Commission Meeting

of

NEW JERSEY GENERAL AVIATION STUDY COMMISSION

LOCATION: Committee Room 16
State House Annex
Trenton, New Jersey

DATE: April 30, 1996
1:00 p.m.

MEMBERS OF COMMISSION PRESENT:

John J. McNamara Jr., Esq., Chairman
John S. Penn
Abraham Abuchowski, Ph.D.
Jack Elliott
Peter S. Hines
Wesley W. Jost
Suzanne Solberg Nagle

ALSO PRESENT:

Robert B. Yudin
(representing Gualberto Medina)

Meeting Recorded and Transcribed by
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TABLE OF CONTENTS

Page

R. John Hansman, Ph.D.
Professor of Aeronautics and Astronautics
Director, International Center for Air Transportation
Director, Aeronautical Systems Laboratory
Massachusetts Institute of Technology 2

Muriel M. Shore, Ed.D.
Mayor
Fairfield Township, New Jersey 47

Joseph Catenaro
Township Administrator
Fairfield Township, New Jersey 47

Rudolph Chalow
Owner/Operator
Rudy's Airport 73

APPENDIX:

Report: "Issues in Mitigation of
Community Noise Impact"
submitted by
R. John Hansman, Ph.D. 1x

Statement submitted by
Muriel M. Shore, Ed.D. 47x

lmb: 1-79 (Internet edition 1997)

JOHN J. McNAMARA JR., ESQ. (Chairman): We are now called to order.

Abe Abuchowski?

DR. ABUCHOWSKI: Here.

MR. McNAMARA: Assemblyman Bagger? (no response)

Linda Castner? (no response)

Port Authority? (no response)

Jack Elliott is here.

MR. ELLIOTT: Here.

MR. McNAMARA: Sorry, Jack.

Phil Engle? (no response)

Senator Haines? (no response)

Pete Hines?

MR. HINES: Yes.

MR. McNAMARA: Bob Yudin?

MR. YUDIN: Here.

MR. McNAMARA: Wesley Jost?

MR. JOST: Here.

MR. McNAMARA: Jack McNamara's here.

Suzanne Nagle?

MS. NAGLE: Here.

MR. McNAMARA: Joe Odenheimer? (no response)

Jack Penn is here.

Hank Rowan? (no response)

Fred Telling? (no response)

Okay. We have a quorum here for a hearing commission -- for a hearing session of our Commission. (counts members) We have a quorum for all purposes.

Today's business will include no committee reports or Chairman's report. There will be no discussion of either old or new business. We have four witnesses scheduled. Professor Hansman from MIT, who is here, has been waiting for 26 minutes, kindly. Welcome, professor.

R. J O H N H A N S M A N, Ph. D.: Thank you.

MR. McNAMARA: Vincent Napp of Old Bridge Airport is supposed to come to testify. Mayor Muriel Shore of Fairfield Township and Mayor Nathaniel Scanapieco of Marlboro Township.

Well, we'll start right in with Professor Hansman.

Professor Hansman, do you swear that the testimony you are about to give this Commission is true, subject to the laws of perjury in the State of New Jersey?

DR. HANSMAN: Yes.

MR. McNAMARA: Dr. Hansman, would you please tell the Commission something about your education and your experience in aviation.

DR. HANSMAN: Okay. Yes, I received my bachelor's degree in physics from Cornell University; a master's degree in physics from MIT; a Ph.D. in physics, meteorology, aeronautics, and electrical engineering, also from MIT; and I'm currently on the faculty in the department of aeronautics and astronautics at MIT. I have a commercial rating at about 5000 hours in airplanes, helicopters, gliders, and that's it.

MR. McNAMARA: Have you ever given testimony as an expert in an aviation matter in any court?

DR. HANSMAN: Not in a court. I've -- not in court.

MR. McNAMARA: Have you ever been retained as an expert witness--

DR. HANSMAN: Yes I have. Yes.

MR. McNAMARA: --in an aviation matter?

DR. HANSMAN: I have been retained as a witness to aviation matters, yes.

MR. McNAMARA: And are you a tenured professor at MIT?

DR. HANSMAN: Yes.

MR. McNAMARA: And not just with reference to you, but am I correct? In determining who is to be a tenured professor at MIT, there is only one question asked, and the question would be: Is he or she the best in the world? Is that the reputation?

DR. HANSMAN: In your field, that's the reputation, yes.

MR. McNAMARA: And it's in their field?

DR. HANSMAN: In your field, yes.

MR. McNAMARA: And, Dr. Hansman, what have you come to talk to us about today?

DR. HANSMAN: I was going to give a briefing on the issues in mitigation of community noise impact from airplanes, discussing some of the basic physics in psychology of noise, and then some discussion of procedural issues.

MR. McNAMARA: Would you please proceed?

DR. HANSMAN: Okay.

I'm going to stand up. (uses overhead projector throughout presentation) All right, I apologize. MIT professors can't talk without view graphs, so -- let me-- I'd like to keep this as informational as possible and just like to give initially a briefing about some issues about noise as it is generated by aircraft and then some of the ways it's measured and then some work we've been doing in my laboratory looking at mitigation techniques.

The noise sources from aircraft, here on this slide, come from different sources. On jet aircraft, you get noise from the fan. You also get noise from the jet exhaust. On a propeller aircraft, you'll get noise from the propeller and also noise from the exhaust like you would in your car. You also get noise from aerodynamics and from vibration.

Let me just show you -- and again, if this is too basic or if it's too detailed, just let me know.

Let me tell you a little bit about engine noise. As you probably know, there are different types of jet engines. The top is a turbojet where essentially all the air goes through the core of the engine, and on the bottom you have a turbofan aircraft where significant amount of the flow goes by the core of the engine and it just goes through the fans. You tend to have more jet noise out of a turbojet. Basically, jet noise comes from the thrust of the jet coming out of the back of the engine. And in a turbofan engine, you'll have some of the noise coming from the fan and some of the noise coming from the jet.

You also get noise, as I said, from the aerodynamics. This is a picture of different noise sources on a typical jet aircraft. You'll get some

turbulent flow from the fuselage. You'll get some basically turbulence coming off the wheels, the leading edge slats, and places like the tailplane. This is some of the noise you would hear on a glider as it flew by -- some aerodynamic noise.

MR. McNAMARA: Doctor--

DR. HANSMAN: Yes.

MR. McNAMARA: --may we interrupt you as you go along with questions? Everyone should feel free to do that.

DR. HANSMAN: Yes, please do.

MR. McNAMARA: The amount -- is there a way to quantify the amount of noise that is heard from these different sources?

DR. HANSMAN: Yes. What I would like to do is to talk a little bit about how we characterize noise, because there are different ways to measure, and then please come back and ask me about the noise when -- after I do them. Let me first make sure that everybody knows what noise is. Okay.

What we think of as noise is basically pressure variations in the atmosphere. Air is expanding and contracting. In our eardrums, we feel -- here's your eardrum here -- feel that expansion and contraction of the air. And there are different ways we'll characterize it, and I'll get into that in a minute. One is how much the pressure is changing -- that's the amplitude or intensity of the noise -- and the other is the frequency of the variation.

One of the things that's amazing about human hearing is that we have a very broad sensitivity range. Okay. In depending on how you measure, you have the sensitivity of about a range of about a million. Because of that, we tend to characterize noise intensity, or the amount of power in the noise,

in a logarithmic scale. I'm sure you've heard these things. I just wanted to make sure that we are all talking on the same--

MR. McNAMARA: Don't assume that we've heard these things. We are not scientists and not all of us are scientists in these fields.

DR. HANSMAN: Okay.

Noise is typically characterized in dB, or decibels. Decibels is the logarithmic scale which is very useful for looking at very broad ranges of parameters. Don't worry about the equation. *P* is pressure. Okay, that would be the amplitude of the pressure change. And in this case, *I* is intensity of the noise which is actually the square of the pressure. So typically we look at the intensity of the noise referenced to some value. In the typical reference that people talk about when they talk about hearing-- When you say that a noise is at 60 dB or 90 dB, it's referenced to the threshold level of hearing for a human. Okay, and there is some number that people use.

Now, the decibel scale is logarithmic. So 0 dB would be the intensity reference to one. So that would be just the level at which a human could barely hear. Okay. And that goes up -- you can see that 3 dB is twice the intensity. Ten dB is 10 times the intensity. And from there, when you go to 20 dB, that's a 100 times the intensity. Thirty dB is a 1000 times the intensity. Forty dB is 10,000 times the intensity. And again, you can have negative values which means essentially you divide by the number. So minus 3 dB is a half the intensity. Minus 10 dB is tenth the intensity, and so on. Okay?

So those are the numbers that I will talk about. Just for reference, I'll give you some typical numbers. You probably can't read these, but I'll read

them for you. These are typical -- this is a curve of typical intensities, again, what people call sound pressure level and dB. The threshold of hearing is 0. A typical public park would be 40 to 50 dB. A loud party would be 70 to 80 dB. An old subway train interior is 85 or so dB. The threshold of pain is about 120 dB, and a noisy jet would be about 110 dB. That's just in the intensity. That gives you a feel for that -- and again I'll talk about that.

Now I would like to say one other thing about decibel scale. When you add, say, 10 decibels -- okay, what that's doing is essentially multiplying times the factor of 10. Okay, so you will see people throw around decibel changes very easily here, but that's actually a fairly significant change in the intensity of the noise. Again, because human hearing is such a broad range, we can tolerate that. Now--

MR. PENN: John, could I ask you a question?

DR. HANSMAN: Please, sure.

MR. PENN: Noise is really something that is like sudden. A noise that continues on at a level that-- Does your ear become attuned to it so it's no longer the same? What I'm referring to is -- see, I have a home down south, and I'm near an airport. The planes fly over and you hear them. But all day long and stuff like that there are boats on the canal. Those boats really make more noise than the airplanes, but you get used to it. So the decibel count cannot be the same.

DR. HANSMAN: Yes, I'm going-- That's a very valid point. It turns out that-- So far I'm starting from the basic physics of noise, and I'm actually going to get to talk a little bit about the psychological impact. And in fact, humans by nature are sensitive to changes. So after a long time, you will

ignore steady noises. So, for example, this fan noise of this overhead projector we've all canceled out and don't even hear it until I mention it, okay. So there are some psychological factors, and I'll actually show you some data.

One of the problems and the reason I'm going to take you through this is it's very difficult to try and quantify a parameter which represents the annoyance of noise, okay. And I'm going to show you what people use. I don't necessarily agree with it, but I'll sort of show you the standard metrics that people use.

MR. McNAMARA: John, could you put that other chart up there for a minute again?

DR. HANSMAN: Yes. By the way, if you need copies, I can get you copies of these, and they are taken out of some standard textbooks.

MR. McNAMARA: Now, here, you said the pain threshold was 130.

DR. HANSMAN: Yes. Typically about 130 decibels.

MR. McNAMARA: A jet aircraft or a jet engine is 110?

DR. HANSMAN: Yes. Again, this is just sort of a rough number. The specifics will depend on thrust and levels and things like that.

MR. McNAMARA: Okay, thank you.

DR. HANSMAN: Okay. But, remember, a difference of 10 dB is a factor of 10 in power. So it's 10 times the power. Okay.

I want to mention the frequency issues, okay. Humans can hear typically from about 20 hertz -- that's 20 cycles per second, okay -- up to 20,000 cycles per second. Different people, depending on their age and what noise they've been exposed to, have different ranges. One of the things that

we'll talk about is that your sensitivity varies over that range. It's not the same over the entire range. And, as a result, when we try to figure out how annoying or how much we really hear something, we have to think not only about the intensity of the noise, but also the particular frequencies that are involved.

There are other issues. Things -- you just mentioned some: masking, issues of duration. Sometimes there can be very annoying tones or pitches -- pitch effects. Everybody knows that it bothers you to hear the screeching on the chalkboard. Okay, that just happens to be a particular frequency that people don't like.

