COMMUNITY ASPECTS

OF

AIRCRAFT ANNOYANCE

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GLOSSARY

A number of terms used in this report to describe the physical characteristics of the airplane stimulus and the socio-psychological factors affecting human reactions to it are described below. More detailed descriptions of the various terms can generally be found in the text of the report itself.

Aircraft Emergent Noise Level (Aircraft Emergent NL) is the difference, in decibels, between the Aircraft SNL and the Background SNL.

Aircraft Sampled Noise Level (Aircraft SNL). This number provides a measure of the noise level on the ground for aircraft flying overhead. It is computed in two steps. The sound pressure levels that are exceeded by 25 percent of the aircraft in the 75-150, 300-600 and 1200-2400 cps frequency bands are determined, and an arithmetic average of these three levels in decibels is computed. The prescribed procedures for making the measurements and the calculations are described in detail on pages 3-10 of Appendix A.

Airport Area. All populated communities within a radius of 15 miles of a major airport are included in the airport area.

Annoyance Reactions (responses). These are the negative feelings of annoyance, bother, disturbance, dislike or discomfort in response to a given stimulus situation. These feelings may be openly expressed or covertly experienced; they may be conscious or unconscious.

Background Sampled Noise Level (Background or Ambient SNL). This number provides a measure of the background noise for a sampling sub-area. It is computed in two steps. An intensity average is determined for the background noise in the 75-150,

300-600 and 1200-2400 cps frequency bands, and an arithmetic average of the decibel levels in these bands is computed. The prescribed measurement and computation procedure is described in detail on pages 12-22 of Appendix A.

Complaint Area. In the original survey design half (4) of the airport areas were selected as having a significant number of community complaints about airplanes. Indications of such community reactions were statements by local CAA, airport management and civic organizations, petitions and resolutions by local groups, newspaper stories of protests, etc.

Complaint Reactions (Behavior). When feelings of annoyance are expressed to other people as a grievance, they are usually considered complaints. They may be stated to a member of the family, to a neighbor, or to the authorities who are responsible for the stimulus situation. The forms of complaint are varied and include conversations, letters, telephone calls, telegrams, petitions, personal visits, etc. In this study only expressions of annoyance conveyed to the authorities were considered as formal complaints.

Decibel (db). The decibel is a unit that is used to express relative sound pressure or relative sound intensity. The sound pressure level (SPL) in decibels is a measure of the sound pressure relative to a reference sound pressure of 0.0002 dyne/cm^2. The SPL is given by the formula

$$\text{SPL} = 20 \log_{10} \frac{p}{0.0002} \text{ db re } 0.0002 \text{ dyne/cm}^2.$$

Demographic. This term refers to such personal and social characteristics of the population as race, age, sex, education, family status, income, occupation, and group membership.

Direct Question. This question clearly states the factors about which an opinion or statement is requested. For example: "When the planes do pass here do they ever fly very low?" bluntly asks about the perceived altitude of planes passing overhead.

Free-answer Question (open, non-directive). The question is so phrased that the respondent must frame his own answer and the interviewer must write down the exact words used by the respondent in his reply. Usually the interviewer continues to question the respondent until a detailed answer is given. For example: "How do you feel about living here?" is a neutral question which requires the respondent to formulate in his own terms his feelings about his neighborhood.

Great Bother With Airplanes SEE Overall Annoyance.

Indirect Question. The general scope of a problem is stated but the specific aspects are not stated. These must be supplied by the respondent. For example: "What kinds of noise do you hear around here?" indicates an interest about noise, but does not mention whether the interviewer is concerned about airplane, traffic, industrial, or human noise. It is a direct question about noise, but an indirect one about any specific source of noise.

No Bother With Airplanes SEE Overall Annoyance.

Non-Complaint Area. In the original survey design, half (4) of the airport areas were selected as having few if any community complaints about airplanes. Indications of the lack of organized complaints were statements by local CAA, airport management, and civic organizations, the absence of any civic protest movement, and the relatively few individual letters of complaint received by the authorities.

Overall Annoyance (bother with airplanes). This is a general rating of the respondents' feelings toward airplanes flying overhead. It reflects the extent to which a person dislikes, is bothered, disturbed or annoyed with the passage of aircraft over his neighborhood. It represents his psychological reactions to all aspects of airplane disturbances such as intense noise, low flying, fear of crashes, dust and oil spray, landing lights, TV flickers, vibrations, etc. There are three general categories of "Overall Annoyance": "No Annoyance", "Some Annoyance" and "Great

Annoyance". Brief definitions of these classifications are presented below and a more detailed discussion of the criteria underlying the classification structure appears on pp. 41-42.

No Bother (annoyance with airplanes). All persons who are not bothered, annoyed, or disturbed now by airplanes passing overhead are included in this category. It includes persons who were never bothered by airplanes overhead as well as those who used to be annoyed but clearly state that they are not now.

Some Bother (annoyance with airplanes). All persons who are bothered, annoyed, or disturbed a little, slightly or moderately by airplanes passing overhead are included in this intermediate category. Respondents generally mention these feelings about airplanes in answer to direct questions asked later in the interview and their expressions of annoyance are not very intense. Statements of annoyance are usually made from time to time during the interview but are likely to be omitted in response to most free-answer and some direct questions. Some of these respondents may also express ambivalence toward the airplanes - statements of mild dislike on some questions and denials of serious annoyance on other questions.

Great Bother (annoyance with airplanes). All persons who are bothered, annoyed, or disturbed intensely, strongly, or greatly by the passage of airplanes overhead are grouped into this category. The respondent often volunteers his serious concern or dislike of airplanes in answer to the early questions. Expressions of annoyance are intense and indicate deep feelings, as for example, "The airplanes zoom right over the house --- you can't hear yourself talk --- they shake the very foundations - crack the windows --- they are terrible, you don't know when they'll hit the house ... my kids scream and are frightened to death of them..." Such strong statements are frequently reported in answer to most questions dealing with the airplane situation.

Pre-coded Questions. The question itself presents a choice of alternative answers and the interviewer circles the code number corresponding to the person's opinion. For example: "Well, in general, how do you like living in this part of (name of city or county) -- would you say you like it very much, that you like it a little, or that you don't like it?" The respondent is requested merely to choose one of the three pre-coded alternatives which are underlined above.

Projective type question. The objective of this type of question is not to elicit a substantive response to a specific question but rather to secure if possible an expression of a respondent's underlying feelings or attitudes. Usually a vague and ambiguous stimulus (series of words, phrases, pictures, etc.) is presented and the respondent is asked to describe or explain his immediate reaction to the stimulus. How he interprets the stimulus situation andhow he reacts to it are considered indirect expressions of his basic attitudes and opinions. For example, a respondent is aksed to complete a series of general phrases such as, "On Sunday I like to ....; Airplanes are ....." The words which he spontaneously chooses to complete these phrases are frequently believed to reflect basic psychological characteristics of the respondent.

Sampling Area. A group of adjacent city blocks or a contiguous rural area in which the aircraft stimulus is considered fairly homogeneous. For the sampling areas less than 2 miles from the end of a runway, the radius of the sampling area is 1/4 mile; at 4-6 miles, it is 1/2 mile;and at 10-12 miles, it is 1 mile.

Sampling Sub-area. Within each sampling area clusters of blocks with quiet or noisy Background SNL's were selected. The sub-area was the smallest sampling unit from which the respondents were selected and interviewed.

Statistically Significant. The probability that a finding could have been reported by chance in only 5 cases out of 100. Tests used included the Chi-square tests of differences between attributes, binomial distributions with 95% confidence intervals, and "F" tests of mean differences. (p.05).

I SUMMARY

Introduction to Study

Since the end of World War II, annoyance and complaints about noisy or low flying airplanes have become an increasing public concern. Following the intense public reaction to the tragic accidents at Elizabeth, N.J. in 1952, the National Advisory Committee for Aeronautics as one phase of its research on the aircraft noise problem, asked the National Opinion Research Center to institute immediately exploratory studies on Community Reactions to Aircraft Disturbances.

This report summarizes the results of 3635 personal interviews with residents living in 180 different types of localities near eight major airports. These interviews were completed during the late spring and fall months of 1953, at which time acoustical measurements were also made in each of these localities to determine the actual airplane and background noise levels to which the respondents were exposed.

This study has three primary objectives:

1) to determine the relationships of human annoyance and overt expressions of annoyance (complaints) with varying airplane noise levels and airplane flight conditions
2) to determine the socio-psychological factors contributing to the adaptation or intensification of annoyance reactions
3) to determine whether the personal interview technique can be utilized in establishing specific criteria for acceptable airplane noise levels

While this initial study clearly indicates the relationships of annoyance with different kinds of airplane noise and operating situations, and while it has succeeded in differentiating a number of significant socio-psychological variables, research has not yet developed to the point where definitive calculation of acceptable noise levels is possible. With additional data and further study, however, it is believed that such criteria can be developed.

Overall Annoyance vs. Sampled Airplane Noise Levels

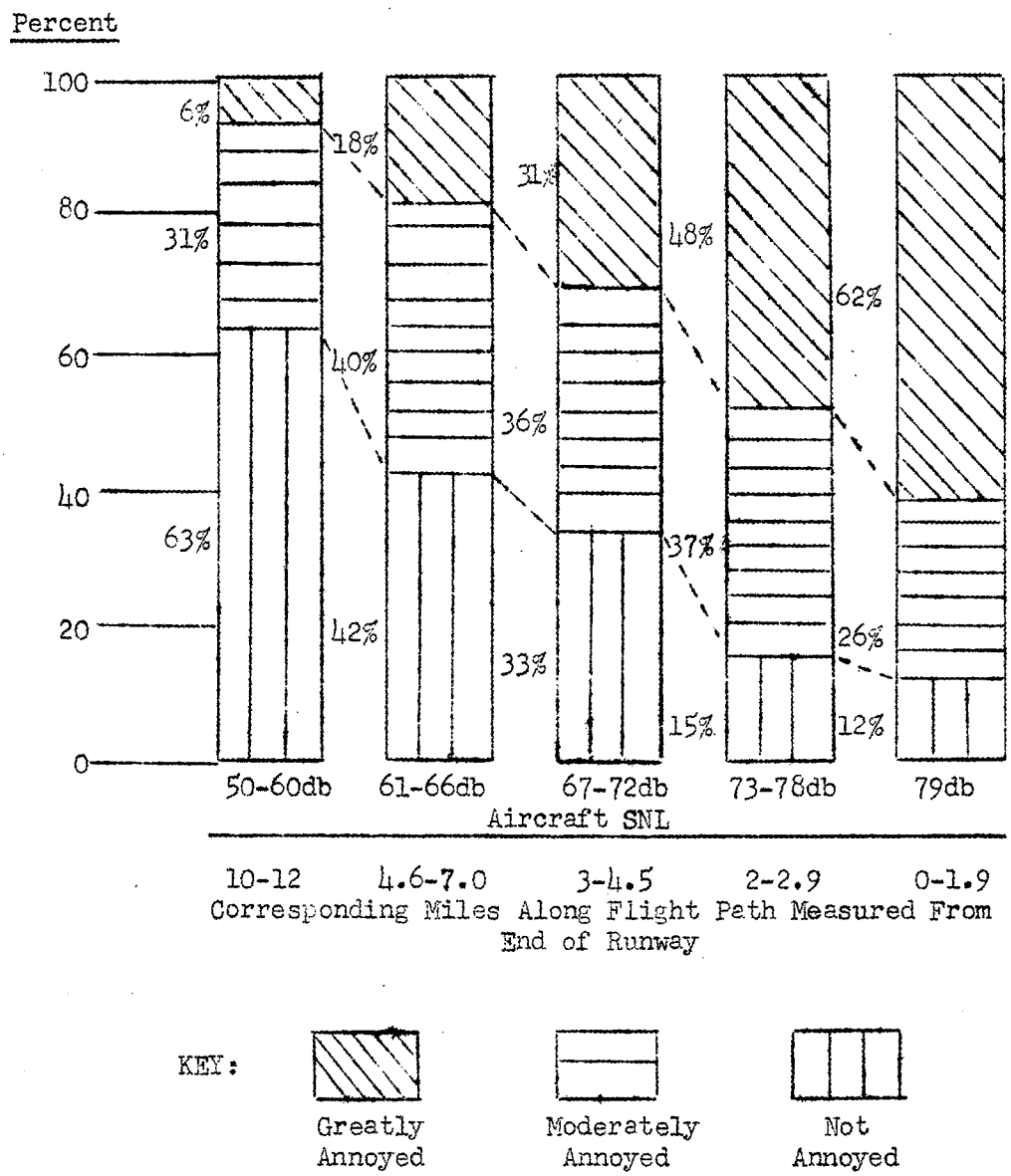
Annoyance with airplanes landing and taking off from nearby runways is a very serious problem for people living close to airports. The actual airplane SNL is 79 decibels or more in communities less than two miles from the end of a runway, and almost 90% of all residents living this close reported some annoyance. About two-thirds to all such respondents were intensely disturbed, while close to a fourth were moderately bothered. Even at two to three miles from the airport, the airplane SNL ranges from 73-78 decibels and 85 percent of all persons living there were bothered by local airplanes. Slightly less than half, however, were seriously annoyed while over one-third were moderately disturbed. In the distant control areas, 10-12 miles out, on the other hand, the airplane SNL averages only 50-60 decibels and very few people were disturbed. Only 6 percent were greatly annoyed, 31 percent were slightly bothered, and about two-thirds weren't bothered at all. Table 1 indicates that overall annoyance varies directly with the intensity of the Airplane SNL.

Overall Annoyance vs. Aircraft Emergent Noise Levels

While there is some indication that annoyance with airplanes is greater when the ambient noise level is lower and the consequent Aircraft Emergent Noise Level (NL) is greater, the data are not consistent for all Aircraft SNL's. Conclusive analysis of the effects of Aircraft Emergent NL was not possible because of our inability to find extreme Aircraft Emergent situations. For example, there were no close areas with a sufficiently high background noise level to reduce the Aircraft Emergent NL to 18 decibels or less, or to find distant areas with quiet enough ambient noise levels to permit the Aircraft Emergent NL to reach 30 decibels or more. In effect, only in the intermediate areas, 3-4.5 miles distant, were there enough interviews under all emergent levels to permit statistical comparisons. In these middle distance areas, however, annoyance was significantly greater when the Aircraft Emergent NL was greater.

TABLE 1

COMPARISON OF OVERALL ANNOYANCE WITH AIRPLANES AND AIRCRAFT SAMPLED NOISE LEVEL (SNL)



When overall annoyance was evaluated by both daytime and nighttime Aircraft Emergent Noise Levels, very little difference was found. This similarity of relationships between annoyance and day or night airplane noise emergence is probably due to the small differences between day and night background SNL's in the sampling areas. In almost a third of all such areas nighttime background noise was 3 db or less than the daytime level and in about half of all areas the difference was only 4-10 db. Thus, in eight out of ten sampling areas the day-night variation was less than 11 db. Consequently, it appears that overall annoyance is a reaction to the total airplane situation, and not just to day or night experience.

Overall Annoyance vs. Frequency of Air Traffic

Annoyance tends to increase when the frequency of airplane exposure is greater, but as in the case of "emergence", these findings are inconclusive because of the difficulty of measuring the "frequency" variable. In the close and middle distance areas, for example, planes circling overhead while getting into position to land or take off may have inadvertently equalized the frequency differentials which were calculated primarily on a direct flight path basis. In the distant areas, however, where flight paths are more distinct, residents living under frequently used airways are more annoyed than those living under lightly used flight paths.

Overall Annoyance vs. Closeness to a Direct Flight Path

Residents who live directly under a flight path are more annoyed than those living a mile or two away from a pathway. Since the distance from the respondent to the airplane is greater when his residence is off the pathway, the noise level is correspondingly lower and the annoyance is less. When the airplane noise level is held constant, however, no significant annoyance differences exist between persons directly under a flight path and those off the flight path. For the closest areas less than one mile from the airport, there was a tendency for persons living off

the flight path to be somewhat less annoyed, but those living from one to two miles from the end of a runway, reported no consistent trend.

Overall Annoyance vs. General Attachment to Community

There are a number of psychological and sociological factors which interact with the physical stimulus and tend to enhance or minimize annoyance reactions. The first important human element is the overall attachment of a person to his community. If a person has compelling reasons for liking his neighborhood, such as advantages of location, community facilities, or living near friends or relatives, he is more likely to make allowances for negative aspects of his neighborhood and to adjust to them. Conversely, if he is generally unhappy about other problems involved in living in his area, the introduction of intense airplane noise stimuli compounds his overall dislike for the area. It is noteworthy that the group reporting "no annoyance" with airplanes consistently express greater overall attachment to their areas.

It has often been suggested that a substantial portion of all local complaints are made by "cranks" who always find fault with everything. But our findings indicate that these "chronic gripers" are a very small part of the airplane annoyance problem. Only one out of every hundred "annoyed" respondents said there was "nothing about their area that they liked," and only four out of every hundred who actually complained to the authorities were also among this "nothing-liked" group. A further indication of the objective nature of the problem is the direct relationship between the degree of annoyance and the actual intensity of the Airplane SNL.

Lack of Anticipation of Airplane Problem

It has also been suggested that people who plan to move into neighborhoods near airports should expect to find a high airplane noise level, and therefore, should "make the best of it" if they decide to move there. But our data show that about a third of all residents already were living in their communities before the nearby airport was fully developed, and that very few of the so-called "newcomers" foresaw their difficulty before moving into the area. Only one percent of the "greatly annoyed" group expected any trouble with airplanes before they moved into their

present homes. Likewise, very few people feel that moving away from their present neighborhoods is the only solution to the airplane problem. Rather, they generally feel that something can be done to improve the local airplane noise and safety situation, so that they can remain where they are.

Overall Annoyance with Airplanes and Other Non-Airplane Disturbances

Some of the data suggest that the recent intensification of airplane noise, accompanying the more frequent use of larger and more powerful airplanes, has for many people been the "straw that broke the camel's back". Those residents who are now most annoyed with airplanes were already seriously bothered by traffic and other noises and by such non-noise problems as flies, mosquitoes, dust, dogs, weather, etc. before airplanes even became a problem. Apparently the prospect of having to adjust to still another intense physical disturbance was just too much for these people, and as a result their overall dislike for the area was increased and airplanes were singled out for their most intense annoyance feelings.

It is probably no accident that airplanes receive the brunt of the critical reactions. In addition to its "Johnny-come-lately" aspects, airplane noise stands out as one of the most intense noise disturbances, seriously disrupting sleep, rest, relaxation, conversation, and radio and TV listening.

Overall Annoyances vs. Previous Exposure to Noisy Neighborhoods and Working Conditions

Ample proof is afforded by survey findings that "time"will not automatically eliminate annoyance with airplanes. The residents who are "greatly annoyed" with airplanes report that they have lived longest in their present areas, have more frequently lived in other noisy neighborhoods over a longer period of time, and have been exposed to more intense noise at work over a longer period than the "moderately annoyed" and "non-annoyed" persons. Yet, their reactions to nearby aircraft are the most intense. A further crucial test of the "automatic adjustment" thesis is afforded by those residents who have never lived elsewhere and presumably have had the

largest continuous exposure to local noise conditions. These respondents should be among the "least annoyed", yet they are not. In fact, the tendency is for greater annoyance to be reported by these long-time residents.

Fear of Aircraft Crashes

When traffic and other noises are criticized, it is noted that they also interfere with sleep, conversation, and radio and TV listening. But a crucial difference between these other noise disturbances and airplanes is the widespread fear that low flying planes might crash into people's homes spreading death and destruction. Almost 80 percent of the "greatly disturbed" offered direct or indirect manifestations of this fear of airplane crashes.

It is our belief that this constant anxiety about possible danger from planes passing overhead is the most important factor inhibiting acceptance of airplane noise. Nearby trolleys, trucks and trains are known to pass over a fixed track or road, and the distribution of sound levels resulting from their passage tends to remain about the same day in and day out. After a period of time, a person can become so accustomed to these traffic sounds that he fails to separate each passage from the general ambient noise complex. The meaning or source of such noise is easily recognized and, therefore, does not have to be consciously identified each time it occurs.

Airplane noise, on the other hand, generally fluctuates more widely from one exposure to another depending on such factors as the altitude, weather conditions, weight of the plane, pilot technique, etc. Airplanes do not fly over a fixed track and, therefore, the perception of the airplane noise varies considerably in its auditory characteristics. If a person is unconcerned about the variety of air operations which are connoted by these variations in sound stimulus, he still may be able to relegate these different airplane sounds to the general background and ignore each separate airplane passage. But if fear of crashes is present or latent, there is concern about the meaning of each separate experience. Each passage reflecting

a somewhat different noise stimulus must be separated from the background and analyzed to determine whether it represents a potential hazard or not. Consequently, while other noises are often ignored after prolonged exposure, fear of crashes is believed to activate a constant tension system which focuses attention on each airplane passage, and prevents the automatic acceptance of airplane noise.

Attitudes Toward Air Transportation

Favorable attitudes toward flying and air transportation, and frequent flying experiences do tend to develop greater tolerance towards airplanes overhead. The "non-annoyed" consistently report more frequently that commercial airlines are "very important" and that they have flown on planes themselves more regularly and more recently. The "non-annoyed" also recognize that airports have to be close to populated areas in order to be convenient for air transportation, while the "greatly annoyed" more often feel the airport should be further out in order to eliminate the danger and noise annoyance to nearby localities.

Demographic Characteristics

Age and education are among the most important personal variables tending to reduce annoyance. Respondents less than 40 years old tend to be more tolerant than those 40-59, but among older persons 60 or more years of age, there was little difference in annoyance.

The more education a person has, the less likely he is to be annoyed. About 26 percent of the "non-annoyed" had college training, compared to only 19 percent of the "greatly annoyed." Home ownership and the continuity of exposure to airplanes also have some effect on reactions to airplane noise. About three-fourths of the "greatly annoyed" own their own homes, while only 70 percent of the "non-annoyed" do so. Likewise, 69 percent of the "greatly annoyed" are usually at home in the afternoon as well as in the morning and evening, while only 63 percent of the "non-annoyed" are always at home and exposed to the airplanes. The "greatly annoyed" also more frequently say their general health is only fair or poor and that they are more sensitive

to noise than most other people. But the vast majority of all annoyance groups say they are in good health and are average in noise sensitivity.

Men and women were about equally bothered by airplane noise, and the number and age of household members also has little effect on overall annoyance. Likewise, relative income and occupation were unimportant in determining annoyance reactions. For equal airplane stimulus conditions, both rich and poor, highly skilled and laborer, were equally annoyed or not annoyed with nearby airplanes.

Overall Annoyance and Expression of Annoyance

It may surprise some readers that the entire discussion thus far has been in terms of the physical stimulus, the intervening psychological and sociological factors which influence the perception of the stimulus, and the human response in terms of feelings of annoyance or non-annoyance... Most administrators who are directly concerned with community reactions to aircraft disturbances tend to think in terms of complaints. Their preoccupation with complaints is understandable, because these are usually the only indicators of community reactions from which they can gauge the underlying public opinion. As every public relations specialist knows, however, letters of complaint are generally prepared by only a fraction of the general public and are not always an accurate reflection of popular feelings. This study is fairly unique in that it is possible to compare the underlying feelings of annoyance with the range of actions taken to express these reactions by different people. It can not be stressed too strongly, however, that underlying feelings of annoyance and overt complaints are two different dimensions of human response and are only related in a very complex fashion...

While about two-thirds of the residents living within two miles of the airport were "greatly annoyed" with the airplane situation, only six percent of this group had ever taken any action to express their hostile feelings to the authorities. This sharp contrast between even intense underlying feelings and expressions of complaints

emphasizes the need to treat them separately. Demographic factors of age, education and social status, for example, are usually regarded as important considerations in influencing expressions of complaint. Younger, better educated persons are generally more likely to institute some civic action than older and less well educated residents But in this particular problem of aircraft annoyance, other specific factors must also be considered.

Factors Influencing Expression of Annoyance

Less than half of all persons had any idea who the proper authorities were who were responsible for improving the local aircraft situation; only 16 percent mentioned the Civil Aeronautics Administration or the Civil Aeronautics Board, and an additional 21 percent mentioned some city or county agency. This ignorance of where to go to register a complaint undoubtedly sharply reduced the volume of complaints. Other reasons contributing to inaction are:

1) the feelings of a third of the "greatly annoyed" that it is physically impossible to improve the situation,
2) feelings of 60 percent of the "greatly annoyed" that the "individual doesn't count", and that it is not possible to influence the proper officials,
3) the feelings of 80 percent of the "greatly annoyed" that local authorities have done nothing to improve the situation and that the most important reason for inaction is lack of concern by these authorities,
4) the belief that those who have tried to complain have not accomplished anything.

Suggestions for Reducing Airplane Disturbance

Contrasted with these pessimistic attitudes towards complaining is the widespread belief that the disturbance is unnecessary and could be greatly reduced if the authorities desired to do so. The actions suggested by the "greatly annoyed" are

generally reasonable, and include such measures as re-routing planes away from congested areas, making planes fly higher where possible, enforcing safety regulations, designing quieter engines, etc. A definite minority of one out of five suggested such drastic action as closing the airport.

Complaint Areas vs. Non-Complaint Areas

The reasons cited above for variations in overall annoyance and for failure to express these feelings of annoyance also help explain differences in levels of complaint among the eight airport areas. In the original survey design four of the areas had been selected as having significant community complaints and four as having few such complaints. Our survey found that there was a significant difference in both the levels of annoyance and the levels of complaints in these two types of areas. In the close population centers (less than two miles from the airport), 55 percent of the "non-complaint" area residents were "greatly annoyed" in comparison with 71 percent of the comparable group in the "complaint areas." Likewise 7 percent of the "greatly annoyed" residents in "complaint areas" actually expressed their feelings to the authorities, while only 2% of the same group did so in the "non-complaint" areas.

Residents in "complaint areas" more often reflect the same psychological characteristics which we found contribute to intense annoyance. They are less strongly attached to their local communities, somewhat more sensitive to other community problems, more spontaneous in expressing their fear of crashes, believe the airlines are less important, and are generally aware of the activities of local pressure groups attempting to secure improvements in the airplane situation. They also feel the authorities are indifferent to their safety and comfort, but they are better educated and better off financially and consequently are not as defeatist as the comparable groups in the "non-complaint" areas. It was not possible to secure a complete sociological history of the kinds of local leadership and the degree of

social organization of these different communities. Consequently, it is not possible to assess fully the role of active pressure groups in determining the volume of complaints.

It is worth repeating, however, that in both the so-called "complaint" and "non-complaint" areas, the level of annoyance with local airplanes is fairly serious. While the volume of complaints have reflected only a fraction of this annoyance, because of intervening psychological or sociological variables, the continued existence of widespread hostility feelings presents a potential threat to the future of aviation... Whether these underlying feelings of resentment will erupt into organized protests and efforts to restrict the operations of local airports can not be easily forecast, but as long as the community hostility persists, the threat is ever present.

II INTRODUCTION TO STUDY

Aviation has achieved exceptional advances in the past twenty-five years. Aeronautical engineers have accelerated the development of faster, safer, bigger and more economical air carriers, culminating in the production of the modern DC-7's and Super Constellations. These giant transports represent a tribute to the vision and perseverance of the early aviation enthusiasts who struggled for public recognition of flying and air transportation. Attesting to the success of their efforts, air traffic and passenger volume have continued to jump to new records. While propeller-driven airplanes are probably already close to their peak of development, the rapid advances in jet propulsion and even rocket design foreshadow still greater achievements in the future.

A discordant note in the generally optimistic picture, however, is the growing problem of hostile community relations. During the 1920's and 30's the location of an airport near a city was usually considered a mark of progress and civic growth. In the past few years, however, an increasing number of communities have begun to question the advantages of having a bustling airport as a neighbor.

As the size, power and number of engines of air carriers were increased to produce additional speed and capacity, unforeseen secondary problems developed for many people living near airports. The constant roar of low-flying planes landing and taking off from nearby runways seriously interfered with normal speech, sleep, radio and television-listening, and other daily activities, and the sight of huge planes flying only a few hundred feet above their homes increased their apprehension of possible accidents.

Since the end of World War II, annoyance and complaints about low-flying planes have mounted steadily. As the two-engined transports were replaced by larger and more powerful four-engine planes and as the volume of air traffic mushroomed, several communities attempted to pass restrictive local ordinances regulating flight patterns

of airplanes. In other cases, individual residents sought relief and compensation in the courts for alleged infringements on property rights by planes zooming overhead. In Newark and Elizabeth, N.J., violent community protests forced the temporary closing of one of the nation's businest airports after a series of tragic local accidents aroused widespread fears and anxieties.

This dramatic explosion of public opinion which actually succeeded in stymying the normal operation of a major airport seriously alarmed public and private aviation authorities and forced the recognition of a new factor in aviation planning. The National Advisory Committee for Aeronautics, as one phase of its research on the aircraft noise problem moved swiftly to assess the significance and implications of these hostile community reactions. The N.A.C.A. requested the National Opinion Research Center affiliated with the University of Chicago, to institute immediately a series of exploratory studies designed to develop appropriate techniques and methods for evaluating the extent and intensity of community disturbances, and to determine, if possible, the factors leading to adaptation and acceptance of given aircraft situations. As an ultimate goal, it was the desire of the N.A.C.A. to ascertain whether the personal interview technique could be utilized in determining specific criteria for acceptable airplane noise levels.

Since there are as yet no jet-propelled transport planes in use by commercial airlines in the U.S., and since propeller-driven planes are likely to continue to be the major type of commercial air transportation in the next few years, it was decided to limit this initial inquiry to the effects of propeller-driven planes.

The first step was to review existing literature for possible clues bearing on human adaptation to aircraft stimuli. While numerous articles have been written over the years about various clinical tests and experiments on the hearing process,

very little has been said about the psychological and social effects of noise experiences. K.D. Kryter 1/ and F.K. Berrien present some of the best summaries of previous research on human aspects of noise. Unfortunately, however, it is almost universally agreed that lack of adequate experimental controls in these past studies make it impossible to state precisely the effects of noise on human behavior. A number of important clues, however, were suggested by these and other reports, and these were incorporated in the study design which is described in the next section.

Numerous exploratory discussions with various government and aircraft industry representatives were held in an effort to develop a more detailed statement of the community relations problems as perceived by these responsible officials. Lists of airport areas were compiled showing traffic volume trends, flight patterns in relation to population centers, and varying indications of community reactions, such as newspaper and magazine articles, petitions of protest and letters of complaint.

Several hundred of these individual letters of complaint which had been received by the Washington office of the Civil Aeronautics Administration were thoroughly reviewed for indications of geographic concentrations of complaint, and of the specific aspects of the aircraft situation which are most annoying to people. Similar analyses were made of letters on file with the Port of New York Authority, operators of the commercial airports in the New York metropolitan area, but adequate analyses of these complaint files were extremely difficult because of the great variability in the details of response. While some letters described particular incidents in detail, most complaints were not at all specific. In general, it was clear that

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1/ K.D. Kryter, "The Effects of Noise on Man". Journal of Speech and Hearing Disorders, 1950, Monogram Supplement #1; F.K. Berrien, "The Effects of Noise". Psychological Bulletin Vol. 43, No. 2,, 1946.

people were disturbed by noise, low flying, fear of crashes, interference with sleep and TV reception. It was also generally felt that the situation could be improved if the pilots and authorities wanted to be more considerate. Statistical tabulation of the relative importance of any of these factors, however, was impractical because most letters were vague and general in their complaint, and no control was possible over the actual character of the airplane stimulus or of the individual characteristics of the complainers.

It became apparent that while the personal appraisals of industry specialists and the evaluations of letters of complaint were useful, they contained obvious sources of possible bias. Only a direct interview of a representative cross-section of residents living under ascertainable aircraft conditions could reveal the complex variability of human response to these conditions. In order to test the feasibility of such a direct approach, a standard questionnaire was designed and pre-tested on about 600 persons in the New York and Chicago airport areas. In cooperation with Port of New York Authority and Chicago Airport officials, a number of city blocks were selected to represent areas under flight paths at varying distances from the ends of frequently used runways. From these blocks respondents were selected at random and interviewed. Both the New York and Chicago airport areas were selected for the pretest because they represented two of the largest commercial airports, and while New York had experienced a recent series of disastrous crashes at Elizabeth, N.J. and Jamaica, L.I., Chicago had been relatively free of such fatal accidents.

The pre-tests clearly indicated that a carefully designed personal interview could uncover differences in the intensity of annoyance with airplanes. It also revealed that certain psychological and sociological factors tend to be more important than others in influencing adaptation to such disturbances. The results of these preliminary explorations were reported to the N.A.C.A., together with a comprehensive research plan for ascertaining statistically reliable measures of community reactions to the airplane situation. This plan was accepted by the N.A.C.A. and its design, execution and results are reported in the following sections.

III STUDY DESIGN

A. Need to Limit Types of Airport Areas -

The first question to be resolved in developing the present study was the limitation on the geographical scope of the research. There are about 6,000 civil airports scattered thruout the U.S. and, theoretically, a sample representing all of these airports could have been selected. For a number of practical reasons, however, this alternative was rejected. First, it was apparent from conversations with government and industry officials that the larger airport areas presented the most serious community situations, and because of the urgency of the problems, it was considered desirable to concentrate on them. Secondly, the large number of airports all over the country represent such a diversity of physical situations that comparisons of human responses would be very difficult. Thirdly, if actual sound measurements were to be taken at each of the sampling areas at the time of the interviewing as would be necessary to achieve an adequate control over variations of the physical stimulus, the expense of scattering these efforts among many areas would be prohibitive. Likewise, the hiring and training of interviewers in many randomly selected areas would also present complications.

A fourth and conclusive reason for rejecting a random national sample was the belief that the major objectives of the study could be achieved most efficiently with a relatively large number of interviews obtained under a limited number of measurably different stimulus conditions. This study was concerned primarily with the extent to which human annoyance varied with the intensification of the aircraft stimulus. It was also directed toward further analyses of the dynamics of deviant annoyance responses under comparable stimulus conditions in order to isolate, if possible, the specific factors which contribute to these variations. To secure a small number of interviews under many kinds of situations might fail to provide enough cases under identical stimulus conditions to permit such detailed analyses.

It was decided, therefore, to study eight large airport areas, in accordance with the following criteria:

1. Traffic volume at each airport must be at least 100,000 operations per year, of which the preponderance are commercial air carrier or equivalent military flights.

2. Landing and take-off flight paths must pass over a variety of population centers which are located from one mile or less to 10-12 miles from the end of a runway. This continuum of exposure is necessary to afford a variety of distance-altitude flight situations and to permit an examination of annoyance responses in relation to the increasing intensity of the aircraft stimulus.

3. Half of the areas must have "serious" community-wide complaints about the airplane situation, while the other half do not have significant complaints.

4. The areas should be selected from different sections of the U.S.

In addition to the above criteria, an effort was made initially to select half of the areas with recent serious accidents and half without any fatal crashes. This factor was believed to be potentially important because fear of crashes appeared to be a significant variable. Upon examination of detailed Civil Aeronautics Board records of airplane accidents, however, it was found that practically every major airport had experienced serious accidents in the past few years. Since this factor, therefore, was fairly uniform, it seemed unnecessary to single it out for experimental control. The actual procedure used to select the eight airport areas was as follows:

1. C.A.A. records of airplane operations were examined and the largest airport areas were selected.

2. Operations officials of the Civil Aeronautics Administration, Civil Aeronautics Board, National Advisory Committee for Aeronautics,

Air Transport Committee and the National Air Transport Coordinating Committee were consulted to learn as much as possible about the air traffic and community situations at these major airports. About half of the airports had to be eliminated from consideration at this stage, because flight paths were generally over open country or water, or were limited to only a few scattered population centers.

3. Questionnaires were sent to the C.A.A. tower chiefs at each of the remaining airports which appeared to meet the survey criteria, to secure additional details on operating conditions and local community reactions.

4. On the basis of the replies to the above questionnaire, a number of the larger airport areas were tentatively selected, and conferences were arranged with the tower chiefs, airport managers, local chambers of commerce and other civic groups to further document the survey criteria.

5. Upon evaluation of all the above information, the following eight areas listed in Table 2 were selected:

TABLE 2

AIR CARRIER AND MILITARY FLIGHT OPERATIONS AT EIGHT AIRPORT AREAS

Area		1953 Flight Operations 1/	Geographic Region	Community Complaints Yes	Community Complaints No
I	New York (Idlewild)	102,000			
	(LaGuardia)	190,000			
	Combined New York	292,000	East	X	
II	Philadelphia (International)	127,000	East		X
III	Minneapolis (Wold-Chamberlain)	150,000	Midwest	X	
IV	Chicago (Midway)	271,000	Midwest		X
V	St. Louis (Lambert)	134,000	Midwest	X	
VI	Memphis	109,000	South		X
VII	Atlanta	119,000	South		X
VIII	Miami (International)	179,000	South	X	

1/ Data reported in the C.A.A. Federal Airways Air Traffic Activity Reports.

B. Need to Select Localities At Each Airport Area With Comparable Airplane Stimulus Conditions

A primary consideration governing the selection of specific communities at which people would be interviewed within each airport area was the need to maintain strict comparability in the variations of the airplane stimulus situations among the different airports.

Since one of the objectives was to determine the extent to which annoyance responses varied in relation to changes in the physical stimuli, it was essential to know what the physical situation was in each area. Unless the aircraft stimulus at the time of the interview was adequately measured, it would be extremely difficult to establish any relationships between intensity of annoyance and variations in the stimulus. Furthermore, it would be impossible to combine data from the eight airport areas properly or to study deviant annoyance responses. It would be impossible to segregate comparable airplane situations to determine statistically whether annoyance was typical or unusual.

Acoustical engineers were consulted and their advice was that a continuous series of direct acoustical measurements should be taken at each sampling area thruout the interview period to average out the effects of variations in aircraft operations. But the cost of such detailed acoustical observations was estimated to be far in excess of the total budget for the survey and, therefore, was impractical. Since acoustical phenomena resulting from airplane flights are closely correlated with variations in airplane operations, however, it was suggested that a preliminary analysis of flight operations at each airport could minimize the expected variations in the sound stimuli and reduce the number of necessary acoustical observations to a reasonable magnitude. This compromise was thoroughly reviewed by acoustical and aircraft operations consultants and, while it was far from ideal, it was considered operationally adequate for this study.

The two major aspects of the sound stimulus which are subject to experimental control are the intensity, as measured by sound pressure levels, and the frequency of airplane flights. Presumably the sound spectrum of propeller-driven aircraft is fairly homogeneous at a given distance from a runway and does not warrant special consideration. The operational factors which were analyzed in order to reduce the variations in the airplane stimulus are discussed below.

