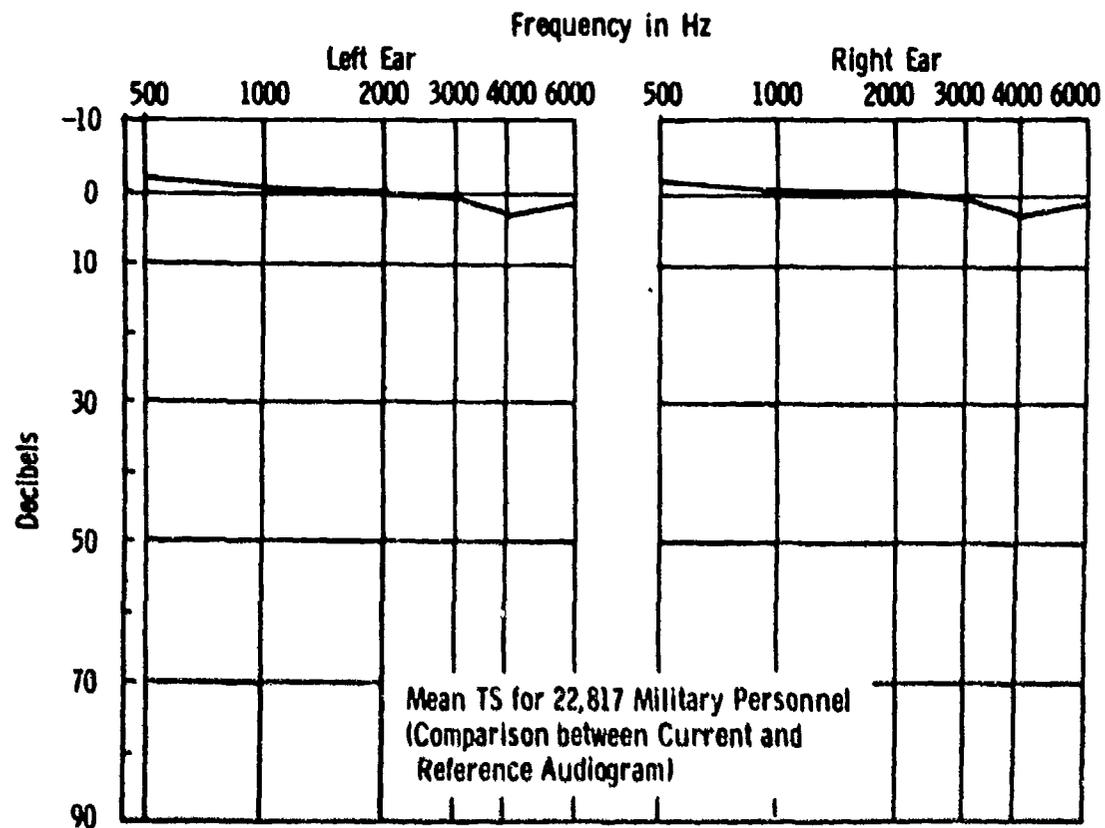


Figure 6. Mean values of threshold shift noted between current and reference audiograms on 22,817 military personnel.