Let me expand on this a little bit. This is sort of showing the issue of frequencies. There is a little model of a keyboard here just to give you the feeling for human hearing. In some sense, these numbers here are the sensitivities of hearing, how well you can hear, so that there are certain notes at the low end that you don't hear as well and certain notes that you hear very well. Okay. So this is what I meant by it's not uniform over the frequency spaces -- certain tones that you can hear.

As a result, one of the things you have to do-- This is data that is used to convert how noisy a particular frequency is. So this is both the sound pressure level and the frequency. And these are what are called contours of equivalent noisiness. Okay. Okay.

Now, as I said, because we vary in sensitivity, one of the things that is done -- and you probably see this -- is something called an A-weighted decibel. And what you do here is you essentially look at the amount of power, amount of intensity of the noise, and you correct for it by how well the humans hear roughly. Okay. So this is, again, just looking at the physiology

of the ear. So sometimes you'll see the noise given to you in sound pressure level. Okay. Sometimes you'll see the noise given to you in what's called dBA, or decibels that have been corrected for the sensitivity of the ear. Okay.

Again, these are some of the physiological or psychological effects of noise. Physiologically, you'll get hearing loss above certain levels. Above 85 decibels, you can get either temporary or permanent loss of hearing depending on the frequency and how long you hear it. So if you sit next to a machine for your entire career listening to the 85 decibels, okay, you might have a problem. A lot of older pilots have this problem at certain frequencies because they sat in airplanes that were generating tones at certain frequencies. At above 120 decibels, threshold of pain -- at 180 decibels, you'll pop your eardrums. Okay, just for the measure there.

When you have noise, you can have task performance degradation, you can have difficulty recognizing speech, there's a problem with sleep interruption, and there, of course, is a problem with annoyance.

Now, the difficulty with looking at annoyance, okay, is that there is some psychological effects that come in, and let me mention a few of the sensitivity factors. First is that the humans tend to adapt to the ambient conditions. Okay, so again, I don't hear the fan noise after a while because I just adapt to it. It's not important. I sort of cancel it out.

Humans, as you noted, are most sensitive to changes, okay, and so they tend to treat the background as a noise level -- what I mean in noise, in a different issue, which is -- it's not important. And then when some other sound comes along, that's considered signaling. You have to pay attention to it. Okay.

There are significant individual differences, okay, in a particular -- there are-- Different people will be sensitive to different tones. One of the other things that we can see is hypersensitivity. This tends to be a problem in the community noise issue, because you have someone who becomes hypersensitive to say an aircraft noise or some other noise, and they can't psychologically cancel it out. It never goes below the background. So the issue of the boats going by your house -- that's in the background. You never hear it. There may be a church near your house that has a bell that goes off every 15 minutes. After a while, you don't hear it. If you are hypersensitive, you can't ignore it. Okay. And this actually leads to a lot of problems. It's what I call the frequent caller syndrome -- that you'll have someone near an airport who always hears the airplanes no matter what. And they are always calling up anytime the airplanes fly near their home.

There have been some attempts to measure this. This was, I think, out of a NASA survey, in their psychological metrics that they use to figure out how bothered people are. There's actually a lot of work going on by NASA working on the high-speed civil transport where they are trying to correlate what people perceive as noise with actually what the noise is. So they actually put microphones in people's houses, and they keep a diary of that. There have also been some experiments where they actually put speakers in their houses, and they have sonic booms go off inside their house at periodic intervals to see how much it bothers them. Okay.

MR. McNAMARA: What did they determine by doing that?

DR. HANSMAN: They're trying to determine whether it would be acceptable to overfly a supersonic aircraft over the U.S., a civil transport, and how much pressure in the sonic boom people could tolerate before it became a problem. At this point, there is still work in progress. So the difficulty is there are no black and white numbers. You know, some people who are not sensitive won't be bothered by anything. People who are hypersensitive will be bothered even if you drop a pin.

MR. McNAMARA: Who's doing that study?

DR. HANSMAN: That's at the NASA Langley Research Center.

MR. McNAMARA: Are you working with them on this or--

DR. HANSMAN: We are not working with that group on high-speed civil transport. We are working with another group at the NASA Langley Research Center looking at techniques to use advanced guidance methods like GPS to allow flight paths that minimize community noise impact. And if we have time, I will mention that at the end of the brief. Okay.

This is the percentage of people that reported activity interference from noise. This was a survey done around the Geneva Airport. So you can see this is based on something -- a noise impact index that I'll mention before -- but you can see as the noise goes up, they get more bothered by different tasks. Typically, work is not bothered too much, but rest or conversation would be bothered.

This, by the way, is a plot of data that tells you that this impact of duration-- Again, don't worry too much about the metrics by what the bigger number here says -- I'm bothered more by it. And what you see is for very short durations of one second or so-- You're really bothered or you're really

startled by the noise. As the sound goes on for longer, you can see that the impact of the noise is less. This is one of the problems with airplane flyover noise is that it's not continuous. It comes and goes. Okay, so there's a rise and fall.

MR. McNAMARA: Doctor, on the chart above that, is it correct to read that chart to say that during the daytime when people are working, it's not very unlikely that they'd be bothered by aircraft noise, unless they are engaged in another activity on that chart?

DR. HANSMAN: No, let me try to explain the chart. The noise -- NNI is the noise something index. I can't remember right now. It is a measure essentially of not only the noise, but how frequently the airplanes fly over and how loud they are.

MR. McNAMARA: Nuisance Index?

DR. HANSMAN: Yes, it may be noise nuisance index. I'll check it here in a minute. But it's again a measure of how much aircraft noise there is. This is the percentage of people in the population who've reported difficulty with those different tasks. So at a low noise index, you can see that not many people reported any problem except with sleep. Sleep is the dash line. So you see, at a low noise index you can be bothered with sleep -- or some fraction of the population. This is only 10 percent, so you might think of this as again the hypersensitive people.

At intermediate levels, what you can see here is that 20 percent of the population is bothered on several tasks: sleep, they have a hard time reading or watching TV, or things like that. As the noise levels get very high, okay, then it turns out that some people can still sleep through the noise. Half

the people can sleep through the noise. It's not a big deal. You know, at these levels, 90 percent of the people would have trouble with conversation. So that's how to read that chart. And you can draw your own inferences from it.

MR. McNAMARA: Okay, thank you.

DR. HANSMAN: Okay.

Okay. All right. The other thing -- this is just a mention of that certain tones matter, and this is actually the noise infrequency coming out of a jet compressor. And it shows you that not only do you have steady noise, but you have these peaks. These peaks are tones coming from things like the blade passing frequency and things like that. So you can get specific sort of tones that you hear, and you'll hear that. By the way, if you listen to a fan take off, you'll hear that sort of steady tone as it goes by on a large fan engine. Where on a jet, a turbojet engine, it will just be a sort of loud rumble. There is no identifiable tones.

Now I'd like to take you through-- Well, maybe before I do this, let me say that there are probably a hundred different metrics for noise, because ultimately you have to figure out how the human is impacted. You can't get into their brain. No two people sort of think alike or have the same level of sensitivity. There are many different metrics. Let me just put up this table that sort of shows you some of the different noise indices that are used in different places. Don't worry about what they are, this is just to convince you that there are a lot of them, and there is not necessarily agreement.

Just in the top *A* Scale -- is the one I mentioned before -- that's just physically the pressure variation in tone corrected for the physical response of the ear.

PNL is something called the perceived noise level.

EPNL is called the effective perceived noise level, and I'll show you how that's calculated just to convince you. That's actually the one that's typically used to characterize noise in the U.S., and there are a whole series of other ones. But again, the effective perceived noise level is the one that is used generally in the U.S. and by ICAO.

MR. McNAMARA: When you say a metric, you mean a standard of measurement?

DR. HANSMAN: Yes, if you wanted to compare two airplanes flying by and say which one is noisier, I can measure it in any of those metrics, any of those measurements. And the question is depending on how you do it. And you'll see that it's fairly complicated to do the calculation, and there is a lot of judgment that's put into the calculation in some sense that it makes it sometimes difficult to know exactly what's your mean. This is just the procedure here. You start with the sound pressure level. That's just the intensity in decibels, just the pressure fluctuation in each third of an octave band. And then you correct for the nonstandard atmosphere. You probably have noticed that on very cold days, you can hear aircraft better than you can on warm, humid days. So there's an issue there.

The next thing you do -- and again what you are trying to do is get a measure in some sense of the annoyance as you correct for the background noise. So you take out the background noise through a procedure -- and again, I'm not going to take you through the details, I'm not sure I could do it on the fly here -- but you do attempt to correct the background noise. Now, there is

a problem which is that there is not a standard background noise. Different environments can have different ones, so there's an issue there.

Then you take the corrected sound pressure level for each third-octave band, and you calculate that noisiness which is based on the sensitivity of the ear -- that was those curves I showed you before -- and you basically sum them over all the bands that you have. Okay, so you get a measure of that. When you do that, you get that number, and then through an equation, which is essentially experimentally derived, you get what's called the perceived noise level. So you get a measure of essentially how much noise is perceived. And then it turns out that after a specific tone, you can hear those tones better so you actually add some more noise for specific tones like on a fan engine. Then, you correct out -- you add a duration effect. And again, don't worry about the details of the duration effect, but it's some metric that attempts to capture how important the duration is. That gives you effectively this effective perceived noise level. And it will be quoted in dB or dBE. People think of it like noise. The same noise you would get at sound pressure level. But you can see in -- my message here is that there's a lot hidden inside those effective perceived noise levels.

Now, that isn't enough. That's a single-event noise question. Now you have to think about the community noise assessment. In the way that's done is for each event, for each flyover, you calculate that effective perceived noise level. And then, in order to correct for the fact that you get bothered by sleep for events between 10 p.m. and 7 a.m., they add 10 dB to the noise. Remember, that's like multiplying it times that factor of 10. So--

MR. McNAMARA: Why, but why?

DR. HANSMAN: Well, the--

MR. McNAMARA: I know that that's when people are sleeping and that's when they are most bothered by noise, but why? Why do they put that in?

DR. HANSMAN: I'm probably not the right guy to ask. I don't know why. I mean, I can tell you that it's a measure. It's a way to attempt to model the fact that noise at night is considered to be more intrusive than noise during the day.

Yes?

MS. NAGLE: Could it have something to do with the fact that there is no other background noise. Didn't you say that was one of the considerations?

DR. HANSMAN: Yes, but the background noise -- it may be a correction, and I'm not sure of how this -- may be a correction for problems in the background noise -- that there's less background noise.

MS. NAGLE: That's what I mean.

DR. HANSMAN: But I actually think it's driven more as an attempt to try to -- that in the perception of the people who put the models together that there is-- The same noise at night is considered to be more intrusive than that noise during the day.

MR. McNAMARA: But that's more or less an unscientific inclusion in the formula.

DR. HANSMAN: Well, let me say that all these formulas, as soon as I went past dBA, which was the physical response, that you are only marginally scientific. Everything from then on is correlation with some

observational or experimental data but is not based on definable laws of physics. You're into, sort of, psychology and sociology here. So there is nothing magic about that number in the fact that it's 10 -- just means that they threw a number in there probably.

MR. McNAMARA: But when they added 10 to that period of time, you say that did what -- it doubled it?

DR. HANSMAN: It -- no, it's a factor of 10 greater.

MR. McNAMARA: Ten greater?

DR. HANSMAN: Yes. That would be the same effect -- the first order, I think, is increasing the intensity of the noise by a factor of 10--

MR. McNAMARA: Okay.

DR. HANSMAN: --okay, during the day. So it would have the same impact. You could have a 10 dB louder noise during the day, and it would count, in the count here, the same as a 1 dB at night. Does that makes sense? (no response)

So what they then do is add up over the 24-hour period all the events. So what you would do -- this is done for an airport -- you would go to the airport. You'd look at all the airplanes that were taking off there. You'd either measure the sound pressure levels or you would calculate them. And then what you would get is a noise effectiveness forecast that would tell you how much noise you're getting at each of these points. And then what you can do is you can draw contours of these noise effectiveness plots. Okay, this is Kennedy Airport here. This was actually done in 1968, but it doesn't really matter too much.