1. Intensity of Airplane Noise

The intensity of airplane noise is closely correlated with variations in the following aircraft operations:

a.) Type of plane - Obviously a lighter one-or two-engine plane has less horsepower and generally propagates less noise than larger four-engine DC-6's or 7's or Super Constellations. It was not feasible to secure an actual count of the different types of airplanes operating out of the eight airport areas, but because they are all major airports located on principal air routes, the variations that now exist with regard to this factor are not believed significant.

b.) Type of operation - Commercial flight operations can be broadly grouped into the following four categories: landing, take-off, circling and cruising operations. The power settings, R.P.M. of propellers, altitude and other technical differences in these operations could create significant variations in the sound stimuli. A vigorous effort, therefore, was made to control this factor in the study design. As will be described in Appendix A, however, most areas are usually subjected to a combination of these operations in accordance with the traffic volume and different wind and weather conditions. Consequently, it was most difficult to find any situations with exclusively landing or take-off operations. Separate

sampling areas which were located under predominantly landing or take-off zones were selected within the communities close to the airport but no distinction was even attempted among the distant control areas which were 10-12 miles from the end of a runway. At this distance and corresponding altitude, it was not believed that significant differences would exist in the sound stimulus. Planes taking off have usually already throttled back and planes landing are also at similar power settings. Appendix A also indicates that there actually was little measurable difference in the sound stimulus among the "landing" and "take-off" sampling areas for a variety of reasons.

c.) Altitude of plane - This is probably one of the most important elements which require control. Since noise is directly related to the distance between the noise source and the observer, it is apparent that, in general, the lower a plane, the louder the noise. While aviation experts assure us that the altitude of a plane landing or taking off usually conforms to an average glide path, considerable variations are known to occur in accordance with the type of plane, pilot technique, pay load, weather conditions etc. Consequently, an area may be designated as having planes pass over at a usual height of 1,000 feet or more, but occasionally a much lower plane will drag over the area. To minimize this variability in operations and to provide distinctly different stimulus conditions, it was decided not to sample communities over a continuous altitude-distance range, but to try to select three discrete altitude-distance intervals with large enough gaps between them to reduce serious overlap. Each landing and takeoff flight path was carefully examined to determine the altitude-distance relationships and an effort

was made to select communities less than two miles from the end of a runway which had planes pass over at less than 1,000 feet as the "close" group. Communities between 2-3.9 miles were skipped whenever possible, and those from 4-5.9 miles were chosen if planes passed over at an average of 1200-1500 feet. Then, population centers between 6-9.9 miles were generally omitted and selections made from areas 10-12 miles distant. This third group constituted a control situation in which planes were generally 2,000 feet or more above the ground and the resultant airplane noise level was expected to have little influence on speech communication and other necessary activities.

As Table 1 indicates, it was not always possible to follow this idealized study design. In a number of areas, the closest communities were 2.5-3.0 miles from the airport, or the only middle distance population centers happened to be only 3.5 miles away. In general, however, the overall plan was followed.

d.) Flight path - Areas located directly under a flight path are generally noisier than communities off to the side of an airoute. As noted above, the distance from the plane to the observer is greater as one departs from the direct flight path, and thus the noise level is reduced. Consequently, a detailed study was made of all flight paths, and sampling areas were selected as close as possible to the direct pathway.

e.) Atmospheric conditions - While the precise relationships between sound propagation and weather variations are not fully known, atmospheric conditions are known to affect sound levels. To reduce the possible influence of this factor, interviews were scheduled during months when good weather conditions predominated. In most of the areas, bad weather constituted less than 10% of the conditions during the interview period.

f.) Background noise level - Since the extent to which a particular aircraft stimulus is distinguishable from other background noises is closely related to the type and level of background noise, an effort was made to select pairs of relatively quiet and noisy sub-areas within each aircraft sampling area. In this way the effects of background noise could be compared for identical aircraft conditions.

2. Frequency of Aircraft Flights

Frequency of exposure to the aircraft stimulus is a function of the number of airplanes passing overhead over a period of time and the extent to which a person is at home during the day or night. The regularity of exposure also varies with the peaking of plane arrivals and departures during certain hours and with the use of certain runways. Due to particular weather conditions, some runways may be used exclusively on certain days or weeks and not used at all during other periods. The difficulty of equating all these differences for each sampling area and airport area is evident. It was decided, therefore, to use as a compromise an hourly average of planes passing overhead during the month of the actual interviewing. It was decided further to limit analyses to two frequency groups: three or more per hour (High Frequency) and one or less per hour (Low Frequency). The time each respondent is at his home or in the sampling area is determined from direct questions secured during the interview and the behavior patterns of all persons who are always at home can be compared with those of other respondents who are away most of the time.

The actual selection of sampling areas for each airport area was arrived at after a detailed conference with local airport tower chiefs and their staffs. In general, there were five steps involved in the choice of specific localities. The flight paths were laid out on a detailed area map; the frequency

of flight was determined; the location of population centers under heavily used and lightly used flight paths was noted; a number of these populated areas were actually visited and tentatively selected; and after a second field trip in the company of a sound engineer, the final selection was made.

The detailed procedures were as follows:

a.) The principal geographic origins and destinations of commercial air traffic at each airport was discussed, and relative frequency of each scheduled operation was ascertained.

b.) The landing and take-off flight paths radiating from each of the above geographic centers were plotted on large airport area maps, for each of the airport runways.

c.) The overall number of aircraft operations during the month of the survey was estimated on the basis of past trends and known changes in air carrier or military operations.

d.) The average percentage use of each runway in landing and take-off operations was next approximated. The relative importance of any special factors such as maintenance or repair of runways or of expected weather conditions was considered.

e.) The cumulative impact of flights over each population center surrounding the airport was determined and all communities were grouped into two "high" and "low" frequency categories.

f.) Three altitude-distance groups were then plotted along each flight path as follows:

(a) 0-2 miles from the end of the runway in which planes were under 1,000 feet in altitude.

(b) 4-6 miles from the end of the runway in which planes were 1,000-1,500 feet high.

(c) 10-12 miles from the end of the runway in which planes were 2,000 feet or more high.

g.) According to overall rates of sound attenuation, the following circles were drawn about each sampling point to represent fairly homogeneous aircraft stimuli: a radius of 1/4 mile for the 0-2 mile distance group; a radius of 1/2 mile for the 4-6 mile interval; and a radius of 1 mile for the control areas of 10-12 miles from the end of the runway.

h.) Each of these sampling areas was personally cruised by the study director or assistant study director to verify the judgements of the tower chiefs and to select at random from within each sampling area the sub-area blocks which were relatively quiet and those which were relatively noisy. An overall sound pressure reading on an "A" scale General Radio type sound meter was used as a rough guide to the preliminary selection of the actual blocks. Actual detailed readings in three separate octave bands were then taken later by the acoustical engineers for use in the analysis.

In the course of cruising about each sub-area, geographic limits were established so that a minimum of about 60 dwelling units were located in each sub-area. The general socio-economic level of each area was roughly approximated and an effort made to maintain a balance of various socio-economic levels in each distance group and type of sampling area among the eight airport areas.

i.) A day or so before actual interviewing was begun, the tentatively

selected sub-areas were revisited in the company of an acoustical engineer to make more precise sound readings. It was then decided whether the preliminary selection was a proper one, or whether it was necessary to make revisions in sub-area boundaries.

While the rigidities of the location of heavily travelled streets and concentrations of population centers introduced some necessary compromises in the actual selection of sub-areas, the effects of these modifications in the sampling design were always controlled in the final analysis. In the instances in which the closest population center was 3 miles from the end of a runway, the actual airplane noise level which was used in the analysis was based on the actual observations of the sound engineer which recorded this variation in distance. Table 4 which compares the actual recorded noise levels with the original sampling design provides a simple illustration. One of the sampling areas in Group No. 5 was actually 3 miles from the end of the runway. Consequently, its noise level was estimated as falling in the 67-72 db class, and all subsequent analyses for the 20 respondents in this sampling area were in terms of reactions to a 67-72 db airplane noise stimulus. The elaborate subjective procedures, described above, were used only to facilitate the preliminary selection of sampling areas. The sound engineer made actual observations of the sound stimulus in each sub-area during the week of the interviewing and his objective measurements were used in segregating equal stimulus conditions. A detailed description of these sound measurements is included in Appendix A, and a summary of these measurements in comparison with the original sampling design is presented in Table 4.

3. Summary of Final Sampling Design

The final sampling design included twelve different aircraft sampling areas with a pair of noisy and quiet sub-areas with the same aircraft situation -- a total of 24 sub-areas at each of the airport locations. Half (6) of these 12 basic aircraft situations were assigned to the closest 0-2 mile zone so

that a large enough sample of greatly disturbed respondents might be available for detailed analysis. A third (4) of the sample areas were in the intermediate 4-6 mile zone and a control group of 2 sample areas were in the 10-12 mile zone.

In the close and intermediate distance groups, two of the sampling areas were under take-off and two under landing operations. Each of these groups was further divided into "high frequency" and "low frequency" situations, so that simultaneous control was achieved over the distance-altitude of planes, the type and frequency of air operation, and the overall background noise level of each sub-area.

In addition, two special situations involving areas off a direct flight path were selected in the 0-2 mile group at the first two airports studied. Due to budgetary reasons, only one special situation was selected in each of the remaining 6 airport areas. The first of these special areas was less than a mile off a direct flight path and was primarily under "take-off" and "high frequency" operations. The second special area differed from the first only in that it was more than a mile off the direct flight path. These special areas were selected to test the relative psychological effects of direct flights and circling operations.

In the distant 10-12 mile zone, only altitude, frequency of flight and background noise level were controlled. The type of operation (landing, take-off or circling) was not considered sufficiently important to necessitate separate control.

Table 3 summarizes the theoretical design of the 24 sampling sub-areas. Table 4 indicates the actual airplane SNL's for each sampling sub-area. These levels are based on the actual acoustical sound measurements and form the basis for all analyses presented in this report.

TABLE 3

SAMPLING DESIGN FOR EACH AIRPORT AREA

Sample Area No.	Distance-Altitude	Operation	Frequency of Flight	Background Noise	
1	0-2 miles under 1000 ft.	Takeoff	High	Noisy	
2	"	"	"	Quiet	
3	"	"	Low	Noisy	
4	"	"	"	Quiet	
5	"	Landing	High	Noisy	
6	"	"	"	Quiet	
7	"	"	Low	Noisy	
8	"	"	"	Quiet	
9	"	Takeoff	High	Noisy	1 mile off flight path
10	"	"	"	Quiet	"
11	"	"	"	Noisy	1-1/2 miles off flight path
12	"	"	"	Quiet	"
13	4-6 miles 1000-1500 ft.	"	"	Noisy	
14	"	"	"	Quiet	
15	"	"	Low	Noisy	
16	"	"	"	Quiet	
17	"	Landing	High	Noisy	
18	"	"	"	Quiet	
19	"	"	Low	Noisy	
20	"	"	"	Quiet	
21	10-12 miles over 2000 ft.	Not Specified	High	Noisy	
22	"	"	"	Quiet	
23	"	"	Low	Noisy	
24	"	"	"	Quiet	

TABLE 4

RELATIONSHIPS OF AIRCRAFT SAMPLED NOISE LEVELS AND ORIGINAL SAMPLING AREA DESIGN

Sample Area Number	Total	Number of Sample Areas in Each Aircraft SNL Category					
		50-60db	61-66db	67-72db	73-78db	79-84db	85+db
1	8	-	-	-	3	4	1
2	8	-	-	-	3	4	1
3	8	-	-	-	3	5	-
4	8	-	-	-	3	5	-
5	8	-	-	1	3	3	1
6	8	-	-	1	3	2	2
7	8	-	-	1	4	2	1
8	8	-	-	1	4	2	1
9 A/	4	-	-	2	1	1	-
10 A/	4	-	-	2	1	1	-
11 A/	6	-	-	5	1	-	-
12 A/	6	-	-	5	1	-	-
13	8	-	3	4	1	-	-
14	8	-	3	4	1	-	-
15	8	-	2	6	-	-	-
16	8	-	2	6	-	-	-
17	8	-	4	3	1	-	-
18	8	-	4	3	1	-	-
19	8	-	3	4	1	-	-
20	8	-	3	4	1	-	-
21	8	8	-	-	-	-	-
22	8	8	-	-	-	-	-
23	8	8	-	-	-	-	-
24	8	8	-	-	-	-	-
Total	180	32	24	52	36	29	7

A. Sampling areas 9-12 represent communities off the direct flight path. In each of two airport areas, 4 sampling sub-areas were selected; in 6 airport areas only 2 sampling sub-areas were included - i.e., 20 sub-areas for the eight airports.

C. Need to Control Selection of Respondents.

The most accurate sampling procedure generally involves the use of straight probability methods in the selection of respondents. In this rigid scheme, no substitutions of households or individuals are possible and consequently, many expensive call backs are necessary to complete assignments. In addition, unless fairly large numbers of respondents are interviewed in each sub-area, chance variations in sex, age or other socio-economic factors are likely to be significant.

Since one of the major purposes of the study design was to facilitate inter-sub-area comparisons of annoyance reactions, it was extremely important to maintain a balance of socio-economic factors among the sub-areas. And since pre-tests indicated considerable homogeneity of annoyance responses in any one sub-area, it was decided to use a modified age-sex quota system in the selection of respondents.

A quota of 20 interviews was assigned to each sub-area, of which 8 were to be males (half under 40 years of age and half over 40 years of age) and 12 were to be females (half over 40 and half under 40). More women were interviewed than men because it was known that women would more often be at home and available for interviewing during the afternoon hours. Only resident adults 18 years old or more were to be selected and persons were to be rejected if their English or their hearing ability was so poor as to make an interview of questionable value. In every case interviewers were instructed to take only one respondent from the same household in order to increase the likelihood of independent responses.

The actual selection of particular respondents to fill the age-sex quota requirements was in accordance with a random procedure. Starting from a varying point on each block (first, second, third, etc. house from each corner) interviewers were instructed to approach each n'th house (factor depended on total number of dwelling units available in a sub-area) and attempt to find an eligible respondent. If no

one was home or if no one home could meet the quota requirements, the interviewer recorded the contact and proceeded to the next n'th house until the quota was filled. If an interview was interrupted or refused, the age, sex and economic level of the respondent was estimated by the interviewer and the reason for the refusal recorded.

In order to minimize the possible effects of variations in the quality of interviewers, the following scheme of assignments was devised. Four interviewers were assigned to each sub-area with a quota of five interviews each. Each interviewer was generally assigned to a pair of noisy and quiet sub-areas in the same sampling area, and each interviewer was sent to at least two different altitude-distance sampling areas. Where travel conditions permitted, an interviewer's assignments were spread among the three altitude-distance groups. In this way, whatever the particular interviewer effects, the impact on inter sub-area comparisons would be minimized.

A further precaution used whenever possible was to schedule assignments in each sub-area so that all interviewing was completed within two or three days. In this way the spontaneity of response was maximized and the secondary effects of conversations among respondents were reduced.

In actual practice there were some slight deviations from the above scheme due to interviewer resignations, illness and other problems involved in field administration. Such modifications, however, concerned only a small fraction of the completed interviews and do not seriously affect any of the results. Each of the interviewers was personally trained by the Study Director or Assistant Study Director, in cooperation with regular field supervisors. Each interviewer participated in general orientation discussion of the purposes of the study, its design and the questionnaire structure. In addition, when it was necessary to supplement regular NORC interviewers with new staff, actual trial interviews were completed with the regular questionnaire in specially chosen locations remote from sampling areas in

which interviews were to be obtained later. These training interviews were personally reviewed with the new interviewers and further practice interviews were assigned where necessary until an acceptable level of performance was achieved.

Table 5 indicates that on the average 2.5 contacts were necessary for every successful interview. Practically all of these multiple approaches, however, were due to respondents being away from home or failing to meet the quota requirements, rather than to any reluctance to cooperate. Only 7.7% were due to refusals or interrupted interviews.

TABLE 5

TOTAL APPROACHES AND COMPLETED INTERVIEWS BY AIRPORT AREA

Airport Area Number	Total Approaches	Completed Interviews	Incompleted Interviews	
			Due to Refusals or Break-offs	Due To Other Reasons
I	1418	482	149	787
II	1175	488	101	586
III	1166	443	72	651
IV	1281	462	98	721
V	1053	440	93	520
VI	983	440	68	475
VII	917	440	48	429
VIII	1065	440	71	554
Total	9058	3635	700	4723

An analysis of the age and sex characteristics of the 700 refusals reveals a preponderance of older women. While only 60% of the quotas assigned were female, 72% of the refusals were by women, of which almost two-thirds were over 40 years of age. The disproportionate number of refusals among older persons was even more evident among men, with three-fourths of the male refusals estimated to be over 40 years of age. The overall effects of these refusals (amounting to less than 8% of the contacts) can not be significant, but it is possible that they contribute to a slight understatement of the general annoyance felt by older people. As will be discussed in Section III, persons over 40 years of age were generally more annoyed with aircraft disturbances than those under 40 years of age. If the older persons

who refused to be interviewed were more disturbed with aircraft than those who were interviewed, some slight understatement of general annoyance would have resulted. Actually, there is no reason to believe this to be the case. Rather, it is our belief that their refusal merely reflects the less cooperative attitude of older people to opinion surveys and does not constitute a serious bias in our results.

D. Structure of the Questionnaire

The overall plan of the questionnaire was to move from a series of more general questions about the community to more specific probes. The reason for this method was to give the respondent an opportunity to talk freely at first about the things uppermost in his mind, both as a means of making him comfortable in the interview situation and of eliciting spontaneous comments about airplanes. The first six questions asked about things in the community which he liked or disliked, about reasons for picking the neighborhood as a place to live, about expected problems in living there and about possible changes in attitude toward the neighborhood and desires to move away. No mention was made of noise or airplanes. Questions 7 and 8 were projective-type "word association" and "sentence completion" questions. Questions 9-11 asked about the overall noise level in the present and previous communities and the kinds of noise the respondent perceived. No mention was yet made of airplanes and only spontaneous comments were probed.

Questions 12-17 were the first direct inquiries about specific aspects of "the airplanes around here". Efforts were made to encourage the respondent to reveal his detailed feelings toward local aircraft. Additional questions were directed towards his general attitudes concerning aviation and his experiences with flying.

Other questions probed noise experiences at work, knowledge of authorities who are responsible for controlling aircraft noise and safety, and attitudes towards the possibility of improving the local situation. The final section recorded various

demographic characteristics of the respondent.

The entire interview averaged about one hour in length, depending upon the intensity of feeling and number of volunteered comments. Table 6 summarizes the structure of the questionnaire.

TABLE 6

STRUCTURE OF QUESTIONNAIRE

Part	Question	Contents
I	2 - 6	Free answer questions about neighborhood
II	7 - 8	Projective type: Word Association and Sentence Completion
III	10 - 24	Direct questions about attitudes and experiences with noise and airplanes
IV	25 - 32	Factors influencing expression of annoyance
V	33 - 46	Respondent characteristics
VI	47 - 54	Interviewer ratings

E. Coding Procedures -

There are two basic types of questions used in this survey, each requiring different coding and editing procedures. The pre-coded questions already have the designated alternative responses printed on the questionnaire, as Question 2 of Appendix C indicates, and the coder merely has to be certain that one and only one category has been circled, or that a recorded spontaneous comment does not contradict the circled code number. For example, Part A of Question 2 reads as follows: "Well, in general, how do you like living in this part of (name of city or county)... Would you say you like it very much -- that you like it a little -- or that you don't like it?"

Like very much. . . . . (1)
Like a little 2
Don't like. 3
Don't know. 4

In this example only "Code 1" has been circled and no comment has been recorded, so the coder merely satisfied himself that only one code has been selected.

The free answer type question which requires the spontaneous answer of the respondent presents a more complicated problem. While the exact words reported by different respondents may vary considerably, the general sense of their replies usually can be grouped into a limited number of meaningful categories. In this type of coding process, the general categories of response are formulated from a sample of actual questionnaires in advance of the coding and the coder then has to read each questionnaire and decide which of the coding categories apply. For example, the following excerpt of Part C of Question 2 is taken from an actual interview in New York City:

Question 2C. "Now usually no place is perfect -- so to be sure I get a complete picture, I'd like you to tell me about anything around here that bothers or annoys you in any way, especially during the summer and fall months.

Answer: Mosquitoes and high level of water so your cellar gets wet, cesspool overflows (Lack of sewers) X No "

Standard Probe to Question 2B:

"Are there any other things that annoy you -- that you just take for granted because nothing much can be done about them? (what are they?)

Answer:
No -- oh airplanes. But what can you do about them X They fly very low. They come zooming down. It makes house shake. You'd think it comes into your house. Its frightening at some times in the middle of the night especially X No I can't think of any."

(7-1,3,5,0)

NOTE: Each "X" designates the respondent stopped talking and the interviewer probed by asking a neutral question such as, "Anything else?"

Part of the coding instructions for this question was as follows:

"Dislikes"

NOTE: "Mentions of 'low flying' will be coded as either a 'fear' or 'noise annoyance' response in codes 7-1 thru 4 depending on the context in which it appears.

If the recorded response is too vague to determine whether 'fear" or "noise annoyance" is involved, consult your supervisor.

Multiple coding is permitted except as noted.

7-1 AIRPLANE DANGER, FEAR OF AIRPLANES--PERSONAL. (Definite expression or implication of personal fear.)

"You don't know when an airplane will hit the house, The airplanes-- you can't hear them before--only when they're on top of you-- I honestly ducked once when I was in my car, The planes come low--you'd think they were on top of the roof, Planes--sometimes they're right on top of you--they are terrible sometimes.

7-2 AIRPLANE DANGER, FEAR OF AIRPLANES--ATTRIBUTED TO OTHERS.

"My kids scream when they come low; My wife is frightened to death of them.

7-3 AIRPLANE NOISE. Code here all direct mentions of airplane noise. (Supervisor will code all mentions of low-flying which do not definitely imply danger or fear in this category.) Do not double-code with 7-4.

"The airplanes coming over--the noise, you can almost shake hands with the pilot, The airplanes zoom over the house, You can't hear yourself talk, The airplanes and their roaring.

7-4 AIRPLANE NOISE--NO BOTHER Code here all direct mentions of noise which are coupled with a disclaimer of bother or annoyance with the noise. (Supervisor will code mentions of 'low flying' without indication of fear and coupled with disclaimer of bother in this category.) Do not double-code with 7-3.

7-4 (Cont'd)

"The planes fly awful low over here but they don't bother me, Some people complain about planes--we're near the airport--they do fly low but they don't bother me, Of course there's the planes but they don't bother us now--

7-5 ALL OTHER COMPLAINTS ABOUT AIRPORTS, AIRPLANES

"They shake the foundations, They crack the windows, The airport--since property taken over it has been left to deteriorate, The airport--made this look like Tobacco Road, The airplanes are a nuisance

---

7-0 FUTILITY OF COMPLAINT. Code here any expression of the hopelessness, uselessness or futility of complaint.

"We're near the airport and have to expect noise--there is nothing you can do about it--must make the best of it, I know nothing can be done about it but it certainly is noisy."

As can be seen, codes 7-1,3,5 and 0 have been selected, indicating:

7-1 Personal fear ("It's frightening at times.....")

7-3 Airplane noise (fly very low X They came zooming down...." On Questions 3-6 "low flying" was more fully explained as both fear and noise nuisance)

7-5 Other complaints about airplanes ("makes house shake")

7-0 Feeling of futility ("What can you do about them?") "

The first six free-answer questions and codes for all of the important direct questions were always checked by a second person to minimize errors of interpretation. Codes on other pre-coded questions and less significant direct questions were verified on a flexible sample basis that was never less than one third of the responses. If a significant number of conflicts arose between the original coder and the checker, the number of questionnaires selected for checking was increased.

The coding procedure was administered as follows:

1. All questionnaires were originally coded on separate coding sheets.
2. The questionnaires themselves were then independently coded by another group of "checkers".
3. A supervisor compared the two sets of codes and resolved any differences.

4. Conferences were held thruout the coding operation to insure uniformity in treatment.

After all of the individual questions had been coded and verified, each questionnaire was reread by a small group of highly experienced coding supervisors and an "overall annoyance" code was determined for each respondent. Each supervisor's judgement was checked independently by another supervisor or by the Assistant Study Director before a final overall code was assigned.

At first, it was hoped that it would be possible to construct a formal scale of annoyance variations on the basis of responses to selected key questions. It was found, however, that respondents were often inconsistent and contradicted themselves during the course of the interview for a variety of reasons. Responses also varied greatly in "intensity" and were frequently offered "out of turn". For example, answers indicating changes in attitudes were often volunteered in reply to a question about "current likes or dislikes" and were not repeated in reply to the succeeding question about changes. These delayed and inconsistent responses made formal scale formation extremely difficult, and convinced us that a careful evaluation of each questionnaire by a panel of experts would be more appropriate. In this way conflicting statements could be judged in the light of the entire questionnaire and an appropriate overall annoyance classification could be determined.

It should be emphasized that the overall annoyance code reflects dislike, bother, annoyance, or disturbance for either airplane noise, fear of crashes, TV picture interference, vibrations or other kinds of airplane disturbances. In most cases airplane noise is mentioned, but in a number of instances, only fear of crashes or one of the other aspects of annoyance are reported. There are eight airplane annoyance categories which may be grouped into three broad classifications as indicated in Table 7.

TABLE 7

DETAILED CLASSIFICATION
OF
OVERALL ANNOYANCE WITH AIRPLANES

Title	Meaning
No Bother (Annoyance)	**Airplanes Do Not Bother Now**
1. Airplanes have never bothered	No indication of ever having been annoyed.
2. Airplanes used to bother -- but not now	Statement of previous annoyance with clear-cut denial of present annoyance.
Some Bother (Annoyance)	**Airplanes Bother Moderately But Not A Great Deal**
3. Airplanes bother some	Qualifications are reported, but no doubt that degree of bother is "some" rather than "a great deal."
4. Airplanes bother some	No qualifications reported. *
5. Airplanes bother some	Qualifications are reported and there is a question whether bother should not be coded "a great deal."
Great Bother (Annoyance)	**Airplanes Bother A Great Deal**
6. Airplanes bother a great deal	Qualifications are reported and there is question whether bother should not be coded "some".
7. Airplanes bother a great deal	Qualifications are reported, but no doubt that degree of bother is "a great deal" rather than "some".
8. Airplanes bother a great deal	No qualifications are reported.

* The term "qualifications", as here employed, means that the respondent has: (a) denied in one or more places a report of bother which he has made in another question, or (b) that he has made other conflicting statements about his reactions to airplanes (e.g., reports bother of one or another kind but says that he is "used to it" or is getting used to it), or (c) that he has conveyed a definite impression of reluctance to express his feelings about airplanes.

No one of the criteria listed below and no single criterion described in the instructions for the individual codes was considered conclusive. All factors were evaluated in reaching an overall selection. In general, the following criteria were given the greatest weight:

1. THE PRESENCE OR ABSENCE OF ANNOYANCE RESPONSES ON SPECIFIC KEY QUESTIONS
2. THE TYPE OF QUESTIONS which elicited the annoyance response
   a.) Free Answer - Annoyance responses to Questions 2-6 generally reflected the greatest degree of annoyance.
   b.) Volunteered Comments which were not in response to direct questions, but were added by the respondent in answer to other questions, were considered next in importance.
   c.) Direct Answers indicating annoyance were third in importance.
   d.) Word Association and Sentence Completion - Annoyance responses to these questions were interpreted in the context of answers to all other questions.
3. FREQUENCY OF RESPONSE - A person who consistently reported annoyance in answer to all types of questions was generally presumed to be more disturbed than one who only occasionally mentioned his annoyance after much probing.
4. THE INTENSITY OF RESPONSE - An exception to criterion (3) was the respondent who omitted or denied his annoyance, but who suddenly stated with great feeling his extreme disturbance. In this case, greater weight was usually given to the intense response.

Although some of the analytical tabulations utilized all eight annoyance categories shown in Table 7 the three major groupings were generally considered most reliable and, therefore, were used more extensively.

The above annoyance categories are solely in terms of feelings about the airplane stimulus. No effort was made to include such traditional "complaint"

classifications as, "threats of legal action, strong complaints" etc. It is our belief that a clear conceptual differentiation should be made between the various stages involved in the process of human response. Each of these stages are actually interrelated in practical experience, but to understand the process, an effort must be made to separate them into the following aspects:

1. The airplane stimulus and its physical attributes
2. The psychological and social factors which influence the individual's perception of the stimulus
3. The annoyance response to the stimulus which is a measure of the favorable or unfavorable reactions of the person to the stimulus
4. The psychological and sociological factors which influence the expression of annoyance
5. The actual variations in the expression of annoyance.

In most administrative situations, only the last stage is partially known to an airport official. He receives letters of complaint or approval of his operation. While such indices of expression are valuable, they are usually relatively few in number and may not truly represent the underlying feelings and attitudes of a majority of residents. Unless the underlying annoyance attitudes are clearly known, it is impossible to evaluate properly the significance and representativeness of complaints. As will be shown in the analysis of this report, while relatively few persons ever "complained" to the authorities, feelings of intense annoyance were widespread among those living close to the airport.

F. Analysis Procedures -

Each respondent was coded in terms of the characteristics of the actual physical noise stimulus to which he was exposed. These characteristics were objectively determined by the acoustical engineer for each sub-area and reflects the general sampling scheme outlined in Table 3.

Aircraft Sampled Noise Levels were separated into the following six intensity categories:

TABLE 8

AIRCRAFT SAMPLED NOISE LEVELS 1/

Category No.	Aircraft SNL	Estimated Miles from End of Runway	No. of Sampling Sub-Areas
1	50 - 60 db	10.0 - 12.0	32
2	61 - 66 db	4.6 - 7.0	24
3	67 - 72 db	3.0 - 4.5	52
4	73 - 78 db	2.0 - 2.9	36
5	79 - 84 db	1.0 - 1.9	29
6	85 + db	less than 1.0	7
			180

1/ Relationships to original sampling design are presented in Table 4.

Background noise spectra were fairly homogeneous because the noise source was usually truck or automobile traffic. The average background SNL's for daytime and nighttime experiences were coded separately into 7 categories as follows:

TABLE 9

BACKGROUND SAMPLED NOISE LEVELS

Category	Background SNL
1	Less than 32 db
2	33 - 36
3	37 - 40
4	41 - 44
5	45 - 48
6	49 - 52
7	53 + db

The difference between the aircraft SNL and the Background SNL during the day or night is called the Aircraft Emergent Noise Level. While each sub-area's respondents are coded in terms of 8 emergence categories, for analysis purposes it was necessary to combine the first 3 groups into one category, the 4th and 5th groups into a second category and the 6th - 8th groups into a third category. The eight Aircraft Emergent NL groups are listed as follows:

TABLE 10

AIRCRAFT EMERGENT NOISE LEVELS

Category	Emergent NL
Low Emergence	Less than 18 db
1	Less than 5 db
2	6 - 11
3	12 - 17
Intermediate Emergence	18 - 29 db
4	18 - 23
5	24 - 29
High Emergence	30 + db
6	30 - 35
7	36 - 41
8	42 db or more

Each of the respondents in the 180 sampling sub-areas was grouped according to aircraft SNL, emergence group and frequency of flight (high and low) category. For example, variations in overall annoyance response were compared for respondents in areas with equal airplane SNL and emergent NL's but with different frequency of flight characteristics. All told, there were 5 different airplane SNL groups, 3 different emergent NL's,and 2 different frequency of flight categories or 30 potential combinations. Actually, it was impossible to find stimulus conditions to represent 6 of these combinations, as for example, emergence of 30 db or more with airplane SNL's of only 50 - 60 db. Consequently, there were actual interviews representing 24 different stimulus situations.

In 9 of these situations, annoyance responses were not significantly different, or the number of interviews was so small as to make more detailed analysis impractical. It was decided, therefore, to combine all respondents into 13 different stimulus categories as shown in Table 11. All respondents in each of these 13 stimulus groups were then divided into the 3 major annoyance classifications and

separate tabulations were prepared for each of the 39 groups of respondents. The analyses of answers by these 39 analytical groups are presented in the next section.

TABLE 11

MAJOR STIMULUS GROUPS USED IN ANALYSIS

Group	Aircraft SNL	Aircraft Emergent NL	Frequency of Flight
1	50-60db	under 18db	High
2	50-60	under 18	Low
3	50-60	18-29	High
4	50-60	18-29	Low
5	61-66	under 18	High
6	61-66	under 18	Low
7	61-66	18-29	Both combined
8	67-72	under 18	Both combined
9	67-72	18-29	Both combined
10	67-72	30+	Both combined
11	73+	under 29	Both combined
12	73-78	30+	Both combined
13	79+	30+	Both combined

G. Tests of Validity

In the analysis of data and in the presentation included in the next section of this report, a number of different tests of significance were used to determine the "statistical validity" of various comparisons. A multi-variate analysis was attempted for the analysis of overall annoyance in relation to the airplane noise, stimuli, emergence and frequency of flight. The traditional "F" test ($P=.05$) of significance was used to test these "mean differences." In most comparisons of the presence or absence of particular attributes, chi-square tests were used and if differences were at the 5 percent level or less, they were regarded as possibly significant. Where the data reflected a binomial distribution, the 95% confidence intervals for binomial distributions were used.

IV. RESULTS AND ANALYSIS

A. Relationships of Overall Annoyance and Airplane Stimulus

1. Overall Annoyance vs. Aircraft Sampled Noise Levels (SNL)

Overall annoyance with low-flying airplanes is very clearly a serious problem among residents who live less than two miles from the end of a runway. Almost 90 percent of all such respondents reported annoyance with nearby airplanes, with 62 percent greatly bothered and 26 percent voicing moderate concern. Conversely, residents who are 10-12 miles distant are hardly bothered at all. Almost 2/3 reported no present bother, while only 6 percent are seriously disturbed. Table 12 which summarizes the relationships of overall annoyance and aircraft SNL, indicates that annoyance increases as the Aircraft SNL is increased.

TABLE 12

OVERALL ANNOYANCE AND AIRCRAFT SNL

Overall Annoyance	Aircraft SNL					
	Total	50-60db	61-66db	67-72db	73-78db	79+db
No bother	32%	63%	42%	33%	15%	12%
Some bother	34	31	40	36	37	26
Great bother	34	6	18	31	48	62
	100%	100%	100%	100%	100%	100%
Number of interviews	3635	650	481	1048	725	731

A closer inspection of the more detailed annoyance codes indicates additional evidence of the seriousness of the aircraft disturbance. Of the 62% who are greatly disturbed in the closest areas adjacent to the airport, two thirds went all out in voicing their intense feelings of annoyance while only a third were not fully consistent in the intensity of their expressions. In contrast, of the 31 percent living in the distant areas who were even moderately annoyed, only one out of three gave unqualified annoyance responses, while two-thirds offered such qualifying

remarks as, "They (the planes) aren't really so bad...they don't really bother me, but....they hardly ever bother...." . These comments indicate further the sharp differentiation in reactions of persons who are less than 2 miles from the airport and those who are 10-12 miles away.

In the subsequent analysis, special attention will be given to the "deviant cases" which report "no bother" in the close areas and those showing "great bother" in the distant areas. Table 13 gives the full detail of overall annoyance in relation to the Aircraft SNL.

TABLE 13

DETAILED OVERALL ANNOYANCE GROUPS BY AIRCRAFT SNL

Overall Annoyance	Aircraft SNL 50-60db	61-66db	67-72db	73-78db	79+db
Never bothered	59%	37%	26%	9%	8%
Used to it now	4	5	7	6	4
Bother some - qualified.	20	25	24	26	17
Bother some - unqualified.	10	15	10	9	7
Bother some - border line to great bother.	1	-	2	2	2
Bother a great deal - border line to "some" bother.	-	1	1	2	2
Bother a great deal - qualified.	2	8	11	18	20
Bother a great deal - unqualified.	4	9	19	28	40
	100%	100%	100%	100%	100%
Number of interviews	650	481	1048	725	731

2. Overall Annoyance vs. Aircraft Emergent Noise Levels

While there is some evidence of a tendency for annoyance to increase as Aircraft Emergent Noise Levels are increased, the relationships are not entirely consistent for all Aircraft SNL's. A rigid test of the significance of aircraft noise emergence was prevented by our inability to find sufficient observations under all kinds of Aircraft Emergent Noise Levels. In the "close" sampling areas where the Aircraft SNL was most intense (79+ decibels) Table 14 indicates that it was

impossible to find any community where the daytime Background SNL was high enough for the Aircraft Emergent NL to average less than 18 decibels. Only one area with but 20 respondents was found in the 2-3 mile zone with an Aircraft SNL of 73-79 decibels and the lowest daytime Emergent NL. Conversely, in the distant "control" areas where Aircraft SNL averaged less than 66 db, only one area could be found with a quiet enough Background SNL to produce a high Aircraft Emergent NL of 30 db or more. So for all practical purposes, only the intermediate sampling areas from 3-4.5 miles away, with an Aircraft SNL of 67-72 db, had enough observations in all aircraft emergence groups to permit valid statistical comparisons.

Another factor which may have obscured the aircraft emergence comparisons is the difference in regularity between the ambient and aircraft stimuli. Certain computational schemes (WADC Technical Report 52-204) have suggested that complaints generally increase as the emergent noise level increases, if both the offending noise and background noise are reasonably steady. In the case of airplane noise, however, even on frequently used airways, the exposure to peak airplane noise levels would be much more irregular than machinery noises or traffic noises. Consequently, this fluctuation of airplane exposure may be interacting with the Aircraft Emergent NL's and confounding the analyses. An indication that there is such an effect is presented in the discussion of "Overall Annoyance vs. Frequency of Air Traffic."

A further difficulty in evaluating annoyance and the extreme Aircraft Emergent NL's was the chance clustering of interviews in the upper and lower limits of each major aircraft emergence category i.e. in seven out of 11 different emergence situations shown in Table 14 more than half of all interviews were in areas where the difference in Emergent NL's was only 6 db or less from the next comparative group. For example, 70% of the 200 interviews with an Aircraft SNL of 61-66db and an Emergent NL of under 18db were in the 12-17db Emergent NL class. Likewise 72% of the next comparative Emergent NL group (18-30db) were in the 18-23db class, an average difference of only 6db. This lack of sharp contrast in absolute Emergent NL's

is summarized in Table 14.

TABLE 14

NUMBER OF INTERVIEWS OBTAINED UNDER VARYING DAYTIME AIRCRAFT EMERGENT NOISE LEVELS

Daytime Aircraft Emergent NL	Aircraft SNL: 50 - 60 db Number	50 - 60 db Percent Subtotal	61 - 66 db Number	61 - 66 db Percent Subtotal	67 - 72 db Number	67 - 72 db Percent Subtotal	73db or More Number	73db or More Percent Subtotal
-5 db.	125	29%	--	--%	--	--%	--	--%
6-11 db.	184	43	60	30	40	32	--	--
12-17 db	121	28	140	70	85	68	20	100
E_1-Subtotal under 18 db. . . .	430	100%	200	100%	125	100%	20	100%
18-23 db	180	90%	201	72%	321	47%	125	36%
24-29 db	20	10	80	28	362	53	223	14
E_2-Subtotal 18-30 db	200	100%	281	100%	683	100%	348	100%
30-35 db	20	100%	--	--%	180	75%	464	43%
36-41 db	--	--	--	--	60	25	424	39
42 db or more. . . .	--	--	--	--	--	--	200	18
E_3- Subtotal over 30 db	20	100%	--	--	240	100%	1088	100%

The previous discussion concerned the day time Emergent NL's, but since nighttime Background SNL's are usually somewhat quieter than daytime levels, it is apparent that it would be even more difficult to find any residential areas close to the airport with a high enough nighttime Background SNL to provide a low Emergent NL.