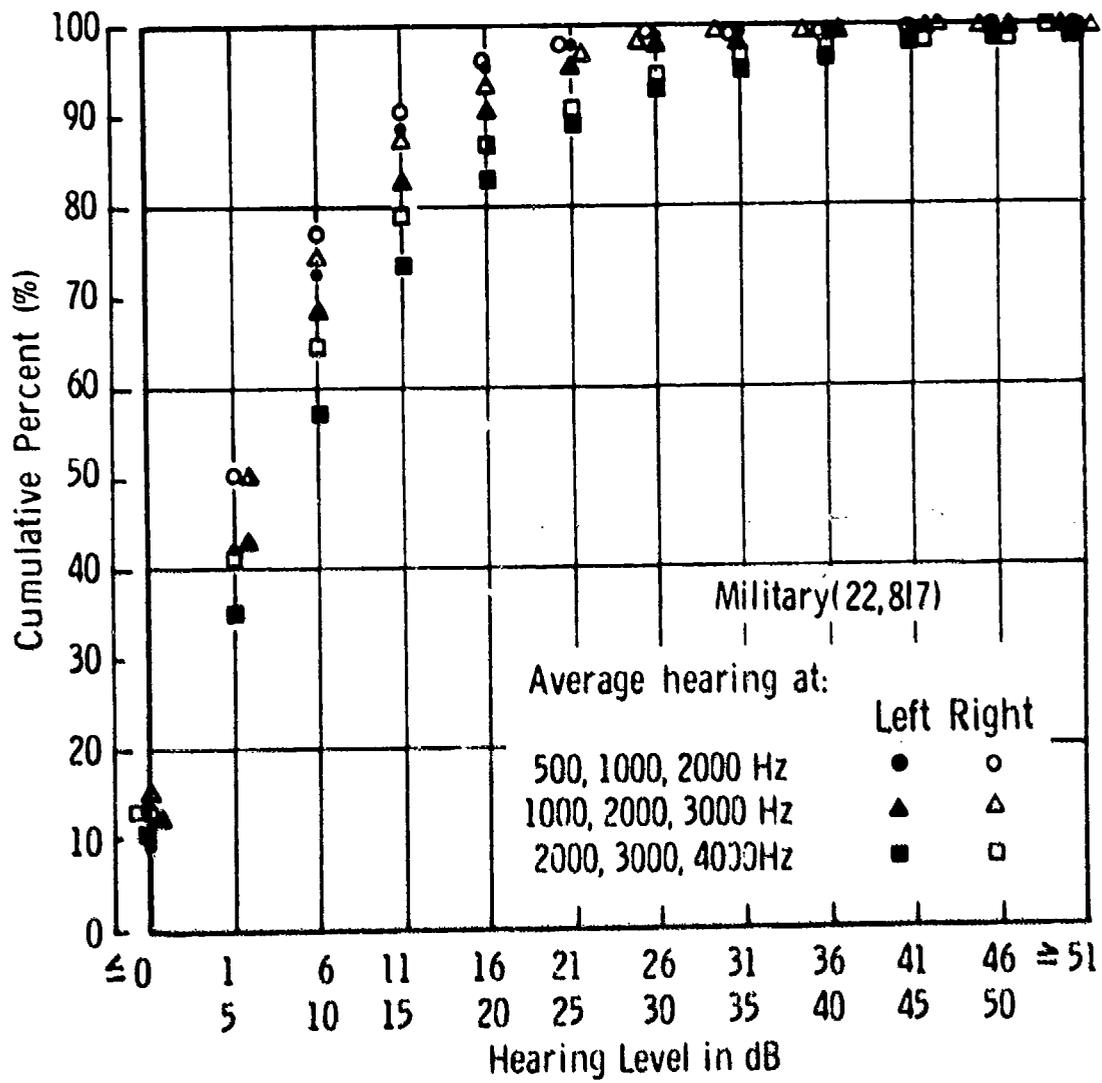


Figure 7. Plottings of cumulative percent of 22,817 military personnel with average hearing levels (using 3 averaging methods) equal to or better than those shown along bottom of chart.

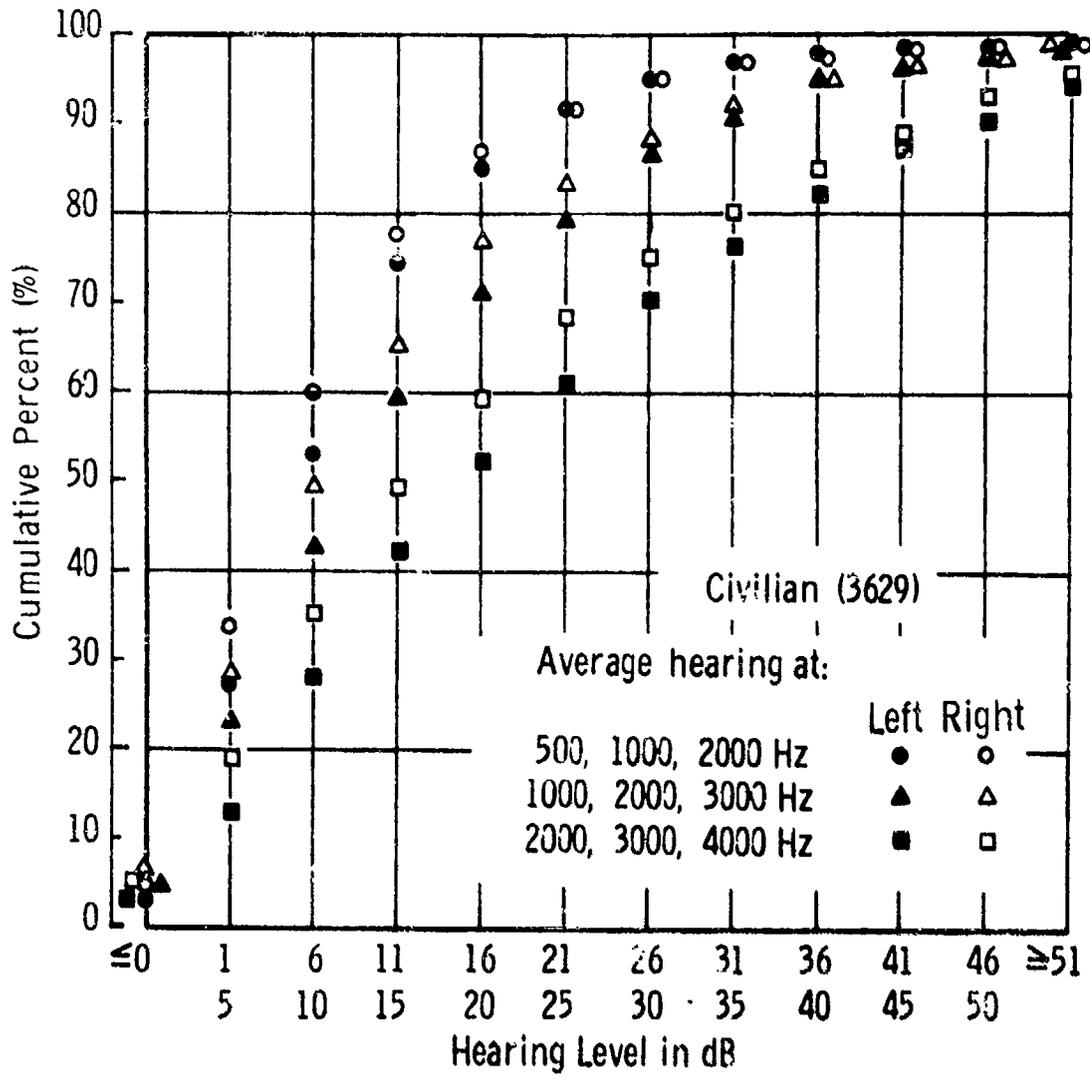


Figure 8. Plottings of cumulative percent of 3,629 civilian personnel with average hearing levels (using 3 averaging methods) equal to or better than those shown along bottom of chart.