So it allows you to look at the contours that have a fairly high noise impact. It's one of the tools that's used to figure out how you modify flight plans, etc.

MR. McNAMARA: This contour of Kennedy was done on one particular day?

DR. HANSMAN: To be honest, I didn't do the -- I mean this is out of a book. These are noise exposure forecasts. There are different ways of doing the calculation. You can do it over one day. You can also do it averaged over a year, or you can average over different periods of time. My assumption is on this particular plot is that something like a yearly average, because you can actually see all the runways are impacted. So on one particular day, you wouldn't be using all runways.

MR. McNAMARA: But primarily, what are they showing -- 1331 -- the parallels?

DR. HANSMAN: Yes, what you can see is you can see the Canarsie arrival and departure procedure. And then you can see the normal IOSs in there. All right.

This is sort of another way to look at aircraft flyover noise. You have the noise coming in. And in fact, you can look at the noise for annoyance, and you can also look at it for loudness, for ear response. And again, the ear response is the dBA. In the noise, again, you do the frequency analysis. You do the perceived noise level, and then you adjust for pure tones and durations. That gives you the effective perceived noise level. Then you do the summation over 24 hours. That's the noise exposure forecast. The

NNI is the noise and number index. So that's the number of aircraft heard within the specific time above the specific threshold.

Then there is something called a composite noise rating which is the number of operations. It considers the time of day and the seasons of the year. And then there is another one which is weighted continuous perceived noise level. Again, it-- So there is a whole spectrum of these. Just on the other side -- and again, you are welcome to copies of these if you want--

MR. McNAMARA: For the record--

DR. HANSMAN: Sure.

MR. McNAMARA: --every slide that you put up there, we will need to have a copy of.

DR. HANSMAN: A copy. Sure.

These are again other rating levels. These are the ones that don't attempt to look at annoyance. They're just looking at the physical response of the noise. So this doesn't have the psychology. So again, that's dBA and then their equivalent sound levels. Again, these are looking at them exposed over different time periods and, perhaps, seasons.

I'm sure you've probably seen these. These are the famous Stage II, Stage III noise criteria which you can see here because it's in the U.S. These are in an effective perceived noise level. The noise level varies with the maximum takeoff gross weight. And there are both takeoff limits, sideline limits, and approach limits. The takeoff -- I don't know the points but is under the takeoff. Sideline is on the side of the airport as you go by; it approaches under the approach. You can see that the levels are around on the order of 100 decibels of, again, effective perceived noise.

Excursions: you're allowed to a little bit above FAR 36 for any one point, but not a lot, and then you can get into trouble. That sort of ends the part under the basics or a description of noise. Are there any other questions on that? I'm happy to go back or clarify. (no response) Okay.

I just wanted to mention some work that we've been doing. This is one of my graduate students. Again, looking at GPS procedures to minimize community noise impact, the work we have been doing is focusing on jet aircraft. Again, the idea is to reduce noise and maintain safety -- maintain or increase efficiency. The constraints have to do with the regulations -- TERPS is the instrument approach procedure regulations -- issues of air traffic control compatibility and operational limitations.

What we do is we take a part-task simulator -- let me just show you here -- we have a flight simulation facility with an on-the-fly noise model. So what we can do is we can fly different procedures. The aircraft that's simulated in the particular noise model that I'll show you the data from is something, I think, it's actually a 747-400 like aircraft -- 747-400 like models. So we have the noise predictions. We can do the footprint. We can fly procedures, and we can fly modified procedures and look at the impact. The data that I will show you, just for simplicity, is single-event data at, I believe, A-weighted sound pressure levels. So it doesn't have the effective perceived noise level stuff.

MR. McNAMARA: Once again, Doctor, the -- when you say A-weighted, what does the *A* stand for?

DR. HANSMAN: Okay. A-weighted means that I take the sound pressure level, and I correct for the sensitivity of my ear to those tones, those

physical tones. So if I'm right at the low end at 20 Hz where you can barely hear it, that doesn't count as much noise. If you're at 1000 Hz where my ear is very good, that counts as more noise. And if you're up at 20 kHz again, my ear's not that very good up there. So what it does is it just corrects for the frequency response. You can actually buy an instrument. If you go buy an instrument to measure sound, it will have a straight scale or it will have a setting which is the A-weighted scale. That's typically what's measured when someone takes a microphone out and measures at the airport.

MR. McNAMARA: Decibels -- it reads in decibels?

DR. HANSMAN: It will read in decibels--

MR. McNAMARA: A-weighted?

DR. HANSMAN: --and it can either be A-weighted decibels or straight at sound pressure level. Okay.

MR. McNAMARA: Thank you.

DR. HANSMAN: All right. Typically, what happens or what we can do is we have the simulation in -- what you'll get-- I'll show you data from contour plots on a single event. This is probably -- I don't know what this is. This is Kennedy here, and this is probably either an arrival or a departure into or out of Kennedy. From the trajectory, it looks like an arrival.

I'm going to talk a little bit about departure procedures and a little bit about arrival. Departure -- that's where you get the most noise. You have high thrust levels. The thrust is coupled with the climb performance so there are some trade-offs you can do. Limitations are placed in our work on the lateral guidance, which way the airplanes go, and vertical guidance, which is really a management of the thrust.

To say a little bit about lateral guidance -- right now on most procedures, departure procedures are assuming either VOR or DME, or actually they're really assuming directional gyro or just heading guidance. So airplanes are typically given a vector or have a heading that they fly outbound. As a result, you can have fairly significant track variations. I'll show you an example. This is Boston-Logan. This is a departure off of 22R on Boston-Logan. This particular procedure for noise reasons requires a left turn to 090 immediately after departure or whatever heading they're given -- the base heading as 090.

Now, one of the things that you see is that there is a fairly large spread in the real tracks -- these are the tracks that are taken -- and there is a community down here that sometimes gets overflown, depending on what the wind direction is. And we did a preliminary study. One of the things that you can do with something like GPS is you can do track vectoring instead of heading vectoring. So instead of giving the heading command, you give a track command to the airplane. This is just an example of -- on the right is the heading command and on the left is the track command.

I should mention here this program that we have calculates the noise impact areas at each of the dB levels. Again, this is dBA. So you can see that the track vectoring-- Let me back up and say that it calculates the impacted land area, and you can set it up to do communities or land area or whatever. This is just doing land area. So that on the base procedure, 1.245 square miles were impacted at the 50 to 60 dB level and 1.177 are impacted at the 50 to 60 dB level when you give that vector. Basically, you can fly the slot over water better using this procedure.

We do find that the very high intensity levels you can't do much about, because the airplanes are climbing fairly quickly, and because they're climbing fairly quickly, the high intensity levels are right near the airport. And it doesn't matter which direction you turn or how early you turn, those still are right over the airport.

Vertical guidance -- basically, we all know this -- climbing at maximum available thrust to a higher altitude before reducing thrust will minimize the noise. Here's just some data. This is land-air exposed to noise over 50 dBA reduced 9 percent by reducing thrusts at 3000 feet instead of 8000 feet in this particular case. This, by the way, is if you ever fly out of Orange County as--

MR. McNAMARA: That says 800 feet.

DR. HANSMAN: Eight hundred feet, I'm sorry. You're right.

MR. McNAMARA: So if they reduce their power by 9 percent at 3000, in other words, hold their power until they get to 3000 instead of reducing somewhat at 800, there's less noise.

DR. HANSMAN: That's right. Yes. So you actually like to keep the power up and climb. And there are issues and trade-off -- and when you put the flaps up and things like that that look at the footprint. But basically, you want to get as high as you can as fast as you can, and typically, you like to climb steeply over the airport if you can do it.

On approach procedures, again, the same thing. You can do vertical and you can do horizontal. Now, there is an interesting factor: There's less thrust on approach. I mean you're not at full power, but by the nature of the types of procedures we typically use and particular to the IOS,

we force the airplanes to fly low underpower for long periods of time. And I'll show you some recommended procedural modifications there. So I'll talk both about lateral guidance and vertical guidance.

On approach, lateral guidance -- okay, typically right now, we can't have tuned approaches because in answering conditions we only have single-access localizer. So you basically have to fly the localizer. If there is a community under the localizer, they just have a problem. Using things like GPS or differential GPS you can do lateral maneuvering approaches so you can do curves or whatever in the approach. I'll show you just an example here -- this is a curved approach to Boston 22 Left as opposed to straight in. Right now we fly straight in to 22 Left where it would be possible if you have enough stabilized segment to actually fly in from over the water and do a left turn onto the final approach course.

MR. McNAMARA: What is the magnitude of the turn?

DR. HANSMAN: That turn there is about 60 degrees.

MR. McNAMARA: Thank you.

DR. HANSMAN: And again, which would be outside the limits for intercepting a localizer. There are issues of how you present a curved trajectory to pilots that we are working on. Again, this shows you the benefit of the curved approach. You can see that by doing the curved approach, land area exposed to the peak noise is reduced by over 50 percent.

Now the final thing I'll mention is vertical guidance. In fact, let me just -- I don't have a standard approach. This is an experimental approach to New York-Kennedy 31 Right. Now, what we typically do, and this is for technical reasons, right now you are required to always intercept a glide slope

from below, because the way the glide slopes work is that you can have false glide slopes above the primary glide slope due to side lopes in the antenna pattern. As a result, you always have to approach the glide slope from below. So the procedure is typically get the airplanes down low, have them intercept the approach from below. And that has the effect of spreading the noise out over a large area because you are now having to fly underpower at relatively low altitude for fairly long distances.

One of the things we are looking at are idle descents to the glide path or continuous descents to the glide path. The notion here is with GPS or some other satellite-based navigation system. You don't have the requirement -- a problem with intercepting a glide slope from above, so you can, in principle, get a benefit from that. I'll show you an example here. Here's a, again, idle descent, or intercept the glide slope from above, again, going into Boston for a right. The one on the left is the standard procedure. The glide slope from above procedure is on the right. And you can see that there's a significant reduction particularly at the relatively low noise levels. Sort of -- you can see the tail of the noise contour, or footprint, is minimized.

MR. McNAMARA: For the record--

DR. HANSMAN: Yes.

MR. McNAMARA: --is there a quantity to the amount of reduction just in case that slide doesn't reproduce?

DR. HANSMAN: Yes. It's -- the data is shown for different noise levels. I'll give you an example. At the 60 to 70 decibel noise level, which is noticeable -- it's above sort of background noise level -- on the standard approach, has a 1.82 square mile impact area. Intercepting the glide slope

from above has a .613 square mile impact area for the 60 to 70 dB noise level. So that's approximately a factor of 2. You've cut the impact area by a factor of 2.

MR. McNAMARA: Cuts it by half, you mean?

DR. HANSMAN: By half, yes.

MR. McNAMARA: Right.

DR. HANSMAN: We're looking at-- This again-- Here's some data on the noise impact. This is area exposed over 60 decibels dBA, A-weighted decibels versus the approach procedure. Again, this is starting the descent from 3000 feet. The nominal procedure's here, and then a single segment 3-degree glide path from 3000 feet is shown next to it. What we call a dual segment, again where you do initially a 5-degree descent intercepting a 3-degree glide path at a 1000 feet, is shown there. And then, again, a 5-degree to 3-degree intercepting at 500 feet is shown here. And then a single 5-degree glide path all the way to the threshold is shown there. So you can sort of see the magnitude of the noise impact.

Again, this is just one metric. To do this really correctly, you need to do a specific site survey and decide where the people are by using a combination of the lateral and vertical--

MR. McNAMARA: On the far right, I can't read the caption. Is that a normal procedure?

DR. HANSMAN: Yes, it's the nominal procedure.

MR. McNAMARA: Nominal.

DR. HANSMAN: That's the standard--

MR. McNAMARA: ILS?