When Overall Annoyance responses are analyzed by daytime and nighttime Emergent NL's, however, very little difference is noted in response patterns. Since more respondents are at home during the evening hours and interference with sleep is known to be very important, it might have been expected that annoyance would vary more closely with nighttime Emergent NL's. The variations shown in Table 15 are relatively small and generally could have been due to chance. This similarity of relationships is probably largely due to the small differences between day and night Background SNL's in our sampling areas. In almost 30% of all sampling areas, nightime ambient noise

was less than 4db lower than the daytime level and in about half of all areas, the difference was only 4-10db. Thus, in eight out of ten situations, the day-night variation was less than 11db. An important exception to this general rule occurred in the areas with the moderate 67-73db Aircraft SNL. Day-night differences were relatively greater for the respondents in the middle Emergent NL group (18-30db) than for those in the high Emergent NL category (30+ db). More than half of all respondents in the daytime middle Emergent NL group shifted to the high Emergent NL (30+ db) during the nighttime period. This shift in relative intensity of aircraft exposure is very important, because as will be seen below, it partly explains the unusual relationship between overall annoyance and emergence for this Aircraft SNL group.

TABLE 15

ANNOYANCE WITH AIRPLANES BY DAY AND NIGHT AIRCRAFT EMERGENT NL

Aircraft SNL	Degree of Annoyance	Aircraft Emergent NL: - 18 db Day	- 18 db Night	18-29 db Day	18-29 db Night	30+ db Day	30+ db Night
50-60 db	No. of interviews	430	331	200	200	20	119
	No Bother	64%	64%	59%	63%	70%	57%
	Some Bother	31	32	34	28	20	37
	Great Bother	5	4	7	9	10	6
		100%	100%	100%	100%	100%	100%
61-66 db	No. of interviews	200	80	281	281	0	120
	No Bother	46%	45%	39%	41%	-	42%
	Some Bother	38	43	42	37	-	47
	Great Bother	16	12	19	22	-	11
		100%	100%	100%	100%	0	100%
67-72 db	No. of interviews	125	0	683	429	240	619
	No Bother	51%	-	28%	36%	37%	31%
	Some Bother	37	-	37	39	34	35
	Great Bother	12	-	35	25	29	34
		100%	0	100%	100%	100%	100%
73+ db	No. of interviews	20	0	348	59	1088	1396
	No Bother	20%	-	8%	7%	15%	13%
	Some Bother	35	-	40	30	29	32
	Great Bother	45	-	52	63	56	55
		100%	100%	100%	100%	100%	100%

As was stated in the beginning of this section, only the intermediate areas with an Aircraft SNL of 67-72 db have enough interviews in all Emergent NL's to permit detailed analysis.

While only 12% of the respondents living in these intermediate zones are "greatly annoyed",and 51% are "not bothered" at all when emergence is under 18 db, the number of "greatly annoyed" increases to 29% and the "no bother" category is cut to 37% when the daytime airplane emergence level is raised to 30 db or more. The even sharper increase in annoyance for the middle emergence groups of 18-29 db is not believed to be analytically significant. In addition to the accidentally high nighttime Emergent NL, already discussed above, which tended to equalize the daytime emergence differences, a chance clustering of certain psychological characteristics in the intermediate emergence group tended to raise the overall annoyance level. Reference to these psychological factors will again be made as they are discussed in the following sections. It should be noted here, however, that this "annoyance notch" in the daytime Emergent NL's is completely eliminated in the nighttime comparison. As Table 15 clearly shows, while only 25% are "greatly annoyed" during the nighttime Emergent NL's of 18-29db, the proportion increases to 34% when the night Emergent NL reaches 30+ db.

The failure for significant annoyance differences to occur in the very low or very high aircraft SNL's may simply mean that under extreme absolute levels of aircraft noise, the relative emergence over the background noise is not too important. For example, a relatively low aircraft noise in the 50-60 db range may be more distinct when it is 18-29 db greater than its background noise but still not more annoying than a similar low airplane noise which is slightly less distinguishable from its background noise level. At the other extreme, an airplane noise of 79+ db may be loud enough to be equally annoying even if it is only 12-17 db above its background. Such hypotheses however, can be only tentative, since full ranges of emergence were not available for comparison at these two extreme airplane noise levels.

3. Overall Annoyance vs. Frequency of Air Traffic

While it may be logical to assume that the intensity of human annoyance increases as the volume of airplanes flying overhead increases, it is not possible to substantiate this finding completely from our survey results.

Only in the distant control areas do people clearly indicate that they are less bothered when planes pass infrequently. When "low frequency" of flight is combined with "low emergence" of airplane noise, the least amount of bother is reported. In the 10-12 mile zone, where the airplane SNL is only 50-60 db, 70% of all respondents report "no bother" when airplane frequency and emergence are low, and barely 3% were greatly annoyed". In contrast, under comparable airplane noise conditions, but with high frequency of air traffic (3 or more planes per hour) only 58% indicate "No Bother" and 8% great disturbance. Likewise, when airplane emergence was increased, 66% of the "low frequency" responses were "no bother" compared with only 52% in the "high frequency" areas.

Table 16 summarizes the interactions of Aircraft SNL, Emergent NL and Frequency of Air Traffic with Overall Annoyance.

TABLE 16

ANNOYANCE WITH AIRPLANES UNDER VARYING AIRPLANE CONDITIONS

Aircraft SNL	Overall Annoyance	Aircraft Emergent NL and Frequency: Less than 18 db High	Less than 18 db Low	18-29 db High	18-29 db Low	30 + db High	30 + db Low
50-60 db	No. of Interviews.	204	226	100	100	20	0
	None	58%	70%	52%	66%	70%	--
	Some	34	27	39	25	20	--
	Great.	8	3	6	9	10	--
61-66 db	No. of Interviews.	120	80	141	140	0	0
	None	39%	57%	35%	44%	--	--
	Some	40	34	40	44	--	--
	Great.	21	9	25	12	--	--
67-72 db	No. of Interviews.	105	20	342	341	160	80
	None	52%	50%	29%	28%	34%	41%
	Some	36	45	37	37	34	35
	Great.	12	5	34	35	32	24
73-78 db	No. of Interviews.	20	0	220	61	161	263
	None	20%	--	10%	8%	22%	16%
	Some	35	--	41	43	33	34
	Great.	45	--	49	49	45	50
79+ db	No. of Interviews.	0	0	42	25	363	301
	None	--	--	3%	8%	13%	13%
	Some	--	--	14	72	24	26
	Great.	--	--	83	20	63	61

The relationship of frequency of air traffic with annoyance is less conclusive in the middle distance and close areas. In the intermediate zone where Aircraft SNL is in the 67-72 decibel range, differences in annoyance level are in the expected direction but are too small to be significant. Among respondents who live less than 2 miles from the airport, a significantly smaller percentage are "greatly disturbed" when emergence of aircraft noise ranges between 18-29 db and when frequency of flight is low. But when emergence is increased to 30 db or more, "frequency" appears to become unimportant.

The lack of decisive results in the closer areas may be due to our inability to control sufficiently the "frequency" variable. While we took great care in our sampling design to select "frequently" used and "less frequently" used flight paths, it may be that circling operations close to the airport of planes getting into position to land or take off have inadvertently equalized the frequency differentials. Of course, the circling planes are usually at somewhat higher altitudes, but they may still be sufficiently low to be annoying. If this is the actual experience, then it is proper to conclude that there are no clear-cut differences in the frequency of noise exposure among the close areas and, therefore, no sharp difference in annoyance response.

4. Overall Annoyance vs. Closeness to a Direct Flight Path

Annoyance among respondents who live off a direct flight path appears to be less than among those who live directly under a path, and to vary directly with the difference in Aircraft SNL. Since the distance from the respondent to the airplane is greater when his residence is off the flight path, the noise level is also lower, and the intensity of annoyance is correspondingly less. The average airplane sound level for over 70% of the sampling areas off the direct flight path was only 67-72 db, about 10 db less than the comparable close areas. This lower noise level is due to the attenuation of sound as the distance from noise source to observer is increased. It is understandable, therefore, that less than 40% of the respondents who lived off the flight path were greatly annoyed in comparison with 60% of those who also lived less than 2 miles from the airport but were directly under a flight path.

When annoyance responses are compared according to equal airplane noise conditions, no significant differences appear between persons on the flight path and those off the direct pathway. This equality of noise levels is achieved by equating the average distances from the respondents to the airplane. While the off path respondents are less than 2 miles from the airport, they are a mile or so from the

pathway and the plane. Consequently, they are actually three miles or more from the source of noise.

Residents who are from 3 - 4.5 miles from the end of a runway, on the other hand, are directly under the flight path, so that the noise level is fairly equal in both cases. An exception to the equality of annoyance appears to occur among a small number of residents who live less than a mile from the airport. In this case, those living off the flight path were less intensely bothered by the airplanes. It is possible, however, that chance clustering of other factors may have contributed to this finding. Table 17 summarizes these data.

TABLE 17

ANNOYANCE WITH AIRPLANES BY AIRCRAFT SNL AND CLOSENESS TO DIRECT FLIGHT PATH

		Aircraft Emergent NL					
		- 18 db		18-29 db		30+ db	
Aircraft SNL	Overall Annoyance	Direct Path	Off Path	Direct Path	Off Path	Direct Path	Off Path
67-72 db	No. of interviews . . .	160	80	523	160	80	45
	No Bother	40%	30%	29%	27%	46%	60%
	Some Bother	34	35	38	34	41	29
	Great Bother.	26	35	33	39	13	11
		100%	100%	100%	100%	100%	100%
73-78 db	No. of interviews . . .	0	20	241	40	403	20
	No Bother	-	20%	8%	17%	17%	35%
	Some Bother	-	35	42	40	34	35
	Great Bother.	-	45	50	43	49	30
		-	100%	100%	100%	100%	100%
79+ db	No. of interviews . . .	0	0	67	0	623	42
	No Bother	-	-	4%	-	12%	19%
	Some Bother	-	-	36	-	23	50
	Great Bother.	-	-	60	-	65	31
		-	-	100%	-	100%	100%

5. Type of Aircraft Operation

No analyses were actually made of annoyance under landing or take-off operations. In analyzing the actual acoustical measurements, it was found that there were only small differences in sound levels of landing and take-off operations. Reasons for this finding are fully explained in Appendix A. Another reason for not evaluating the significance of airplane operations is the finding that most areas represent combinations of all airplane operations. It was felt, therefore, that since the stimulus conditions were mixed, it would be improper to attribute overall reactions to the separate types of operations.

B. Overall Annoyance vs. General Attachment to Local Neighborhood

In the preceding section, the overall expressions of annoyance were correlated with the various physical aspects of the airplane stimulus. In succeeding sections, an effort will be made to evaluate the psychological and social factors influencing the formation and subsequent expression of these feelings of annoyance.

The first important human element affecting overall annoyance with airplanes which will be discussed is the overall attachment of a person to his community. The intensity of the airplane disturbance as well as any other community problem must always be viewed in the context of this overall attitude toward the local area. If a person has very strong attachments to his residential community, he is more likely to make allowances for the negative aspects of the area and to make an effort to adjust to these disturbances. Conversely, if he is generally unhappy about his neighborhood for other reasons, the presence of intense airplane noise stimuli generally adds to the overall dislike of the area. Our survey data clearly support these general psychological findings.

When asked:". . .In general, how do you like living in this part of (name of city or county). . .would you say you like it very much - that you like it a little - or that you don't like it?", more than 70 percent of all respondents indicated that they liked it "very much." Persons who were "not bothered" by airplanes, however more often liked their neighborhood "very much", while persons "greatly bothered" more often liked it only "a little" or "not at all." Table 18 presents these findings.

TABLE 18

OVERALL ATTITUDE TOWARD LOCAL AREA

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Like very much	80%	78%	72%
Like a little.	13	16	20
Don't like	7	6	8
Number of interviews . .	1148	1237	1250

Even when the airplane noise level is controlled as shown in Table 19, overall feelings toward the area and toward airplanes overhead are closely intercorrelated. It is noteworthy that the group reporting "no bother" always express the greatest overall attachment, while the most disturbed like the area least. Though the differences are generally small, they are statistically significant for the most intense airplane noise levels. Likewise, the two deviant groups, "great bother" under very low airplane noise, and "no bother" under very high plane noise also follow this pattern. The former group likes its area less and the latter likes it more.

TABLE 19

OVERALL ATTITUDE TOWARD LOCAL AREA BY AIRCRAFT SNL

	Aircraft SNL							
	50-60 db		61-66 db		67-72 db		73+ db	
	No Bother	Great Bother	No Bother	Great Bother	No Bother	Great Bother	No Bother	Great Bother
Like very much	81%	79%	83%	81%	79%	77%	77%	69%
Like a little.	12	21	12	14	13	16	18	22
Don't like	7	-	5	5	8	7	5	9
No. of interviews. .	402	38	197	85	339	318	186	784

This pervasive relationship between overall attachment and airplane annoyance is also reflected in Table 20 when frequency of air traffic and emergence differences are most distinct. While the "greatly annoyed" and "moderately annoyed" reflected these differences the contrast is greatest among the "non-bothered". In the areas with lower airplane noise levels, where "frequency" differences were most significant, and in the intermediate aircraft levels where an emergence effect was most pronounced, the more intense the airplane stimulus the less likely a person was to like his area very much. In the intermediate areas with the highest emergence levels, 93% liked their areas very much. This exceptionally intense local attachment is one of the chance psychological factors which we previously said contributed to a lower overall annoyance in these sampling areas.

TABLE 20

OVERALL ATTITUDE OF RESIDENTS NOT BOTHERED BY AIRPLANES TOWARD LOCAL AREA BY FREQUENCY OF AIR TRAFFIC AND SELECTED LOW AIRCRAFT SNL'S

Aircraft SNL	Aircraft Emergent NL	Overall Attitude	Frequency of Air Traffic High	Low
50-60 db	- 18 db	No. of interviews	117	158
		Like very much	75%	79%
		Like a little	15	13
		Don't like	10	8
50-60 db	18-29 db	No. of interviews	66	63
		Like very much	86%	92%
		Like a little	8	6
		Don't like	6	2
61-66 db	- 18 db	No. of interviews	47	44
		Like very much	76%	84%
		Like a little	15	9
		Don't like	9	7

When asked:"What would you say are some of the things you like about living in this part of (city or county)?", the various annoyance groups generally named similar things. The "non-annoyed" group, however, tended to mention more often such special factors as convenience of community facilities and social ties while the

"greatly annoyed" more frequently were pre-occupied with the physical aspects of the neighborhood. . .the healthy pleasant atmosphere, suburban environment, etc.

Only 1% of all annoyance groups said there was nothing about the area that they liked. This very low completely negative answer, occurring uniformly in all annoyance groups indicates that there are few "cranks" among our interviews. It has often been suggested that a substantial portion of all complaints about airplanes are made by "cranks" who have nothing else to do but write to the authorities. If this "nothing liked" group is considered as composed primarily of "cranks," then it is significant to note that only four out of every hundred people who actually complained to the authorities also reported "nothing liked". The overwhelming majority who complained appear to be quite loyal to their communities.

Table 21 indicates the kinds of things the various annoyance groups report they like about their areas.

TABLE 21

THINGS LIKED ABOUT LOCAL AREA 1/

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Convenience of location	40%	41%	41%
Convenience of facilities	43	43	39
Social aspects.	45	44	41
General physical aspects.	53	55	57
Area is quiet	17	18	16
Cheap rent - low expenses	2	2	2
Nothing liked	1	1	1
Number of interviews.	1147	1236	1248

1/ Percentages add to more than 100% because some respondents gave more than one reason.

As will be shown throughout this section, responses of the deviant groups consistently reflect the general findings, reinforcing our confidence in the overall analysis. On this question, almost 80% of the "greatly bothered" in the most distant 10-12 mile areas were concerned about the physical aspects of their surroundings, and 22% of them mentioned that they liked the general quiet of their neighborhoods. In contrast, only 43% of the bulk of the respondents who were "not bothered" by airplanes in these same distant areas mentioned physical aspects and only 13% singled out the general "quiet" as an advantage of living in their area.

When asked:"how did you happen to pick this neighborhood to live in?", all respondents gave essentially similar answers. Almost forty percent indicated that it wasn't a personal decision, that they had no choice,or that it was an accident. About one out of five mentioned convenience to their job, or general convenience of the location, and almost one-third offered specific social or physical advantages of the area.

Very few of the residents anticipated dislike of any particular aspects of their areas before they moved there. The annoyed groups, however, more frequently expected some difficulty with non-aircraft situations. About one out of every four people who were generally bothered by local airplanes had such forebodings while only 19 percent of the "non-bothered" group had such expectations. Oddly enough, only about 1% of the "greatly annoyed" expected trouble from local airplanes, and even fewer "moderately annoyed" voluntarily mentioned airplanes. Most of the conditions respondents expected to dislike involved problems of location, facilities, kinds of neighbors, and physical aspects such as congestion, weather, mosquitoes, dust, etc.

Much has been made of the notion that people should expect intense airplane noise if they move close to the airport. The fact is that few actually realize the consequences of their move until they have lived in the area a few months. It should also

be recognized that about one third of the residents lived in their areas before the airports were fully developed.

Further indications of the very strong attachments most people have for their neighborhoods are revealed in their answers to the question: "Do you like living here now more than you used to, or not as much?" Over 40% of all residents, regardless of airplane annoyance, said they "liked it better." About 20% of the "greatly annoyed", however, in comparison with only 15% of the "non-annoyed" stated that they "liked it less." The "non-annoyed" who live under the most intense airplane noise like the area even more than the average non-annoyed person, while the "greatly annoyed" under low aircraft noise like it less than the average "greatly disturbed" person.

When those who said they liked their neighborhood less were asked why, only 16% of the "greatly annoyed" mentioned some aspects of airplanes, while 23% mentioned other kinds of local noises. Only among the "greatly annoyed" who lived under the most intense aircraft noise levels (aircraft SNL of 79+ db, and emergence 30+ db) did the percentage mentioning airplanes reach as high as 38%. The failure of more residents who were "greatly disturbed" with airplanes to mention them voluntarily on the early "free answer" questions may be partly due to a difficulty in semantics. In our pretest interviews, it was found that some respondents didn't consider the airplanes overhead or at the nearby airport as "anything around here that bothers or annoys. . .". They considered airplane noises and other aspects of airplane disturbances as things outside the neighborhood, intruding themselves on the community. Consequently, they didn't mention airplanes in the free answer stage because they didn't think the questions referred to such matters. Another contributing reason for such a low response rate is the possibility of suppression and repression. Since airplane annoyance is very intense, respondents may have been reluctant to discuss the problem fully with a stranger or, unconsciously, they may have kept it in the

back of their minds in order to avoid unpleasant feelings which would be stimulated by such a discussion. This possibility needs further investigation to be verified.

In any event, the vast majority of local residents do not feel that "moving from the area" is their solution to the airplane situation. Only 39% of the "greatly disturbed" and 30% of the "non-annoyance" group have ever "felt like moving away from (their) neighborhood." Even when income differences and home ownership are eliminated as possible deterrents to mobility, the bulk of the residents are strongly attached to their neighborhoods and don't want to move. Respondents were first divided by income class and then by home ownership and annoyance status, and answers to this question tabulated. Of the "greatly disturbed" with incomes less than $6000 per year, 51 percent of the renters felt like moving and 35 percent of the home owners had considered moving. Of those "greatly disturbed" who earned more than $6000 per year, only 44 percent of the renters and 39 percent of the owners wanted to move.

Reasons offered for wanting to move followed the pattern of reasons for disliking the area, and were largely unrelated to the airplane situation.

When actual plans to move are considered, the number who have definite intentions to leave the area amounts to less than 2% of all respondents -- 98% accept the prospect of continuing to live with the various local problems. Only 10% of the residents have ever made an actual effort to find another place to live and for a variety of reasons only 1.7% had completed plans to move.

C. Overall Annoyance vs. Non-Airplane Disturbances

The recent intensification of aircraft noise, accompanying the more frequent use of larger four-engine airplanes, appears for many people to be the "straw that broke the camel's back." Our survey findings clearly indicate that those residents who are most "greatly annoyed" with airplanes were already seriously concerned with other traffic and human noises, and with such non-noise physical problems as flies, mosquitoes, dirt and dust, dogs, weather, etc., even before airplanes became a serious problem. It is logical to assume that the previous process of accommodation to the non-airplane disturbances required a major psychological effort, and that the superimposition of the new aircraft situation precipitated a very intense annoyance response. The heightened overall annoyance with airplanes is in part a reflection of these pent-up reactions to the other dislikes in their neighborhoods, and conversely, the introduction of intense aircraft stimuli have probably reduced their tolerance of other physical disturbances in the area.

It is probably no accident that airplanes have been singled out from all the other physical problems to receive the brunt of the annoyance responses. In addition to the "Johnny-come-lately" aspects of aircraft noise, it is undoubtedly among the most intense disturbances and by connoting certain possibilities of personal danger, it makes each exposure stand out clearly from the background of other problems. The special factors that probably make airplane noise different from train, trolley or locomotive noises will be fully discussed in the next section of this report. Evidence that the non-airplane disturbances do contribute to greater airplane annoyance will be presented below.

The second question of the interview asked the respondent, "to tell. . .about anything around here that bothers or annoys you in any way. . ." No hint was given of any particular type of disturbance, so that answers are completely free and spontaneous. As a result of the criteria used in the overall coding procedures, one

is not surprised to find that annoyance with airplanes is reported more often by the "greatly bothered." Annoyance with other noises, and with non-noise situations, however, are also greater for this group. In contrast, more than three times as many "non-annoyed" spontaneously report no dislikes about their local area. Table 22 summarizes answers to this question.

TABLE 22

KINDS OF THINGS IN LOCAL AREA THAT BOTHER OR ANNOY RESPONDENTS AS MENTIONED IN ANSWER TO SECOND QUESTION 1/

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Fear of airplanes	-- %	1%	11%
Airplane noise	--	5	30
Other airplane complaints	--	2	10
Traffic and other outside noise	25	26	25
Human and other noise	10	12	15
Disadvantages of location	7	8	10
Inadequate facilities	19	23	26
Social problems - class - race	8	7	8
Other physical aspects and miscellaneous complaints	38	45	48
Nothing disliked	25	15	7
Number of interviews	1143	1234	1245

1/ Percentages add to more than 100% because some residents mentioned more than one annoyance.

It is significant to note in passing that of the small minority of deviant "greatly bothered" residents in the 10-12 mile control areas, about 53% were disturbed by traffic noise in comparison with only 31% of the "non-bothered" in these same communities. Likewise, only 16% of the atypical group who were "not bothered" by planes under the most intense airplane noise levels were annoyed with traffic noise in contrast with 25% of the majority who were greatly annoyed with airplanes in these localities.

On the assumption that some respondents may have failed to mention airplane noise on this early question because they were apprehensive of the interview situation, or failed to recognize that airplanes were considered a local problem, or for some other special reason, answers to the first two direct questions about noise and airplanes were combined with those reported above in Table 22 and analyzed further. Theoretically, there are 85 additional opportunities in the other questions included in the interview, when annoyance with airplanes could have been indicated. These could also have been combined into an unduplicated tally of mentions of airplane noise annoyance. Such a costly tabulation, however, would not be justified since the net increase in accuracy is not likely to be more than 4 or 5 percent. Practically all respondents who were annoyed with airplane noise mentioned their feelings on the first two direct questions.

On the basis of these combined tabulations, it was found that the contrasts among airplane annoyance groups were increased. The "greatly bothered" consistently are more annoyed both with other noises and with non-noise disturbances. As shown in Table 23, 84% of the "greatly annoyed" were bothered by airplane noise. The remaining 16% are disturbed by fear of crashes, vibrations, landing lights and other aspects of local airplanes. Likewise, 57% of the "greatly bothered" mention dislike of other noises and 67% reveal other non-noise disturbances. In contrast, only 37% of the "non-bothered" are troubled by other noises and 57% by non-noise problems. The interrelations of these annoyances are even more striking. As Table 23 shows, only 4% of the "great bother" group said they were bothered by nothing in reply to the three questions included in this tabulation, while 36% were bothered by all three types of disturbances. In sharp contrast 28 percent of the "no bother" group had no complaints, 50% had only single complaints about other noises or non-noise situations. Only about one-fifth of the "no bother" group mentioned both noise and non-noise problems.

TABLE 23

KINDS OF THINGS IN LOCAL AREA THAT BOTHER OR ANNOY RESPONDENTS

Percent Bothered By:	Overall Annoyance with Airplanes		
	No Bother	Some Bother	Great Bother
Airplane noise only	0%	7%	12%
Airplane noise + other noise	0	8	15
Airplane noise + non-noise	0	9	21
Airplane noise + non-noise + other noise	0	12	36
Total bothered by airplane noise	0%	36%	84%
Other noise only	15%	7%	2%
Other noise + non-noise	22	18	4
Other noise + airplane noise	0	8	15
Other noise + airplane noise + non-noise	0	12	36
Total bothered by other noise	37%	45%	57%
Non-noise only	35%	23%	6%
Non-noise + other noise	22	18	4
Non-noise + airplane noise	0	9	21
Non-noise + airplane noise + other noise	0	12	36
Total bothered by non-noise	57%	62%	67%
Total bothered by nothing	28%	16%	4%
	100%	100%	100%

If the residents who are annoyed by airplane noise are further separated into two groups according to the intensity of their annoyance as shown in Table 24, the greater sensitivity of the most intensely annoyed becomes crystal clear. Almost half of all residents who are "greatly bothered" by airplanes are "often" bothered by the plane noise itself, are also bothered by other noises and non-noise phenomena. About 70% of the "greatly annoyed" are "often" bothered by airplane noise, while only 30% of the "moderately annoyed" report such intense feelings about airplane noise.

TABLE 24

INTERRELATIONS OF ENVIRONMENTAL DISTURBANCES

BY INTENSITY OF AIRPLANE NOISE ANNOYANCE

	Overall Annoyance	
	Some Bother	Great Bother
Plane Noise Bothers Often:		
Total number of interviews.	81	520
Plane noise only bothers.	17%	14%
Plane noise + other noise bothers	19	21
Plane noise + non-noise bothers	19	19
Plane noise + other noise + non-noise bothers . .	45	46
All respondents.	100%	100%
Plane Noise Bothers Occasionally		
Total number of interviews.	191	399
Plane noise only bothers.	16%	17%
Plane noise + other noise bothers	28	30
Plane noise + non-noise bothers	26	14
Plane noise + other noise + non-noise bothers . .	30	39
All respondents.	100%	100%

In addition to the mere mention of non-airplane annoyances, the intensity of such dislikes was also coded. Not only are the "greatly annoyed" more frequently bothered by other noise and non-noise disturbances but their intensity of annoyance with these non-airplane phenomena is consistently greater. While 31 percent of all residents who are "greatly annoyed" by airplanes are intensely troubled by non-noise disturbances, only 21 percent of the "no-bother" group report such intense dislikes.

It should have been mentioned earlier that the objective Background SNL's of all airplane annoyance groups are fairly equal. Differences in response, therefore, are largely psychological and, as will be shown in Table 26, even the non-annoyed frequently report the presence of airplane noise in their close areas but say it doesn't bother them. Table 25 shows how the daytime Background SNL's are about the same for all annoyance groups.

TABLE 25

DAYTIME BACKGROUND SNL's

Background SNL's	Overall Annoyance: No Bother	Some Bother	Great Bother
32 db or less	2%	1%	*
33-36 db.	8	7	4
37-40 db.	14	10	10
41-44 db.	24	28	32
Sub-total - Relatively quiet.	48%	46%	46%
45-48 db.	15%	21%	22%
49-52 db.	20	20	22
53 + db	17	13	10
Sub-total - Relatively noisy.	52%	54%	54%
Number of interviews	1148	1237	1250

* Less than 0.5%.

Although the number of residents who voluntarily mention airplane noise as one of the kinds of noise present in the area increases as the level of airplane noise increases, the percentage who are bothered by the noise remains fairly stable. In practically every type of area, the proportion of "no bother" who even mention the presence of airplane noise is less than the comparable "great bother" group. This is to be expected in the lower airplane noise levels, since there is no compelling reason to mention airplanes when they are not actually very noisy. In the higher aircraft SNL's, however, where emergence is greatest, almost 2/3 of the deviant group who are "not bothered" by airplanes are aware that they are noisy...this indicates comparable ability to report the presence of acoustical stimuli. The "greater bothered" under very low airplane noise levels (50-60 db) are undoubtedly more senstitive to noise in general. About 60% of them mention airplane noise and practically all are bothered by it. This group had mentioned earlier that they especially liked the general quiet of their areas. Table 26 summarizes the feelings of annoyance with airplane noise in response to the first direct question about "noises in the area."

TABLE 26

PERCEPTION AND ANNOYANCE WITH AIRPLANE NOISE BY TYPE OF AIRCRAFT STIMULI

Aircraft SNL	Daytime Emergent NL	Frequency of Air Traffic	Overall Annoyance Groups C/					
			No Bother		Some Bother		Great Bother	
			Mention Planes	Percent Bothered	Mention Planes	Percent Bothered	Mention Planes	Percent Bothered
50-60 db	- 18 db	High	8%	0%	31%	46%	65%	91%
		Low	5	0	23	29	33	100
	18-29db	High	46 A/	0	66	39	57	75
		Low	27	0	44	36	56	80
61-66 db	- 18 db	High	28	0	27	62	56	93
		Low	9	0	30	33	71	80
	18-29db	Both	23	0	50	40	60	81
67-72 db	- 18 db	Both	22	0	28	46	53	88
	18-29db	Both	41	0	57	40	75	87
	30 + db	Both	50	0	63	35	84	85
73 + db	- 29 db B/	Both	39	0	65	32	82	90
73-78 db	30 + db	Both	62	0	65	36	87	90
79 + db	30 + db	Both	65	0	85	46	94	89
All interviews			31%	0%	56%	39%	83%	89%

A/ Represents only 30 cases.

B/ Includes 67 cases from the 79 + db category and 281 cases from the 73-78 db group

C/ Mentions of airplanes are expressed as percentages of all respondents in each airplane stimulus-annoyance category. Of those mentioning airplanes, the percentage who are bothered by them are shown in the adjoining column.

Of those residents who are bothered by airplane noise, the "greatly bothered" are more intensely annoyed by the noise itself. Of the "greatly bothered" who were disturbed by airplane noise, about 56% said they were bothered frequently while only 30% of the "moderately bothered" reported frequent airplane noise annoyance.

Since more than half of the "no bother" group actually live in noise areas, it is not surprising that 25% mention traffic, commercial or industrial outside noises. It is significant, however, that only 25% of the residents who are "not bothered" by airplanes are bothered by traffic noises, compared with 40% of the "greatly bothered"

group who live under comparable conditions. It is also important that while about the same number of all annoyance groups mention human and other noises, a higher proportion of the "greatly annoyed" are bothered with these other noises.

Table 27 summarizes the percentages of each annoyance group mentioning these noises on the first direct question about noise. Percentages differ from those shown in Table 23 because some respondents not mentioning airplane noise on this question did so on the following question and are included in Table 23.

TABLE 27

PERCEPTION AND BOTHER WITH DIFFERENT NOISES

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Mention airplane noise	31%	56%	83%
Bothered by airplane noise	0	22	74
Mention traffic noise	72%	70%	67%
Bothered by traffic noise	25	30	40
Mention human noise	39%	47%	41%
Bothered by human noise	9	13	16
Mention other noises 1/	28%	32%	29%
Bothered by other noises	11	13	17
Number of interviews	1148	1237	1250

1/ Includes such unusual noises as garbage cans, fire trucks, drunks, dogs, etc.

The greater sensitivity of the "greatly annoyed" to the perception and annoyance with physical disturbances has been fully demonstrated in the preceding analyses. That this overall intensity of annoyance also distorts the perception of the kinds of local aircraft operations will next be shown.

When asked: "In general, do the planes seem to fly over this area very often, fairly often or only occasionally?", 90% of the "greatly annoyed" answered often -- while only 55% of the "non-annoyed" and 73% of the "moderately annoyed" gave the same answer. The sample design of course equated the frequency of exposure in all altitude-distance sampling areas. Table 28 presents these findings.

TABLE 28

PERCEPTION OF FREQUENCY OF FLIGHT

Respondent Says Airplanes Fly Over:	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Very often.	21%	32%	59%
Fairly often.	34	41	31
Occasionally.	45	27	10
Number of interviews.	1148	1237	1250

When asked: "When the planes do pass here, do they ever fly very low?", 91% of the "greatly annoyed" again said "yes" compared with 31% of the "non-annoyed." Under every kind of airplane noise situation, perception of the altitude of the planes is closely related to the overall annoyance. Over 80% of the "greatly annoyed" living 10 to 12 miles away say "Planes fly very low," while only 20 to 25% of the "non-annoyed" in the same areas gave this answer. Conversely, less than 60% of the "non-annoyed" living close to the airport where planes are seldom more than 600 to 700 ft. high, say "planes fly low."

TABLE 29

PERCENT SAYING PLANES FLY VERY LOW

Aircraft SNL	Daytime Emergent NL	Frequency of Air Traffic	Overall Annoyance: No Bother	Some Bother	Great Bother
50-60 db	- 18 db	High	24%	37%	82%
		Low	20	48	83
	18-29 db	High	39	47	71
		Low	14	56	100
61-66 db	- 18 db	High	19	42	80
		Low	15	41	86
	18-29 db	Both	27	46	91
67-72 db	- 18 db	Both	30	70	73
	18-29 db	Both	35	65	92
	30 + db	Both	41	63	90
73 + db	- 29 db	Both	42	67	92
73-78 db	30 + db	Both	45	69	94
79 + db	30 + db	Both	57	67	92
All interviews regardless of airplane situation			31%	60%	91%

Of those saying planes sometimes do fly very low, the following question was also asked: "Do they fly very low practically always, fairly often or only occasionally?" Showing the same type of distortion, almost 60% of the "greatly annoyed" said "often," while only 20% of the "non-annoyed" gave this answer. Again it is interesting to note the deviant groups. About a third of the "greatly annoyed" living in distant areas say planes fly very low "often". In the close areas as many as 57% of the "non-annoyed" compared with 67% of the "greatly annoyed" living in the most intense airplane situation said "often."

TABLE 30

PERCENT SAYING VERY LOW FLYING PLANES PASS OFTEN

Aircraft SNL	Daytime Emergent NL	Frequency of Air Traffic	Overall Annoyance: No Bother	Some Bother	Great Bother
50-60 db	- 18 db	High	0%	27%	35%
		Low	0	10	40
	18-29 db	High	12	23	20
		Low	0	21	35
61-66 db	- 18 db	High	11	15	50
		Low	43	18	16
	18-29 db	Both	7	30	27
67-72 db	- 18 db	Both	5	6	50
	18-29 db	Both	20	27	48
	30 + db	Both	14	39	58
73 + db	- 29 db	Both	21	31	64
72-78 db	30 + db	Both	35	30	57
79 + db	30 + db	Both	57	42	67
All interviews			20%	29%	57%

The projective type word-association and sentence-completion answers also demonstrate the higher sensitivity of the "greatly annoyed" residents. Although the word-association questions usually evoked more critical comments about airplanes among the "greatly annoyed," the numbers of critical responses were small. The sentence-completion questions were generally more successful in differentiating cirtical attitudes. In answer to the phrase: "Airplanes are. . . .", 61% of the "greatly annoyed" said "noisy" compared with only 13% of the "non-annoyed" and 34% of the "moderately bothered" groups. Another 12% of the "greatly annoyed" offered such critical comments as, "dangerous" or "too low" compared with 7% of the "non-annoyed."

D. Special Factors Which Intensify Annoyance with Airplane Noise

In the previous section, it was suggested that aircraft noise is singled out from among other local physical disturbances for the most intense annoyance reactions. Some of the reasons why adjustment to aircraft noise is more difficult than to other physical disturbances will be discussed in this section.

The first obvious reason is the generally higher level of airplane noise in the close areas. Although average daytime background SNL's seldom rise as high as 53 db, airplane SNL averaged over 80 db in the close areas whenever planes passed overhead. This higher noise level sticks out "like a sore thumb" and seriously interferes with many activities. When all respondents were asked: "In what way does airplane noise bother or annoy you?", twice as many "greatly bothered" mentioned interference with sleep, rest, work, study and concentration. They also more often felt that the character of the airplane noise was annoying -- "It's a screeching noise," "The roar is terrific," "It's like thunder when they go over" -- are some of the comments. The "moderately annoyed" more often complained about the "flicker of their TV picture." Interference with conversation, radio and television listening was also frequently mentioned by all groups.

While fewer people were annoyed by traffic and other noises, the kinds of activities which were disturbed are similar to those already discussed in connection with aircraft noise. Over 40 percent of those bothered by traffic noise mention interference with sleep, while less than half as many say it interrupts conversation or radio or TV listening. Table 31 indicates the various activities disturbed by airplane and traffic noises.

TABLE 31

REASONS FOR ANNOYANCE WITH AIRPLANE AND TRAFFIC NOISE

	Airplanes		Traffic		
Interferes with:	Some Bother	Great Bother	No Bother	Some Bother	Great Bother
Sleep, rest, relaxation.	20%	39%	48%	41%	40%
Hearing radio or TV.	39	37	18	21	13
Conversation	25	26	12	17	11
TV picture	17	11	--	--	--
Work, housework, study	3	6	6	6	8
Number of interviews	272	919	287	376	504

In 37 percent of the interviews with "greatly annoyed" respondents some noises were reported as bothersome while other noises were not. In most cases, the airplane noise was the bothersome noise. "Moderately annoyed" persons reported such differential noise reactions in 29% of the cases, while only 17% of the "non-annoyed" mentioned such divergent responses. When asked directly: "Why is it that (one) noise seems to bother you and (the other) noise doesn't?", the largest number said the bothersome noise "is louder". A somewhat smaller number said it interferes with some particular activity and a fourth of them mentioned fear of crashes as the reason for greater annoyance. The noise which was not annoying, on the other hand, was generally considered necessary or pleasant or one to which the respondent was already accustomed.

Aside from the intensity difference, why is it that more people are able to become used to such noise as rumbling traffic and screaming children than to airplanes? While our interviews provide some direct information on the dynamics of adaptation, additional depth interviews are needed to document our hypotheses. We suggest some of these hypotheses in this report, however, because they tend to integrate a number of our findings which will also be presented.

It is necessary first to try to understand what is commonly meant by "becoming used to" a noise. Most people probably mean that after a period of time they fail to differentiate among the variety of sounds that constitute the overall ambient noise level. They know that there is a nearby street with heavy traffic or children who make noise as they play and after a while they accept these sounds as inevitable. The secret is that they can relegate to the role of background all of these various noises. The meaning or source of each noise is clear and unchanging, and, therefore, does not have to be consciously identified each time it occurs. The road is a fixed distance from the house, and each usual rumble of a truck or drone of a car connotes an unvarying message of passing traffic. After a while it appears that a process analogous to psychological fatigue may set in, in which a person actually may cease to respond consciously to the noise or even be aware of its presence.

Airplane noise, however, differs from traffic noise in several important aspects. In addition to the higher intensity which has already been demonstrated, airplane noise usually fluctuates more widely over a considerable range of intensities and other auditory characteristics. Since airplanes do not fly over a fixed track or even within the narrow confines of a street, the type of operation -- landing, take-off, circling or cruising -- the type of plane, its pay load, atmospheric conditions, pilot technique, etc., will determine the unique sound characteristics of each passage.

If a person is unconcerned with the great variety of air operations which are connoted by these variations in sound stimulus, he may still relegate these different airplane noises to the general background and ignore each separate airplane passage. But, if an element of fear of crashes exists, it is very difficult to submerge the individual noise experiences. Each passage of an airplane may represent a potential threat, and regardless of the number of previously experienced safe flights, each different airplane noise must be analyzed to determine what the plane is doing and whether this is going to be a potential hazard... It is our belief that this constant

tension-provoking process of identifying the meaning of different airplane sounds is the most important factor which differentiates airplane noise from other noises. Evidence supporting this belief is presented below.