DR. HANSMAN: ILS procedure--

MR. McNAMARA: With the standard vectoring into the--

DR. HANSMAN: Vectoring in and intercept from below--

MR. McNAMARA: --into the glide slope

DR. HANSMAN: Yes. And I believe that this was an 1800-foot level off -- coming in at 1800 feet and then beginning your descent on the 3-degree path. So right now we are in the middle of-- There's some issues here, let me just mention it. It turns out you can see that you get the best descent at a 5-degree glide path. We've actually done some informal experimental runs with a MD-11 attempting to fly these into Kennedy, basically, the 2-segment approach where you intercept from above under visual conditions, and the pilots report that this is actually difficult to fly. So there's a safety issue here where you have to decide how low you want to stabilize. And my guess is we'll probably, right now-- Airline pilots typically won't accept unstabilized conditions below 1000 feet, so we'll probably stabilize at 1000 feet. Right now that's a research issue that we're flying line pilots on right now. One last thing--

MR. McNAMARA: When you say stabilize at 1000 feet, the normal glide slope runs somewhere around 2.5 to 3 degrees?

DR. HANSMAN: That's right.

MR. McNAMARA: You can be stabilized on a 5-degree glide slope. When we're in a helicopter, you'd be well stabilized at a 10-degree glide slope.

DR. HANSMAN: That's right. The problem is that typically jet aircraft haven't been designed to be able to rotate out of a 5-degree stable glide

slope. So you actually have a hard time landing something like a MD-11 out of a 5-degree glide slope. That just was not in the design spec when they designed the airplane.

MR. McNAMARA: These are transport--

DR. HANSMAN: Typically--

MR. McNAMARA: --category aircraft?

DR. HANSMAN: Yes. Now, for general aviation aircraft or other aircraft, there's actually no difficulty flying something like a 5-degree, 6-degree glide path. So, I think, that that's another thing that we haven't specifically looked at that you could consider which is having steeper segment--

MR. McNAMARA: General aviation--

DR. HANSMAN: General aviation approaches procedures--

MR. McNAMARA: --procedures.

DR. HANSMAN: Yes. And that's something that's again enabled -- once you get to GPS procedures -- because you don't have to have a single glide path. You can basically specify or even dial in a procedure with different glide paths. Again, this just shows a prototype approach chart for the 1000-foot intercept. So you fly 3000 to a wait point, and then you do the descent down to 1000 feet where you intercept the glide path.

There is some safety data that's out from the Flight Safety Foundation that does say, in fact, that you like to have stable final descent guidance into approaches. They did a worldwide study of approach accidents, and what they found was that the most dangerous conditions are actually very shallow nonprecision approaches, that what happens is nonprecision approaches where the final descent path is less than 1 degree have a

significantly higher safety or accident record. The presumption is that pilots are descending. They have a hard time not going down, and they have a tendency to go for the wrong set of lights. If you spend a lot of time on a nonprecision approach -- if it's effectively a very shallow angle -- you have a tendency to get down and fly level and then, perhaps, go after the wrong target. So there's some other advantages of having a steep approach.

One last thing that we're doing -- this is a modeling technique that we use. If you have a particularly sensitive noise site, one of the things that you can do is that you can create a way to essentially identify protective zones around that, what we call exclusion zones. And again, this is more of a computational technique that allows you to say, "Okay, I have a school or something here that I want to protect" -- maybe it's the White House. Then what you do is you can identify mathematically a model that allows you to predict where you shouldn't fly to have that noise impact in that zone. So again, it's another study being done by one of the students.

That's sort of what I had at the prepared level of view graphs. If there are any questions or whatever, I will be happy to answer or expand.

MR. McNAMARA: You were going to address the difference or quantifying the different noises that come from an aircraft, engine noises versus vibration noises, and so on.

DR. HANSMAN: Yes. Let me go back -- I won't try to dig for the slide. The biggest noise source from aircraft is typically engine noise. The engine noise comes from two primary sources--

MR. McNAMARA: Are you talking about a jet aircraft?

DR. HANSMAN: Yes. We'll start with jet. It's similar for a propeller aircraft. You get noise from the fan. In a propeller aircraft that would be noise from the prop. And you get noise from the exhaust gases going out of the engine. In a piston engine, that would be coming out the muffler. In a jet engine, it's coming out the back of the engine in the jet. That noise comes -- let me back up.

The fan noise comes from several factors. One is turbulence that's created by the fan. And on a propeller, sometimes you'll get supersonic effects at the tip. So some aircraft which have very fast propellers, you'll actually hear them when they take off. They have sort of a blat when they come in I think. Well, I won't give specifics, but you'll recognize that's an airplane that's under high thrust. You can actually hear the tips going supersonic, and that's a very directional noise. So when the airplane takes off, goes by you, you'll sort of hear a very sharp blat as it comes by. The exhaust noise is very similar to the exhaust noise you would have from a car -- you are probably familiar with.

On the jet, the fan noise tends to be radiated both forward and backward off of the engine. And again, if you've been near an airport when you hear the sort of tones -- if you listen to a modern airplane with a high bypass ratio engine, with a big engine, you'll hear the fan noise and the tones. They have big fans that tend to have more fan noise than jet noise.

On an old airplane, a DC-8, you know, a KC-135, or something like that, where it will sort of have a sharp rumbling noise, that's jet noise. That's noise coming from the exhaust gas coming straight out the back of the jet. And of course, when you have an afterburner, you have even more of that. That noise is the noise that people are able to suppress by adding diffusers or

mixers in the back of the engine. So these hush kits that people put on engines are typically put on to reduce a lot of that jet noise. What that noise comes from is you have a high-speed jet of air coming out the back of the engine with relatively low-speed air, and you create turbulence on that boundary. And that is essentially what creates the noise.

MR. McNAMARA: And how does the hush kit hush it?

DR. HANSMAN: What it does is it mixes the air. So instead of having a very sharp speed difference, you have a gradual speed difference. So the air mixes smoother, and you don't quite get the same kind of turbulence.

MR. McNAMARA: Is there a cost in thrust?

DR. HANSMAN: There is some, yes, but not too bad. It's mainly just in the installation costs and design costs. And again, the modern airplanes, the high bypass-ratio engines that we have in essentially all modern jet transport aircraft, are significantly better in noise because what they're doing -- the bypass ratio-- Is everybody familiar with what the bypass ratio is? Let me go to one of the figures to show that.

MR. McNAMARA: To show bypass ratio?

DR. HANSMAN: Yes.

MR. McNAMARA: Simply, it's the amount of air that goes around the outside of the jet engine as through the core.

DR. HANSMAN: Yes, this is a turbofan engine. In a turbojet engine, all the air that comes into the engine goes through the core. The core is where the burning occurs. So you compress the air, you burn it, and then you send it out through a turbine. And so all the air goes through the core. So you have just primarily jet noise coming from there. And then some of the

older 707 design had some bypass. Typically the bypass ratio was one or two. And modern engines will have bypass ratios of five or six. So five times the air goes through the fan as goes through the core. So I have much less jet noise, but I have more propensity for fan noise. But fan noise is not as intense as jet noise.

This shows you actually the radiation patterns and the different components from the engine, if you can see it. This is actually time. So the first noise you hear is the fan noise. Then you might hear the compressor and turbine in the core. There is some airframe noise which is at a lower level you see here. And then when the airplane goes by you, you hear the jet noise. So again, in your model, if you can hear an airplane taking off at you, you can remember the fan noise and, when it goes by your hearing, primarily the jet noise. Does that answer your question?

MR. McNAMARA: Yes, thank you.

Doctor, given what you've just testified, given us testimony about, can you make comments or is it true to say that the same man will find the same noise from an aircraft not just in one situation and not not just in another situation?

DR. HANSMAN: Yes. For example, if the background noise is very loud, if they are working next to some noise force or something like that, they may not even hear the overflight noise. If you're sitting quietly in the wilderness, that will be a significant change. So the exact same noise, same tones or whatever, can be perceived very differently.

MR. McNAMARA: And given the same situation but two men or women in it, one can find the noise to be noxious and the other will find it not to be?

DR. HANSMAN: Yes. Absolutely.

MR. McNAMARA: And given the same location, the same person can find it to be noxious during the evening. They say with the same ambient noise, the same ambient noise background, the same person can find it to be noxious at a particular time of day, but not at another?

DR. HANSMAN: Yes. And I'm not sure exactly what those are -- which times of day. But depending on what they're doing, and what their activities are, and what they're mental state is, they can take the same noise at different times of day or even the same time of day and feel different impacts from the noise.

MR. McNAMARA: And finally that a person who you referred to as being hypersensitive to noise, for perhaps reasons other than noise -- for instance, the classic mother-in-law situation. If a person is bothered by the mother-in-law, then whatever noise the mother-in-law makes, they will be hypersensitive to that. Not because she makes an abnormal amount of noise, but just because she's the mother-in-law. That's a situation where the same level of noise could be distressing in one circumstance but not in another. If the mother-in-law, for instance, and the mother make the same amount of noise, one could be found to be noxious and the other not?

DR. HANSMAN: Yes. In some sense, you can think of it as the fact that you can have a psychological increase in the sensitivity, or what we

call the gain or amplification -- where for certain types of noise or certain things which may be driven by other factors--

MR. McNAMARA: Have you found any populations or examples where a population was sensitized to aircraft noise through propaganda or publicity against aircraft noise where that sensitized them to noises they weren't sensitive to prior to the propaganda?

DR. HANSMAN: I don't know about that. I don't have experience in that. I do have experience with, again, what I would consider to be hypersensitive individuals who have a very -- what's the right word? -- are bothered by the noise in the airport, and once they sort of get triggered, then they can't ignore any noise from the airport even if it's significantly lower. So again, this is the hypersensitivity coming in. I think if you go to experience-- If you talk to airports around the country, you will find that each of the airports will have specific individuals that they can name to you that they would consider to be hypersensitive individuals. So it's a standard phenomenon. At the same time, you would have people who are actually experiencing much high noise level not complaining at all or not bothered at all.

MR. McNAMARA: Do you know how many years NASA has been studying aircraft noise -- aircraft and airport noise?

DR. HANSMAN: The study of aircraft and airport noise has gone up and down over the past 20 years, but I believe that they've been studying it for over 20 years -- 25 years. There are particular things that they are interested in, for example, helicopter noise which we haven't talked about. There are some other noise sources from helicopters that can make them

difficult -- I should have mentioned that they tend or can -- some helicopters can have low-frequency noise which can be particularly disturbing. It actually can be subaudible, but you can feel it in your body. And you'll get blade flap noise and blade vortex -- interaction noise where the wake from the helicopter hits other wakes or parts of the helicopter. And you'll get noises there. So those have also different noise signatures.

MR. McNAMARA: And has MIT been consulting with NASA throughout the course of their noise studies, or has MIT come to the aircraft/airport noise study at a more recent time?

DR. HANSMAN: The work that we've been doing has only been over the past two or three years. There was work done at MIT in sort of fundamental sort of physics of noise generation. Probably, again, in the 70s. I didn't do that work, but there are other people that did that work. I would also refer you to a fairly comprehensive book on aircraft noise written by Michael Smith. It's called *Aircraft Noise* out of the Cambridge aerospace series. And it's a fairly nice, comprehensive book which describes both the noise and the different mitigation techniques.

MR. McNAMARA: Is Mr. Smith affiliated with MIT?

DR. HANSMAN: No. He's affiliated with Rolls-Royce engine division or he was.

MR. McNAMARA: Those were my questions. Now for the Commission.

Mr. Elliott?