Direct or indirect expressions of fear of crashes are reflected in comments by 80 percent of the "greatly bothered" and by almost 2/3 of the "moderately disturbed" persons. About 6 out of every 10 "greatly bothered" directly admit their fears, while only 25 percent of the "moderately disturbed" directly state that they are afraid of possible crashes when they hear an airplane coming toward their house. Table 32 indicates the very high correlation between fear of crashes and intensity of overall annoyance. No direct expressions of fear are shown for the "non-annoyed", because the presence of such comments usually placed a person in an "annoyance category."

TABLE 32

PERCENT OF RESPONDENTS MENTIONING FEAR OF CRASHES IN ANSWER TO SELECTED KEY QUESTIONS

Content of Questions	Overall Annoyance: Some Bother — Percent Indicating Fear on Each Question	Some Bother — Cumulative Percent of Unduplicated Respondents	Great Bother — Percent Indicating Fear on Each Question	Great Bother — Cumulative Percent of Unduplicated Respondents
Present dislikes about area . . .	1%	1%	11%	11%
Noises heard in area - kinds of bother.	10	11	33	35
How do you feel about planes? . .	20	22	49	58
Importance of airplanes	2	23	2	59
Reaction to closing Newark Airport	4	25	6	60
Subtotal-Direct expressions of fear		25%		60%
Present attitudes about flying. .	48	31	53	17
Necessity of having airports near city	23	38	33	20
Subtotal-Indirect expressions of fear		38%		20%
Subtotal-not expressing any fear		37%		20%
Total all respondents		100%		100%
Number of interviews		1237		1250

It is interesting to note that fear of flying itself is still quite widespread among the general population. Thirty-eight percent of all residents who are definitely "not bothered" by airplanes flying over their area, are nevertheless fearful of flying in a plane themselves. While 48% of the "moderately annoyed" and 53% of the "greatly annoyed" mention such indirect fear of airplanes, it is clear that the mere mention of such anxieties about flying is not necessarily indicative of fears of possible crashes into one's own home. A person who is afraid of flying, however, probably is more likely to develop fears of local crashes when he hears of such accidents elsewhere. Likewise, 19% of the "not bothered" group, while not necessarily fearful of crashes into their own home because they usually live some distance from the airport, felt that having airports close to populated cities was a definite hazard.

The dramatic importance of fear in aggravating overall airplane annoyance is again emphasized in the responses of the deviant groups. Although only 33% of all "greatly bothered" expressed fear of crashes in reply to the first direct question about noise, 75% of the "greatly bothered" in the distant areas expressed such fears. This group also more often complained about interruption of sleep. It is also interesting to find that more of the "greatly annoyed" living in the intermediate airplane noise and emergence areas (airplane noise 67-72 db and emergence 18-29 db) are fearful of crashes than respondents living under equal airplane noise but higher noise emergent conditions (30 db +). This is probably another one of the chance psychological factors contributing to the greater annoyance we earlier noted among this intermediate emergence group.

Further indications that fearful persons find it difficult to become accustomed to airplane noise over even long periods of time will be presented in the next section.

E. The Effects of Time on Adaptation

It has been said that people will become accustomed to airplane noise just as they have become "used to" train and automobile noises. It is said that airplane noise is a new experience and that with the passage of time people will learn to accept it. Our survey results clearly indicate that even after 15 or more years of exposure, time has not automatically reduced airplane annoyance.

On the contrary, our survey shows that more than other groups, those who are now "greatly bothered" have lived longest in their present areas, have previously resided a long time in other communities which they felt were noisy, that the previous source of this noise was more often airplanes, that they more often worked at jobs which they considered noisy and that they more often describe their present areas as noisy. All of these findings indicate that prolonged exposure does not necessarily reduce annoyance if other psychological factors such as fear of crashes are present which prevent the submergence of aircraft noise into the general ambient noise complex. On the contrary, those residents with the greatest past exposure are the most annoyed persons because the additional exposure has meant more fearful experiences.

As Table 33 shows, those now "greatly bothered" have lived in their present areas longer than the "non-annoyed" group. In order to be sure that unequal age differences were not confounding the analysis, all persons under 40 years of age were separated from those 40 years or more. The differences again are especially significant among the older persons but even among the younger group, the variations are consistent.

TABLE 33

LENGTH OF RESIDENCE IN PRESENT AREA BY OVERALL AIRPLANE ANNOYANCE

Length of Residence	Under 40 Years			40 Years or More		
	No Bother	Some Bother	Great Bother	No Bother	Some Bother	Great Bother
- 6 months	10%	7%	7%	7%	4%	5%
6 months to 1 year	5	7	5	4	3	3
1 year to 2 years	11	13	9	6	5	5
2 years to 3 years	10	10	9	5	5	6
3 years to 5 years	11	15	13	10	9	9
5 years to 10 years	20	17	22	20	16	18
Less than 10 years	67%	69%	65%	52%	42%	46%
10 years to 15 years	11	7	12	11	12	14
15 years and longer	22	24	23	37	46	40
10 years or more	33%	31%	35%	48%	58%	54%
Number of interviews	595	630	566	553	607	684

Although only slightly more "greatly bothered" say they formerly lived in noisy neighborhoods, 60 percent of them lived in these other noisy areas more than 4 years, while only 53% of the "non-annoyed" lived there that long. Even though traffic and human noises represented the vast bulk of previous noise experiences, 15% of the "greatly bothered" compared with only 9% of the "non-annoyed" reported airplane noise as present in their former neighborhoods. This is a significant difference and further emphasizes our contention that living with airplane noise over longer periods of time does not necessarily reduce annoyance.

TABLE 34

REPORTED NOISE EXPERIENCES IN FORMER NEIGHBORHOODS

Reported Noise Level Of Former Neighborhoods	Overall Annoyance: No Bother	Some Bother	Great Bother
Very noisy	17%	18%	19%
Fairly noisy	17	19	17
Subtotal - noisy	34%	37%	36%
All quiet	60%	55%	58%
Never lived elsewhere	6	8	6
Subtotal - quiet	66%	63%	64%
Number of interviews	1124	1210	1219
Reported Duration Of Noisy Residence			
- 4 years	47%	49%	40%
4-10 years	25	25	28
10 + years	28	26	32
Number of interviews	372	443	432
Reported Kinds of Noise In Former Residence			
Airplane	9%	12%	15%
Traffic	74	71	71
People	39	36	39
Other	15	20	21
Number of interviews	377	448	427

Greater exposure to noise while on a job also fails to reduce annoyance with intense airplane noise. While about an equal number of all annoyance groups report that they have been exposed to noisy working conditions about the same length of time those "greatly bothered" by airplanes also say that the noise at work bothered them more often. They also report more often that the source of noise especially on previous jobs was inside machinery indicating that the level of noise was probably more intense. Yet, the greater or more intense experience with noise in other

neighborhoods and on their jobs did not reduce their annoyance with airplane noise. Table 35 indicates the comparative experience with noise on the two most recent jobs.

TABLE 35

EXPERIENCE WITH NOISE ON REGULAR JOBS

A. Present or Most Recent Job

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Noise Level			
Very noisy	23%	24%	23%
Fairly noisy	26	27	25
Fairly quiet	35	31	34
Very quiet	16	18	18
Number of interviews	872	967	958
Noise Bothers			
Very much	7%	7%	9%
A little	23	29	34
Not at all	70	64	56
Number of interviews	423	487	464
Kinds of Noise			
Inside machinery	20%	24%	22%
Usual outside	16	13	12
Unusual outside	5	7	6
Office	5	6	4
Airplane	3	3	3
Human	8	10	9
Miscellaneous	2	2	3
Don't remember	41	35	41
Number of interviews	423	493	459

TABLE 35 (CONTINUED)

EXPERIENCE WITH NOISE ON REGULAR JOB

B. Other Noisy Jobs

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Ever Had Other Noisy Job			
Yes	22%	25%	25%
No	56	48	52
Never had other job	22	27	23
Number of interviews	868	963	958
Noise Bothers			
Very much	6%	12%	13%
A little	34	39	36
Not at all	59	47	51
Don't remember	1	2	*
Number of interviews	188	241	225
Kinds of noise			
Inside machinery	48%	53%	57%
Usual outside	20	14	18
Unusual outside	13	17	17
Office	10	6	7
Airplane	6	7	5
Human	17	15	10
Miscellaneous	6	8	6
Number of interviews	188	234	221

* Less than .5%.

When asked: "Why is it that the noise bothers you (or doesn't bother you)?", the "greatly bothered" who were annoyed by work noise most often answered, "It makes you nervous...scares the pants off you...it breaks your nerves." The next most frequently given reasons were interruption of work or special intensity or character of the noise. Of those not disturbed by noise at work, from 60-70 percent merely said they became "used to it." Reasons for becoming "used to it" were: "Too busy to notice, it was part of the job, you had to accept it...not nervous...trained to ignore it..."

Other surprising results of the effect of previous noise experiences are the apparent distortions of perception of noise levels. Although the present overall ambient SNL's were fairly equal, the "greatly annoyed" it will be remembered were most bothered by other local noises. They also tended to describe their areas as noisiest. More than half of them said their present local areas are noisy, while only 35% of the "non-annoyed" and 44% of the "moderately disturbed" gave this answer. Table 36 summarizes the characterization of the present overall noise level.

TABLE 36

REPORTED OVERALL AREA NOISE LEVEL BY OVERALL ANNOYANCE GROUP

Reported Overall Area Noise Level	Overall Annoyance: No Bother	Some Bother	Great Bother
Very noisy	12%	12%	21%
Fairly noisy	23	32	33
Subtotal - noisy	35%	44%	54%
Fairly quiet	46	42	37
Very quiet	19	14	9
Subtotal - quiet	65%	56%	46%
Number of interviews	1148	1237	1250

In an effort to determine the influence of past experiences on the above present judgements of area noise levels, all persons who said they used to live in noisy neighborhoods were separated from those reporting only quiet previous residences or never having lived elsewhere.

According to general findings of past research on such diverse modalities as olfaction, weight, size, aesthetics etc, the more extreme a previous sensory experience, the less extreme a current experience is likely to appear. It would follow, therefore, that respondents who reported living in other noisy areas in contrast with other respondents should generally judge their present area noise levels as being quieter. Yet, we find the opposite is true for respondents who are "greatly

bothered" by local airplanes, dispite the fact that the actual ambient SNL's are substantially the same for all annoyance groups. While the tendency to distort present noise levels is greatest among older persons, the difference is still substantial for younger persons.

TABLE 37

REPORTED PRESENT AREA NOISE RATING

BY RESPONDENTS WHO SAY THEY FORMERLY LIVED IN NOISY AREAS

Reported Present Area Noise Rating	Under 40 Years			40 Years or More		
	No Bother	Some Bother	Great Bother	No Bother	Some Bother	Great Bother
Very noisy	6%	6%	12%	10%	10%	16%
Fairly noisy	28	24	34	16	27	29
Noisy	34%	30%	46%	26%	37%	45%
Fairly quiet	46	50	43	49	43	43
Very quiet	20	20	11	25	20	12
Number of interviews	206	237	196	171	209	233

There are several possible explanations for the apparent reversal of the expected anchorage of judgements. For one thing, previous experiments with anchorage of judgement phenonoma have usually dealt with fairly simple unitary stimuli. Secondly, the reference stimulus is usually of comparable magnitude and presented only a short interval before the test judgement is made. When the reference stimulus is much greater or much smaller than the test experience, past findings indicate that there is little anchorage.

In this study there is no control over the magnitude of the reference experience. Reliance is necessarily placed on the memory of the respondent and since a number of years generally have elapsed before the test judgement, it is possible that a memory factor may also be involved. An even more important factor, however, is likely to be the first reason cited. Unlike a pure tone, weight or simple shape of an object which are generally used in laboratory experiments as the reference stimuli, neighborhood noise especially aircraft experiences are much more complex. In such

complex phenomona, it has previously been reported that anchorage also ceases to operate. 1/

An even more conclusive test of the influence of prolonged exposure on adaptation to airplane noise is afforded by the 248 respondents who never lived elsewhere, but have grown up with the noise in their areas. It should follow from the "automatic adjustment with time" hypothesis that those who have never lived elsewhere should be less annoyed with airplanes than other respondents who have lived elsewhere. Yet, the tendency is just the opposite; while 28% of the residents who never lived elsewhere report "no bother", 32% of all other respondents were in this category. While the small numbers involved make this difference a statistically insignificant one, it is important to note that the direction of the difference is contrary to what would be expected on the basis of the "automatic adjustment" thesis.

It is also consistent with our other findings to note that the "never lived elsewhere" group also overwhelmingly rate their areas as noisier if they are "greatly bothered" by airplanes. This distortion occurs dispite the fact that actual background SNL's are lower for the "greatly bothered". Table 38 compares the actual background SNL's and Table 39 shows the reported area noise ratings.

1/ Hulda McGarvey, Arch. Psychology #281, 1943

TABLE 38

ACTUAL BACKGROUND SNL'S FOR PERSONS WHO NEVER LIVED ELSEWHERE

Background SNL	Overall Annoyance		
	No Bother	Some Bother	Great Bother
-32 db.	-%	1%	-%
33-36 db.	6	6	2
37-40 db.	3	2	6
41-44 db.	16	23	28
Subtotal quiet	25%	32%	36%
45-48 db.	29	31	31
49-52 db.	15	9	27
53 + db	31	28	6
Subtotal noisy. . . .	75%	68%	64%
Number of interviews .	68	97	83

TABLE 39

PRESENT AREA NOISE RATING FOR PERSONS WHO NEVER LIVED ELSEWHERE

Reported Area Noise Rating	Under 40 Years of Age			40 Years or Older		
	No Bother	Some Bother	Great Bother	No Bother	Some Bother	Great Bother
Very noisy.	9%	14%	26%	17%	15%	19%
Fairly noisy.	21	47	44	25	44	35
Subtotal noisy. . . .	30%	61%	70%	42%	59%	54%
Fairly quiet.	52	35	26	42	39	31
Very quiet.	18	4	4	16	2	15
Number of interviews. .	44	58	57	24	39	26

Some of the factors which do facilitate adaptation to airplane noise will be discussed in the next two sections.

F. The Effects of Attitudes and Experiences with Flying on Overall Annoyance

Feelings that commercial airlines are very important and that the airport has to be close in the city definitely create a more tolerant attitude toward local air operations. Those residents who frequently travel on planes are also less annoyed with airplanes passing overhead.

When asked: "Do you feel that commercial airlines are very important to (name of city), fairly important or not important at all?", only a very small minority felt that the airlines were unimportant. The group who were "not bothered" with local airplanes, however, more often felt they were "very important", while the "greatly bothered" more frequently said they were only "fairly important". When asked why they were important, more of the "not bothered" group mentioned the essentiality of air transportation and the "time saving" feature of faster travel. More of the "greatly bothered" mentioned the economic value to business and the community. Table 40 summarizes these attitudes about commercial airlines.

TABLE 40

ATTITUDES TOWARD COMMERCIAL AIRLINES

Importance of Airlines	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Very important	86%	82%	77%
Fairly important	9	12	15
Not important	1	2	3
Don't know	4	4	5
Number of interviews	1137	1228	1243
Why Important			
Essential transportation	53%	52%	47%
Time saver	48	48	44
Economic value	38	42	41
Other favorable reasons	18	19	19
Number of interviews	1053	1128	1182

When asked: "Do you think the airport here has to be located close to the city or could it just as well be built further out?", 53% of the "no bother" group answered, "Has to be close", compared to only 35% of the "greatly disturbed." The answers of the deviant groups again emphasize the validity of the overall relationships. About 85% of the "non-annoyed" living under intense airplane conditions felt the airlines were very important, and 60% said they had to be close. But only 74% of the "very annoyed" living far out felt the airlines were very important and only one-third said they had to be "close." Convenience for travel was the usual reason offered to explain why the airport had to be close, while danger to nearby residents, noise disturbance and a feeling that it could just as well be built elsewhere were reasons given for locating it farther out.

Having someone working for or associated with the airlines or airplane industry contributes only slightly to less airplane annoyance. About 36 percent of the "not bothered" have had someone connected with flying activities, but 33% of the "greatly bothered" report similar associations. Only 9% of the "not bothered" and 7% of the "greatly annoyed" respondents had been connected with these air activities themselves. Immediate family constituted the bulk of the others who had been in the employ of the Air Forces or airlines.

More than half of the "not bothered," however, had personally flown in an airplane and usually more frequently and more recently than the "greatly bothered." Only 44% of the latter had ever flown and 47% of the "moderately annoyed" had direct personal experience with flying. Table 41 indicates these personal flying activities.

TABLE 41

PERSONAL EXPERIENCES WITH FLYING

Number of Times Flown	Overall Annoyance: No Bother	Some Bother	Great Bother
None	49%	53%	56%
1 - 2	17	18	19
3 - 4	9	7	6
5 +	25	22	19
Number of interviews	1148	1237	1250
Years Ago Made Last Flight			
Less than one	25%	20%	22%
1 - 2	12	13	11
2 - 4	19	16	13
4 - 6	7	10	11
6 +	27	34	36
Don't remember	10	7	7
Number of interviews	575	573	540

Even when flying experiences of other members of the family are considered, 19% of the "greatly bothered," compared with 16% of the "not bothered," still reported no personal or family flying experiences. The "greatly bothered" also more often reported that the other family member was a distant relative, while the "not bothered" usually said it was a husband or wife, or a member of the immediate family.

There was no significant variation with respect to experiences with airplane accidents. About one out of five residents knew of someone who had been in an an accident, and in practically every case it was a serious one. The deviant "greatly disturbed" who live under very low airplane noise conditions, however, reported that one-third of them knew of such accidents. This may explain why fear of crashes is so prevalent among this special group. In 3 out of 4 cases, however, these accidents had occurred four or more years ago, so that the experiences, though not too recent, still linger in their memory.

When asked: "How do you feel about flying?", 74% of the "not bothered" offered favorable comments, while only 60% of the "greatly bothered" had any "kind words." More than half of the annoyed were afraid of flying, while only 38% of the "not annoyed" were afraid to fly. About 3% of the "greatly bothered" didn't like the noise or vibrations in the cabin, 12% complained about air sickness and 2% about delays in schedules; the remainder gave only vague replies.

Attitudes about flying have remained fairly stable over time, with only 8% saying that they have changed their views during the past year or so. About 6% say they like it more than they used to, while only 2% like it less.

G. The Effects of Demographic Factors on Annoyance

The "greatly annoyed" tend more often to be middle-aged housewives with a high school or grammar school education, who rent their homes. The "non-annoyed" more frequently are younger, have more education, are in somewhat better health, and say they are less nervous and less bothered by noise than the average person. Family size and composition, income and occupation appear to have little effect on annoyance. None of these demographic differences, however, are particularly striking or as important as the psychological factors we have already mentioned, such as fear of crashes, overall attachment to the area and annoyance with other physical aspects of their neighborhoods.

1. Age

About 52% of the "non-bothered" are less than 40 years old, while only 45% of the "greatly bothered"are this young. About 40 percent of the most annoyed, on the other hand, are in the middle age brackets of 40-59 years; while only 34 percent of the "non-bothered" are in this group. No significant differences exist among older persons 60 or more years of age. Table 42 indicates the age and annoyance relationships.

TABLE 42

AGE AND OVERALL ANNOYANCE

Age	Overall Annoyance		
	No Bother	Some Bother	Great Bother
- 24 years	9.7%	7.4%	7.1%
25-29 years	11.3	12.1	10.6
30-34 years	14.9	14.9	13.1
35-39 years	16.2	16.8	14.6
40-44 years	13.2	14.3	14.3
45-54 years	15.3	15.7	17.9
55-59 years	5.0	6.0	7.5
60-64 years	5.4	5.3	5.4
65-69 years	4.3	3.8	3.9
70 years and older	4.7	3.7	5.6
Number of respondents	1140	1232	1248

2. Education

The more education a person has, the more tolerant he generally tends to be toward airplanes. About 26% of all the "non-bothered" say they had some college education, while only 19% of the "greatly bothered" had as much formal schooling. On the other hand, about 28% of the latter had only grade school training, compared to 21% of the "non-bothered."

This close relationship between greater education and greater tolerance is true for all sampling area groups. In the most distant areas (10-12 miles) 34% of the "non-bothered" had college training compared to 28% of the "greatly bothered." In the 4.6-7.0 mile area, where aircraft noise is only 61-66 db, 25% of the "no bother" group had a college background, while 21% report only a grade school education. In contrast only 18% of the "greatly bothered" in the same area had college training and 32% had only grade school experience.

Even in the closest areas, less than 2 miles from the airport, the "greatly annoyed" have less education. While about 20% of all annoyance groups had college training, 28% of the "seriously disturbed" only went to grade school compared to 22% of the "non-bothered" group.

TABLE 43

EDUCATION AND OVERALL ANNOYANCE

Level of Education	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Completed college.	12%	11%	9%
Some college	14	10	10
Completed high school.	33	34	31
Some high school	20	23	22
Grade school or less	21	22	28
Number of interviews	1143	1234	1241

3. Sex

Both men and women were about equally annoyed with airplane noise. Although three percent more women were "greatly bothered" with airplane disturbances, the difference is small and just within the range of sampling error. Only in the intermediate airplane noise levels does the tendency for women to be somewhat more annoyed than men approach the significant level. In all other situations, the differences are very small. Table 44 summarizes these data.

TABLE 44

SEX AND OVERALL ANNOYANCE

Airplane Noise Level	Percent Bothered	
	Male	Female
All respondents.	1445	2167
No bother.	32.7%	30.8%
Some bother.	34.8	33.5
Great bother	32.5	35.7
50-60 db - No. of interviews	263	385
No bother.	64.6%	61.6%
Some bother.	30.8	31.4
Great bother	4.6	7.0
61-66 db - No. of interviews	193	286
No bother.	41.4%	42.7%
Some bother.	39.8	40.2
Great bother	18.7	17.1
67-72 db - No. of interviews	410	628
No bother.	35.1%	31.6%
Some bother.	37.3	35.6
Great bother	27.6	32.8
73 + db - No. of interviews.	579	868
No bother.	13.4%	12.8%
Some bother.	33.2	30.7
Great bother	53.4	56.5

The slight tendency for women to be more annoyed than men with local airplanes is probably due to their somewhat greater exposure to the airplane stimulus. As housewives, they are more often in the local neighborhood all day, while most

men are away at work during the day. Table 45 shows the percentage of each annoyance group who are usually in the area during the morning, afternoon and evening.

TABLE 45

PERCENTAGE OF EACH ANNOYANCE GROUP USUALLY AT HOME DURING MORNING, AFTERNOON AND EVENING

Time	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Morning.	68%	69%	71%
Afternoon.	63	66	69
Evening.	92	93	94
Number of interviews .	1148	1235	1250

It is interesting to note that the "non-bothered" living under the most intense airplane noise conditions are usually in the area the least often. Only 62% of them are at home in the afternoons and 64% at home in the morning. Conversely, the "greatly annoyed" living under the lowest airplane noise, are most frequently at home at all hours; 82% are home in the morning, 80% in the afternoon and 98% at night.

4. Occupation and Income

When occupation and income differences are first evaluated, the "non-annoyed" tend to cluster in the professional and white collar trades with higher income levels, and the "greatly annoyed" tend to concentrate in the less skilled occupations and lower income brackets. These variations, however, are largely artifacts of our survey design. Although great efforts were made to equalize the socio-economic characteristics of sampling areas in the various altitude-distance groups, it was found that close-in areas were generally less prosperous than distant suburban communities. Consequently, the occupational and income characteristics are highly correlated with airplane noise level and, therefore, with overall annoyance.

When occupation and income classes are compared for each aircraft stimulus group, no significant variations appear. The slight differences are all within the limit of chance fluctuations. Tables 46 and 47 summarize these controlled comparisons.

TABLE 46

INCOME AND OVERALL ANNOYANCE BY AIRPLANE SNL

Overall Annoyance and Aircraft SNL	Family Income			
	- $4000	$4000-5999	$6000-7999	$8000+
A. Aircraft SNL of 50-60db				
No bother	59%	65%	67%	60%
Some bother	34	30	30	31
Great bother	7	5	3	9
Number of interviews	197	209	99	124
B. Aircraft SNL of 61-66db				
No bother	46%	40%	33%	46%
Some bother	37	44	34	39
Great bother	17	16	33	15
Number of interviews	184	170	88	41
C. Aircraft SNL of 67-72db				
No bother	34%	30%	34%	32%
Some bother	36	38	39	42
Great bother	30	32	27	26
Number of interviews	355	412	163	116
D. Aircraft SNL of 73 + db				
No bother	13%	13%	16%	9%
Some bother	30	33	30	37
Great bother	57	54	54	54
Number of interviews	564	557	189	117

TABLE 47

OCCUPATION AND OVERALL ANNOYANCE BY AIRCRAFT SNL

Overall Annoyance & Aircraft SNL	Professional, Proprietors	Clerical, Sales	Craftsmen, Operatives	Service, Laborer	Retired, Unemployed	Housewives
A. Aircraft SNL of 50-60db						
No bother.	67%	62%	63%	80%	40%	60%
Some bother.	30	34	32	20	60	31
Great bother	3	4	5	0	0	9
No. of interviews.	122	94	83	25	5	313
B. Aircraft SNL of 61-66db						
No bother.	48%	42%	29%	42%	50%	42%
Some bother.	36	42	46	27	12	42
Great bother	16	16	25	31	38	16
No. of interviews	70	69	65	26	8	237
C. Aircraft SNL of 67-72db						
No bother.	31%	37%	34%	35%	70%	32%
Some bother.	35	34	38	40	15	36
Great bother	34	29	28	25	15	32
No. of interviews.	141	110	178	71	13	514
D. Aircraft SNL of 73 + db						
No bother.	14%	17%	13%	16%	19%	12%
Some bother.	32	28	35	30	15	32
Great bother	54	55	52	54	66	56
No. of interviews.	183	151	255	100	26	727

5. Family Composition

Variations in household size and composition also appear to have little effect on airplane annoyance. About the same proportion of each annoyance group have the same numbers of people, adult members only, or younger or older children. Tables 48 and 49 summarize these data.

TABLE 48

HOUSEHOLD SIZE AND OVERALL ANNOYANCE

Number of Members in Household	Overall Annoyance Groups		
	No Bother	Some Bother	Great Bother
One	3%	2%	3%
Two	23	24	25
Three	25	24	25
Four	27	26	25
Five	12	13	13
Six and over	10	11	9
Number of interviews	1148	1236	1248

TABLE 49

HOUSEHOLD COMPOSITION AND OVERALL ANNOYANCE

Type of Members	Overall Annoyance Groups		
	No Bother	Some Bother	Great Bother
Self only	3%	3%	3%
Other adults only	39	36	38
Adults and children under 6 yrs.	26	27	26
Adults and children 6 yrs. and over	32	34	33
Number of interviews	1148	1236	1248

6. General Health

Persons who are "not bothered" by airplanes say their general health is somewhat better than do the "greatly annoyed." However, the percentage who say they are in poor health is about the same, indicating that "cranks and chronic complainers" have little weight in our annoyance groups. Of course, seriously ill or bed-ridden persons were not interviewed, so it is not possible to cite the effect of airplane noise on those who are acutely ill.

TABLE 50

REPORTED GENERAL HEALTH OF RESPONDENTS AND OVERALL ANNOYANCE

Reported General Health	Overall Annoyance		
	No Bother	Some Bother	Great Bother
Good.	85%	81%	78%
Fair.	12	15	18
Poor.	3	4	4
Number of interviews.	1139	1229	1245

All persons who said their general health was only fair or poor were asked to describe their illness, and about the same proportion of each annoyance group mentioned what might be considered serious sickness.

The "greatly bothered" also appear to rate themselves "more nervous than other people." About 23% of them said they were more nervous, while only 18% of the "non-bothered" and 22% of the "moderately annoyed" said so. Conversely, 34% of the "non-annoyed" said they were less nervous compared to 44% of the annoyed groups.

When asked: "Does noise seem to bother you more than it does other people or not as much?" the bulk of all respondents rated themselves about the same as other people. About 16% of the "greatly bothered", however, said they were more annoyed, compared to only 8% of the "non-annoyed" group. Similarly 37% of the "no bother" group said they are less bothered by noise, in contrast to only 31% of the "greatly bothered" group. When pressed for an explanation, the persons who were more bothered usually answered, "Because I am more nervous," while the "less bothered" consistently said, "Because I am 'less nervous'." Only half as many "less bothered" attributed their lower sensitivity to past exposure to noisy situations, compared to the number citing "lack of nervousness" as the reason.

H. Factors Influencing Expression of Annoyance Feelings

Although, as this report indicates, overall annoyance with local airplanes was fairly intense, only one half of 1% of the "moderately annoyed" and only 5% of all "greatly annoyed" ever expressed their feelings to the authorities. Only 6 percent of the "greatly bothered" who lived close to the airport ever complained compared with the fact that almost two-thirds of all residents living less than 2 miles out were "greatly bothered." This disparity between community feelings and overt complaints emphasizes the importance of treating them as different parameters which are related but by no means identical.

Whether a person who feels strongly about a local problem accepts the situation or protests to the proper authorities is a function of several important variables. Of course, such demographic factors as age, education and social status are important. Older people with less education and lower income levels have been found less likely to express formal complaints about social problems. But with respect to a problem such as airplane noise, factors which are equally significant are a knowledge of the proper authorities, feelings about the physical possibility of improving the situation, expectation that the authorities will be receptive to suggestions and that the individual has collective power to influence these officials. On most of these factors our respondents had negative attitudes which undoubtedly impeded their desire to express their annoyance. Few of the respondents knew who the proper authorities are, or felt that they could influence them to improve the local situation. But should some dramatic incident like a local crash publicize the names of the responsible officials and should an active citizen's group systematically solicit letters of complaint or signatures to a petition, it is more than likely that the volume of community complaints would increase substantially. It should be emphasized that formal complaints presented by even 5% of the population could represent a very large number of aroused citizens and create a serious threat to airport operations.

Less than half of all respondents knew who was responsible for improving the airplane situation in their areas. One could say that if they felt strongly enough about the problem, they would find out who these authorities are. In many situations, however, other factors discourage even such efforts. In any event, that they did not know the proper authorities helps explain why complaints are so low. The authorities most frequently mentioned are city officials, the CAA, and the airlines. The CAA actually is the one group which has the primary responsibility for establishing airways and flight regulations. Yet, only 16% of all residents know this.

TABLE 51

AUTHORITIES WHO ARE BELIEVED TO BE RESPONSIBLE FOR CONTROLLING THE LOCAL AIRPLANE SITUATION

	Overall Annoyance		
	No Bother	Some Bother	Great Bother
City and County agencies.	17%	21%	21%
The CAA or CAB.	16	16	16
Airlines.	14	12	11
Pilots.	8	7	8
Airport operators	8	8	9
Federal Government.	3	3	3
State Government.	2	2	3
Miscellaneous wrong answers	6	10	8
Don't know.	42	37	37
Number of interviews.	1148	1237	1250

When all of those who felt some improvement was needed in the airplane noise and safety situation were asked: "Do you think it's possible for the authorities to do anything. . .?", almost 7 out of 10 "greatly disturbed" and 6 out of 10 "moderately annoyed" answered "yes." Only 12-14% felt it was physically impossible to do anything and about a fifth to a fourth weren't sure it was possible. This pervasive belief that the necessary tools are available to improve the situation is probably one reason why feelings of annoyance are so intense.

TABLE 52

PERCENTAGE BELIEVING IMPROVEMENT IN AIRPLANE SITUATION IS POSSIBLE

	Overall Annoyance	
	Some Bother	Great Bother
Believe it possible.	61%	69%
Do not believe it possible	14	12
Don't know	25	19
Number of interviews	472	883

When asked: "What do you think they could do?" a majority said, "Make the planes fly higher or re-route the planes." These appear to be rational suggestions. Only one out of five felt the airport should be closed and moved to another area.

TABLE 53

SUGGESTED ACTIONS BY AUTHORITIES

	Overall Annoyance	
	Some Bother	Great Bother
Reroute planes - change runways.	15%	27%
Make planes fly higher - stop low flying	26	38
Move airport - close down airport. . . .	20	18
Enforce regulations - make flying safer.	10	6
Restrict runways	*	*
Make engines quieter	16	17
Miscellaneous improvements	18	12
Don't know and no answer	16	13
Number of interviews	276	592

* Less than 0.5 percent.

Almost half of the "greatly annoyed" and 38 percent of the "moderately annoyed" felt that the authorities have done nothing to remedy the situation; less than one in five believe they have made any effort to improve it. This mass ignorance of official actions to reduce noise annoyance and safety hazards exists despite the introduction of preferential runway systems and the establishment of other noise

abatement programs in most of the areas. Table 54 summarizes these negative attitudes.

TABLE 54

PERCENTAGE BELIEVING AUTHORITIES HAVE TRIED TO IMPROVE SITUATION

	Overall Annoyance	
	Some Bother	Great Bother
Tried to improve.	19%	18%
Not tried to improve.	38	49
Don't know.	43	33
Number of interviews.	472	878

When asked: "Why haven't they done anything?" about half didn't know why. About a fifth of the "greatly bothered" felt not enough people had complained, and about 10% felt the authorities weren't interested in the local welfare.

Probably the greatest single factor inhibiting more complaints is the widespread lack of faith in the ability of the individual to contribute to social change. When asked: "Do you think that you and your neighbors could help get the authorities to improve the airplane situation?" about 60 percent said, "No" or "Don't know." Only 36% of the "moderately bothered" and 42% of the "greatly bothered" felt they could contribute to some improvement.

When this minority was asked: "What could you do?", the most frequent suggestions were to sign petitions and to visit officials. Only 7% of the "greatly bothered" said, "write a letter or send a telegram," and but 2% thought of telephoning. Petitions require the initiative of a pressure group, and letters, visits or phone calls to authorities presuppose knowledge of whom to address. It is highly significant that the forms of complaint considered appropriate by our sample of residents also had the effect of reducing the number of actual complaints. Most of the respondents didn't know the proper authorities and in half of the areas there were no organized groups soliciting complaints.

TABLE 55

FORMS OF COMPLAINT CONSIDERED APPROPRIATE

	Overall Annoyance	
	Some Bother	Great Bother
Discuss with civic group.	9%	10%
Sign a petition	25	37
Write a letter or telegram.	9	7
Telephone complaint	-	2
Visit officials	26	21
Join together - general collective action .	18	14
Miscellaneous suggestions	11	13
Don't know.	15	10
Number of interviews.	171	367

Reasons for believing it futile to complain parallel those given in explanation of official inaction. The most frequently mentioned were the feeling that authorities wouldn't pay attention or that enough people wouldn't join together in complaint. Of those who felt that it was futile to complain about 38% of the "greatly bothered" said flatly, "The authorities don't care," or "nothing can be done." About 2/3 of all those who actually did complain to authorities, on the other hand, felt that their efforts were a failure.

In summary, widespread pessimism that the individual could contribute anything toward the improvement of the airplane situation, feelings that even if they did complain, the authorities wouldn't pay attention, together with ignorance of who these authorities actually are, contributed to the relatively small number of complaints coming to the attention of local authorities. Underlying this feeling of futility, however, is a widespread annoyance and a feeling that it could be avoided if the authorities cared to take the necessary action. As long as there is widespread annoyance with local aircraft, a potentially serious public relations problem exists. Unless this undercurrent of hostility is recognized, it could under certain circumstances result in situations similar to the Newark, N.J. and Jamaica, L.I. reactions.

I. Eight Airport Areas Compared in Accordance with Overall Level of Complaints

In the original survey design, four of the airport areas were selected as representing communities with significant complaint levels, and four as having relatively few complaints. Replies from residents in these two types of areas are evaluated in this section of the report in an effort to determine the differences in underlying annoyance levels and the reasons for variations in complaint activities.

Areas which had been designated as "complaint centers" consistently reported higher "annoyance" than the "non-complaint" areas. While 41 percent of the residents in "complaint" areas were "greatly bothered," only 28% of the "non-complaint" area respondents were "seriously disturbed." Likewise over one-third of the "non-complaint" residents were "not bothered," in contrast with one-fourth of the "complaint" area responses.

TABLE 56

OVERALL ANNOYANCE BY PREDESIGNATED LEVEL OF COMMUNITY COMPLAINT

Overall Annoyance	Complaint Areas	Non-Complaint Areas
No bother.	26%	37%
Some bother.	33	35
Great bother	41	28
Number of interviews	1805	1830

While "complaint" areas report more annoyance at all airplane noise levels, the greatest differences occur in the middle and upper intensity ranges. It is highly significant that while there is a sizeable annoyance differential for the sampling areas closest to the airport, a majority of such residents even in the "non-complaint" areas are "greatly bothered." From conversations with local authorities and airport personnel, one would not have suspected such widespread feelings of annoyance. Table 57 indicates the overall annoyance by aircraft SNL.

TABLE 57

OVERALL ANNOYANCE, BY AIRCRAFT SNL AND PREDESIGNATED LEVEL OF COMMUNITY COMPLAINTS

	Complaint Areas				Non-Complaint Areas			
Aircraft SNL	Interviews	No Bother	Some Bother	Great Bother	Interviews	No Bother	Some Bother	Great Bother
50-60 db	320	60%	33%	7%	330	66%	29%	5%
61-66 db	161	39	39	22	320	45	41	14
67-72 db	605	25	37	38	443	43	36	21
73-78 db	401	11	36	53	323	19	38	43
79 + db.	318	9	20	71	414	14	31	55

Part of this annoyance differential may be due to the unequal distribution of different types of sampling areas among the eight airport areas. "Complaint" areas happened to have a more than proportionate share of the intermediate 2-4.5 mile sampling areas which reported especially high annoyance levels. "Non-complaint" areas, on the other hand, had a larger share of the very close and the very distant sampling areas, so the net effect of these differences is not likely to be great. In fact, on an overall balance, the "non-complaint" areas actually experienced a somewhat louder airplane stimulus than the "complaint" areas. So it may be said that the overall annoyance difference is slightly understated due to this factor. Table 58 shows the actual airplane stimulus conditions in both types of areas.

TABLE 58

ACTUAL AIRCRAFT SNL's FOR EACH ANNOYANCE CATEGORY

Airplane Noise	Overall Annoyance: No Bother, Complaint	No Bother, Non-Complaint	Some Bother, Complaint	Some Bother, Non-Complaint	Great Bother, Complaint	Great Bother, Non-Complaint
50-60 db	40%	32%	18%	15%	3%	3%
61-66 db	12	22	11	20	6	8
67-72 db	33	28	37	25	31	18
73-78 db	9	9	24	20	29	27
79 + db.	6	9	10	20	31	44
	100%	100%	100%	100%	100%	100%
No. of interviews	470	678	599	638	736	514

The differences in overall annoyance and expressions of annoyance among "complaint" and"non-complaint" areas are largely due to the very same psychological and sociological factors which have already been described in previous sections. Respondents in "complaint" areas are less strongly attached totheir local communities, are somewhat more sensitive to other community problems, are more spontaneous in expressions of fear of crashes, believe airlines less important, are aware of the civic groups pressing for an improvement in noise and safety conditions, yet feel the authorities don't care about their welfare. In addition, they are better educated and better off financially - two attributes which generally encourage greater articulation.

While adequate knowledge is not available on the kinds of leadership and social organization of these different areas, it is reasonable to draw the inference that the mere existence of these pressure groups in the "complaint"areas makes it easier and more socially acceptable to express complaints. But the extent to which local publicity of widespread annoyance actually heightens annoyance itself, can not be determined from our data.

In response to the first free answer question :"Tell me about anything around here that bothers or annoys you in any way. . .", more "non-complaint" area people consistently said, "There is nothing that bothers or annoys me." "Complaint" area respondents, on the other hand, more often mention other noise and non-noise problems, as well as airplane noise itself. This pattern of response, as we have seen, generally contributes to greater overall annoyance.

TABLE 59

KINDS OF THINGS WHICH BOTHER OR ANNOY RESIDENTS

	Overall Annoyance					
	No Bother		Some Bother		Great Bother	
	Complaint	Non-Complaint	Complaint	Non-Complaint	Complaint	Non-Complaint
Fear of planes . . .	--%	-- %	1%	* %	11%	10%
Plane noise.	--	--	5	5	35	30
Other plane disturbances . . .	--	--	2	2	10	11
Traffic noise. . . .	27	26	23	32	26	28
Other noise.	14	9	16	11	17	15
Disadvantage of location	3	4	2	2	1	1
Inadequate facilities	10	6	12	6	13	7
Social aspects . . .	23	18	31	20	32	23
Other dislikes . . .	50	36	53	44	54	48
Nothing disliked . .	20	28	13	19	6	10
No. of interviews.	424	596	629	665	548	481

* Less than 1%.

There are no significant differences in the way people describe the overall noise level of the areas, but in each instance the more annoyed say their areas are noisier, and the less annoyed say they are quieter. This again indicates the tendency for perception to be influenced by overall annoyance.

TABLE 60

REPORTED OVERALL NOISE LEVEL BY PREDESIGNATED LEVEL OF COMMUNITY COMPLAINT

Reported Area Noise Level	Overall Annoyance: No Bother, Complaint	No Bother, Non-Complaint	Some Bother, Complaint	Some Bother, Non-Complaint	Great Bother, Complaint	Great Bother, Non-Complaint
Very noisy	11%	13%	12%	13%	21%	22%
Fairly noisy . . .	24	23	31	31	31	34
Fairly quiet . . .	47	44	44	42	37	37
Very quiet	18	20	13	14	11	7
No. of interviews	469	672	598	634	735	512

The greater perceptiveness of the "complaint" area residents to most noises, however, is also suggested in the answers to the first open question on the kinds of noises heard in each local area. "Complaint" area respondents more often mention airplane, human and other kinds of noises, while "non-complaint" area people more often mention traffic noises. The differences in report of airplane and traffic noises are too small to be regarded as fully statistically significant, but the differential report of human noise is a significant variation.

TABLE 61

KINDS OF NOISE HEARD IN AREA

Reported Kinds of Noise	Overall Annoyance: No Bother, Complaint	No Bother, Non-Complaint	Some Bother, Complaint	Some Bother, Non-Complaint	Great Bother, Complaint	Great Bother, Non-Complaint
Airplane	35%	29%	60%	53%	85%	81%
Traffic.	69	75	68	74	65	71
Human.	44	36	53	41	45	36
Other.	28	28	33	31	32	26
None	5	4	1	1	*	*
No. of interviews	469	672	598	634	735	512

* Less than .5%

The proportion of residents who are bothered by each kind of noise does not vary significantly from one type of area to the other. In every case the variations are within the limits of sampling error.

TABLE 62

BOTHER BY DIFFERENT NOISES COMPARED BY OVERALL AIRPLANE ANNOYANCE AND PREDESIGNATED COMPLAINT LEVEL

	Overall Annoyance					
	No Bother		Some Bother		Great Bother	
Percent Bothered	Complaint	Non-Complaint	Complaint	Non-Complaint	Complaint	Non-Complaint
By plane noise . . .	--	--	37%	41%	90%	87%
No. of interviews.	(161)	(196)	(358)	(336)	(621)	(412)
By traffic noise . .	34%	35%	41%	45%	59%	62%
No. of interviews.	(324)	(504)	(405)	(468)	(475)	(365)
By human noise . . .	25%	19%	32%	26%	38%	40%
No. of interviews.	(206)	(239)	(320)	(262)	(329)	(182)

When asked: "In what way does the airplane noise bother or annoy you?", more "complaint" area people showed intense fear of possible crashes as the crucial factor. Interruption of radio and TV programs was also more frequently mentioned, while other reasons were about the same for both groups.

TABLE 63

REASONS OFFERED TO EXPLAIN WHY AIRPLANE NOISE BOTHERS

	Overall Annoyance			
	Some Bother		Great Bother	
	Complaint	Non-Complaint	Complaint	Non-Complaint
Fear of crashes	7%	1%	37%	28%
Interrupts radio or TV listening	40	42	41	32
Interrupts conversation	22	30	28	25
Interrupts sleep, relaxation	20	21	38	42
Interrupts work or study	2	4	6	5
Interrupts TV picture	14	22	11	10
Amount or character of noise	12	5	20	14
Other reasons	5	7	11	10
Number of interviews	128	133	553	351

When asked: "Why is it that one noise (usually airplane) seems to bother you and (the other) noise doesn't?", more of the "complaint" area residents also spontaneously mentioned fear of crashes as the determining factor. This more intense fear is probably a major reason for greater annoyance among "complaint" area reasspondents.

Previous noise experiences are about the same for both types of areas, so noise experience can not be responsible for differences in annoyance. If anything, the "complaint" area people say they lived in slightly more noisy neighborhoods. The "non-complaint" areas, however, have a greater proportion of residents who never lived elsewhere, which emphasizes their strong attachments to their areas.

TABLE 64

NOISE EXPERIENCES OF RESPONDENTS BY OVERALL AIRPLANE ANNOYANCE LEVELS

Reported Noise Levels of Former Neighborhoods	Overall Annoyance: No Bother		Some Bother		Great Bother	
	Complaint	Non-Complaint	Complaint	Non-Complaint	Complaint	Non-Complaint
Very noisy	16%	17%	20%	17%	20%	16%
Fairly noisy . . .	19	16	21	17	17	17
All quiet.	61	59	56	54	60	55
Never lived elsewhere. . . .	4	8	3	12	3	12
No. of interviews	462	662	587	623	719	500
Reported Noise Levels of Most Recent Job						
Very noisy	22%	23%	25%	23%	23%	23%
Fairly noisy . . .	29	24	27	28	23	29
Fairly quiet . . .	34	36	29	33	36	30
Very quiet	15	17	19	16	18	18
No. of interviews	361	511	487	480	567	391

The "non-complaint" area residents also consistently believe the airplanes are more important, but "complaint"area people have had more direct experiences with flying. About 8% more "non-complaint" respondents felt the airplanes were "very important," and about 13% more "complaint"area persons had actually flown in an airplane.

TABLE 65

ATTITUDES AND EXPERIENCES WITH FLYING

	Overall Annoyance					
	No Bother		Some Bother		Great Bother	
Importance of Airlines	Complaint	Non-Complaint	Complaint	Non-Complaint	Complaint	Non-Complaint
Very important . . .	82%	90%	77%	86%	74%	81%
Fairly important . .	12	6	16	9	17	13
Not important. . . .	2	1	3	1	3	2
Don't know	4	3	4	4	6	4
No. of interviews.	464	673	593	635	733	510
Number of Times Flown						
None	41%	54%	46%	60%	51%	63%
1-2.	19	17	20	16	20	18
3-4.	10	8	9	5	7	4
5 +.	30	21	25	19	22	15
No. of interviews.	468	677	598	637	736	514

Only about 7% of the "greatly bothered" respondents in "complaint" areas and 2% in "non-complaint" areas ever made a direct complaint on the airplane situation. The explanations for this relative passivity are generally similar to those already advanced in the previous section. Few people knew the proper authorities, only a minority believed that they could personally do anything to help, and a majority felt that nothing could be done or that the authorities were indifferent to complaints.

A dramatic difference between "complaint" area and "non-complaint" area residents is in their knowledge of the activities of local pressure groups trying to do something about the situation. When asked, "Have you read or heard about any local groups or organizations trying to get the authorities to do something about the airplane situation?", 27% of the "moderately annoyed" and 40 percent of the "greatly annoyed" living in "complaint" areas answered "yes," in contrast with only 7% and 11% of the comparable groups in "non-complaint" areas. This feeling that annoyance is widespread and that responsible groups are actually complaining about the air-

planes undoubtedly reinforced individual feelings of disturbance and made it more socially acceptable to complain to the authorities.

The fact that "complaint" area residents also happened to be better educated and in the higher income brackets also facilitated the vocalization of complaints. About a fourth of all annoyed "complaint" area residents had some college education, while only 18% of the "moderately annoyed" and 14 percent of the "greatly annoyed" "non-complaint" area respondents had ever been to college. Most of the other demographic characteristics of age, sex, noise sensitivity, etc., were equal in both groups. Table 66 summarizes the educational and income differences.

TABLE 66

EDUCATIONAL AND INCOME COMPARISONS

	Overall Annoyance					
	No Bother		Some Bother		Great Bother	
Education	Complaint	Non-Complaint	Complaint	Non-Complaint	Complaint	Non-Complaint
Completed college. .	14%	11%	12%	10%	13%	6%
Some college	16	12	13	8	11	8
Completed high school	31	34	36	33	30	32
Some high school . .	17	22	19	26	19	27
Grammar school . . .	22	21	20	23	27	27
No. of interviews.	466	677	597	634	730	511
Income						
Under $4,000	34%	36%	33%	38%	37%	41%
$4,000 - 6,000 . . .	36	36	40	39	37	40
$6,000 - 8,000 . . .	15	17	16	13	14	14
$8,000 and over. . .	15	11	11	10	12	5
No. of interviews.	453	664	583	634	713	509

V. SOME OF THE MAJOR GAPS IN KNOWLEDGE OF THE EFFECTS OF AIRPLANE NOISE ON MAN

While this study has provided valuable evidence on the effects of airplane noise on man, it has also suggested a number of questions which require additional research. In preceding sections our survey findings were presented together with their limitations. In this concluding section of the report, some of these limitations will again be summarized to gain perspective of the tasks ahead.

One of the most important methodological lessons revealed by this initial research is that the combined efforts of the acoustical, aeronautical and social scientists are required to understand fully the complex interrelationships between the airplane noise stimuli and human responses. Before the social scientist can learn more about annoyance and complaint reactions, it is clearly evident that the acoustical and aeronautical engineers must first differentiate and describe the characteristics of the airplane stimulus in greater detail. Before the physical scientists, on the other hand, can decide which parameters of the stimulus require control, the social scientist must be consulted about the human limitations of perception.

The entire analytical scheme which was finally used in this study is based on the assumption that the characteristics of the airplane stimulus can be clearly differentiated and measured. Variations in human response are compared with variations in the airplane stimulus and after any differences in the personal characteristics of respondents are statistically controlled, the remaining differences in annoyance and complaint responses are attributed to the differences in the airplane stimulus. Likewise, variations in human response are analyzed under comparable stimulus situations, and an effort is made to identify statistically the socio-psychological factors which influence these variations in individual annoyance and complaint responses. If the airplane stimulus is inadequately controlled it will be more difficult to establish

meaningful relationships to annoyance responses and the effects which are attributed to specific socio-psychological factors may merely reflect different reactions to different stimulus conditions. It is apparent, therefore, that fruitful research in this field requires the close collaboration of both the physical and social scientists.

In the follwoing section a brief description will be presented of some of the major gaps in our knowledge of both the physical stimulus and of the socio-psychological factors interacting with the stimulus situations.

A. Gaps in Our Knowledge of Airplane Stimulus Characteristics

1. The Effects of Irregularity of Exposure

In the present N.A.C.A. study an effort was made to control for frequent (average of 3 or more per hour) and infrequent (average of one or less per hour) exposure to the aircraft stimulus. As the results indicate, however, it was not always possible to secure even this gross measure of control. The maze of circling patterns of airplanes criss-crossing over the close and intermediate sampling areas may well have prevented clear-cut differentiation of stimulus conditions. Consequently, correlations between annoyance responses and irregularity of average exposure were somewhat inconclusive. In any future research, an effort should be made to secure more distinct stimulus situations; it may be possible to select airport areas where there is less variability in wind and weather conditions, and, therefore, more regularity in utilization of the same runway and flight paths.

It may also be desirable to investigate further the effects of irregularity of exposure from hour to hour and from day to day. At some airports there are definite peak hours when the volume of air traffic is fairly heavy while at other hours each day there are practically no airplanes landing or taking off. Likewise, at some airports wind or weather conditions on certain days sometimes require almost all flights to pass over selected communities while on other days different weather conditions result in very few airplanes passing over the same communities. The effects of such variations in exposure to airplane stimuli on annoyance and complaint responses should be explored. If distinct stimulus situations can not be found, additional acoustical measurements will be necessary to take account of these variations.

2. The Effects of Emergent Noise Levels

In the present study it was not possible to find sampling areas close to the airport with sufficiently loud background SNL's to reduce the intense airplane SNL to a low emergent noise level. Conversely, it was also impossible to find distant sampling areas with a low enough background SNL to result in a very high emergent NL.

Only in the middle distance areas was it possible to secure all types of emergent NL conditions. Although most airport areas will present the same difficulties, effort should be made to find special airports at which these atypical airplane emergent NL's are present. It will then be possible to test more fully the interaction of airplane SNL and emergent NL with annoyance responses.

3. The Effects of the Location of a Respondent's House Directly Under a Flight Path or Off the Flight Path

Only a limited number of interviews were secured from residents who lived off the direct flight path. In addition, because of circling operations it is uncertain whether these sampling areas did not actually have planes pass overhead at a higher altitude. Problems involved in the control over this variable are similar to those already discussed under "Irregularity of Exposure." If airports with less variable flight conditions can be found, a broader analysis of the factor may be possible.

4. The Effects of Other Acoustical Factors

In the present study only peak intensity levels were measured in three selected octave bands (75-150 cps, 300-600 cps and 1200-2400 cps). In addition, efforts should be made to explore the significance of such other acoustical parameters as:

a. Rate of change of noise level -- time interval of peak airplane SNL.
b. Variations in frequency spectrum of the airplane noise resulting from the airplane approaching and passing overhead, including the Doppler Shift.
c. Spectral characteristics of the noise which produce such descriptions of the noise as screeching, whining, blasting, whooshing and booming.
d. Other qualitative characteristics of the noise which carry specific connotations to different residents.

B. Gaps in Our Knowledge of Socio-Psychological Factors Influencing Feelings of Annoyance

1. Structure of Overall Annoyance

In the present study, dislike, bother or disturbance with airplane noise was combined with feelings of annoyance with vibrations, TV picture interference, landing lights, fear of crashes and other miscellaneous airplane nuisances into one overall annoyance rating. In addition to such a gross index of annoyance, it would also be desirable to know more about the relative importance of each of these aircraft nuisances, of their interactions and historical development. In the present study inferences were drawn regarding the key role of "fear" and of the minor role of TV picture scrambling. While such inferences appear to be reasonable, additional direct comparative information should be secured on the relationships of these factors.

2. Knowledge Possessed by Residents of the Purposes of Different Air Operations

In this N.A.C.A. study, sampling areas were selected in terms of the principle kinds of civilian air operations to which residents were exposed. Consequently, some areas were designated as landing, take-off or cruising zones. In any future research, questions should be asked to determine systematically the extent to which residents are actually aware of these different air operations and can recognize them from characteristics of the sound stimulus. An effort should also be made to elicit annoyance responses to each of these different operations and to compare them with the intensity characteristics of the airplane SNL.

In the case of jet airplanes which are operated by the Armed Forces, the extent to which residents are aware of the different kinds of local missions should be determined. At some bases, a variety of operations occur including such activities as training, testing, defense scrambling, and air cargo transport. The extent to which residents are aware of these different activities, are able to identify them and differ in their feelings about them should be ascertained.

3. Feelings of Residents About the Importance and Necessity of Different Air Operations

To what extent do residents feel differently about the importance of civilian and military operations? To what extent do they differentiate between training or testing activities and air carrier or defense scrambling operations? In the event that a resident feels differently about the relative importance of these activities, does this fact influence his feelings of annoyance with these activities? A further basic factor which should be investigated in relation to this question is the respondent's feelings about the nation's security. Does he feel we are in imminent danger of attack, or does he feel the nation is relatively secure? Does he feel that his particular community is a likely target area or does he feel that his area is non-strategic? These attitudes may influence general feelings about the necessity of particular military operations and in particular whether they are necessary in the respondent's locality.

4. Knowledge Possessed by Residents of Flight and Safety Regulations

To what extent are residents aware of the existence of various flight regulations designed to minimize community disturbances? Such regulations might cover preferential runway use, minimum altitude and flight path patterns directed away from populated areas, limitations of certain operations to daytime periods, prohibitions of stunting, power diving, sonic boom passage, etc. Our results indicated widespread ignorance of these administrative regulations, but these questions were only asked if a person felt the airplane situation should be improved. It is possible that some respondents were not asked these questions because they felt it wasn't possible to improve the situation. Consequently, it would be desirable to ask these questions of all respondents.

5. Feelings of Residents About the Necessity of Different Flight Regulations

To what extent are residents convinced that every consideration has been given to their welfare, and that passage of airplanes over their areas is absolutely

essential? Assuming that some operations are considered essential and others are not, do these feelings influence annoyance and complaint reactions?

6. Feelings of Residents About the Actual Observance of Flight Regulations

Assuming that the respondent agrees with the reasonableness of various flight regulations, to what extent does he feel that they are actually observed by the pilots? To what extent does he feel that the local civil airlines and military authorities are sincerely interested in enforcing the regulations? To what extent does he feel that pilots are concerned with the community welfare and are abiding by the regulations? To what extent does he differentiate between civilian and military authorities and pilots? Does he feel differently about the maturity, training and skill of civilian and military pilots? What about local government authorities -- are they believed to be interested in minimizing airplane disturbances? If they are, how effective have they been?

7. Relative Importance of Other Local Disturbances

In the N.A.C.A. study, the first six questions were designed to provide an unbiased picture of a respondent's feelings about the advantages and disadvantages of living in a particular neighborhood. Because the questions were of the general "free answer" type, little information was secured systematically on the relative importance of these negative or positive aspects of living in an area. Additional information might also be gathered about the specific activities affected by these non-aircraft disturbances and the time pattern of adjustment to them. In our analysis, it was suggested that the airplane problem was superimposed on a series of other local problems and, therefore, may have been "the straw which broke the camel's back." Further direct evidence should be secured of the possible transference of hostility feelings to the airplane situation and conversely, of the heightening of annoyance with non-aircraft problems as the result of the introduction of intense aircraft noise experience.

8. The Effects of Previous Exposures to Noisy Situations

An effort was made to have each respondent report more about his previous experiences with noisy situations. The limitations of "memory biases" restrict the types of data which can reliably be obtained, but further attempts should be made to get additional insight into the processes of past adjustment to these situations. Were respondents bothered at first by the noise and at what point and under what circumstances did they become accustomed to it? If they failed to get used to it, what aspects contributed most to continued annoyance?

C. Gaps in Our Knowledge of Factors Influencing Expressions of Annoyance

This entire question is perhaps one of the most important and yet, the least predictable. It involves the complex factors which relate different individuals to various local groups and government functions, and while these relationships are known to very greatly, an effort should be made to learn more about them. Below are listed a number of factors which should be investigated:

1. The General Structure of the Community

How closely knit and organized is the community? What kinds of local organizations exist and are expected to act in the solution of different civic problems? How important are these organizations and what previous experience have they had in successfully coping with local problems? Who are the opinion leaders and how influential are they in initiating and leading local activities?

2. The Role of the Individual Citizen and His Feelings About Participation in The Solution of Local Problems

How does the respondent visualize his status and role in the community? Does he feel that he is expected to express his feelings about civic problems directly to the appropriate authorities or through his civic organizations, local newspapers or some other way? How would he usually express himself on a local problem? Has he actually ever complained to anyone about other local problems? What happened? Does he feel it is proper to complain or not? Does he feel it proper to participate if the action is initiated by established civic groups or does he feel that individual initiative is proper? What about new problems vs. old ones? Does he expect others to act first and suggest the proper course of action on each new problem or does he feel that each person should spontaneously speak for himself?

3. Knowledge of the Proper Authorities

This factor proved very important in the NACA study. In any future research it must be ascertained and controlled.

4. Feelings About the Physical Possibility of Improving the Airplane Situation

To what extent does the respondent feel it is physically possible to improve the airplane situation if the authorities wanted to act? Obviously, if one were completely pessimistic about the mere possibility of altering the airplane situation, there would be little incentive to express annoyance to the authorities.

5. Feelings About the Feasibility of Improving the Airplane Situation

Does the respondent feel that the various authorities would be interested in his expression of annoyance and would they act favorably if they considered his complaint justified? What previous experiences has he had, or has he heard about concerning the responsiveness of the authorities?

6. Feelings About Group Attitudes

Does the respondent feel that most of his neighbors feel as he does about the airplanes or does he feel that he is in the minority? Does he feel it would be socially acceptable to complain or does he feel that he would face group censure if he expressed his annoyance?

While the above factors are not an exhaustive list of pertinent considerations affecting expressions of annoyance, they are believed to contain the most important of the many variables. While the measurement of these "complaint potential" factors and the understanding of their dynamic interactions is a difficult task, an effort must be made to evaluate them if one is to appreciate the varying relationships between feelings of annoyance and their overt expression in different forms of complaint.

APPENDIX A

A SURVEY OF BACKGROUND AND AIRCRAFT NOISE IN COMMUNITIES NEAR AIRPORTS

A SURVEY OF BACKGROUND AND AIRCRAFT NOISE IN COMMUNITIES NEAR AIRPORTS

I. INTRODUCTION

This report presents the results of a survey of noise levels in residential communities in eight cities having major airports. The noise survey was part of a larger study on the community aspects of disturbance by aircraft, conducted by the National Opinion Research Center. The major objectives of the noise survey were twofold:

1) To determine the statistical properties of the background noise, in the absence of aircraft noise, in each sampling sub-area in each airport center;

2) To determine the statistical properties of the aircraft noise stimulus in the sampling areas in each airport center.

In this report we describe the measurement procedures and we present the results of the measurements. We then manipulate the data for each sampling sub-area to yield a specification of the stimulus in terms of a few numbers. In the manipulation of the data our objective is to obtain numerical descriptions that rank order the sampling sub-areas according to specified physical characteristics of the noise stimulus. The numerical descriptions are to be used to compare

the range in human responses, as measured by the NORC opinion survey, with the measured variations in the physical noise stimulus.

Since the objectives of the noise survey are rather specialized we must use special procedures for the measurement of the stimulus and for the manipulation of the measurement data. It is clear, for example, that a simple measure like the overall noise level does not provide an adequate rank-ordering of stimuli that have appreciable differences in spectrum shape. For the purposes of this survey, special terms are used to specify the numbers that we select to describe the stimulus. These terms are:

1) Aircraft Sampled Noise Level - This number provides a measure of the noise level on the ground for aircraft flying overhead. The procedure for computing the Aircraft SNL is given on pages 20-21.
2) Background Sampled Noise Level - This number provides a measure of the level of the ambient background noise for a sampling sub-area. There is both a daytime and a nighttime Background SNL. The procedure for computing the Background SNL is given on pages 7-10.
3) Aircraft Emergent Noise Level - This number is the difference between the Aircraft SNL and the Background SNL. It indicates the extent to which the aircraft noise "emerges" above the background noise.

Each of the above terms implies that specific steps are followed in making the noise measurements and in manipulating the measurement data. The procedure for evaluating each number will be discussed fully in the following sections of this report.

II. BACKGROUND NOISE

A. Procedure

In order to describe adequately the background noise in a community, it is necessary to measure and to specify several quantities. It is certainly not valid to make one measurement of sound level at one point in the community at one time, and then to call this result the "background noise for the community." Ideally, we should record the sound-pressure level of the noise at all audible frequencies, at all times through the day and night, and at all points in the community. Such a large scale measurement program is, however, clearly impractical. In order to obtain useful data without a prohibitively large number of measurements, we must sample the noise in frequency, in time, and in place. If the samples are selected properly, they can provide an adequate description of the background noise in a community.

First let us examine how variations in background noise from point to point in a community are accounted for in the measurement procedure. One of the considerations

in the original selection of each sub-area was that the background noise at all residences within the sub-area be more or less the same. For example, the residential area may be selected to be the row of houses on either side of a busy street. Or, the streets within the area may be very lightly travelled, and most of the noise may originate from a busy street 1/4 mile away. Because the noise was more or less the same throughout most sub-areas, it was usually necessary to make measurements of background noise at only one position within each sub-area. In some cases, however, where some non-uniformity in the noise was expected, measurements were made at two or more locations.

The noise level near a busy street will, of course, depend upon the distance from the street. In this survey, all measurements were made near typical residences, regardless of their distance from noisy streets, since the objective was to evaluate the noise to which residents are exposed, and not to evaluate the characteristics of the noise sources. The measuring microphone was always located about 5 ft above the ground.

All measurements were made during weekdays in order to obtain a sample of the type of noise that occurs most frequently. Readings were taken during two periods of the day: 1) 9:30 a.m. to 4:30 p.m., and 2) 1:00 a.m. to 5:00 a.m. These times were selected because the background noise in most areas remains reasonably stable within each of these periods, and hence measurements

made over a short interval of time within each period would be fairly representative of measurements for the entire period. Selection of these measuring periods avoids rush hours and evening hours during which the level of traffic is not uniform.

All measurements were made in octave bands of frequency, using a conventional sound-level meter in combination with an octave-band analyzer. Almost all the readings of sound-pressure level were taken in three octave bands of frequency: 75-150, 300-600, and 1200-2400 cps. These three octave bands appear to provide an adequate sample of the frequency spectrum since, in most cases, the spectrum of background noise does not deviate markedly from location to location in a given residential community, or from community to community.

The sound-pressure level in each octave band generally fluctuates with time, the fluctuations being as great as 15 decibels in some cases. In order to evaluate these short-time fluctuations in the background noise, the sound-pressure level in each of the three octave bands was sampled at regular intervals. Successive readings of sound-pressure levels in the 75-150, 300-600, and 1200-2400 cps bands were taken at regular intervals of 5 seconds. That is, the instantaneous reading on the meter on the octave band analyzer was recorded every 5 seconds. The "slow" meter scale was used for all readings of background noise. The cycle was repeated until 15 or more readings had been taken

in each of the three bands. In some cases as many as 30 readings were taken in each band, if it was judged that this larger number would be required in order to obtain a reasonably stable statistical picture of the distribution in levels.

Each reading was taken to the nearest 5 decibels. The data were recorded on sheets of the type shown in Fig. 1. As each reading was taken, an "x" was recorded on the data sheet in the appropriate square. The data obtained from a sequence of readings were recorded, therefore, as three distributions of levels in three frequency bands.

For each sub-area, at least two data sheets of the type shown in Fig. 1 were completed -- one or more for daytime and one or more for nighttime. In some cases, additional sets of readings were taken during either the daytime or nighttime periods. These additional data served to verify the assumption that the distributions that described the background noise levels remained reasonably stable throughout these periods.

B. Results

From data sheets of the type shown in Fig. 1 our objective is to derive a reasonably simple quantitative description of the background noise existing at the time the measurements were made. In each frequency

band we have, in effect, a distribution curve that indicates how the samples of sound-pressure level are distributed along the decibel scale. A distribution that is concentrated at one point along the scale represents a noise with very little fluctuation. If there are large fluctuations, the distribution is broad.

From each data sheet of the type shown in Fig. 1 our task is to derive a single number that provides a statistically meaningful description of the background noise. The number we select will be used to rank order the 180-odd sampling sub-areas studied in this survey according to background noise. We shall call the number the Background Sampled Noise Level.

For each of the distributions, we compute first the mean sound-pressure level on an intensity basis. In order to perform this computation, the procedure is to (1) convert all decibel readings to relative intensity, (2) compute the mean relative intensity, and (3) convert this mean relative intensity back to decibels. For example, suppose we have the distribution shown in Fig. 1 for the 300-600 cps band, in which four samples were measured in the range 35-40 db, eight at 40-45 db, one at 45-50 db, and two at 50-55 db. The intensities corresponding to these ranges of sound-pressure level are in the ratio 1:3:10:30 (since 10 decibels represents a tenfold increase in intensity, and 5 decibels represents approximately a threefold increase). If the intensity in the lower range

(35-40 db) is called unity, the average relative intensity is

$$\frac{4 \times 1 + 8 \times 3 + 1 \times 10 + 2 \times 30}{15} = 6.5$$

which is about 8 db above the reference intensity. Thus the average level computed by this procedure is 46 decibels. The median level, on the other hand, is 42 decibels.

We observe that the mean computed on an intensity basis gives considerable weight to measurements of high sound-pressure level, and relatively less weight to measurements of lower sound-pressure level. This mean computed on an intensity basis appears to yield a realistic single measure of the noise exposure experienced by residents in a community. It provides a less arbitrary measure than, say, the level that is exceeded by 25 or 50 per cent of the samples.

Computation of the mean levels for each of three frequency bands and for daytime and nighttime measurements yields a total of six numbers that describe the background noise in each sub-area. The data for each sub-area are tabulated elsewhere. Curves showing how these mean levels are distributed in the 180-odd sub-areas in the eight cities are given in Figs. 2 to 4. Each figure shows two curves, representing the cumulative distribution of levels in a given frequency

band for nighttime and for daytime. For example, Fig. 3 shows that, in 50 per cent of the areas, the mean background level in the 300-600 cps band exceeded 33 db at night. In 95 per cent of the areas, the level exceeded 22 db, and the mean level was greater than 46 db in only 5 per cent of the areas.

From these three pairs of cumulative distribution curves we show in Figs. 5 and 6 a statistical picture of the noise spectra in the daytime and in the nighttime. Each curve indicates a spectrum that is exceeded in x per cent of the areas, where x is the number that labels the curve. A curve labelled 25 per cent, for example, depicts a background noise spectrum that is exceeded in 25 per cent of the areas in which measurements were made.

Each noise spectrum is defined by only three points, since most of the measurements were made in only three octave bands of frequency. Some measurements were made in other octave bands, however, and those measurements indicate that the background noise spectrum is usually rather smooth. We are usually justified, therefore, in joining the points in Figs. 5 and 6 by smooth curves, and in extrapolating the curves below 75 cps and above 2400 cps.

The next step in the data reduction is to combine the mean sound-pressure levels for the three frequency bands to obtain a weighted averaged level for each

sub-area. If we examine the spectra for the individual sub-areas we find that they usually have the form shown in Figs. 5 and 6. Provided the spectrum shapes are reasonably similar, we are justified in computing a simple arithmetic mean of the levels in the three frequency bands 75-150, 300-600 and 1200-2400 cps. We use this average to rank order the sub-areas in terms of background noise.

Thus, if the levels in the 75-150, 300-600 and 1200-2400 cps bands are 54, 46 and 41 db (as in the example of Fig. 1) the weighted mean would be

$$\frac{54 + 46 + 41}{3} = 47 \text{ db}$$

For each sub-area we compute a separate average for daytime and for nighttime. The 180-odd sub-areas in the survey are rank-ordered according to the average level of background noise computed by this procedure. The number obtained by this procedure is, by definition, the Background Sampled Noise Level in decibels.

For the usual type of background noise spectrum, i.e. the spectrum shape shown in Figs. 5 and 6, and for a background noise that does not exhibit large fluctuations, the Background SNL is about 19 db below the overall sound level read on the "C" scale of a sound level meter, and is about equal to the sound level read on the "A" scale of a sound level meter.

The Background SNL's for the individual sub-areas have been tabulated elsewhere, and a cumulative distribution curve of these levels (both daytime and nighttime) is shown in Fig. 7.

In order to code the data on background noise it is necessary to divide the sub-areas into categories or groups according to the Background SNL. The data are divided into the following 7 categories:

Category	Background SNL db
A	$\leqslant$ 32
B	33-36
C	37-40
D	41-44
E	45-48
F	49-52
G	$\geqslant$ 53

The levels in each sub-area, classified according to this scheme, have also been tabulated. In addition, the differences between daytime and nighttime Background SNL's, classified into three categories ($\leqslant$ 3, 4-10 and $\geqslant$ 11 db), have been computed and tabulated.

Each category of Background SNL has a range of 4 decibels. Such a fine division may not be required in much of the analysis, and some combination of the categories can probably be made.

III. AIRCRAFT NOISE

A. Procedure

Most of the measurements of aircraft noise were made in the areas that were specially selected on the basis of distance from the airport and location with respect to regularly used flight paths to and from ends of airport runways. As far as possible areas were selected in which only one type of aircraft noise predominated, i.e. most of the flights over a given area were landings or take-offs (not both), and the aircraft operated within certain limits of altitude. It is clear that this ideal situation is only approximated in practice. Over areas designated as "landing" there will be an occasional take-off; over areas close to an airport where altitudes for take-offs and approaches are normally 1000 ft or less, there will be some circling operations at higher altitudes.

Measurements of aircraft noise in a given area were usually made on occasions when the background noise survey was in progress in the same area. Measurements were not restricted to aircraft that were undergoing operations for which the area was designated, although most of the aircraft were undergoing such operations. Measurements were made for all aircraft that produced noise levels substantially above the background noise. For all measurements the position

of the microphone was noted and the distance from the ends of airport runways was later determined from maps.

In addition to the measurements in the designated areas, some measurements were made at other locations near the airport, at known distances from airport runways. These measurements were made at times when aircraft operating from the airport did not pass over the designated areas. These additional data served to increase the size of the sample of measurements, and hence to increase the validity of the statistical analysis of the data to be described below.

The noise levels produced by the aircraft were not read directly from an octave-band analyzer. The noise was first recorded on a magnetic tape recorder, together with suitable calibrating signals to permit determination of absolute levels. Each time an aircraft passed overhead, the tape recorder was switched on and a 10-30 second sample of the aircraft noise was recorded, including the time before and after the level reached a peak value. For each recording the attenuator settings on the recording instrument were noted. A 400 cps calibrating signal was recorded from time to time, and the attenuator settings were again noted.

After the completion of the survey the tape recordings were analyzed by means of an octave-band analyzer and a graphic level recorder. The graphic level recorder

draws on a strip of paper a trace which represents the time variation of sound-pressure level in each octave band of frequency. Traces of the calibrating signal were also made on the graphic level recorder, and these served to set the absolute level of the recordings of aircraft noise. The entire measuring system was calibrated at all frequencies, and corrections were applied for non-uniformities in frequency response, and for differences in averaging characteristics of the graphic level recorder and the sound level meter. Thus all data were corrected to give results equivalent to the readings that would be obtained on the "fast" scale of a sound level meter.

B. Analysis of Results

In the analysis of the recordings of aircraft noise, the objective is to obtain a statistical description of the aircraft noise levels in the areas around each airport. As noted above, this total aircraft noise is a composite of (1) noise from aircraft undergoing a specific operation for which the area is designated, and (2) noise from aircraft undergoing other operations in that area. The noise is controlled largely by aircraft of the first type, since they are in the majority.

The statistical description of the aircraft noise that is presented in the following discussion does not

include data on the frequency of occurrence of the aircraft. The measurements in the present survey yield information only on the levels of the aircraft noise, without regard for the number of times the aircraft pass overhead.

Since only a limited time was available for the survey, it was not possible to make large numbers of measurements of aircraft noise in each area. A valid statistical description of the aircraft noise levels in a given area could be gathered only if a period of weeks and even months were spent making measurements at each airport center.

From the data at hand, valid statistical descriptions of the aircraft noise can be obtained only if the data from different airport centers are combined. Such a combination of data is possible if we make the following assumption: We assume that the statistical characteristics of the aircraft noise levels in an area a given number of miles from the end of a runway (measured along the flight path) are independent of the particular airport center or city in which the area is located. We distinguish, however, between areas designated as "landing" and those designated as "take-off." This assumption implies that differences in flight regulations, circling patterns, etc. at different airports do not materially modify the statistical description of aircraft noise levels in areas that are the same distance from airport runways,

but in different airport centers. In effect, the assumption implies that the aircraft noise levels are determined by only two independent variables: (1) distance from end of runway, measured along the flight path, and (2) designation of area as "landing" or "take-off."

The validity of the above assumption cannot be verified with confidence from the limited data at hand. General observations of aircraft operations in various airport centers would indicate that the assumption is not unreasonable. The analysis of the data will proceed on this basis.

In the analysis of the results, the discussion will be restricted primarily to the peak levels as the aircraft passes over the measuring locations. The time characteristics of the noise will, of course, be dependent upon the altitude of the aircraft. If the aircraft is only a few hundred feet high, the peak will be sharp, as illustrated in the trace shown in Fig. 8a. This trace was recorded by the graphic level recorder, and represents the sound-pressure level in the 300-600 cps frequency band at a distance of one mile from the end of the runway as the aircraft takes off. When the aircraft is at a higher altitude, a flatter trace is obtained, since the relative distance between the aircraft and the microphone changes less rapidly. Fig. 8b shows a trace taken at an area 4.3 miles from the end of a runway.

The measurements of aircraft noise levels are summarized in Figs. 9 to 18. Data are given only in the frequency bands from 75 to 2400 cps. For the types of noise spectra encountered in this study, the contribution of levels below 75 cps and above 2400 cps is probably not important in the evaluation of the effects of the noise on people. A separate figure shows the levels for each of five frequency bands, for both landing and take-off areas.

To explain how these figures were constructed, let us focus our attention on one - say Fig. 11 - which gives the sound-pressure levels in the 300-600 cps band, for take-off areas. Each point on the graph represents a measurement on a separate aircraft. From the recording of this aircraft, the peak level in decibels is obtained by the procedure described above. From the known position of the microphone, the distance from the end of the runway, measured along the flight path, is obtained. These two numbers - the peak level in decibels and the distance in miles - determine a point in Fig. 11.

There is considerable spread in the levels of aircraft measured a given distance from the airport. This spread is attributable to a number of factors, of which the following are the most important:

1) The measurements represent different types of aircraft, from DC-3's to DC-6B's and Super-Constellations.

2) The position of the flight path relative to the measuring microphone may change appreciably from one measurement to the next. For some measurements, the aircraft passes directly overhead; for other measurements, the aircraft passes at an oblique angle.
3) The atmospheric conditions, in particular the wind and temperature gradients and turbulence, vary from day to day and from hour to hour.
4) At a given distance from the airport, pilots may use different engine power settings, with consequent differences in radiated noise.

In order to examine the distribution of levels at a given distance in more detail, let us restrict our attention to the group of measurements in the range 3-5 miles from the end of the runway. About 44 measurements are clustered in this distance group, which can be represented by an average distance of about 4 miles. In Fig. 19 a cumulative distribution curve is plotted, showing the per cent of measurements in this distance group that are less than the level designated by the abscissa. This cumulative distribution forms a relatively smooth curve. This curve shows that 25 per cent are less than 56 db, 50 per cent are less than 64 db, 75 per cent are less than 68 db, and 90 per cent are less than 75 db. Hence on Fig. 11 four points are plotted at a distance of

4 miles, representing each of these four percentage levels.

Similar cumulative distribution curves are drawn for other distance groups, and hence four points are plotted on Fig. 11 for each of these groups. Joining the points in the manner shown in Fig. 11, we obtain four curves which indicate how the sound-pressure level decreases with distance from the end of the runway. Ninety per cent of all measurements fall below the upper curve, 75 per cent fall below the next curve, etc. The same procedure is followed for other octave bands of frequency.

The data in Figs. 9 to 18 are re-plotted in a different form in Figs. 20 to 23. In each figure noise spectra are shown for several distance groups. For the figure marked 25 per cent, for example, the spectra depict levels that are exceeded in 25 per cent of the measurements made in the survey. The smooth curves indicate the spectra for take-off areas, both take-off and landing areas are shown.