MR. ELLIOTT: In reference to the question of noxious noise versus nonnoxious noise which you brought up, Phil Boyer, the president of

the Aircraft Owners and Pilots Association, has a presentation which makes that very clear. In this presentation, he plays music, and he has video of a noise-monitoring machine recording the decibels of this music. I believe he was playing Bach. It was rather loud, and it was very pleasant. He didn't use the terms noxious and nonnoxious. He said there is pleasant noise and unpleasant noise. Then he turned off the music. And he turned on the wailing of an emergency vehicle, showed the noise decibel reading, which was exactly the same, and you wanted to stand up and scream. It was a very graphic illustration of the fact that the same noise level can, on one hand, be pleasant and, on the other hand, very irritating. I've sat at symphony concerts where you thought that the full orchestra -- full volume -- was going to blow the roof off, but it was not unpleasant. If an airplane made half that much noise, I would think it would be unpleasant. That, I present, is a good illustration of the fact that there is a difference between pleasant and unpleasant noise even at the same decibel reading. Thank you.

MR. McNAMARA: Mr. Yudin.

MR. YUDIN: I'll give you the impossible.

DR. HANSMAN: Okay.

MR. YUDIN: Educate me, in just a few minutes, on any information you have between the difference between propeller noise -- noise created by reciprocating aircraft in jets?

DR. HANSMAN: Okay. Well, there are a couple of things. First off, the propeller, typical in a jet fan, is constrained. There is a shroud around it. Where in a duct -- where in a propeller, you don't have that duct. So as a result, you tend to get more energy radiated, more noise off the side on a

propeller than you do with a fan. One of the things that you hear is something we call the blade-passing frequency. Every time a blade comes by -- you know, it's whack, whack, whack, whack, whack -- you can hear it on a helicopter. On a propeller engine that speed is faster. A helicopter rpm is 700 or 800. A typical engine rpm is 2500 rpm. So you can't necessarily distinguish the individual blades, but in fact, you're hearing those blades come by.

On a fan engine, there are many more fans, so the blade in there is turning faster -- so the blade passing frequency is even higher. As I said on a propeller airplane, you have the propeller, you have the engine exhaust, and then you may have some aerodynamic noise. Again typically that's lower than that. Although some times you will hear a whistle. For example, Piper Arrow. When you hear a Piper Arrow fly by, you'll -- with the landing gear down -- and you'll hear a whistle coming from -- off of the landing gear, that would be an aerodynamic noise.

The intensity levels tend to be lower on a propeller airplane than on a jet airplane by a fairly significant amount. On the other hand, the jet aircraft will climb faster. One of the biggest things that you can get for noise suppression is to just get distance between you and the receiver -- between the source and the receiver. So because jet aircraft have fairly sharp climb gradients, often they get up high faster. I don't know if I answered your question clearly.

MR. YUDIN: Well, I think what you said is that while propeller-driven aircraft is not as noisy as a jet, the jet, because of its capability of fast climb overall, would create less noise for surrounding residents.

DR. HANSMAN: Here's one way you can think of it -- which is the jet will give you significantly more noise right at the airport because they're real loud when you are close to them. However, 10 miles away from the airport, the jets are up pretty high. They're not going to have as much impact on the -- or maybe even 2 miles away. In the piston engine airplanes, they may not be climbing as fast, so they may still be down fairly low a few miles away from the airport.

MR. YUDIN: What distance, because you just touched on the 10 and then you went to 2 -- with a jet, at what distance, when it initially takes off, what distance horizontally would the noise be less?

DR. HANSMAN: What's your definition of less?

MR. YUDIN: Well, for the -- I think the definition of an average resident, not someone who is supersensitive because nothing will satisfy that individual.

DR. HANSMAN: That person, yes.

MR. YUDIN: But, an average person, at what point does the jet become less?

DR. HANSMAN: Let me show you a picture that I think will, hopefully, help. This is the only departure case I have. Don't hold me to these numbers, because I'm not sure about the airplane involved. This is either 747-400 like airplane or it's a 727. This is the Logan Airport here. That distance is about 10,000 feet, so it's about 2 miles. This is the 110 to 120 dB contour. You can see that that's just on the runway itself and on the sidelines of the runway. This is the 90 to 100 dB contour on climb. You can see that it's in the area right around the runway. It goes a little off the end of the runway,

and it's right under the track of the airplane -- out about a mile and a half. Just for purposes of illustration, 80 to 90 dB, here, is this darker green. It goes out about 3 miles--

MR. YUDIN: Okay. Let me interrupt you for a second now.

DR. HANSMAN: Sure.

MR. YUDIN: This is commercial.

DR. HANSMAN: Yes.

MR. YUDIN: And we're not really concerned with that. And you said about 2 miles with this kind of aircraft. With corporate jets, do you have any knowledge of any distance with them? Because we're general aviation, we're really not--

DR. HANSMAN: Corporate jets will have similar climb profile, will be similar depending on which type of -- corporate jets actually span performance-wise a much bigger range. You can have older jets which are barely Stage II compliant. And then you can have the new ones which are fan jets which are very quiet. So there's a real spread, but I would expect the contours would be similar on average. And again, you have to look at case-by-case basis, airplanewise on that. There's much less uniformity in the corporate fleet than there is in the commercial fleet.

MR. YUDIN: So you would still hold to the 2 miles.

DR. HANSMAN: On the order of 2 to 3 miles, yes.

MR. YUDIN: Now, would that be the case with the newer corporate?

DR. HANSMAN: The newer corporates would be better, again, because they'll tend to have more climb performance and they'll tend to be quieter enginewise. Okay.

MR. YUDIN: Okay. Thank you.

MR. McNAMARA: Mr. Hines?

MR. HINES: If I could, Doctor, with all this research and all these studies and graphs and what have you, we can measure all the noise we want, but where is this information taking us to technology-wise, as far as the industry is concerned, particularly, say, with the general aviation side of aviation?

DR. HANSMAN: I think that technology's taken us a couple of places. One is new airplanes are clearly getting quieter. I mean, they are better. One of the problems is that we're still flying a lot of older planes. So, you know, there is an issue of what's the cost to replace the airplanes.

I actually think that the GPS technologies, the navigational technologies, offer a lot of promise because we can at least know what our noise impact is, and we can control where we put down the noise. Now that's actually going to create a problem because now you suddenly have to decide where you are putting the noise consciously as opposed to "Jeez, it just happened." I think it also creates an opportunity in places where it's pretty clear where the best place to put the noise is -- like when you have an approach down a river or something like that. That's pretty straightforward. And areas where you have communities all the way around the airport, it's a more difficult problem.

There will never be an airplane with no noise, but the manufacturers recognize that noise is a constraining factor in their ability to operate. The manufacturers tend to respond to the requirements of the users. So if an airline comes to them and says, "Hey, we have to operate this airplane at this noise level out of this airport, and we really want to operate out of this airport," they can trade off other things on the design. They may be trading off performance, amount you can carry, or other factors to minimize the noise. But you can't get a zero-noise airplane, at least, not a jet airplane, maybe electric.

MR. HINES: We're seeing that corporate jets are getting quieter. That's becoming quite apparent, but are you aware of anything happening as far as the piston side of the industry?

DR. HANSMAN: There's some work that's been done; in fact, there was some work done at MIT. I was involved to minimize tow plane noise. We had support from the FAA to do this. We did two things. You can reduce the noise from the propeller by reducing the load of the propeller. So what we did in this particular case is we went from a two-blade prop to a four-bladed prop. It reduced the blade loading on the prop. We also put significant mufflers on the engines, and we were able to get a significant reduction. I think it was like 10 dB reduction in the tow plane noise. This was used in places in rural areas where there's no background noise, so people weren't particularly sensitive to it. So you can do some things there.

MR. HINES: Are they doing it though, sir?

DR. HANSMAN: It has been applied in some areas, but not--

MR. McNAMARA: There is an STC for that kind of conversion for some tow planes?

DR. HANSMAN: No. It turns out that the individual who did it and built it decided not to go for an STC because they didn't want the liability exposure I think. But technically it's understood.

MR. McNAMARA: Can be done.

DR. HANSMAN: Yes. Can be done.

MR. HINES: I know over in Germany they require some pretty awful looking mufflers on some aircraft to get the noise level down.

DR. HANSMAN: Sure.

MR. HINES: We don't seem to have gone in that direction in this country.

DR. HANSMAN: I would work the propeller problem before the muffler problem. The muffler does reduce the thrust, so you get a performance decrement from that. And again, now you get into the trade-off. Is it better to climb and get high, or are you going to put a muffler on, keep me down lower and closer to the population?

MR. McNAMARA: Scimitar blades -- is that--

DR. HANSMAN: It's a similar thing. Again, you are trying to minimize the loading. You're trying to reduce the amount of lifting carried at the tips of the propellers where you are making the most noise.

MR. McNAMARA: Are there other questions over here?

Mr. Jost.

MR. JOST: I was going to ask the same question he did about the exhaust and the propeller. But is the information on the exhaust, on the

mufflering, and the propellers being made available to the manufacturers so that they don't -- maybe they don't think to come to MIT to ask for that -- but are the papers being distributed to reduce the exhaust? A motorcycle going down the road makes a lot of exhaust noise. And a Saratoga, which I had for quite a while, made a lot of noise on takeoff. And I would have thought that maybe with some blade technology and maybe improved mufflering without diminishing the power of the aircraft could reduce that somewhat.

DR. HANSMAN: Yes. The problem is-- I think it's sort of a cost trade-off issue which is, sure, you can go to a three-blade prop on your Saratoga and that will reduce the noise, and you go to a four-blade prop. Unless you have some strong compulsion to do it, do you really want to spend the $10,000 it would cost you to reprop the airplane? So that's sort of the issue. That's what I meant by the fact that there's a lot of older airplanes flying out there flying. I mean, you are always in this sort of catch-22. What's the economic incentive to equip on the airplane? Now, on the airline side in certain airports, you know if you don't meet certain noise requirements, you can't fly into the airport. They have economic incentive to do it.

I don't think the general aviation community can tolerate much. They don't make enough money to justify big investments. The question then comes as what can you find as a relatively inexpensive investment. That's one of the reasons why, I think, the things like the GPS has a lot of problems because you will equip for other reasons, and then you can take advantage of that equipment to minimize the noise, whereas going and reproping your airplane is a harder thing to justify.

MR. JOST: The propeller makes significantly more noise than the exhaust would be on IO-540, for instance?

DR. HANSMAN: You have to-- They're roughly comparable, my guess is, on takeoff. You're getting more out of the prop on takeoff. You're probably getting a little bit more out of the engine on approach.

MR. JOST: It would seem to me that the exhaust problem would not be a significant change because it's a difference in manufactured -- a few more baffles or a little more size or something like that.

DR. HANSMAN: The exhaust -- all those airplanes are muffled. There are mufflers on those airplanes.

MR. JOST: Yes, I know.

DR. HANSMAN: We're talking secondary mufflers here. For example, in the tow plane there were secondary mufflers that went all the way to the tail of the airplane. The reason why it was worthwhile there was those airplanes were climbing under full power all the way to whatever their release altitude was. And it was actually in a setting with a valley -- this is something to talk about -- but the valley will actually focus the noise. So that if you are flying the middle of the valley, the community was upset. So they were doing everything they could to minimize the impact. So again, it's like all design -- your aircraft designs are trade-offs that you are looking at. Will that design change buy its way onto the airplane? Could you sell an airplane with that? It's an advantage, and maybe we're coming to an era where you can, I don't know.

MR. JOST: Thank you.

MR. McNAMARA: Questions? (no response)

I have two, well, just one in fact. We were talking about the GPS approaches, and you had mentioned that there was an air traffic control consideration in trying to have the higher performance approaches. Does air traffic control have a problem? Will they have a problem if there were a change of procedure to go from say 3 degree approach as to 10 degree approach, as for general aviation and especially general aviation jets -- corporate jets? Just ATC.

DR. HANSMAN: Yes, ATC. I don't know. It depends on their -- it probably will be site specific. However, there is, as you know, probably a general willingness within air traffic control to consider new techniques as this free flight concept and to other techniques. So I think to the extent that they can do it, there is an integration issue that they have to figure out how to integrate the airplanes on different approaches.

MR. McNAMARA: Equipment-wise there shouldn't be any -- I mean if the DGBS is in place, there shouldn't be any equipment problem or hardware problem.