Data for both landings and take-offs are plotted in Figs. 20 to 23. There is apparently no significant difference in the noise levels for landings and for take-offs for areas that are the same distance from the ends of runways.

The data shown in Figs. 9 to 23 represent a composite of measurements on about 250 aircraft. The composite plots show the distribution of sound-pressure levels to which residents who live under regularly used flight paths are exposed. In general, for a given distance from the airport, the greatest sound-pressure levels are measured when large aircraft, such as DC-6's and Super Constellations, follow flight paths that are directly over measuring locations. The lower sound-pressure levels are measured for smaller aircraft, such as DC-3's, or for aircraft which deviate considerably from the flight paths that are usually followed in take-offs and landings.

At high frequencies (e.g. in the 1200-2400 cps band) the measurements of aircraft noise at the most distant areas are usually limited by background noise. A comparison of the measurements of aircraft at 7-10 miles, in Figs. 13 and 18, with the measurements of background noise, in Fig. 5, indicates approximately the same distribution of levels for the two cases.

In order to obtain a single number that describes the aircraft noise for each area we must specify the distribution of levels in each band of frequency by a single number, and we must combine or average the levels in different frequency bands. To specify the distribution of levels in each band, we select the level that is exceeded 25 per cent of the time. That is, we describe the level of aircraft noise over a

given area as the level that is exceeded by 25 per cent of the aircraft that fly nearby. We feel that this measure is more appropriate than the median level, since the neighborhood reaction to the noise is determined primarily by the noisiest aircraft that fly overhead.

The levels in the different frequency bands are combined in the same way as the background levels, i.e. the levels in the 75-150, 300-600 and 1200-2400 cps bands are averaged arithmetically. This procedure allows us to compare the background noise with the aircraft noise, and to take differences between the two directly.

If we determine the levels that are exceeded by 25 per cent of the aircraft and average these levels in the 75-150, 300-600 and 1200-2400 cps bands, we obtain a number that we designate as the Aircraft Sampled Noise Level.

We have used the above procedure to compute the Aircraft SNL's for areas in each distance group, and we have plotted the results in Fig. 24. The same curve applies to take-off and landing areas since, as Figs. 20 to 23 show, there is apparently no significant difference between the noise levels measured in take-off and in landing areas.

From Fig. 24 we can determine directly a measure of the aircraft noise levels over each of the designated areas in each airport center, provided the assumptions given on pages 15 and 16 are valid. For each area, we determine the distance along a typical flight path from the end of the airport runway to the area. For this distance we determine the Aircraft SNL directly from Fig. 24.

For sub-areas 9, 10, 11 and 12 a somewhat different procedure is followed, since very few measurements of aircraft noise were made in these areas. These four sub-areas are located close to the airport, but are 1 to 1-1/2 miles from regularly used flight paths. We measure the perpendicular distance d from the flight path to the area in question, and we estimate the average height h of the aircraft at the point on the flight path from which the perpendicular distance is measured. We then compute the quantity 20 log (d/h) db, which is the difference, in decibels, between the level measured directly under the flight path and the level at distance d, assuming geometrical spreading of the sound from the aircraft. In most cases, this correction is of the order of 10-15 db. This difference is then subtracted from the level read from Fig. 24. The Aircraft SNL's for the areas off the flight path are somewhat less reliable than the levels for areas near the flight path because less reliable data on the distribution of levels are available for the off-path areas.

The Aircraft SNL's for each area, computed by the methods outlined above, have been tabulated elsewhere. We have also tabulated the Aircraft SNL's by categories or groups, in order to facilitate coding of the data. The Aircraft SNL's have been divided into six groups, each with a range of 6 decibels.

IV. AIRCRAFT EMERGENT NOISE LEVEL

The Aircraft SNL defined above is a measure of the aircraft noise stimulus to which communities near regularly used flight paths are exposed. One would expect the community response to be rather closely related to the Aircraft SNL. One would also expect that, in areas exposed to the same Aircraft SNL, the response would depend upon the background noise. More precisely, one would expect the response to depend upon the extent to which the aircraft noise exceeds the background noise to which the community is exposed day after day.

In order to permit testing of this hypothesis we have computed and tabulated differences between the Aircraft SNL and the Background SNL, for both day and night. The difference, in decibels, between the Aircraft SNL and the Background SNL has been defined as the Aircraft Emergent Noise Level.

We have also tabulated the Aircraft Emergent Noise Levels by categories or groups, in order to facilitate coding of the data. The differences have been divided into categories that each have a 6-decibel range.

V. LIST OF EQUIPMENT

The following equipment was used in the measurements of background and aircraft noise during the survey:

General Radio Sound Level Meter, Type 1551-A
General Radio Octave Band Analyzer, Type 1550-A
General Radio Sound Level Calibrator, Type 1552-A
Shure Brothers Rochelle Salt Microphone, Type 9898
10 ft cable connecting microphone to Sound Level Meter
Magnecorder Tape Recorder, Type PT63-AH
Power supply and auxiliary equipment to permit operation of tape recorder from automobile battery
Bruel and Kjaer Graphic Level Recorder, Type 2304.

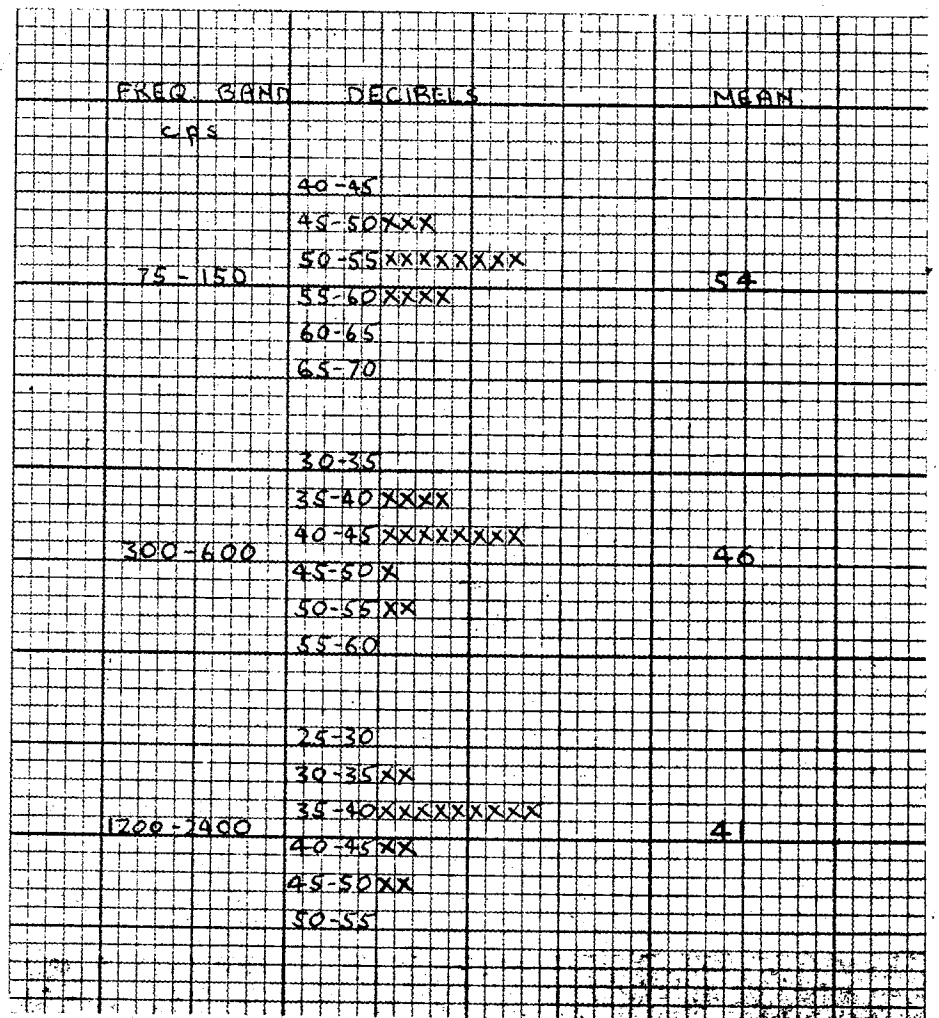


FIG. 1 WORKSHEET ILLUSTRATING MEASUREMENT PROCEDURE FOR BACKGROUND NOISE

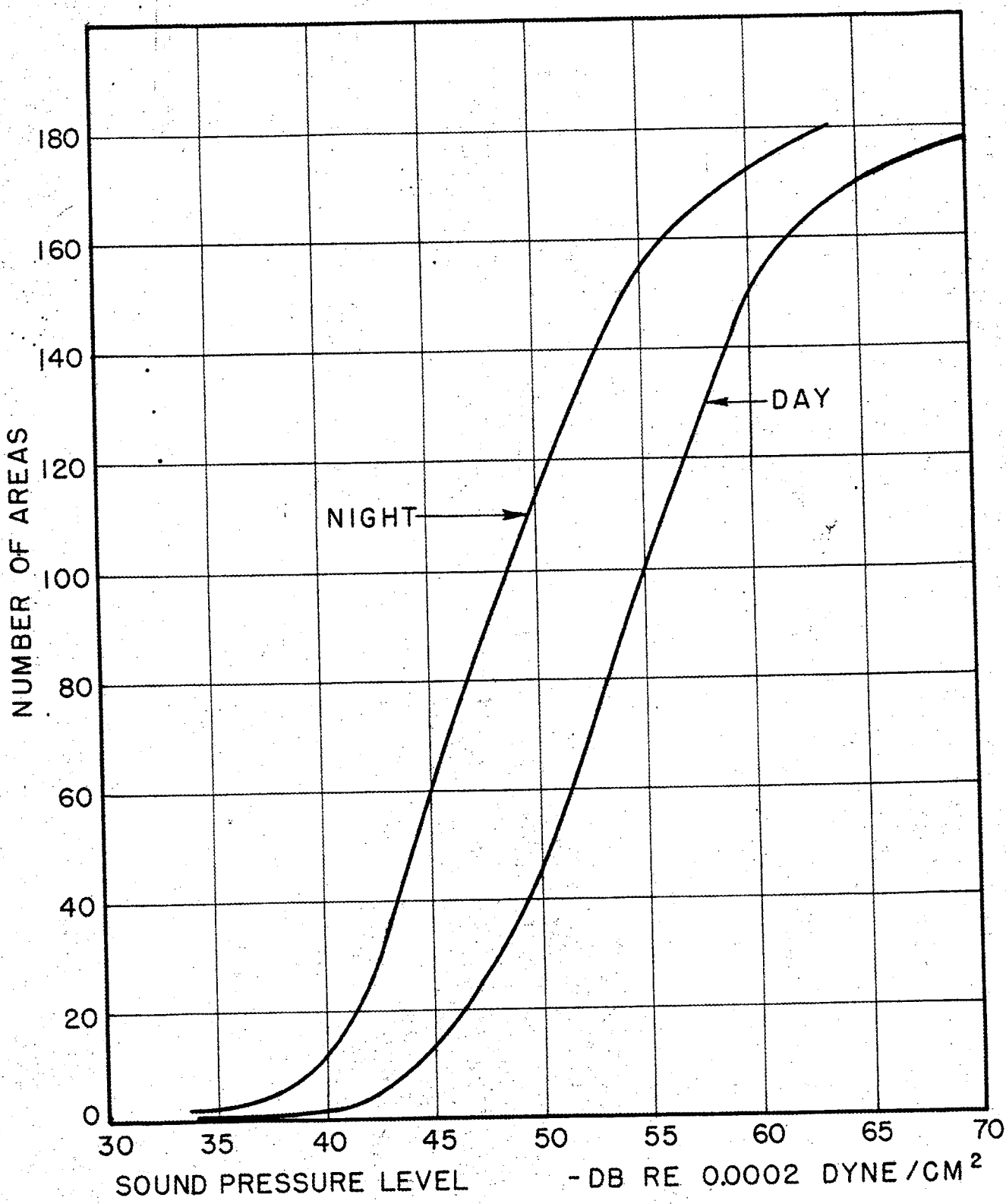


FIG. 2 CUMULATIVE DISTRIBUTION OF BACKGROUND LEVELS IN 75–150 CPS BAND

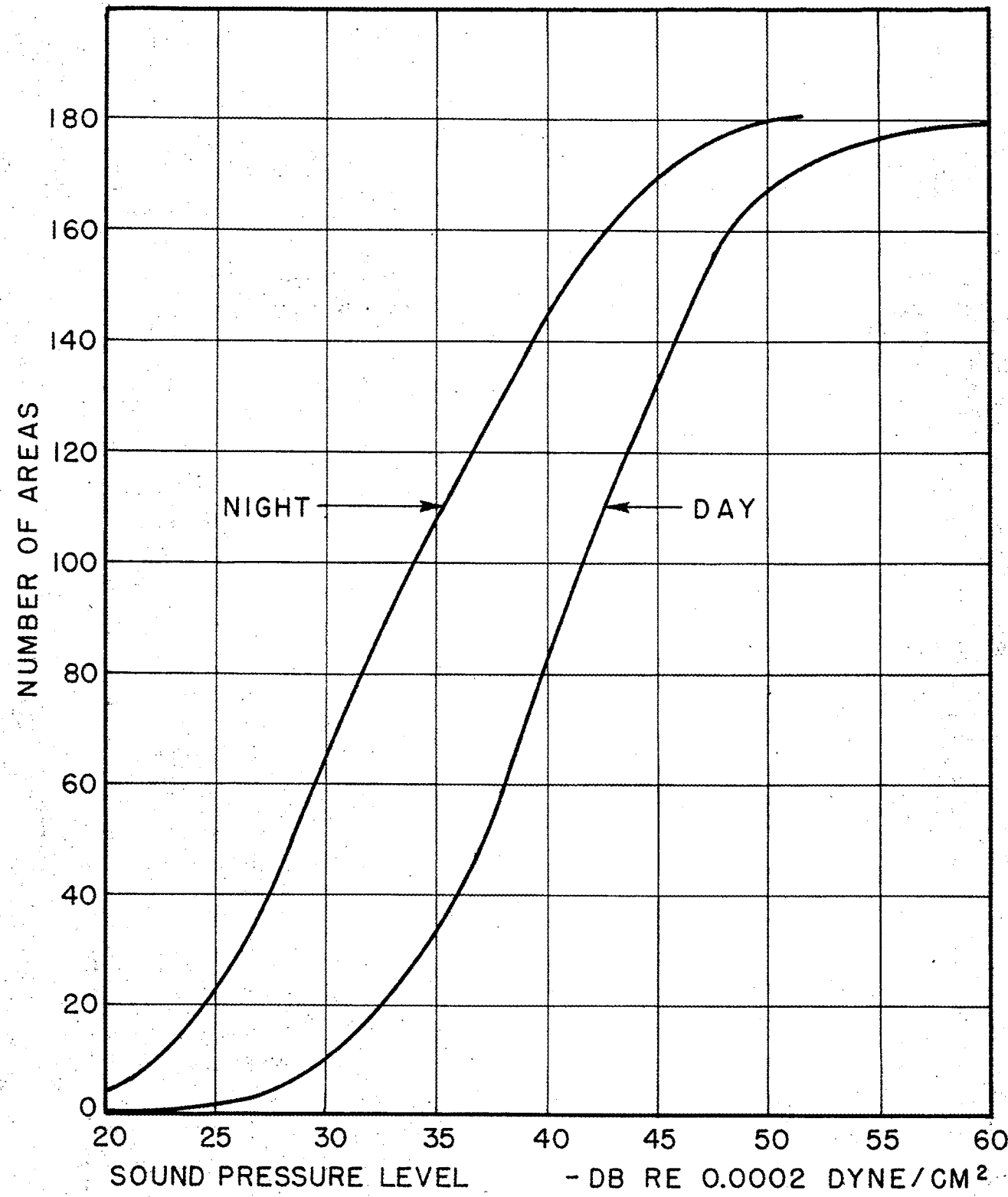


FIG. 3 CUMULATIVE DISTRIBUTION OF BACKGROUND LEVELS IN 300-600 CPS BAND

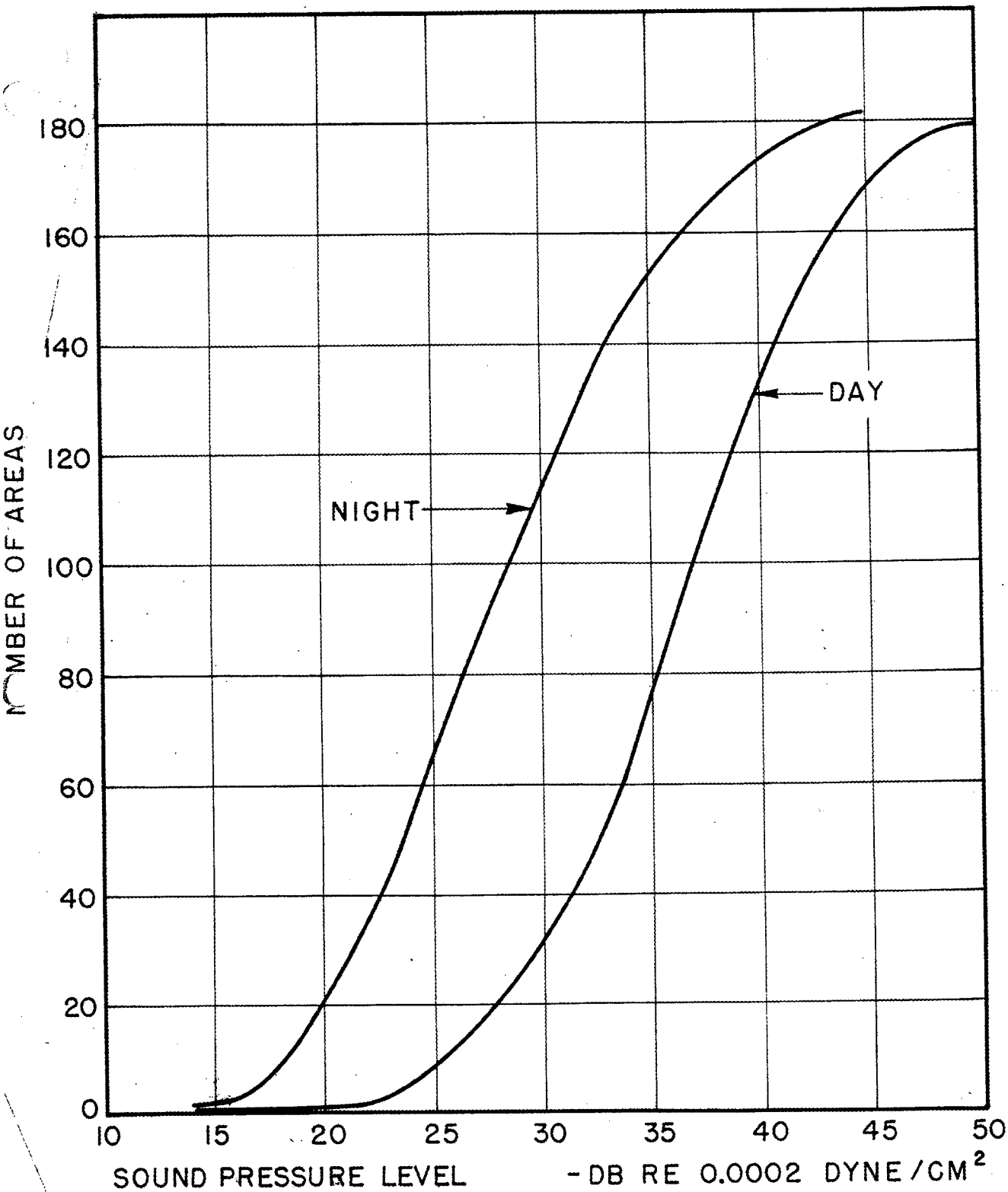


FIG. 4 CUMULATIVE DISTRIBUTION OF BACKGROUND LEVELS IN 1200-2400 CPS BAND

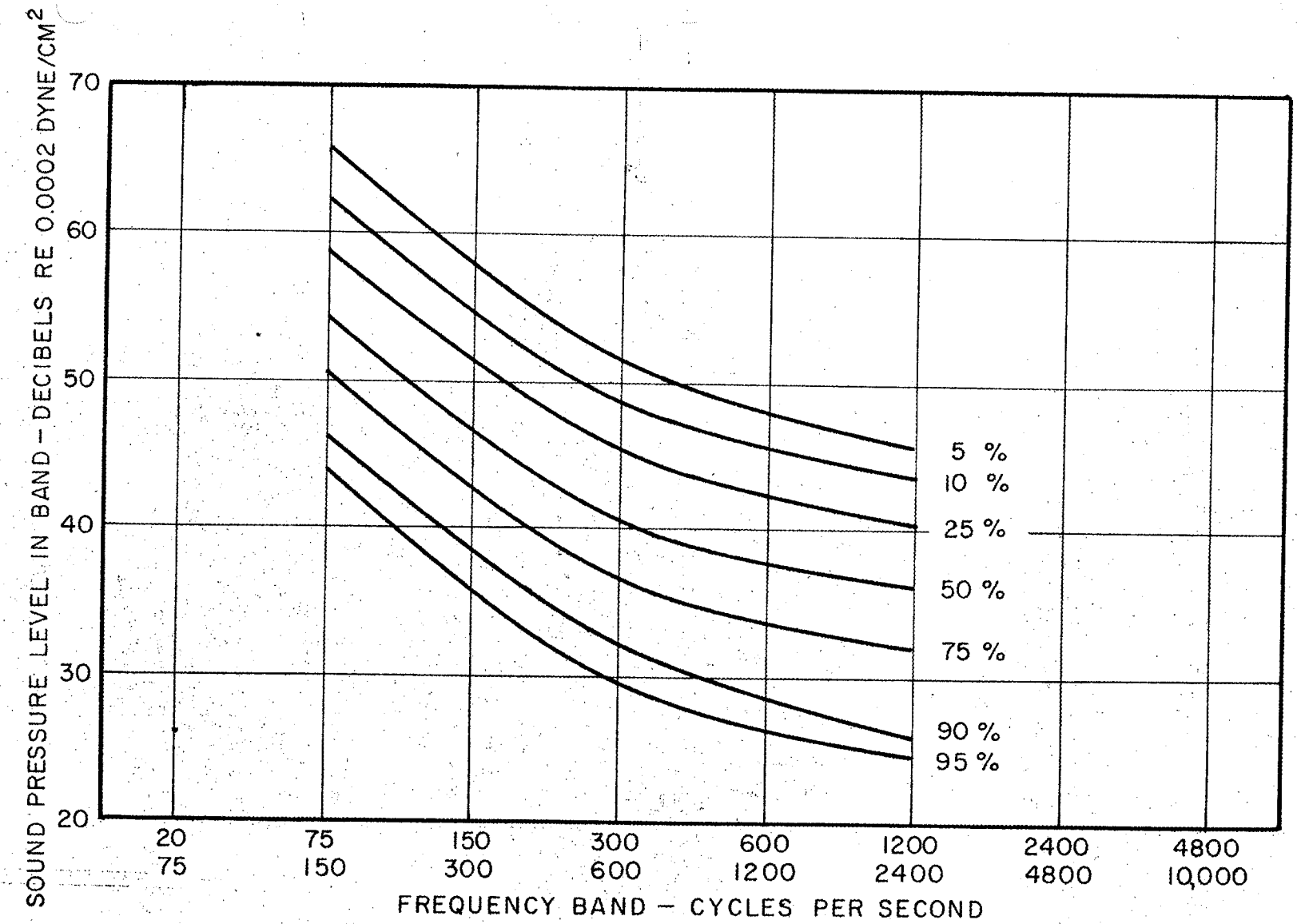


FIG. 5 MEASUREMENTS OF DAYTIME BACKGROUND NOISE

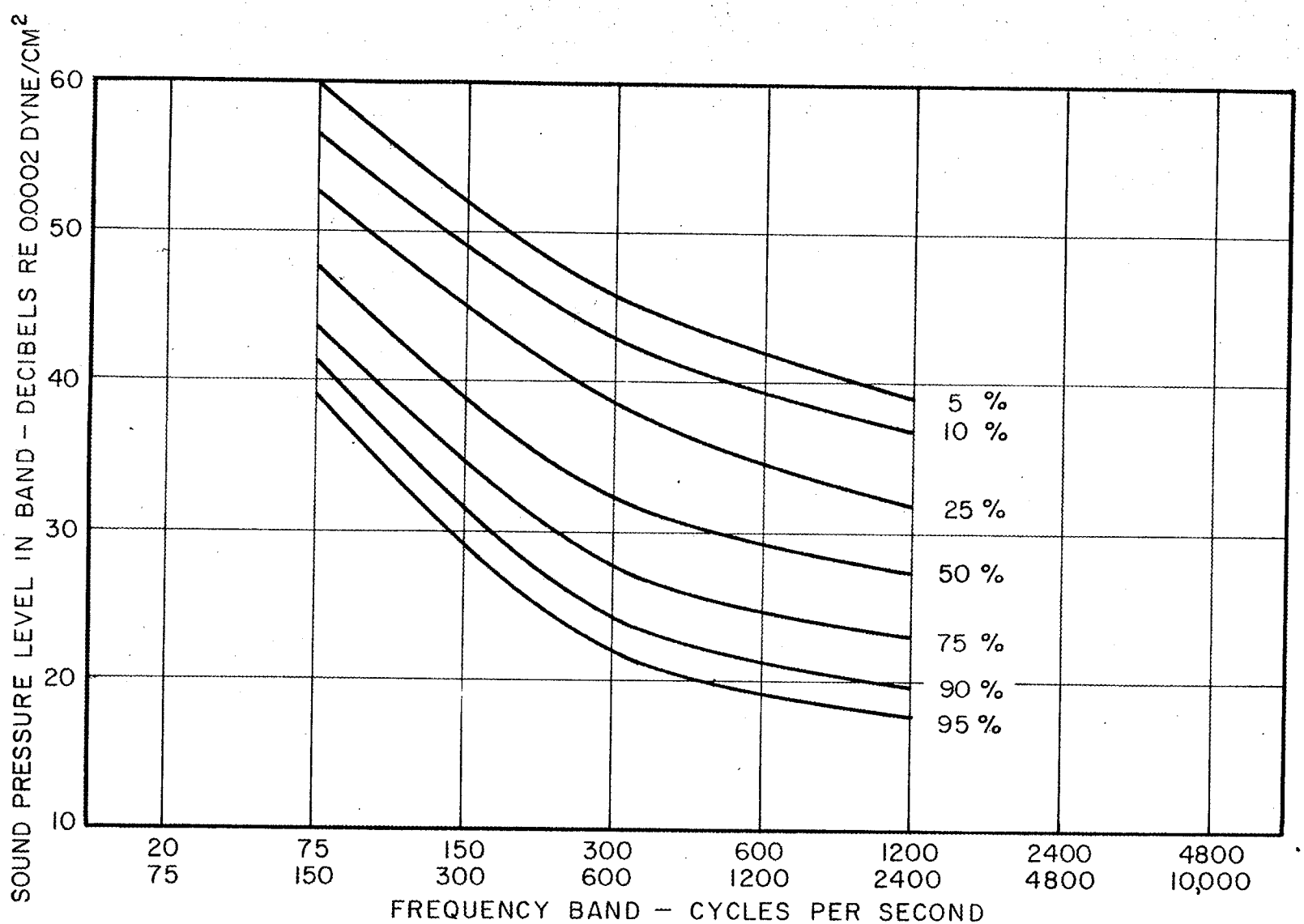


FIG. 6 MEASUREMENTS OF NIGHTTIME BACKGROUND NOISE

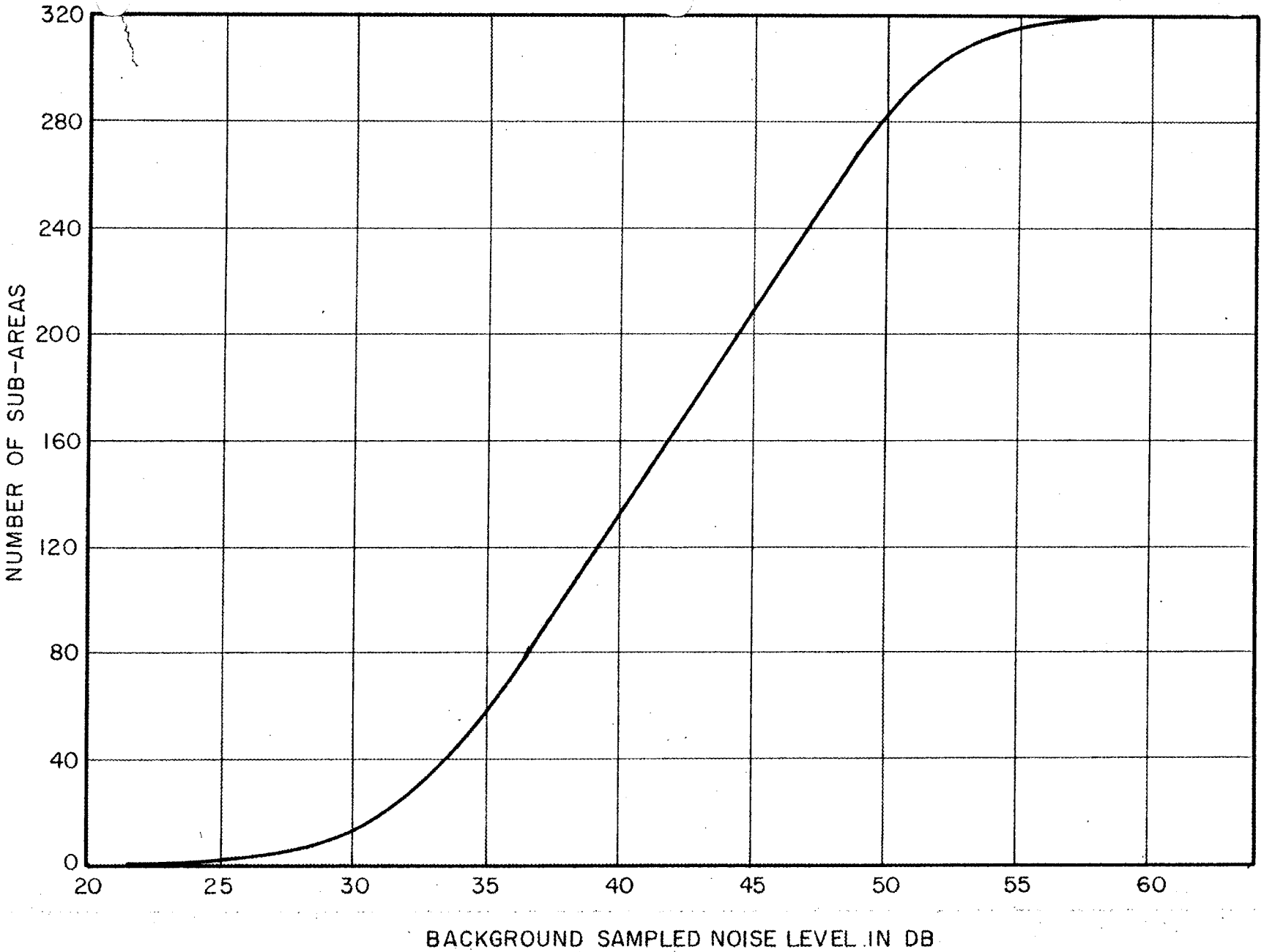
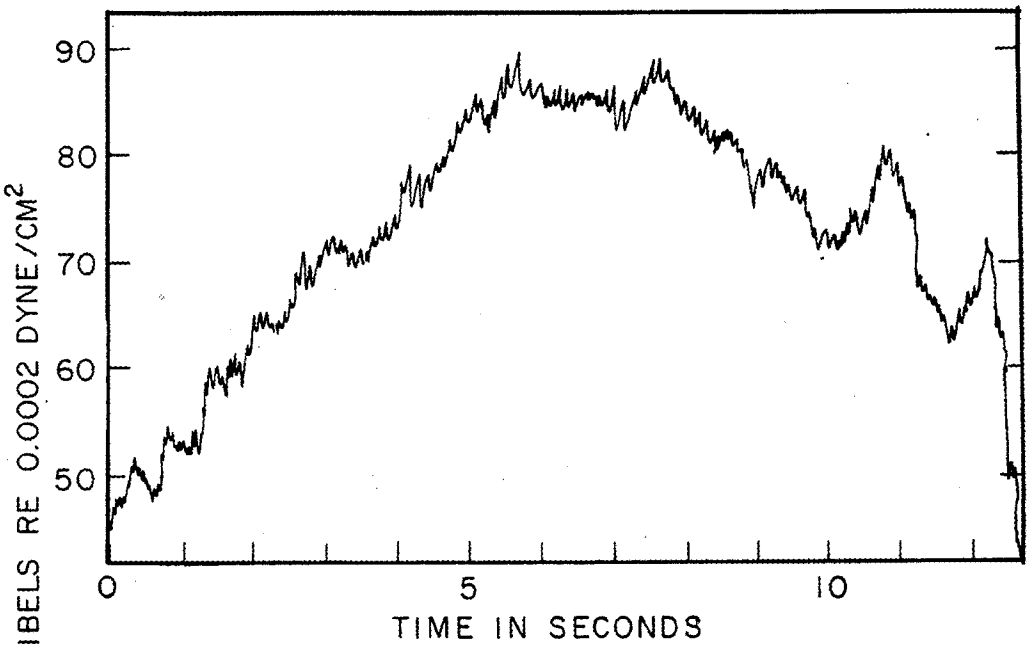
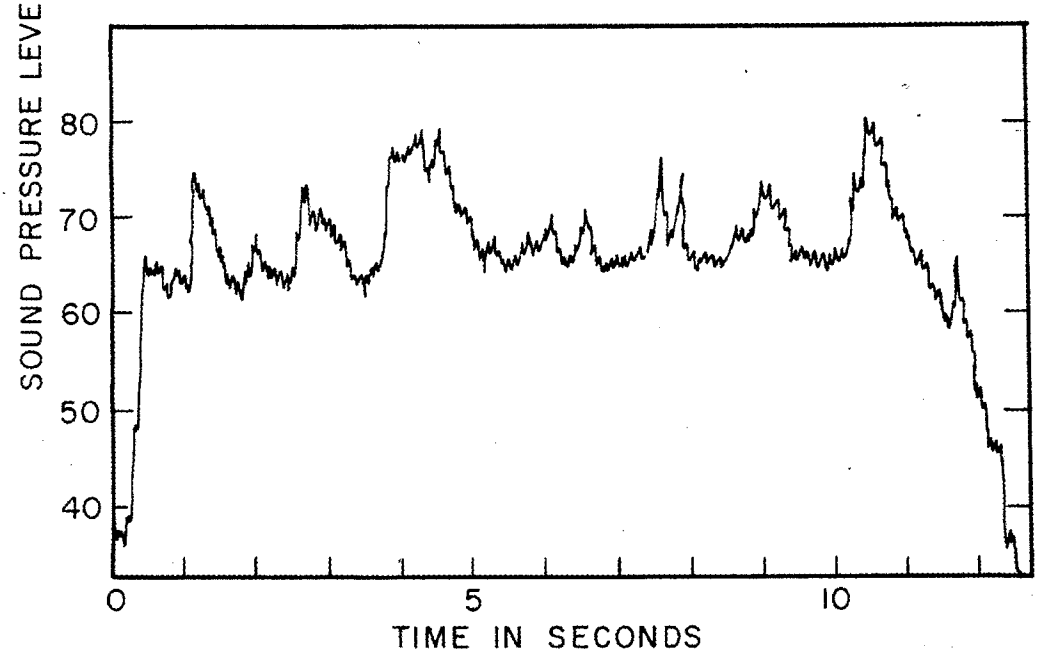


FIG. 7 CUMULATIVE DISTRIBUTION OF DAYTIME AND NIGHTTIME BACKGROUND SAMPLED NOISE LEVELS IN 180 SUB-AREAS. LEVELS ARE COMPUTED BY THE METHOD OUTLINED IN THE TEXT.



(a) 1.5 MILES FROM END OF RUNWAY



(b) 4.3 MILES FROM END OF RUNWAY

FIG. 8 TYPICAL VARIATIONS OF TAKE-OFF NOISE IN 300-600 CPS BAND, TRACED BY GRAPHIC LEVEL RECORDER

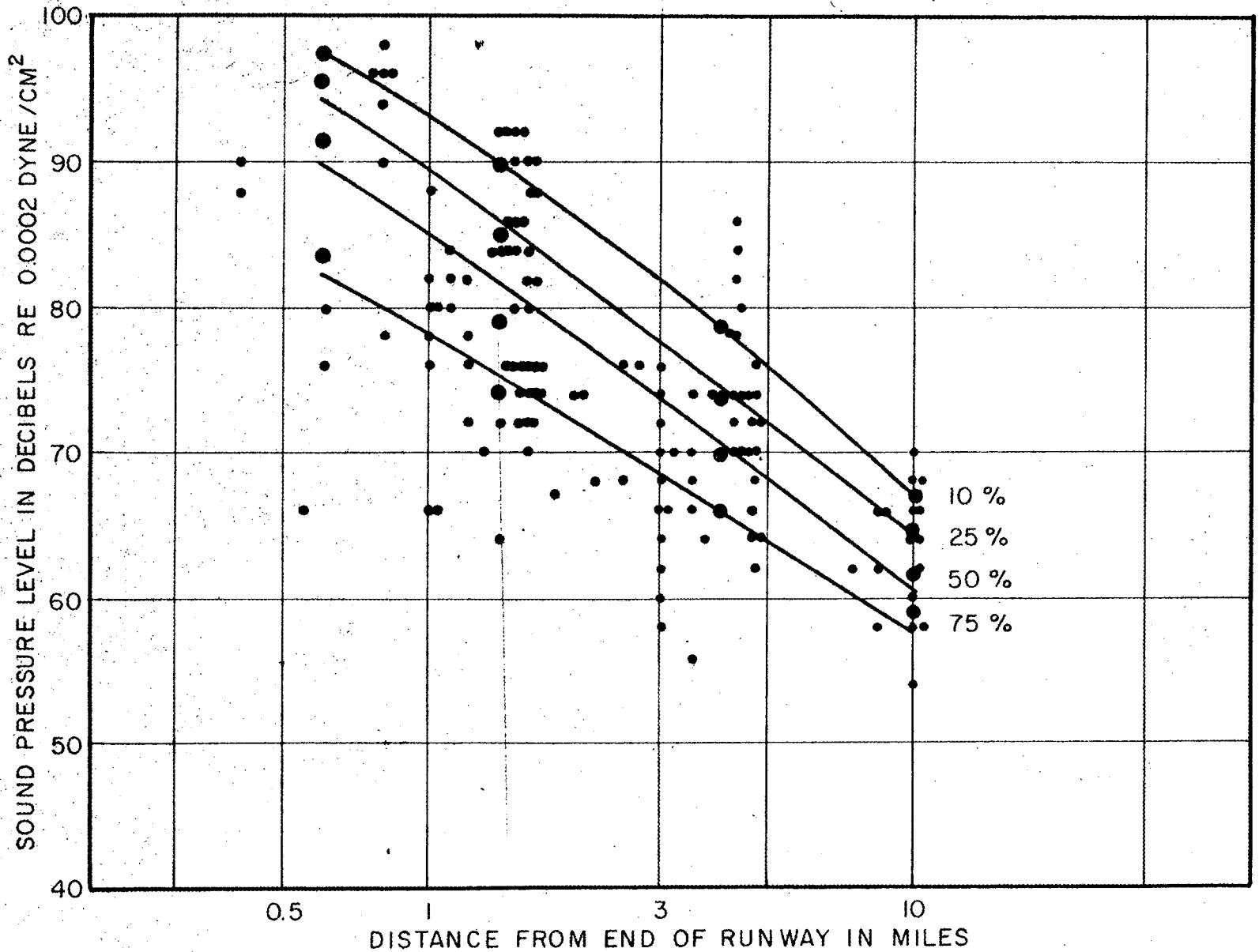


FIG. 9 MEASUREMENTS OF AIRCRAFT OVER "TAKE-OFF AREAS"
75-150 CPS BAND

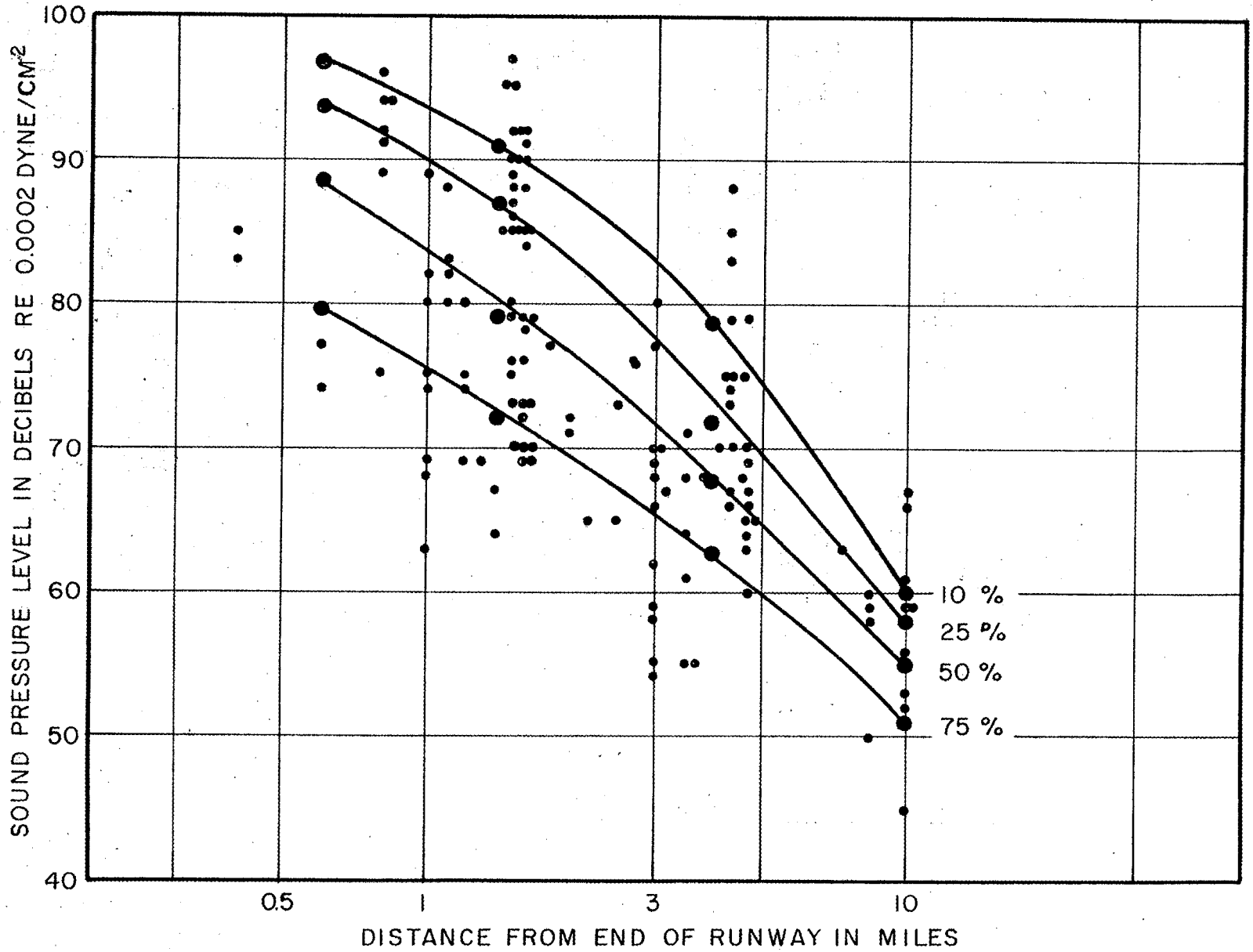


FIG. 10 MEASUREMENTS OF AIRCRAFT OVER "TAKE-OFF AREAS"
150-300 CPS BAND

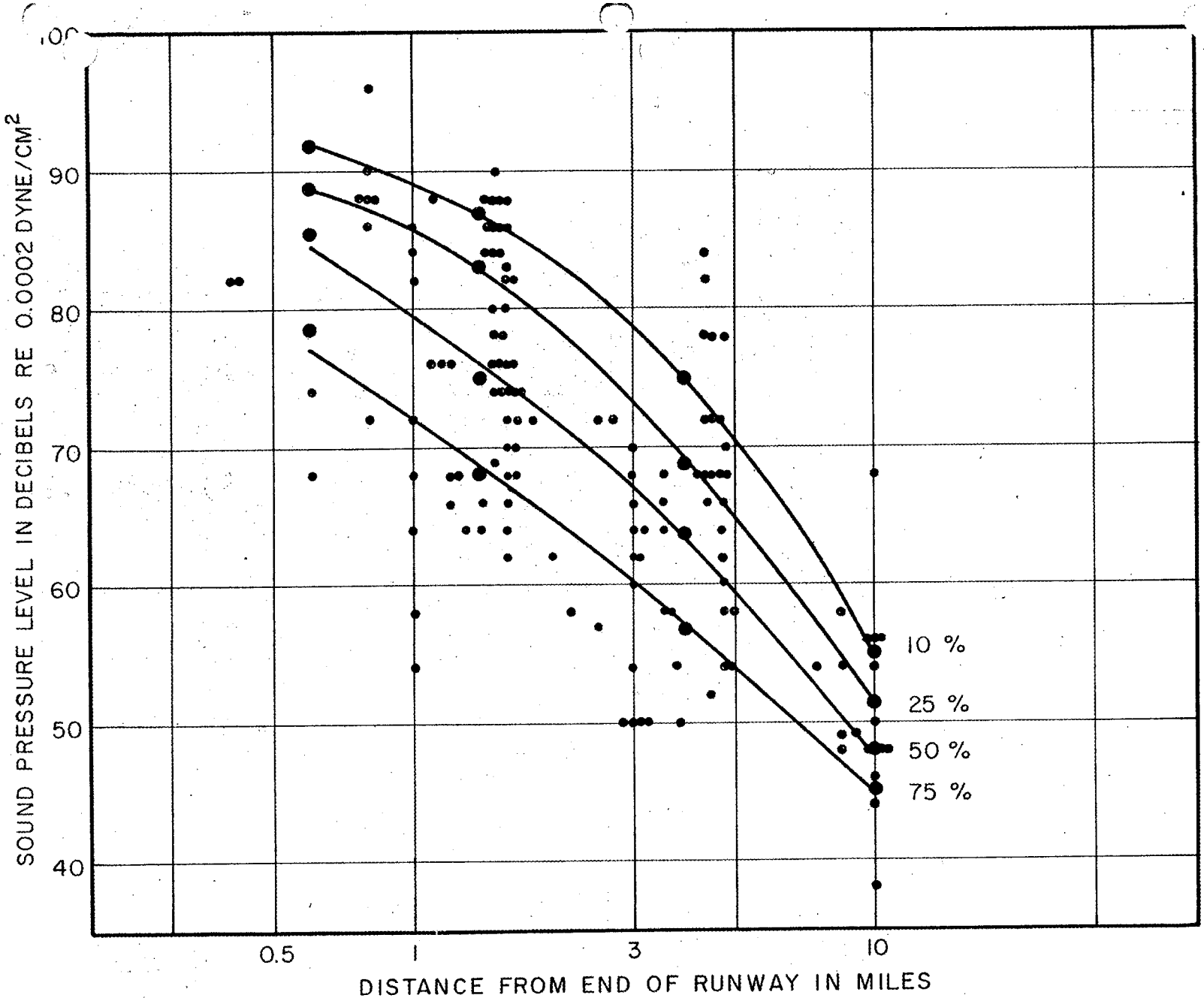


FIG. 11 MEASUREMENTS OF AIRCRAFT OVER "TAKE-OFF AREAS"
300-600 CPS BAND

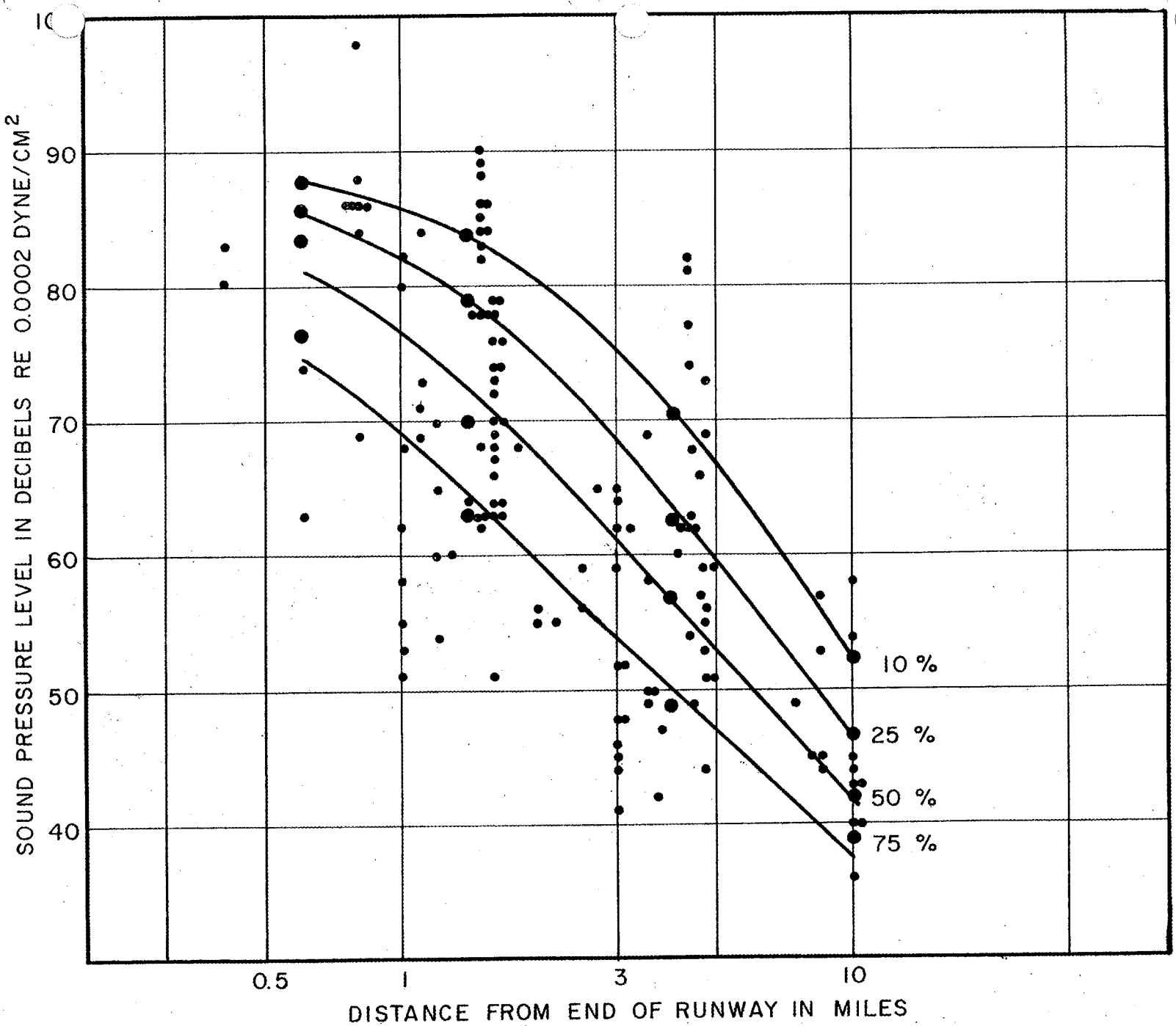


FIG. 12 MEASUREMENTS OF AIRCRAFT OVER "TAKE-OFF AREAS"
600 - 1200 CPS BAND

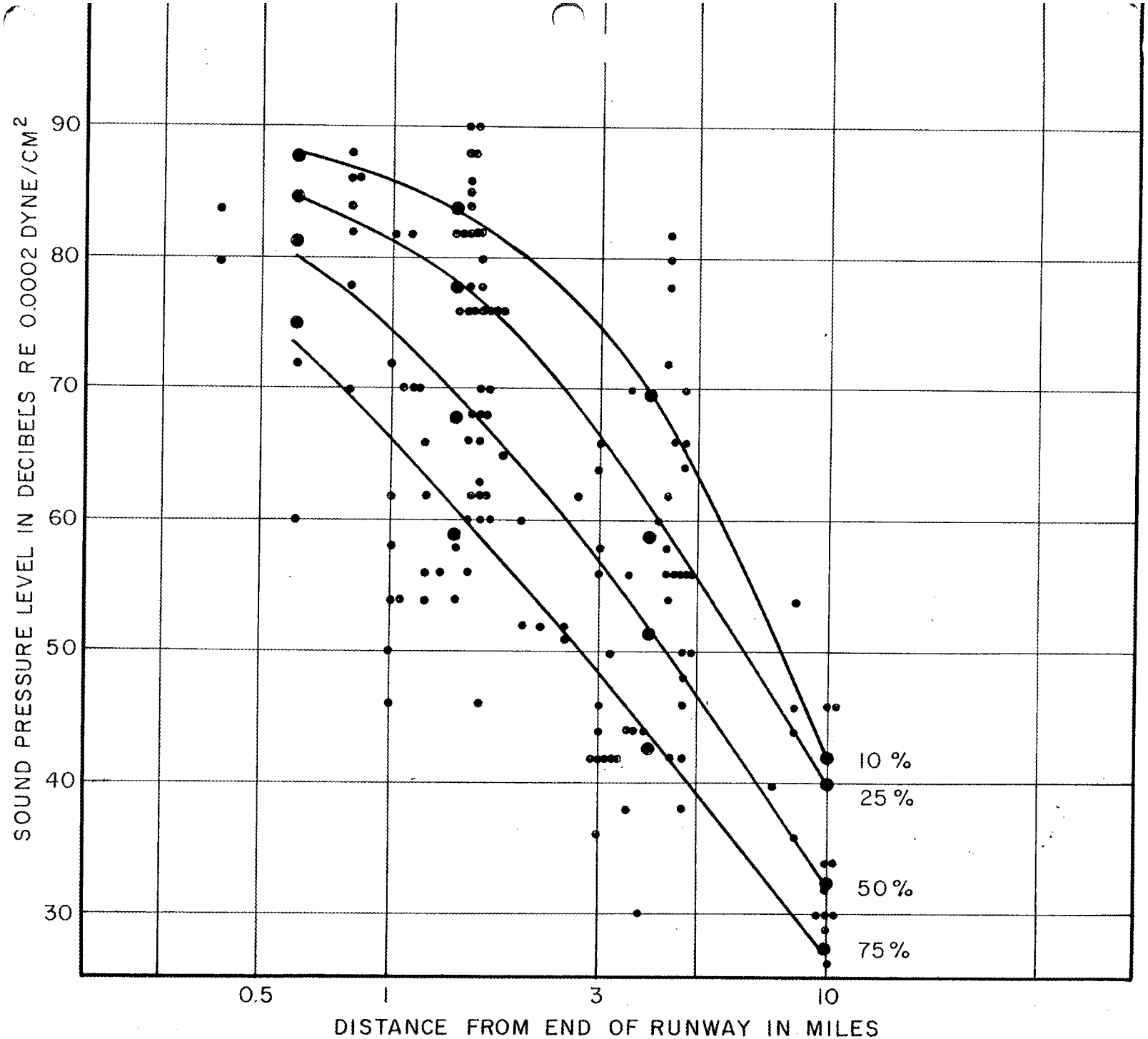


FIG. 13 MEASUREMENTS OF AIRCRAFT OVER "TAKE-OFF AREAS"

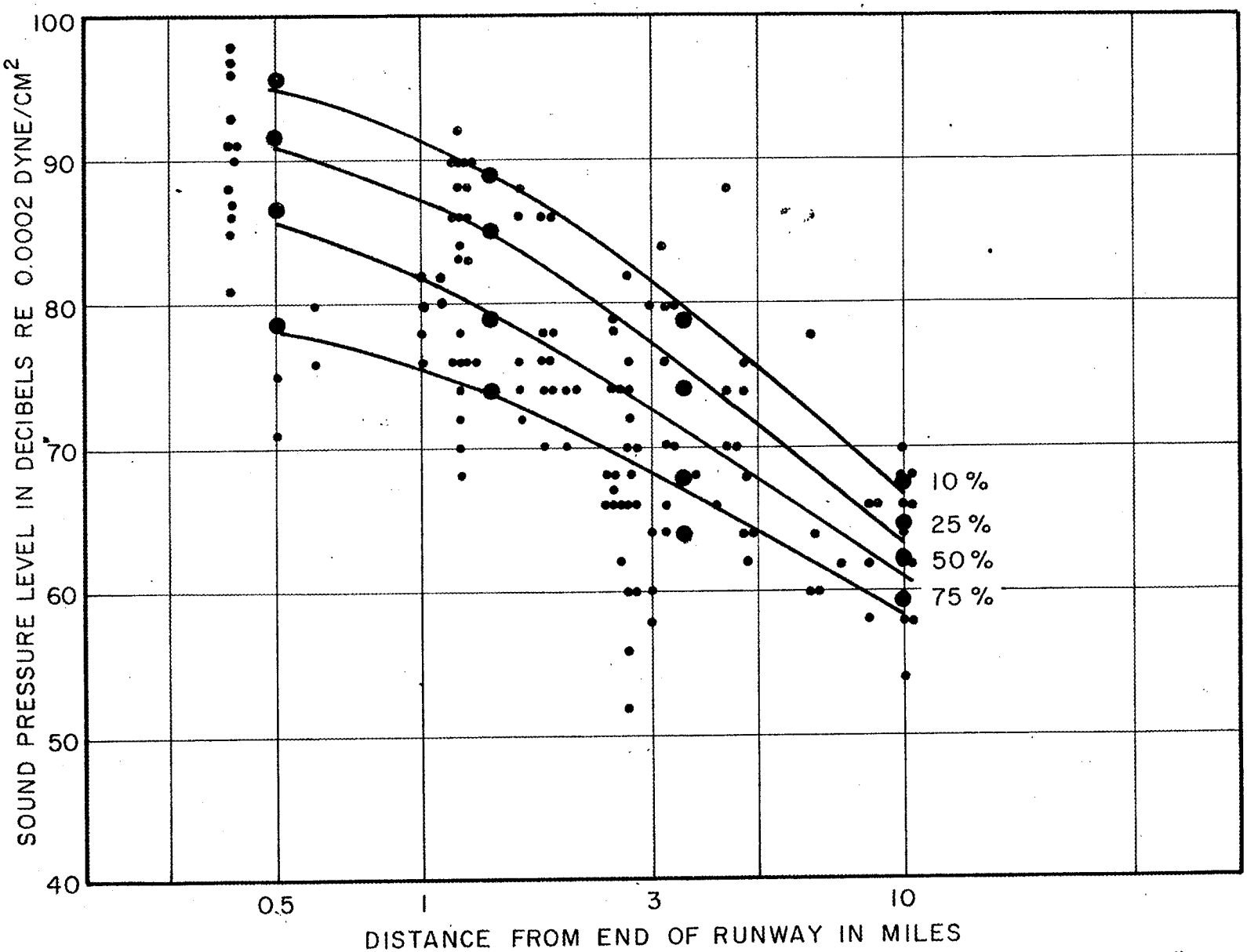


FIG. 14 MEASUREMENTS OF AIRCRAFT OVER "LANDING AREAS"
75 - 150 CPS BAND

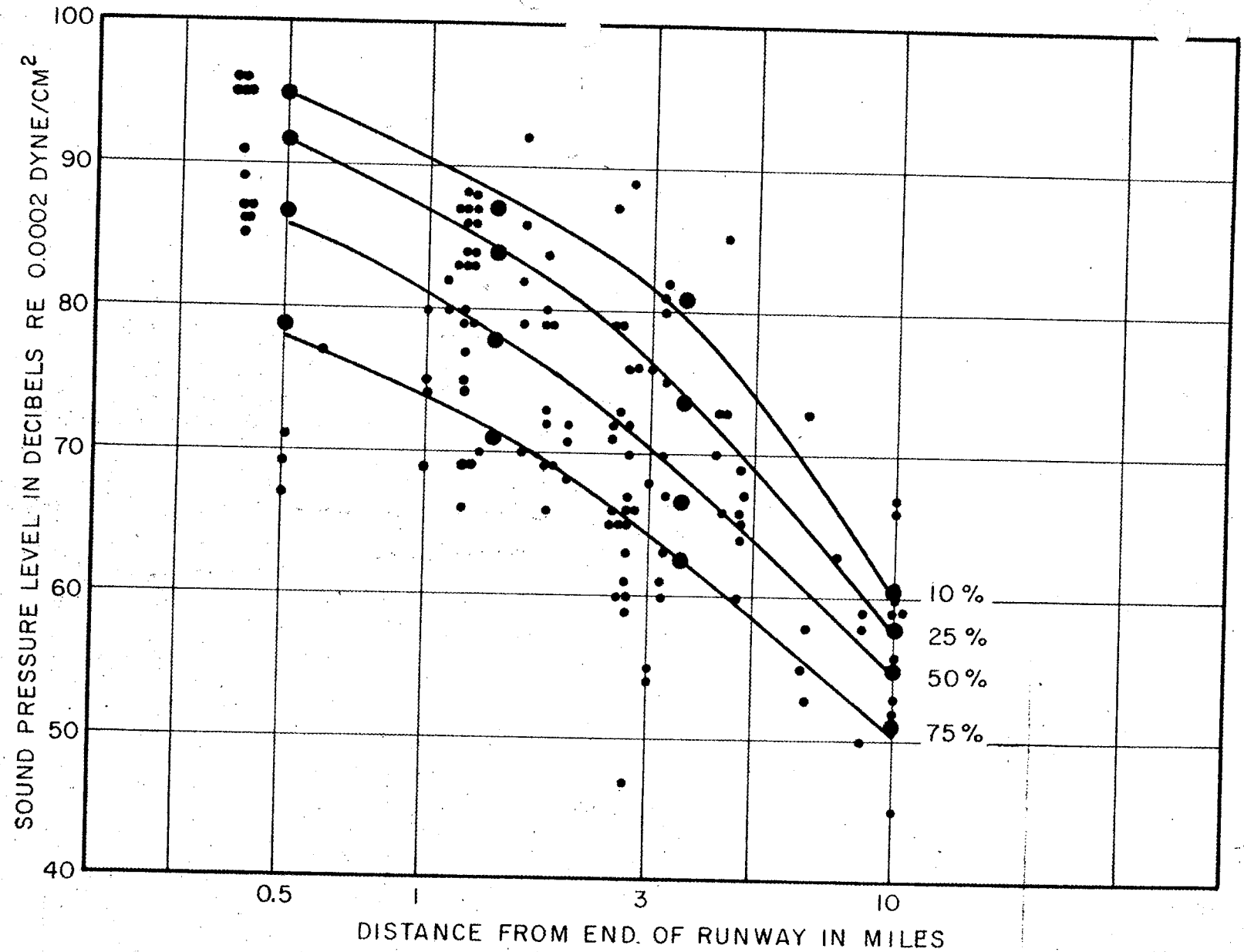


FIG. 15 MEASUREMENTS OF AIRCRAFT OVER "LANDING AREAS"
150-300 CPS BAND

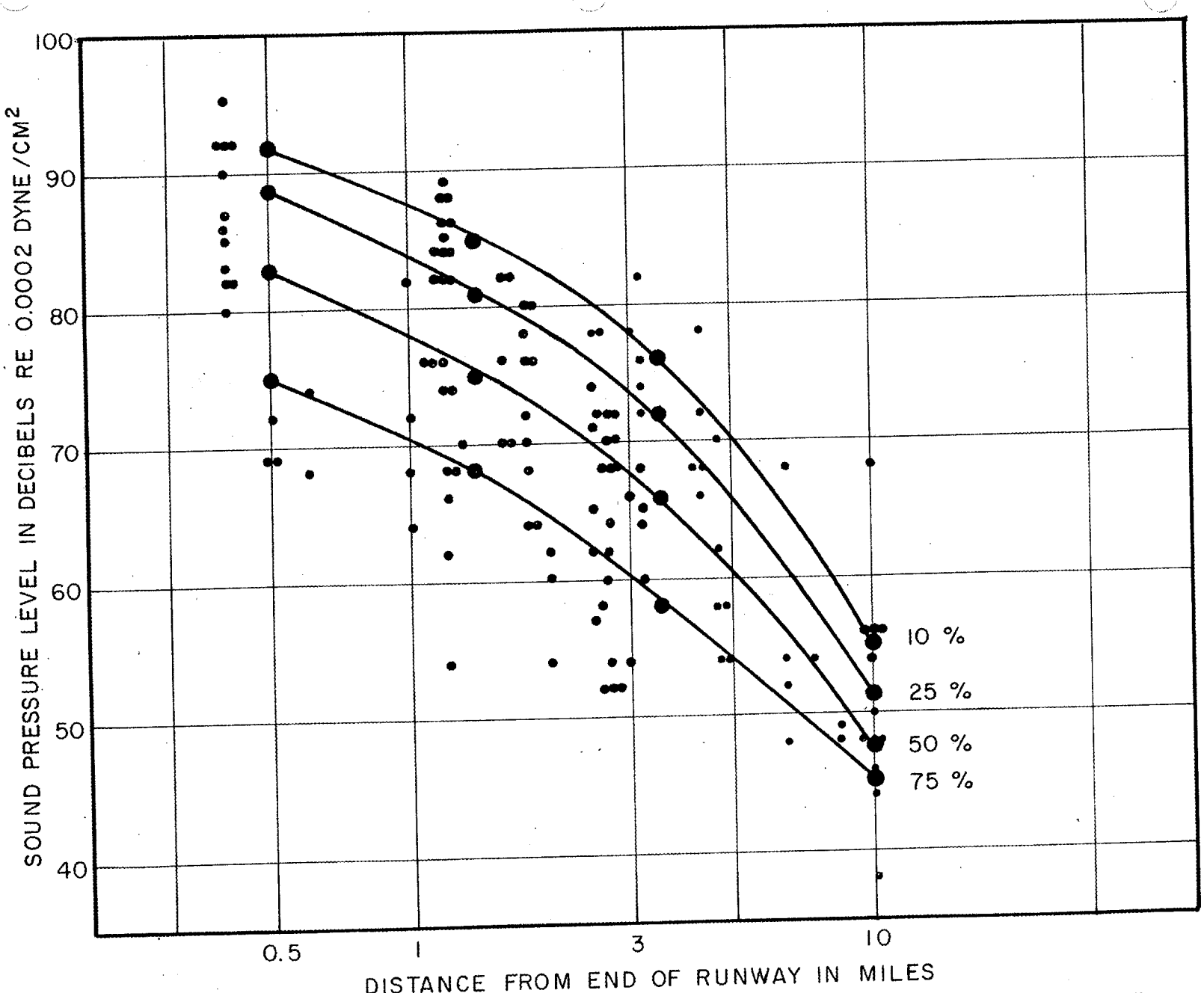


FIG. 16 MEASUREMENTS OF AIRCRAFT OVER "LANDING AREAS"
300-600 CPS BAND

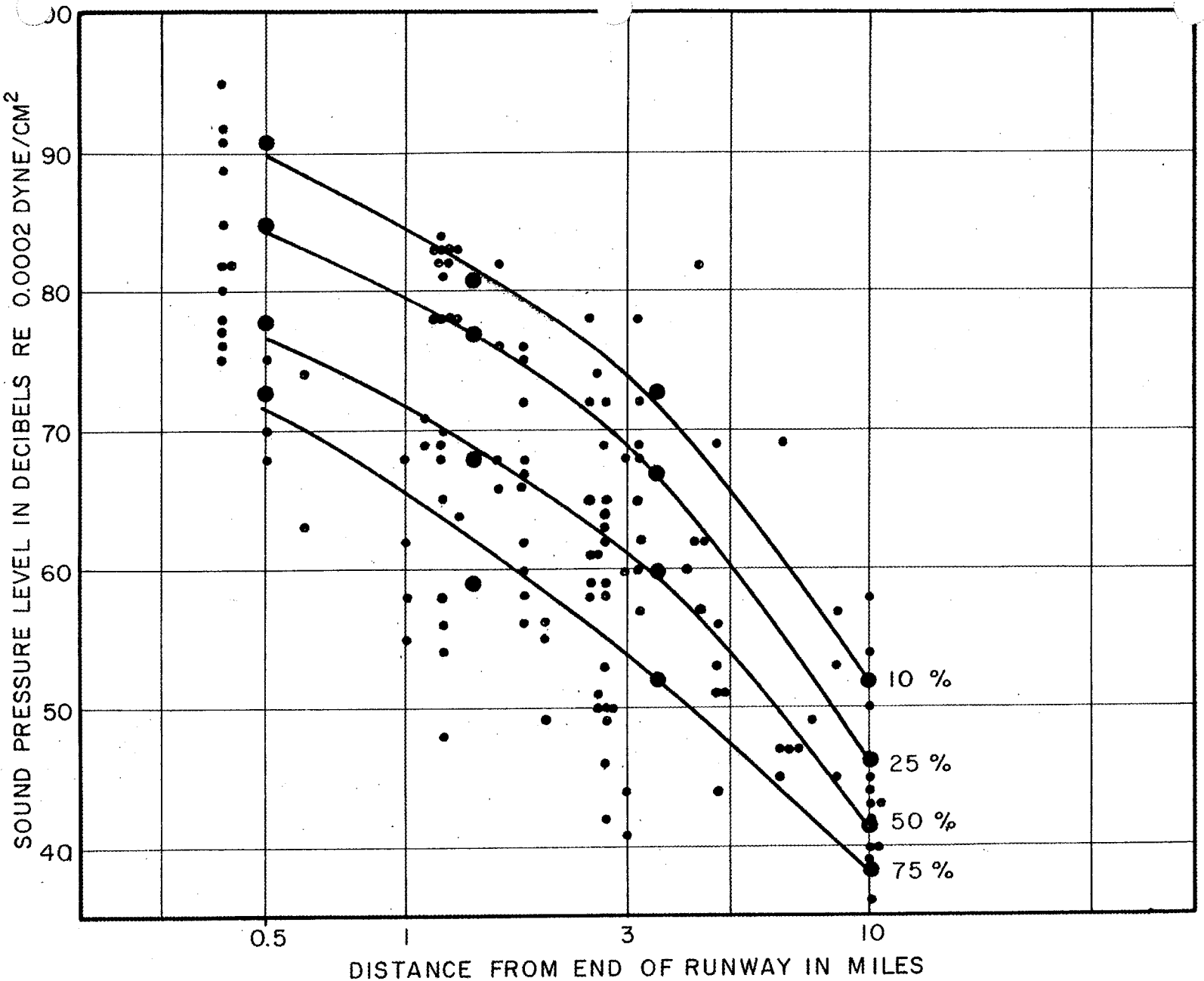


FIG. 17 MEASUREMENTS OF AIRCRAFT OVER "LANDING AREAS"
600 - 1200 CPS BAND

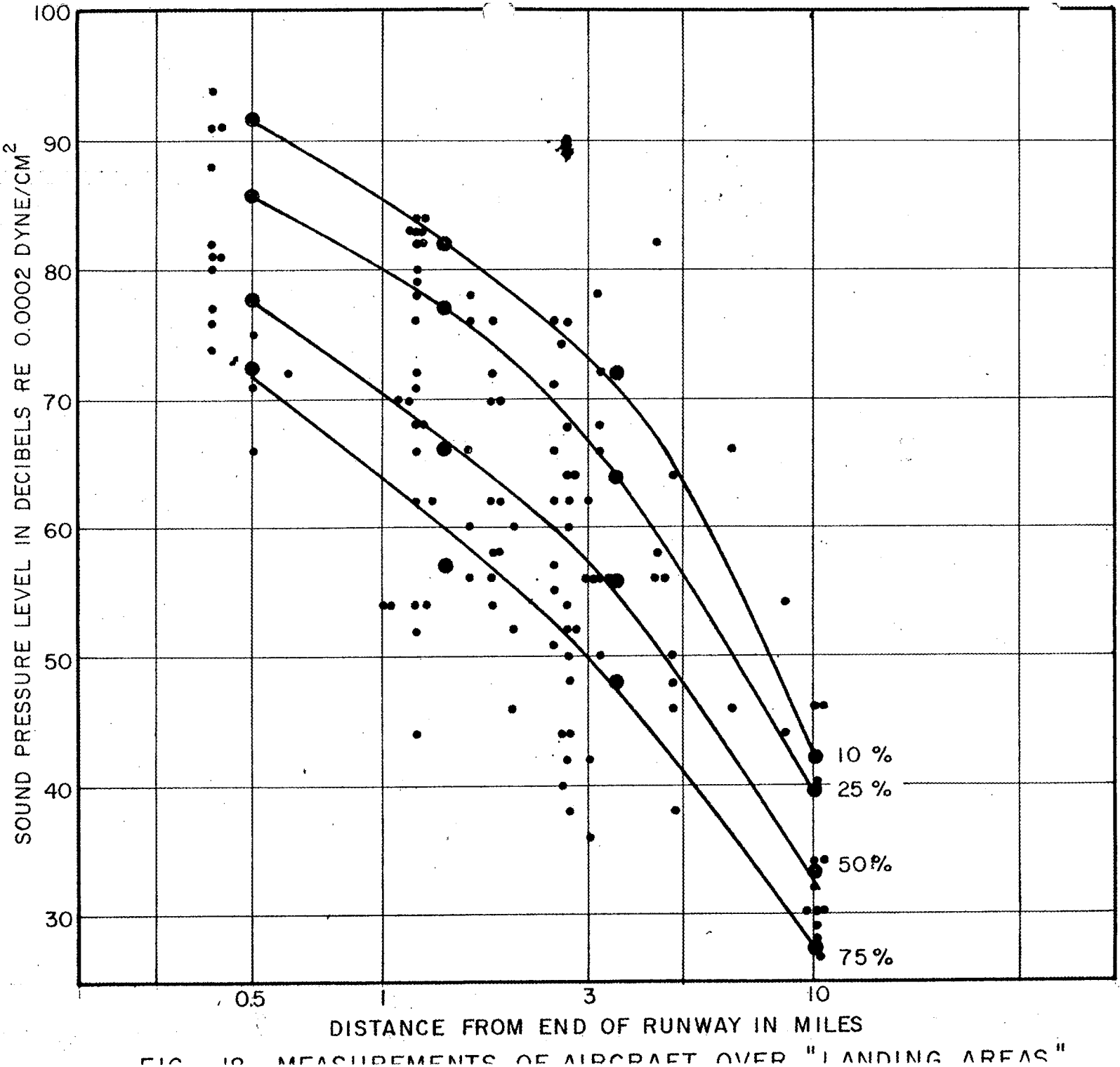


FIG. 12 MEASUREMENTS OF AIRCRAFT OVER "LANDING AREAS"

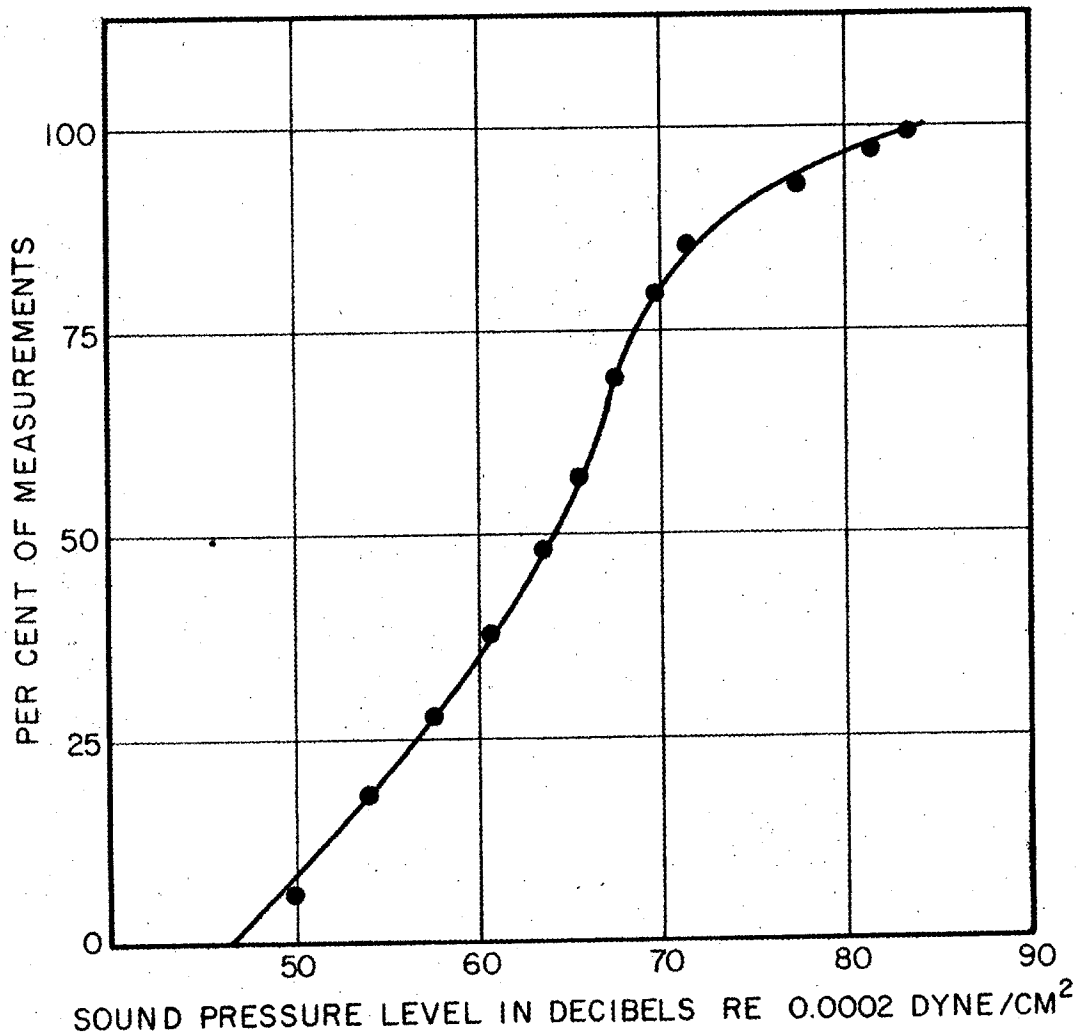


FIG. 19 CUMULATIVE DISTRIBUTION OF AIRCRAFT NOISE LEVELS IN 300-600 CPS BAND TAKE-OFF AREAS 3-5 MILES FROM END OF RUNWAY.