DR. HANSMAN: No, there isn't an equipment problem, but the difficulty -- consider the final approach controller who now has to integrate two approaches to the same runway. So he or she has some scheduling issues that are different from what they used to have before. So now--

MR. McNAMARA: Well, that's if they're doing that. All I'm talking about are noise abatement procedures through steeper approaches and steeper departures. All other things being constant should, should ATC have a problem with that?

DR. HANSMAN: No, if they don't mix the procedures. But it may be difficult for them, if you mix the steep and nonsteep approach.

MR. McNAMARA: I see, if they have an ILS and DGPS working at the same site--

DR. HANSMAN: To the same runway, yes.

MR. McNAMARA: --or they are handling airline traffic at the same time there handling general aviation traffic.

DR. HANSMAN: Yes, that was the issue. If you had to mix them -- but if they are separate -- a controller can't tell the difference between the 3 degree and the 6 degree approach from their screen except for the altitudes. But it's procedurally not much different.

MR. McNAMARA: Thank you very much.

Are there any other questions for Dr. Hansman?

Dr. Hansman, we can't thank you enough for taking your entire day today to come down in this bad weather, take your time, and help us -- give us this very valuable testimony. On behalf of all of us, a very heartfelt thanks.

DR. HANSMAN: Okay. Thank you.

MR. McNAMARA: Is Vincent Napp here? (no response)

Is Mayor Muriel Shore here? Ms. Shore, would you please come forward. If you have somebody here to council you or to help you, please have them come forward, too.

Now for the record, you are Mayor Muriel Shore of Fairfield Township.

MAYOR MURIEL M. SHORE, Ed.D.: That's correct.

MR. McNAMARA: And with you?

DR. SHORE: Is--

J O S E P H C A T E N A R O: Joseph Catenaro, Township Administrator, Fairfield Township.

MR. McNAMARA: And do you swear that the testimony you are about to give this Commission is true subject to the laws of perjury in the State of New Jersey?

MR. CATENARO: I do.

DR. SHORE: I do.

MR. McNAMARA: Do you have some prepared statements to make?

DR. SHORE: Yes, I do.

MR. McNAMARA: Do you have them in written form?

DR. SHORE: Yes, I do.

MR. McNAMARA: Would you be kind enough when you're finished to give a copy to the court reporter and, please, proceed.

DR. SHORE: Thank you very much.

It's a pleasure to be here. I appreciate the opportunity to provide testimony to you, The New Jersey Aviation Study Commission, concerning Fairfield's relationship with the Essex County Improvement Authority, owners and operators of the Essex County Airport in Fairfield, New Jersey.

Historically, the relationship between the township and the airport was not a good one. In the 1970's, when Curtiss Wright decided to sell the airport property, considered prime real estate in Fairfield, the township originally had an interest in purchasing it. When it appeared the township

could not afford the purchase price of $8 million, there was considerable, legitimate concern regarding who the purchaser would be, how the property would be used, what future plans there might be to expand airport operations, and the resultant loss of ratables to the township. When the county announced its intent to purchase the property, Fairfield's concerns escalated into a widely publicized and politicized confrontation.

In an effort to resolve township concerns, Essex County agreed to enter into an agreement with Fairfield based on certain conditions including prescribed annual payments for in lieu of tax payments, designation of property zones with prescribed restrictions, an identification of the statutory authority of the airport and the township regarding future development plans, and creation of an airport advisory committee. This contract was in perpetuity.

From the time the agreement was executed in 1976 until 1988, the Essex County Improvement Authority lived up to the agreement. In the later half of 1988, ECIA stopped making payments, and Fairfield ended up with an eight year period of expensive litigation and a fractured relationship with the improvement authority, resulting in negative perceptions of the airport. Fairfield taxpayers were outraged that the township was obligated financially to continue to provide police, fire, and health services to a public body that was not meeting their financial obligations to the township.

I will not detail the frustration of the Fairfield taxpayers, but I will tell you that public demonstrations were waged at the airport by concerned citizens from not only Fairfield, but from surrounding towns as well. Communication all but ceased to exist between the airport and the township.

This controversy became the subject of every political campaign in the township. No relief was provided by the then county executive, Mr. D'Alessio, or the Essex County Board of Chosen Freeholders. At one point, in frustration, Fairfield withheld a quarterly payment of taxes to Essex County to send a message. Essex County answered with a fine of $11,000 instead and no offer of help.

This history is important for you to understand and consider when evaluating different types of entities owning and operating general aviation airports within the State. Problems such as those I described are worthy of your consideration and deliberation in making recommendations for the preservation of the airport system in New Jersey.

Fortunately, things have changed for the better. Just this month, an end to this eight-year dispute occurred, though thousands and thousands of taxpayer dollars were expended in that eight-year period. While I say expended, the taxpayers of Fairfield would say wasted. When I took office in January of 1995, I was determined to do everything I could to get this issue resolved. With the help of County Executive Jim Treffinger and membership changes on the ECIA Board of Commissioners, new relationships were forged which resulted in a commitment to enter into a settlement agreement. That settlement agreement was unanimously approved this month by the Township of Fairfield, the Essex County Improvement Authority Commissioners, and the Essex County Board of Chosen Freeholders. It is now before the FAA for their approval. As soon as that approval is received, ECIA will begin their payments to Fairfield on a scheduled basis.

Along with this resolve is mutual interest in forging a true partnership between the airport and the township. Fairfield has long been concerned about the location of the airport, as it sits dead center between a regional high school of four sending districts and an elementary school in Fairfield. Safety is a big concern of the residents who would not want to see the airport expanded. One would have to visit the airport site to see the unusual close proximity to schools that I have cited. By current standards today, no planner would recommend putting such an airport in the center of a populated community like ours. However, the airport was there before the township sprung up around it. Thus, you can now better appreciate why the community is necessarily concerned about future development and expansion of airport traffic.

A very big issue for residents is noise. Several home owners complain about not being able to sit in their backyards and have a conversation due to the noise. When Curtiss Wright operated the airport during the war years as a manufacturing and test site -- this use, however, no longer exists and is being substituted by other aviation activities.

There is also concern about the amount of recreational flying activity at the airport. The number of touch-and-go landings are a subject of resident worries. There are a number of flight schools, including a helicopter school operating at the airport, which residents worry about due to the number of amateur pilots utilizing the airport. Residents would identify safety as a number one concern of theirs.

Also, the control tower is not manned 24 hours a day. This is another concern for residents as the airport operates 24 hours a day. Residents

worry about late night traffic and the degree to which airport security exists to monitor such traffic.

Residents have often recommended that they receive some type of tax credit as an offset for the environmental disturbance they must live under due to airport activity and related impacts. And as mayor, I agree and urge your Commission to consider this.

I am very committed to create a positive relationship with the airport authority, and I believe the present improvement authority commissioners are equally committed. Within the past five years, the physical airport property has dramatically been improved creating a real enhancement to the township. Tie-down areas have also been improved and expanded. A new hanger building has been erected, and the administrative offices has been relocated from a run-down looking building. As the airport completes its renovation plan, the township benefits from the new, modern look and aesthetically positive environment.

I believe it is important for you, the Commission, to require the establishment of airport advisory committees to exist between airports and their host community and/or communities. Coexistence issues are important and constructive vehicles for officials and residents to offer input and provide recommendations which are essential. These advisory committees are very valuable.

I would also recommend that you undertake a complete evaluation of all existing airports in New Jersey and determine if all are suitable to meet the State's goal for advancing economic growth in New Jersey. Some airports, such as the one in Fairfield, may have only limited benefit. The State needs

to rate the opportunities provided by current airports, perhaps determine which airport sites provide greater opportunities, and evaluate the feasibility of building new airports in more feasible sites capable of meeting long-term needs.

Fairfield residents do not want a Teterboro Airport in our community. Our geography, density, and proximity to residential and commercial sites would not make sense for any airport expansion.

In conclusion, the governmental relationship with the Fairfield Airport is changing and will become even more positive in time. We have been assured that the airport has no intent to expand its current operation. If that assurance should change, I can tell you most assuredly there will be a political uprising in the community. I caution policy makers over utilizing the inherently beneficial use cliche. My sense is that public entities have had enough of a no say relationship, especially when they are paying the bills.

I assure you, the Commissioners, that we in Fairfield will cooperate with you in any way possible. We understand your charge, and we seek to work together with you in planning the future of general aviation airports.

And thank you for the opportunity to provide this testimony.

MR. McNAMARA: Thank you very much. Speaking as one Commissioner, agree with you entirely about having airports advisory committees. I've noticed for one that those airports that have them -- no matter how difficult their circumstances are, their location in the town or, in the case of Teterboro, their location in five towns -- an advisory committee seems to be the mechanism that causes these relationships to work, and it causes the rancor that can otherwise arise to not come to life.

I'd like to ask -- you had made some statements. You had talked about aircraft landing at night, and you didn't know if the airport had the security to monitor that traffic such that it would be safe. What did you mean by that?

DR. SHORE: The residents are very concerned that aircraft is coming in at nighttime. We're very accessible in our town to Route 80 and Route 46. Primarily, they are concerned about illegal drug traffic that could have access to that area. And knowing from the airport management that they have a limited security for us, there is reasonable concern about that and the monitoring capability.

MR. McNAMARA: Have there been any incidents that you know of that involved drugs or illicit contraband being processed through Essex County Airport or Fairfield -- you call it Fairfield Airport?

DR. SHORE: Yes, Fairfield. It's really called Caldwell Airport I understand.

MR. McNAMARA: When I was a boy, it was Caldwell Airport. Now it's Fairfield Airport?

DR. SHORE: I believe according to your maps that it's still listed as the Caldwell Airport.

MR. McNAMARA: We have it as Essex County.

DR. SHORE: Okay. They are the owners and operators.

MR. McNAMARA: Right.

DR. SHORE: I can not give you any instance where we would have knowledge that that did occur. However, looking at the need for security and looking at the daytime security effort, you know, the community does

believe that there's got to be sufficient security in place 24 hours a day. If it operates 24 hours a day, they want that security.

MR. McNAMARA: Now, when you say security, are you really talking about a police force type security or a local guard security -- some security service in terms of a police protection type security, not an air traffic control type of security.

DR. SHORE: I believe that's correct.

MR. McNAMARA: Okay.

Economic impact that you were talking about -- what economic impact does the Fairfield, aka Essex County Airport, make to the community or the region around the airport?

DR. SHORE: Well, Fairfield is basically made up of about two-thirds of an industrial base. So there are a good number of small and probably medium-sized corporations in the area. And probably, the airport contributes in terms of the capability for traveling in and out of the airport and servicing some of those areas. I have asked the airport management to actually even provide me with information that we could better understand just what their contribution is, starting with the Township of Fairfield. Because certainly for people that use the airport, I'm sure that they use a lot of our businesses in the area. I would hope that they would in terms of restaurants, cleaners, car rental, etc. But they have not been able to quantify for me what they would contribute to the economic growth in Fairfield. But they're very quick to say -- and I'm sure it's true -- that there is some benefit, but we do not know what that dollar benefit is.

MR. YUDIN: We might be able to do that for you right now.

DR. SHORE: Good.

MR. McNAMARA: You will be very pleased to know that the Department of Transportation in less then 36 hours will unveil an economic study of the direct impact and the indirect impact of the Fairfield Airport on the Fairfield area. Am I correct in saying that, Jack? And you don't mind if I--

MR. PENN: No. No. I think that maybe the mayor would like to know that we conducted thoroughly over an 18-month period an economic impact study of 37 airports in the State of New Jersey, and your airport was one of them. We had consultants working up in your area extensively who have not only interviewed the airport but all of surrounding industry. So we have the figures, and we have the economic study. You'll be getting a copy -- you'll get an overall copy of everything, but you're going to get one that's just specific for that particular airport -- that's in the printers right now -- that they'll break down the income of the airport, the induced income, and other income that shows actually the value of that airport to the community. I think you may have the figures there.