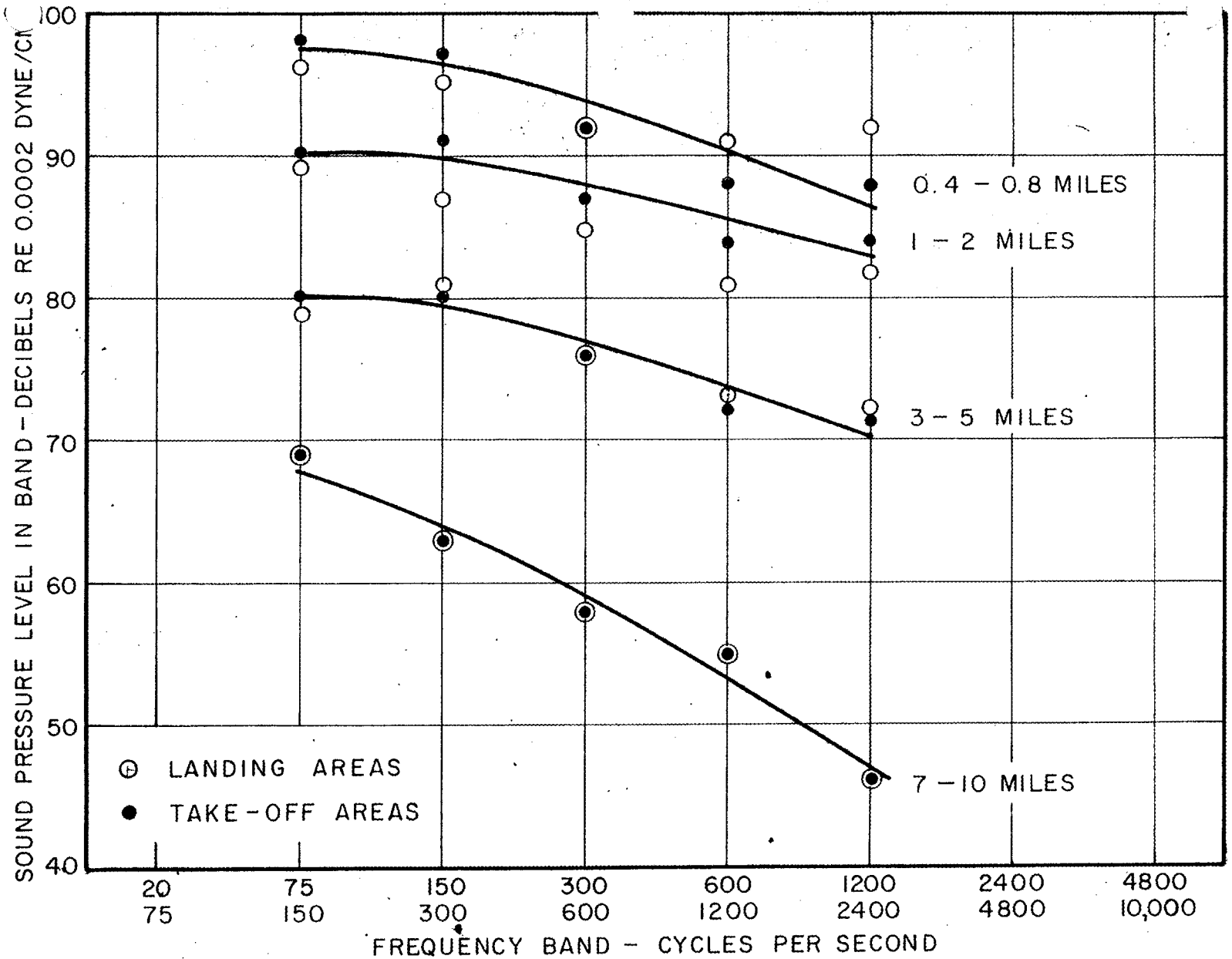


FIG. 20 OCTAVE BAND SPECTRA OF AIRCRAFT NOISE AT VARIOUS DISTANCES FROM END OF RUNWAY. 10 PER CENT OF MEASUREMENTS EXCEED VALUES SHOWN.

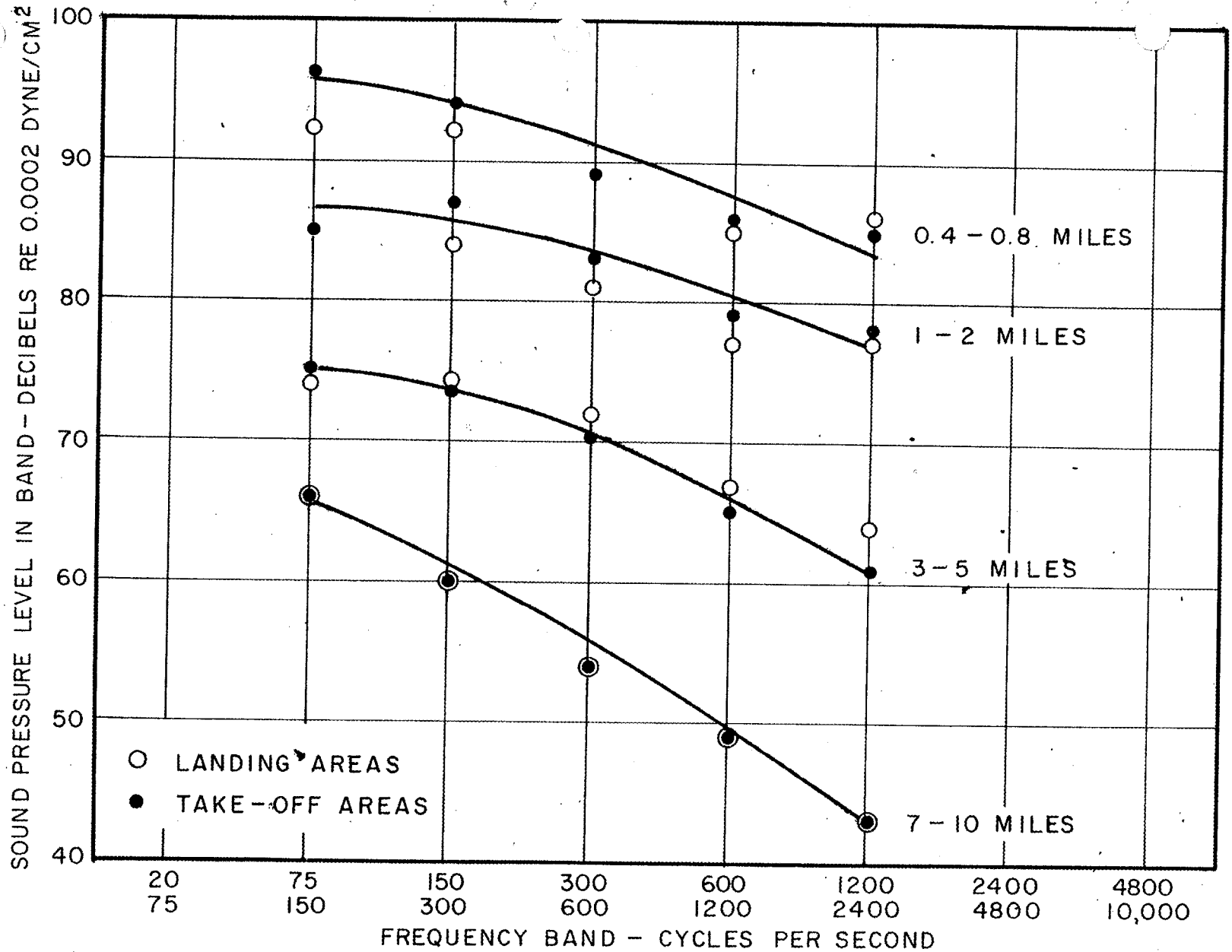


FIG. 21 OCTAVE BAND SPECTRA OF AIRCRAFT NOISE AT VARIOUS DISTANCES FROM END OF RUNWAY. 25 PER CENT OF MEASUREMENTS EXCEED VALUES SHOWN.

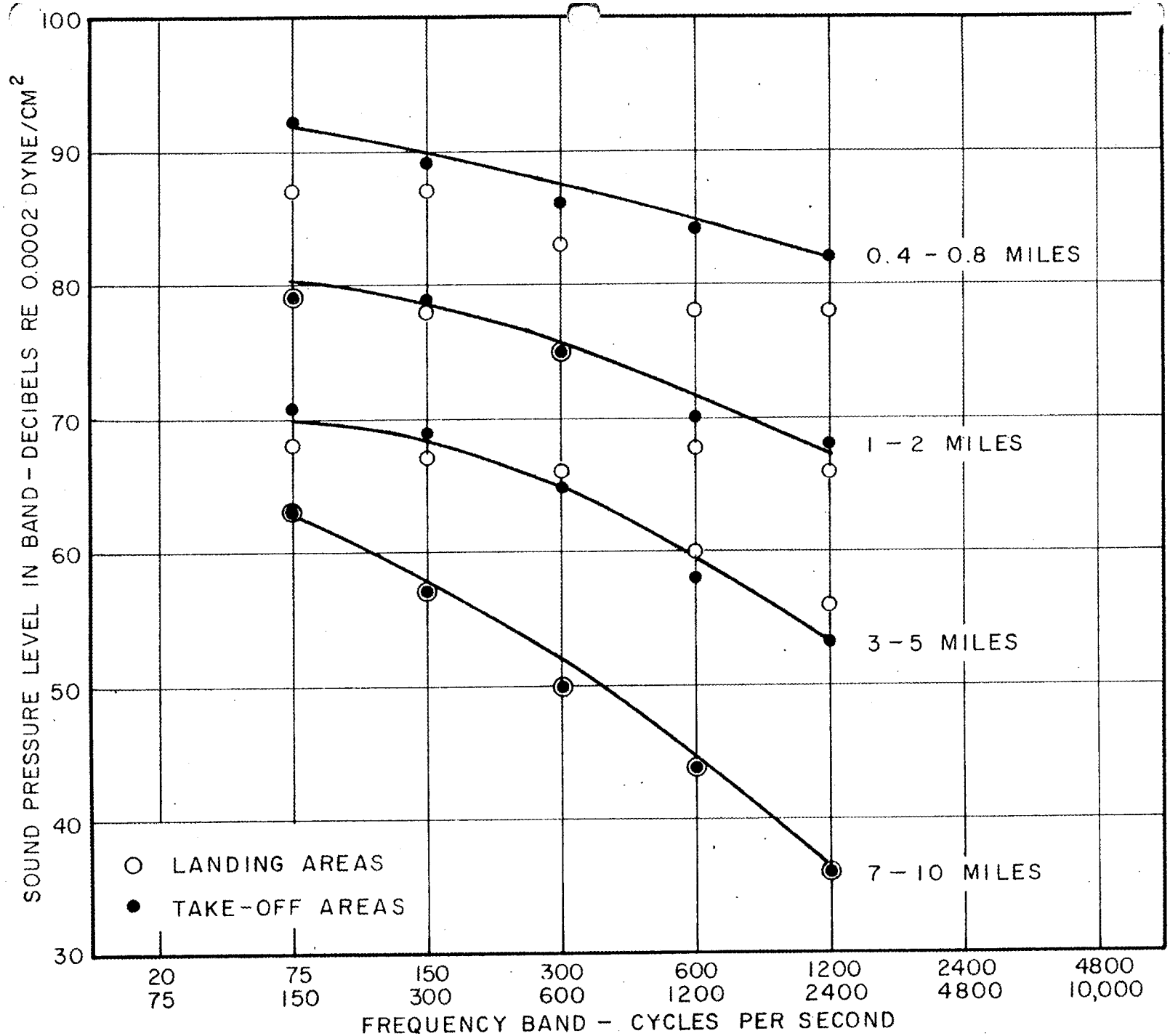


FIG. 22 OCTAVE BAND SPECTRA OF AIRCRAFT NOISE AT VARIOUS DISTANCES FROM END OF RUNWAY. 50 PER CENT OF

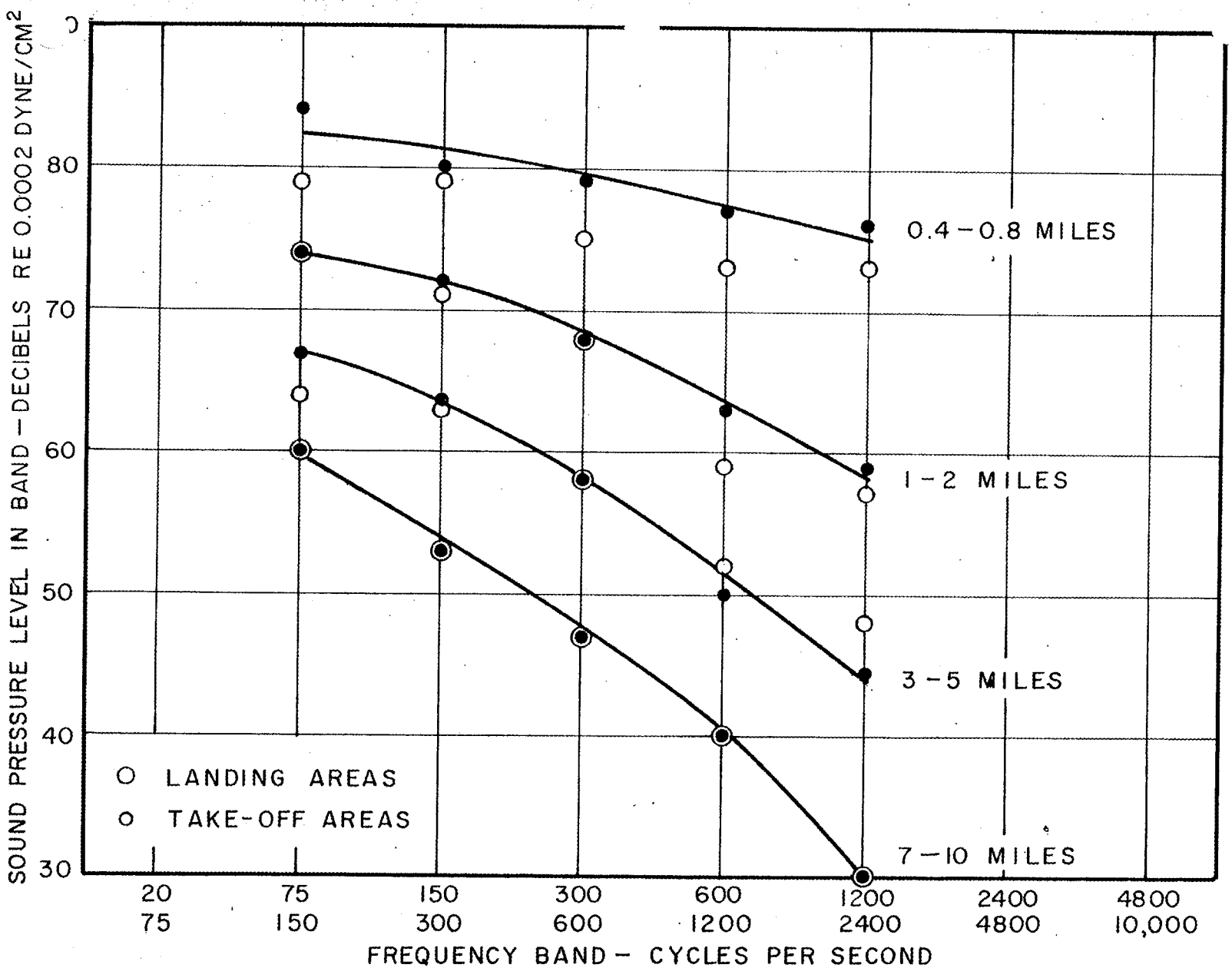


FIG. 23 OCTAVE BAND SPECTRA OF AIRCRAFT NOISE AT VARIOUS DISTANCES FROM END OF RUNWAY. 75 PER CENT OF MEASUREMENTS EXCEED VALUES SHOWN.

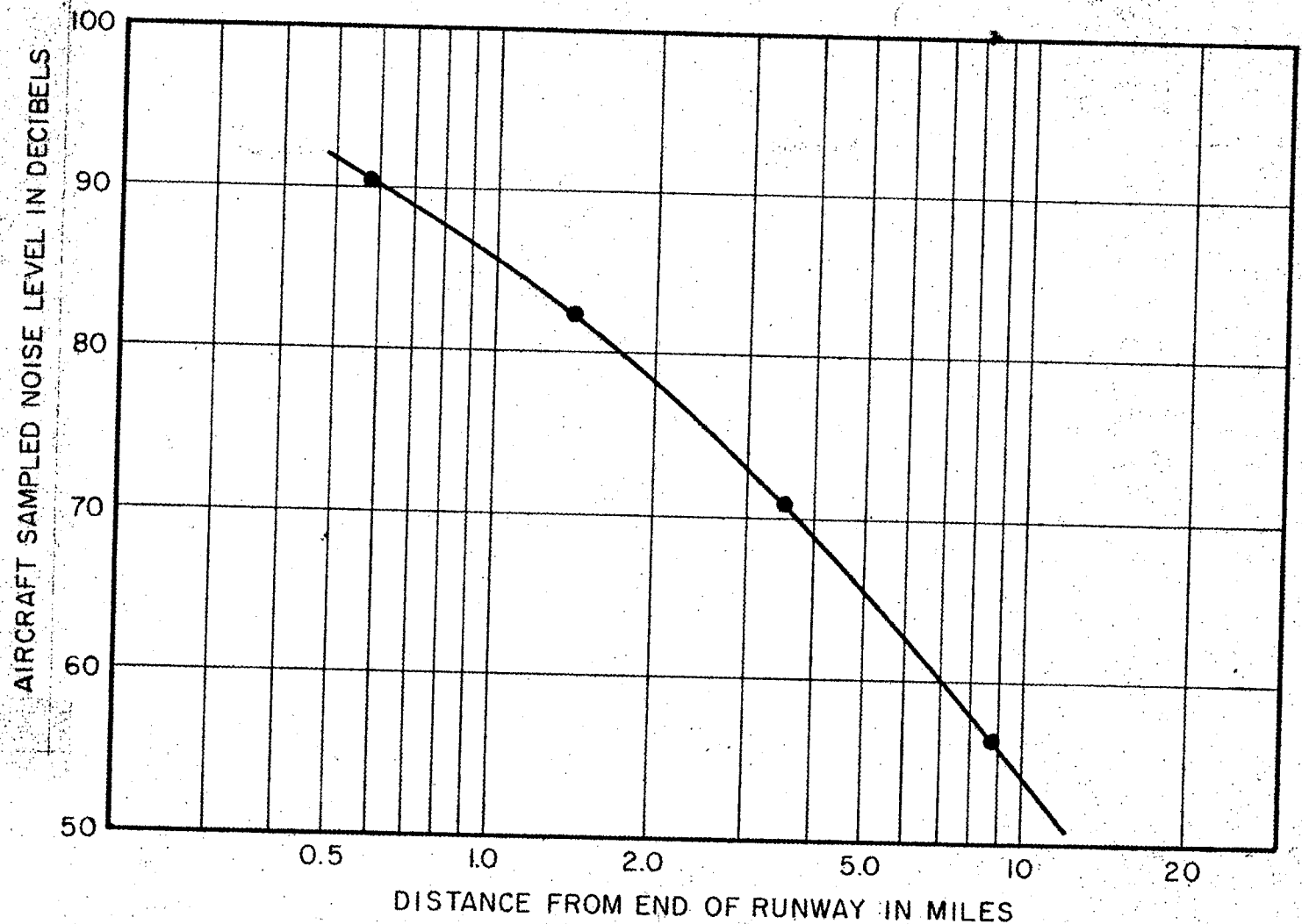


FIG. 24 CURVE USED TO SPECIFY AIRCRAFT NOISE STIMULUS IN SAMPLING AREAS. SEE TEXT

Questionnaire No. - -

CONFIDENTIAL
Survey 338
5-18-53

NATIONAL OPINION RESEARCH CENTER
University of Chicago

Area _____ Time interview began _____

Hello. I'm from the National Opinion Research Center. We're doing a public opinion study of how people feel about living in different areas, and I'd like to get some of your ideas.

---

1. By the way, have you ever been interviewed before?

Yes. . . . . -X
No . . . . . -Y

---

2. A. Well, in general, how do you like living in this part of (name of city or county) -- would you say you like it very much -- that you like it a little -- or that you don't like it?

Like very much . . . . 6-1 *(Ask B-D)
Like a little. . . . . -2 *(Ask B-D)
Don't like . . . . . -3 **(Ask E-G)
Don't know . . . . . -4 **(Ask E-G)

*IF "LIKE VERY MUCH" OR "LIKE A LITTLE" ASK:

B. What would you say are some of the things you like about living in this part of (name of city or county)?
(What are some of the things that make this a good place to live?) 6-

C. Now usually no place is perfect -- so to be sure I get a complete picture, I'd like you to tell me about anything around here that bothers or annoys you in any way, especially during the summer and fall months. 7-

D. Are there any other things that annoy you -- that you just take for granted because nothing much can be done about them? (what are they?)

To be answered by interviewer only:
Did you hear any planes passing overhead while asking the questions on this page?

Yes. . . . . -X
No . . . . . -Y

QUESTION 2 (Continued)

**IF "DON'T KNOW" OR "DON'T KNOW" ASK:

E. Could you tell me about some of the things around here that bother or disturb you in any way, especially during the summer and fall months? 7-

F. Are there any other things that annoy you -- that you just take for granted because nothing much can be done about them?

G. Now, what would you say are some of the things you like about living in this part of (name of city or county)?
(What are some of the things that make this a good place to live?) 6-

3. How did you happen to pick this neighborhood to live in?
(What are some of the particular reasons for your moving here?) 8-

4. A. Before you moved here, was there anything you thought you might not like about living here?

Yes.	9-R*(Ask B)
No	-0
Don't know	-X

*B. IF "YES": What was that? (Anything else?) 9-

To be answered by interviewer only:
Did you hear any planes passing overhead while asking the questions on this page?

Yes.	-X
No	-Y

5. A. Do you like living here now more than you used to or not as much?

More	10-1* (Ask B)
Not as much.	-2* (Ask B)
Same	-3
Don't know	-R

*B. IF "MORE" OR "NOT AS MUCH": Why is that? 10-

---

6. Have you ever felt like moving away from this neighborhood?

Yes.	11-R* (Ask B&C)
No	-0
Don't know	-X

* IF "YES" ASK:

B. Why did you feel like moving? (Any other reasons?) 12-

C. Have you taken any definite steps to find another place?

Yes.	11-1**(Ask D)
No	-2

**D. IF "YES" TO C. ASK: What are they? 11-

Planes passed: Yes . . . . -X No. . . . -Y

7. Now I'd like to ask you a different kind of question that I think you'll find interesting. The idea is to find out how quickly one word reminds you of another word. I'll read you a list of words, one at a time, and you tell me the very first word you think of when you hear each one.

For example, if I said "sweet", you might say "candy" -- do you understand? Just say the very first word that comes to your mind.

1. ( ) bread_____	6. ( ) noisy_____	11. ( ) airport_____
2. ( ) salt_____	7. ( ) happy_____	12. ( ) sun_____
3. ( ) bother_____	8. ( ) accident_____	13. ( ) reckless_____
4. ( ) school_____	9. ( ) taxes_____	14. ( ) black_____
5. ( ) coffee_____	10. ( ) reading_____	15. ( ) danger_____

NOTE: Check the box next to any word that takes more than 3 seconds to answer.

13-	15-	17-
14-	16-	18-

---

8. That's fine, next I'll give you the beginning of a sentence and you add a few more words as quickly as possible to finish it. For example, if I said "I feel" ----- you might add "fine today" or "hungry" or however you feel.

1. On Sunday I like to_____. 19-
2. Food prices are_____.
3. The thing that bothers me most is_____

_____.
4. Airplanes are_____.
5. Summer time is_____.

---

9. Now, to get back to the main questions. Would you tell me about the noise around here -- would you say it's very noisy -- fairly noisy -- fairly quiet -- or very quiet?

Very noisy.	20-1
Fairly noisy.	-2
Fairly quiet.	-3
Very quiet.	-4
Don't know.	-5

Planes passed: Yes. . . . . X No . . . . Y

10. What kinds of noise do you usually hear around here? (any other?)
RECORD IN FULL, THEN CIRCLE AS MANY CATEGORIES AS APPLY IN COLUMN A, AND ASK QUESTIONS B-D FOR THE FIRST TYPE OF NOISE AND FOR EACH OTHER TYPE OF NOISE MENTIONED.

None. 20-0
Don't know. . . . -X

Circle Code in Col. A if mentioned	A	B. Does the __ noise bother or annoy you in any way?	*C. In what way? (What are you usually doing when it bothers you? Anything else?)	*D. Does it bother you very often, fairly often, or only occasionally?
Airplane	20-6	Yes. . . 21-1*(ask C&D) No . . . -2**(see E) Don't know -3**(see E)	22-	Very often. . . 25-9 Fairly often. . -0 Occasionally. . -X Don't know. . . -Y
Outside traffic or commercial	-7	Yes. . . 21-4*(ask C&D) No. . . -5**(see E) Don't know -6**(see E)	23-	Very often. . . 26-1 Fairly often. . -2 Occasionally. . -3 Don't know. . . -4
Other people or children	-8	Yes. . . 21-7*(ask C&D) No . . . -8**(see E) Don't know -9**(see E)	24-	Very often. . . 26-5 Fairly often. . -6 Occasionally. . -7 Don't know. . . -8
Other (specify)	-9	Yes. . . 21-0*(ask C&D) No . . . -X**(see E) Don't know -Y**(see E)	25-	Very often. . . 26-9 Fairly often. . -0 Occasionally. . -X Don't know. . . -Y

**E. If "YES" to one type of noise, and "NO" or "DON'T KNOW" to another, ASK: Why is it that _____ noise seems to bother you and _____ noise doesn't? 27-

Planes passed: Yes . . . . . X No. . . . . -

11. A. How about the noise in other places you have lived? Have any of them been very noisy -- fairly noisy -- or have they all been rather quiet?

Some very noisy.	28-1*(Ask B,C&D)
Some fairly noisy.	-2*(Ask B,C&D)
All rather quiet	-3
Never lived elsewhere.	-4
Don't know	-5

* IF "VERY" OR "FAIRLY" NOISY ASK:

B. About how long did you live (there?) at the last noisy one?

Less than 1 year	28-6
1 year but less than 2	-7
2 years but less than 4. . . .	-8
4 years but less than 10 . . .	-9
10 years or more	-0
Don't know	-X

C. What kinds of noise were there? (Any other?)

Airplane or airport.	29-1
Outside traffic or commercial.	-2
Other people	-3
Other (specify).	-4
Don't know	-5

D. When did you move away from there?

Less than 1 year	29-6
1 year but less than 2	-7
2 years but less than 4. . . .	-8
4 years but less than 10 . . .	-9
10 years or more	-0
Don't know	-X

12. A. Some people have complained about airplanes around here. How do you feel about them? 30-

B. Are there any (other) things you dislike about the planes flying around here?

Yes.	31-R*(Ask C)
No	-Z

*C. IF "YES": What don't you like about them? (anything else?) 31-

Planes passed: Yes. . . . X No . . . . Y

13. In general, do the planes seem to fly over this area very often -- fairly often -- or only occasionally?

Very often	32-1
Fairly often	-2
Occasionally	-3
Don't know	-4

---

14. A. When the planes do pass here do they ever fly very low?

Yes.	32-5*(Ask B)
No	-6
Don't know	-7

*B. IF "YES" ASK: Do they fly very low -- practically always -- fairly often -- or only occasionally?

Always	32-8
Often.	-9
Occasionally	-0
Don't know	-X

---

15. A. Do you seem to notice the airplanes more often at certain times than at others?

Yes.	33-R*(Ask B&C)
No	-1
Don't know	-2

*IF "YES" ASK:

B. When are they most noticeable?
(If Day, Evening or Night not mentioned: PROBE -- Are they more noticeable during the day, evening, or night? Record in full, then circle the categories below which apply.)

Day (6 a.m. to 6 p.m.	33-4
Evening (6 p.m. to 11 p.m.). . .	-5
Night (11 p.m. to 6 a.m.). . . .	-6
Other (specify).	-7
Don't know	-8

C. How is it that you notice them more then? (What are you usually doing then?) 34-

---

Planes passed: Yes. . . . X No . . . . Y

16. A. Do the airplane noises around here bother you more than they used to, or not as much?

Bother more.	35-1*(Ask B)
Bother not as much	-2*(Ask B)
Bother same.	-3*(Ask B)
Never bothered	-4
Don't know	-5

*B. Why is that? 36-

---

17. A. How about your neighbors -- how do they feel about the airplanes over here? 37-

B. Have you ever talked about the airplanes with them?

Yes.	37-R
No	-0

---

18. A. Do you feel that commercial air lines are very important to (name of city) fairly important, or not important at all?

Very important	38-1*(Ask B)
Fairly important	-2*(Ask B)
Not important.	-3*(Ask B)
Don't know	-4

*B. Why is that? 38-

---

19. A. Do you think the airport here has to be located close to the city, or could it just as well be built further out?

Close to city.	39-1*(Ask B)
Further out.	-2*(Ask B)
Don't know	-3

*B. Why is that? (anything else?) 39-

Planes passed: Yes. . . . . - X No. . . . . -Y

20. A. Have you or anyone in your family ever been in the Airforce or worked for the airlines or airplane industry?

Yes.	40-1*(Ask B&C)
No	-2
Don't know	-3

*IF "YES" ASK:

B. Who was that? 40-

C. What did they do?

21. A. Have you ever flown in an airplane?

Yes.	41-R*(Ask B&C)
No	-0**(Ask D)
Don't know	-X

*IF "YES" ASK:

B. About how many times?

Once or twice.	41-1
Three or four times.	-2
Five or more	-3
Don't know	-4

C. When was the last time? 41-

**IF "NO" ASK:

D. Has any one in your family ever flown in one?

Yes.	42-R***(Ask E)
No	-1
Don't know	-2

***IF "YES" TO D ASK:

E. Who was that? About how many times has (he, she) flown?

Relationship	Number of Times Flown (circle category) 1-2	3-4	5 or more	Don't know
42-	A	B	C	X
42-	A	B	C	X
42-	A	B	C	X
	42-	42-	42-	42-

22. A. How do you feel about flying? 43-

B. What are some of the (other) things about flying you don't like so much? (anything else?)

Planes passed: Yes. . . . X No . . . . Y

23. A. Have your feelings about flying changed in any way during the past year or so?

Changed.	44-R*(Ask B&C)
Not changed.	-0
Don't know	-X

* IF "CHANGED" ASK:

B. In what way have they changed?
(Do you like flying more or less than you used to?)

Like more.	44-1
Like less.	-2

C. Why is that?

24. A. Has anyone you know ever been in an airplane accident?

Yes.	45-R*(Ask B,C&D)
No	-1
Don't know	-2

*IF "YES" ASK:

B. Who was that? 45-

C. Was it a very serious accident--fairly serious -- or only a minor one?

Very serious	45-5
Fairly serious	-6
Minor.	-7
Don't know	-8

D. About how long ago was that?

Less than 1 year ago	45-9
1 year but less than 3	-0
3 years or more.	-X
Don't know	-Y

25. Who do you think is mostly responsible for <u>controlling</u> airplane noise and safety around here?

46-

47-

26. Do you think that anything <u>should</u> be done to improve the airplane noise and safety situation in this part of (<u>name of city</u>)?

Yes.	47-4(Ask Q.27-31)
No	-5(Skip to Q.32)
Don't know	-6(Ask Q.27-31)

Planes passed: Yes. . . . X No. . . . Y

27. A. Do you think it's possible for the authorities to do anything (more) about the situation?

Yes.	47-7*(Ask B)
No	-8
Don't know	-9

IF "YES" OR "DON'T KNOW" TO Q. 26 ASK:

*IF "YES" ASK:

B. What (more) do you think they could do? 48-

28. A. As far as you know, have the authorities done anything to improve it?

Yes.	48-0 *(Ask B)
No	-X**(Ask C)
Don't know	-Y

*IF "YES" ASK:

B. What have they done? (anything else?) 49-

**IF "NO" ASK:

C. Why haven't they done anything? 50-

29. A. Have you read or heard about any local groups or organizations trying to get the authorities to do something about the airplane situation?

Yes.	51-1*(Ask B&C)
No	-2

*IF "YES" ASK:

B. Who are they? 51-

C. What sort of things are they suggesting? 52-

Planes passed: Yes. . . . X No. . . . Y

30. A. Do you think you and your neighbors could help get the authorities to improve the airplane situation?

IF "YES" OR "DON'T KNOW" TO Q. 26 ASK:

Yes. . . . . 53-R*(Ask B)
No . . . . . -0**(Ask C)

*IF "YES" ASK:

B. What could you do? 53-

*IF "NO" ASK:

C. Why not? 54-

31. A. Have you yourself ever tried to help do something about the airplanes around here?

Yes. . . . . 55-R**(Ask C&D)
No . . . . . -0* (Ask B)

*IF "NO" ASK:

B. Is there any particular reason why you haven't? 55-

**IF "YES" ASK:

C. What did you do? 56-

D. Did it do any good?

Yes. . . . . 56-R***(Ask E)
No . . . . . -0****(Ask F)
Don't know . . . . . -X

***IF "YES" TO Q. 31D ASK:

E. In what way did it help? 57-

****IF "NO" TO Q. 31D ASK:

F. Why not? 57-

Planes passed: Yes. . . . X No . . . . Y

ASK EVERYONE THIS QUESTION

32. A. You may have read or heard about the closing of the Newark, New Jersey Airport last year following a series of local accidents.

Do you think it was a good idea or bad idea to close the airport at that time?

Good.	58-1** (Ask B)
Bad	-2** (Ask B)
Qualified	-3** (Ask B)
Don't know.	-4

**B. Why do you feel that way? (any other reasons?) 58-
59-

---

33. A. Do you happen to belong to any clubs, groups or organizations that take an interest in any community matters?

Yes	60-R* (Ask B)
No.	-0

* IF "YES" ASK:

B. Could you tell me which ones? 60-

---

34. Are you usually in this neighborhood during the:

	Yes	No
Morning (6 A.M. - 1 P.M.)	61-1	61-4
Afternoon (1 P.M. - 6 P.M.)	-2	-5
Evening (6 P.M. - 11 P.M.)	-3	-6

Planes passed: Yes. . . . . - X No. . . . . -Y

35. A. What is your present occupation? (Record both type of work and line of business.)

Job: _____ 62-

Industry: _____

NOTE: If respondent is main earner skip B&C and ask Q. 36 and 37.
If respondent is housewife, retired, or student, ask B&C.

B. What is the occupation of the main earner in this family? 63-

Job: _____

Industry: _____

C. Have you ever had a job outside of your home?

Yes.	63-R(Ask Q.36&37)
No	-Z(skip to Q.38)

If respondent is now employed or used to work away from home, ask Q. 36 and Q. 37.

36. A. What would you say about the noise where you (last worked) work? Is (was) it very noisy -- only fairly noisy -- fairly quiet -- or very quiet?

Very noisy	64-1*(Ask B,C&F)
Fairly noisy	-2*(Ask B,C&F)
Fairly quiet	-3
Very quiet	-4
Don't know	-5

*IF "NOISY" OR "FAIRLY NOISY" ASK:

B. What kind of noise is (was) it? 64-

C. Does (did) the noise at work bother you very much, only a little or not at all?

Very much	65-1**(Ask E)
A little	-2**(Ask E)
Not at all	-3**(Ask E)
Don't know	-4

**E. Why is that? 65-

F. How long have you worked (did you work) there?

If respondent is now employed or used to work away from home, ask Q. 37.

37. A. How about any of your other jobs — were any of them under very noisy, or moderately noisy conditions?

Yes.	66-1*(Ask B,C&D)
No	-2
Never had any other job. . . .	-3
Don't know	-4

*IF "YES" ASK:

B. What kind of noise was it? 66-

C. How long did you work there? _____. 67-

D. Did the noise bother you very much, only a little, or not at all?

Very much.	67-9**(See E)
A little	-0**(See E)
Not at all	-X**(See E)
Don't know	-Y

**NOTE: If noise did bother in Q. 36, and did not bother in Q. 37 or vice versa, ask:

E. Why is it that the ___ noise seemed to bother you and the _____ noise didn't? 68-

38. Do you happen to have a television set in the house here?

Yes.	69-1
No	-2

39. Education:

What was the name of the last school you attended?

What was the last grade or year you completed in that school?

Completed College.	69-3
Some college	-4
Completed high school. . . .	-5
Some high school	-6
Completed grade school or less	-7

Planes passed: Yes. . . . . - X No. . . . . - Y

40. Family Composition:

Including yourself, how many people live in this household? _____
Please list them for me.

Relation to head of family	SEX M	SEX F	AGE About how old is
Self	M	F	
	M	F	
	M	F	
	M	F	
	70-		71-

41. A. In general, how would you describe your health — good — only fair — or poor?

Good. 72-1
Only fair . . . . . -2*(Ask B)
Poor. . . . . -3*(Ask B)
Don't know. . . . . -4

* IF "ONLY FAIR" OR "POOR" ASK:

*B. Why is that? 72-5
-6

42. Would you say you are more nervous or less nervous than other people?

More. 72-7
Same. . . . . -8
Less. . . . . -9
Don't know. . . . . -X

43. A. Does noise seem to bother you more than it does other people or not as much?

More. . . . . 73-1*(Ask B)
Same. . . . . -2
Less. . . . . -3*(Ask B)
Don't know. . . . . -4

*IF "MORE" OR "LESS" ASK:

B. Why is that? 73-

Planes passed: Yes. . . . . - X No. . . . . - Y

44. Here is a card with a list of typical family incomes. Could you tell me the one which comes closest to the amount that all members of your family earned last year. I mean how much money did they get all together from all sources -- before taxes and other deductions?

A. under $2,000.	74-1
B. $2,000 - 4,000.	-2
C. $4,000 - 6,000.	-3
D. $6,000 - 8,000.	-4
E. $8,000 and more	-5

---

45. Do you rent or own this house? (check one and get appropriate information)

____ Rent -- IF RENT, Ask: A. How much do you pay per month, including the cost of heat, light and cooking fuel?

$ _____ 75-

____ Own -- IF OWN, Ask: B. About how much would you say your home is worth today?

$ _____

---

46. A. How long have you lived in this part of (name of city)? _____ years.

B. How long have you lived in this house? _____ years.*

*IF LESS THAN 3 YEARS ON "B", ASK:

C. Where did you live just before moving here? _____

D. How long did you live there? _____ years.

E. Do you remember about when you moved here? Month _____ Year _____. 76-

---

TO BE ANSWERED BY INTERVIEWER ONLY

47. A. Respondent's home address:

_____

B. Type of dwelling unit:

Single dwelling unit . . . . . -X

Multiple dwelling unit . . . . . -Y *(Answer C)

*C. IF MULTIPLE DWELLING: How many floors? _____.

What floor does respondent live on? _____.

TO BE ANSWERED BY INTERVIEWER ONLY

48. Economic Level:

A.	77-1
B.	-2
C.	-3
D.	-4

49. Race of respondent:

White.	77-5
Negro.	-6
Other.	-7

50. Time interview ended _____ Date _____

51. Interviewer's Signature:

78- 79- 80-

INTERVIEWER'S RATINGS

52. A. Did you feel the respondent was being frank and open in his answers?

Completely frank	1
Occasionally not frank	2 *(Ask B)
Usually not frank.	3 *(Ask B)
Can't say.	4

*B. Why do you feel that way?

53. A. Were there any special factors which interfered with the interview?

Yes.	X *(Ask B)
No	Y

*B. IF "YES": What were they?

54. While you were interviewing was it:

	Yes	No
Very windy	Y	N
Rainy.	Y	N
Cloudy	Y	N
Clear.	Y	N