MR. McNAMARA: I have the figures in front of me. There's no doubt about it. I just can't find them. (laughter) This is not alphabetized, or if it were, I've got it out of alphabetical order. I've been pouring through it. But I can tell you this, without having the details right in front of me -- I do have some numbers in front of me -- it appears that the economic -- the direct impact of the Fairfield Airport on the Fairfield region would be in the nature of $33 million annually. The secondary impact would be another $31 million for a total impact of about $64 million.

Now, when this study is published, we will have -- that will also be able to tell you the number of jobs that that has put into the Fairfield region and many other things about the nature of the airport. But you can see that it has an enormous impact economically and is very beneficial which, I guess, is what you were anticipating anyway when you say that it is the highway of commerce to your local industry.

Have there ever been any accidents at Essex County or Fairfield Airport that affected the schools or the school children?

DR. SHORE: No, but there have been accidents at the airport that quite frankly were in some residential areas. There were some deaths related to those. No residents but people that were flying the plane. You would really--

MR. McNAMARA: Are these located on the airport?

DR. SHORE: Yes. But I guess the one time, and I've made it in my testimony is -- you'd have to come out and see where the airport is located because our regional school system has well over 2000 students and staff there. Then we've got this local school. But in the meantime, you have a whole residential area all built up around it. So the proximity is really an issue of concern.

MR. McNAMARA: Let me see if I can focus on this concern. I have just a few minutes to ask you these questions. If magically the airport could be made five times larger without increasing the size of the aircraft that went in there -- in other words-- Dr. Hansman -- still in the room? -- am I correct in surmising that the noise made by an aircraft will be directly

proportional to, in general terms, the size of the aircraft or the weight of the aircraft?

DR. HANSMAN: (speaking f rom audience) Roughly.

MR. McNAMARA: Roughly speaking. Taking that as a premise for this question, if we would not increase the size of the aircraft coming in -- if the aircraft going into the airport remained the same, but the land around the airport got magically much larger, would that be a better situation? And so that the boundaries of the airport and those schools would all be located further away from the center of the airport.

DR. SHORE: Yes, I would think that that would be a better situation, but--

MR. McNAMARA: Now, if the aircraft that were going in there were -- stayed the same, and it was said to you that extending the length of the runway would cause those operations of those aircraft to be much safer because they'd have a longer -- and also somewhat quieter -- because they'd have a longer distance to run on their takeoff before -- and start to climb out -- before they came to the airport boundary-- Instead of being lower, they'd be higher, so they'd be quieter, and because, as they came in, with higher momentum, they'd have a longer distance to stop. Assuming there would be no -- I'm not trying to sell you anything -- I just wanted to know what your thinking on this is. There'd be no change to the type of aircraft that used the airport. Would that seem to be a better situation to you -- that would make it quieter and safer?

DR. SHORE: No and I will tell you why. Because by extending those runways, you're now going to bring aircraft even much closer to the sites

that I pointed out to you, the schools, etc. I mean, you'd have to come out and see the land the airport is built on to gain an appreciation of that. So while you extend the runway, now you're going to have further encroachment closer to those structures that we're concerned about.

MR. McNAMARA: And if you did not, you would say that you are opposed to an extension of the runway because that would cause the aircraft to come closer to structures. And if I were to say, let's assume for a minute that if we extended the runway, the aircraft would get further away from those structures. I have been out there several times. If we were to extend the runway or if the runway were to be extended, aircraft could operate with a greater margin between it and the existing buildings surrounding the airport. Would you be in favor of that extension?

DR. SHORE: I would really have to see a plan. And so in the absence of having specific information, I would not make a commitment. I would want to see the--

MR. McNAMARA: I'm not asking for a--

DR. SHORE: No. No. No, but--

MR. McNAMARA: I'm not asking for a commitment.

DR. SHORE: --you are asking for a yes or a no, and I just want to see it.

MR. McNAMARA: You can change your mind.

DR. SHORE: No, I'm not looking to do that. I want to be as helpful--

MR. McNAMARA: I'm just trying to find out--

DR. SHORE: --as possible.

MR. McNAMARA: I'm just trying to find out if many townships have a reluctance to talk about lengthening runways. Longer runways are -- because and mostly because they are afraid of becoming another Newark, where you would have much heavier noise here -- aircraft coming in. The aircraft by correct implication mean more superstructure needed or infrastructure needed to handle traffic and other things. They don't believe that if you lengthen a runway that won't happen. Some do and some don't. I'm trying to classify Fairfield. Which one is Fairfield? Does Fairfield feel that if the runway is extended, is lengthened, that that will be done and ignored to the greater safety of aircraft operations without changing significantly the nature of the operations or the aircraft that use it? Or does it feel that the length of the runway and it's going to change the nature of the airport?

DR. SHORE: I would say to you that the residents would believe that the expansion of the runway would probably bring with it expanded use. But that would not be the only reason that they would be opposed to an expanded runway. I think there would be concern about the proximity now that you're going to bring that runway closer to those other structures. And if I could just add one other thing that is probably more problematic in Fairfield, and I just want to mention it so you'll take note of it, there is a lot of recreational flying that takes place at that airport. We have a number of flight schools in operation. Other airports, I hear, charge a touch-and-go landing fee, and in a way, it discourages people from the up and downs, etc. And this airport does not impose any touch-and-go fee. And I will again say to you that on a weekend, which is problematic for residents, I get more complaints on weekends than I do during the week.

MR. McNAMARA: What airports in New Jersey are charging that fee?

DR. SHORE: I understand the Morristown Airport and others charge a touch-and-go landing fee, but there is none at this airport. So as a result of that, there is concern that we have a lot of up and down. And I've been out there. I've gone up to the tower. I've watched the operations. I've gotten very friendly with the Caldwell Aviation Association. All in my effort to better understand safety and really the aviation issues. So I'm trying to become as educated as I can to really work with residents and dispel some of their concerns. So I've taken a real personal interest. But I will tell you that something like limiting touch-and-go landings versus just free for all that they can do as many as they want, you know, is something that I really believe a small change like that could have a positive impact on the community.

MR. McNAMARA: Okay.

Are there other questions?

What I'm going to do is ask Bob -- can you take over the meeting? I have to take Dr. Hansman back to the airport, and I know he has to depart also. If you'll excuse me, I've made a commitment, as I've said, but I don't want to leave without thanking you very much for coming.

DR. SHORE: Thank you.

MR. McNAMARA: And I'm going to review the questions and answers on the record, and when we receive the transcript, that you give.

Thank you very much.

DR. SHORE: Thank you.

MR. YUDIN: Are there any other questions?

MS. NAGLE: I congratulate you on finally making a long-term arrangement with the current Essex County Improvement Authority. Can you tell me when you finally made that agreement -- I was just curious -- did you get paid for the previous eight years?

DR. SHORE: They will be paying us over a five-year period. And that dollar amount which was a court judgment is $700,000. So as soon as the FAA signs the agreement, we will have our first payment which will be in the neighborhood of 200 and some thousand. And then, on a yearly basis, it's estimated that the payments in lieu of taxes would be somewhere in the neighborhood of $85,000 annually.

MS. NAGLE: Do you have-- So that's $85,000 that they will pay the town of Fairfield for the services that you provide.

DR. SHORE: That's correct.

MS. NAGLE: Do you have any idea what it costs the town of Fairfield to have Essex County Airport in your town providing these services?

DR. SHORE: These services and the formula to calculate the services are based upon ratabilities. And so, as part of the agreement, there is a very detailed formula that determines that amount. It's just like the town having services ready and waiting. We have to provide them 24 hours a day, 7 days a week. So, you know, we would have to tell you what that dollar amount is for providing all those services, and I don't have that information with me.

MS. NAGLE: So the money that you're receiving is $85,000 annually. Are there any property taxes on any of the improvements that are

at the airport. Any of the buildings that are used for like the flight school or maintenance or--

DR. SHORE: I'm going to let the administrator answer that, but I just really want to clarify, too, that those payments are not solely for an exchange of services, but it was really in recognition that by the county owning that property that we were going to be losing significant ratabilities in the town. So that this was also a compensation for ratabilities that would be lost to the community, so it is not purely for service. It's a combination of both.

Joe?

J O S E P H C A T E N A R O: Yes. Thank you.

The $85,000 is a payment in lieu of property taxes. So we really don't have a figure calculated in that $85,000 figure for providing essential services, fire, police, emergency services, whatever. So in compensation to the township for taking all of the property out of production from the tax rolls, that's what the $85,000 a year represents.

MS. NAGLE: So that, I mean, there's no other charges then if you have--

MR. CATENARO: No.

MS. NAGLE: --a restaurant. The restaurant doesn't pay property taxes?

MR. CATENARO: No. That's all part of ECIA's property.

MS. NAGLE: I have a question on the schools. We have a little picture, but I can't figure out where these schools are. The regional high school, you said, is on one side of the airport; the elementary school is on the

other side. Are these in direct line with the flight path of one of the runways or no? Do the planes fly directly over these schools on takeoff or landing?

MR. CATENARO: The landing on the one area off Passaic Avenue -- I don't know if you are referring to a map -- but it's parallel to the regional school. Upon approach, as a plane is descending with a very, very shallow descent, it actually travels in some cases less than 40, 50 feet above vehicles that are driving. Some who aren't familiar with the airport's location driving down the street, can see an aircraft approaching, and be quite disoriented to see a plane almost--

MS. NAGLE: I can see that it's close to the roads, but you seemed to be quite concerned about the schools.

MR. CATENARO: Right. A miscalculation or, God forbid, if--

MS. NAGLE: So it's right over the schools as well?

MR. CATENARO: It's parallel to the school if I can highlight it on here for you.

MS. NAGLE: Can you tell me which was there first? Not that one has to close because the other one is there, but was the airport there and then they decided to build the schools or had--

DR. SHORE: The airport was owned and operated by Curtiss Wright, and it had very limited use when it was in existence. And as I had mentioned in my testimony, it was really used as a manufacturing site and for some testing. So it was not the airport that it is today. It had an entirely different purpose and, you know, very limited use.

MS. NAGLE: Do you have an airport advisory committee in Fairfield?

DR. SHORE; There is a, as part of the agreement with our community -- there is an airport advisory committee. It consists of representatives from the ECIA. Mr. Banker generally chairs that committee. There is -- as the mayor of Fairfield, I sit on that committee. There is representation from North Caldwell and West Caldwell. It's not a very active committee. Since I've been mayor, it's met once. But now that this issue is behind us with the settlement, you know, I certainly intend to encourage the meeting of this group on a much more regular basis.

MS. NAGLE: Thank you.

MR. YUDIN: Are there any other questions?

MR. ELLIOTT: Are there any county roads in Fairfield?

DR. SHORE: Yes, quite a few.

MR. ELLIOTT: Does the county pay the town of Fairfield anything in lieu of taxes for the land that those roads take up that might otherwise be ratabilities?

DR. SHORE: No.

MR. ELLIOTT: Could you explain to me the difference between the roads and, let's say, 4000 feet of runway?

DR. SHORE: I think the information you would really need to be aware of to help answer what might seem like that type of question would be that, at the time Curtiss Wright was selling the airport, Fairfield was very much opposed to the county purchasing it. And it was because of that controversy that there was an agreement made that to get Fairfield's cooperation and to really establish a good-neighbor policy so there would be no opposition to this, this deal was struck. So its genesis really came out of a highly charged political

environment at a time when the township was in an uproar and very anti the county being the purchaser of the property.

So I think if you can understand that, it may make that question look a little bit different to you. It was really done to gain cooperation. They really sat down, both bodies, and they ironed out this agreement together. And it is a perpetuity agreement, and it has been upheld in the courts. And while we know that the Essex County Improvement Authority is the only authority to have such an agreement, we all know that and understand it, you have to go back and really look at the history of how and why this came about.

MR. ELLIOTT: Thank you.

MR. CATENARO: Commissioner Elliott, if I could answer that question in another vein, the county roads -- we don't derive any payment from the county as we do from the ECIA for use of the airport. But also, the residents of the township have daily access on the county roads which they are technically owners, and they derive direct benefit from that. Whereas the average citizen doesn't derive any direct benefit from the airport operation and certainly doesn't own it, as they do county roads.

MR. ELLIOTT: Well, as our Chairman pointed out, the airport brings something like $64 million to the community. I would think that is some benefit. It helps businesses in the community, it serves many people who do live in the community, and there seems to be a tendency that aviation is not transportation; it's just a waste of time; it's fun and games; but traveling on a road is transportation. I would say to you that aviation is today the most efficient means of transportation there is, and it is transportation. So highways are one form of transportation, and an airport is another form of

transportation. And I think it needs to be looked at as a form of transportation, and it does bring benefit to the community. Whether there are as many drivers as there are pilots, it has nothing to do with that. The airport makes a vital contribution. If we closed down all the airports in this country tomorrow, this country would be bankrupted in about two days. Those airports do make a vital contribution.

DR. SHORE: And if I could just add, I would certainly and in all of my conversations with officials and airport owners and operators, I have never brought forth the view that Fairfield would be expecting this airport to close its doors. And we recognize -- and that's why I have it in my testimony -- we recognize that they were there before us. But the view would be, though, that as we move forward and as development or expansion is anticipated, that's something that's got to be looked at in terms of the impact and worked on together. And if I could just add one other point, it was very important to us this year to have a Fairfield representative appointed by the Essex County executive to be a member of the Airport Authority Commission. And I think that was another important step to really get people working together and for Fairfield to believe that they had some representation.

I think those things with the airport committee begins to set a different tone and a different relationship. And I really believe, because of all the problems with this money issue, we've never really scratched the surface of what a true partnership could really be between Fairfield and that authority. And they are sitting there with low-interest loans. And you better believe now that I want to be a mayor that gets out there and says, "You can do a lot of things to help me." But now that we have this out of the way, I mean, I see a

bright new future. Much really can be done, but I wanted you to have the history of what a bad relationship can do so that you can better appreciate that, as Commissioners, systems need to be put in place to help people forge these partnerships and to work together.

MR. ELLIOTT: Well, Mayor, I would just say that the -- I believe that the aviation community in your area in Fairfield has a strong appreciation of the efforts that you have put forth since you've been mayor to establish a relationship between the community and the airport and to make an effort to understand the problem. Through such efforts as yours, I think that there can be an understanding and that both sides can live together -- understand and accommodate the needs of each other. There need to be compromises on both sides, and they can only exist when someone is willing to listen and to learn. You have been instrumental, I know, in establishing the relationship which will lead to that agreement of the parties.

DR. SHORE: Thank you.

MR. YUDIN: Mayor Shore, have you had any instances where residents have come to you and told you that real estate agents who were the real estate agent that sold them their home implied or indicated that the airport was going to be sold or closed when they were thinking about buying a house in your community?

DR. SHORE: No. No. No one said that to me.

MR. YUDIN: Because we have heard stories of that nature. One of the things we're contemplating is recommending that there be some kind of disclosure when an individual is buying a home within a certain number of miles of an airport. That at the closing, there'd be actual written disclosure

that they are buying a home within *X* number of miles from that airport. And we have heard where some real estate agents have just -- "Oh, the airport is closing, don't worry about it" -- and you have not heard anything along those lines?

DR. SHORE: No.

MR. YUDIN: The fire--

DR. SHORE: They call me about other things, but not that. (laughter)

MR. YUDIN: Okay. The fire service in your community, is it a volunteer fire department?

DR. SHORE: Yes, it is.

MR. YUDIN: And is you ambulance there volunteer also?

DR. SHORE: Yes, it is.

MR. YUDIN: Okay. Your police, of course, is paid?

DR. SHORE: Yes.

MR. YUDIN: Is there a fire service on the airport itself? In other words, is your fire department the primary, first response unit, or if there is an accident on the airport, is there an airport fire service that handles it first with your fire service being called in as backup? Are you familiar with what the situation is there?

DR. SHORE: I know that there was a change. And I'm really not 100 percent certain, but I don't want to tell you what I think, I mean, the administrator's saying he believes it's primary.

MR. YUDIN: Do you think you're primary now?

MR. CATENARO: I believe so.

MR. YUDIN: So whether it's a structure on the airport or an actual aircraft, you believe that you're the primary--

MR. CATENARO: We respond immediately.

MR. YUDIN: --responder?

You do respond immediately?

DR. SHORE: We do respond, yes.

MR. CATENARO: Yes.

MR. YUDIN: So you still might be a secondary, but they might be an automatic coresponse?

DR. SHORE: Right.

MR. YUDIN: Now, you had indicated that you thought you had figures on what the cost -- because you mentioned in your testimony that your residents up until now anyway were very upset about how much the airport costs them, them the taxpayers. And you were getting nothing back in return for the eight year although you seem to have that problem resolved now. But do you have available that you could send to us -- I know you don't have it now -- what you believe the cost to your township is in support services?

DR. SHORE: For the airport?

MR. YUDIN: Well in other words, whatever you think it costs. Your community was complaining--

DR. SHORE: We can provide you a report on that.

MR. YUDIN: Can you put a dollar value at some time and send it to us so that we can put it into the record? We've asked this question of a number of other communities who have said, "Gee, we're spending *X* amount of dollars and not getting anything in return." Of course, now that we have

this economic impact study, the overall figure which you weren't told is about $1.3 billion a year. It's put into the economy of New Jersey from the 35 airports that were studied. And you heard what the figure is relative to your airport, about $62 million-$63 million. But we would like to know what in dollars what it actually costs, what you feel it costs you for the support services. You can prorate the cost of the fire truck, that's part of it, and any other services.

Now, you don't clear the runways or any of the approaches or anything like that -- your Department of Public Works? It's all done by the airport?

DR. SHORE: They do that. That's correct.

MR. YUDIN: So your basic services are your fire, your police, and your ambulance. And then you lose tax revenues from what you've said, and that's what this money is that you're going to be getting now.

MR. CATENARO: That's what the -- correct.

DR. SHORE: Yes.

MR. YUDIN: We'd like to have those figures so we can balance and just see -- and I would think that you would want those figures, too. Because if you got residents coming to you complaining, and you can say, "Wait a second, do you realize how beneficial this airport to us?" maybe that'll make your job a little easier. Because I imagine you've got restaurants, residents who work in those restaurants, and a whole number of assorted other primary and secondary services that are benefiting from that airport being there. And I come from Wyckoff, and I travel Fairfield Road often. I am very familiar with the airport and the actual structures and the runways. So just

about everybody here has been in and out of your airport at one time or another.

It's our understanding that there's about 80 acres of wetlands. Is that your understanding also?

DR. SHORE: Yes it is.

MR. YUDIN: Okay, I don't have any questions. Does anyone else? Sure.

DR. ABUCHOWSKI: You expressed a concern about expansion of the airport. Do you have any reason to believe that expansion is being contemplated by the airport?

DR. SHORE: No. In my testimony I say that that we've been assured that there is no expansion anticipated.

DR. ABUCHOWSKI: Because the airport does appear to be landlocked, doesn't--

DR. SHORE: That's correct.

DR. ABUCHOWSKI: --seem to be anyplace for it to go. So it would be fairly impossible for it to be expanded. Okay.

MR. YUDIN: You haven't asked a question, Jack?

MR. PENN: I'm satisfied with the testimony so far. I'm satisfied with all the answers. (laughter)

MR. YUDIN: Well, there being no further questions, I'd like to thank you on behalf of the Commission for coming down here. It's a long drive from Caldwell. I drive it almost every day. Thank you for your testimony. We certainly appreciate it. If you could get us that information.

DR. SHORE: Yes, we will do that.

MR. YUDIN: From what I understand in a few days, you'll have the data on the--

DR. SHORE: We'll look forward to receiving that.

MR. YUDIN: --actual economic impact. We do thank you for your testimony.

DR. SHORE: Thank you very much.

MR. CATENARO: Thank you.

MR. YUDIN: Are these gentlemen here to testify?

Rudy, you've testified already, right?

R U D O L P H C H A L O W: Negative.

MR. YUDIN: No. Would you like to testify?

(witness speaking from audience; no microphone)

MR. YUDIN: I really think we really should stick to the schedule and let Jack make the determinations on the testimony. I just don't know if I have the power, the authority to change the scheduling.

MR. ELLIOTT: Who else is on the agenda?

MR. YUDIN: They're not here. That's a Mr. Napp and Mayor Scanapieco from Marlboro Township.

MR. ELLIOTT: What time were they listed at?

MR. YUDIN: Two and three and it's 3:50. Well I'm going to just take it on my own authority. You're here. Why don't you come on up to the mike, and we'll give you an opportunity to talk.

MR. CHALOW: I have a map here I'd like to put up so maybe I can point out--

MR. YUDIN: Would you first just identify yourself please? Speak into the mike.

MR. CHALOW: My name is Rudolph Chalow. I own and operate Rudy's Airport. The identifier is 25NAN in the city of Vineland, New Jersey.

MR. YUDIN: How do you spell your last name Rudy?

MR. CHALOW: C-H-A-L-O-W.

MR. YUDIN: All right. Do you swear that all your testimony is the truth under penalties of perjury?

MR. CHALOW: I do.

MR. YUDIN: Okay. We'd like to hear what you have to say.

MR. CHALOW: I'll just try to take a couple of minutes to show you -- these are the properties that we bought to develop an airport. In the 50's, we assembled numerous properties with tax liens to create an airport. Object was to have a long runway. While clearing tax liens on the property for the long runway, we established a short runway -- 2800 feet -- east-west on property with clear titles. The proposed long runway would go up here. We went and cleared that because there was a ditch here, and we took the ground from here so we wouldn't have to cross the runway.

About a month after clearing the titles for the long runway, the State condemned the property for Route 55, cutting property for the long runway in half. This is Route 55. In condemnation proceedings, the State took two acres off the end of the east-west runway giving us $300 for 2 acres or $150 an acre. The local tax assessor assessed us $750 per acre. Clearing property for Route 55 encouraged growth of trees due to additional sunlight.

December 5, 1988: published changes -- the Air Safety and Hazard Zone Act -- create a clear zone at each end of the runway in which all structural development, including industry-- Industrial and commercial would be prohibitive. The clear zone trapezoid colocated with the end of the runway -- 250 feet wide, 1000 feet long, and 450 feet the width. That would be right out here. It should be a clear zone. We have been getting letters since about 1970 from the State stating that airport inspection encouraged letters such as received on August 3, 1990. Runway floods the first 200 feet of Runway 26 in heavy rain. When it happened -- when they put 55 in, in between the two lanes there's like a ditch, and the water just drains right down there. And they put a 3-foot tunnel right there, and the water just floods right on the runway when it rains.

Trees which are in direct approach-departure path of Runway 26 have grown considerably, since part of the property adjacent to Route 55 is State property. These are the letters we got. I would recommend that the trees in the area be topped to lower approach-departure ratio for use of this runway. This is from chief of department of aviation in New Jersey.

MR. YUDIN: Rudy, let met just interrupt you. Relative to the trees and in the safety, have you had any conversations with Jack or anyone in his department about this?

MR. CHALOW: I'm getting to the letters we have written.

MR. YUDIN: Okay.

MR. CHALOW: We have written letters, and I have the copies of the letters here if you would like to see them.

In 1990, a person in his division of aeronautics edited a letter and suggested I send it to the region and design engineer, which I did. I never received a reply or acknowledgment.

March 17, 1995: received a letter advising FAA 50-10 inspection. Disclosed discrepancies as follows, trees on the east side of Highway 55 should be topped. I replied March 27, 1995 that I agree, they are on State property, and to advise proper authority for their removal. Also, referred their letter to August 3, 1990. This has been going on for 5 years.

On October 30, 1995, Ashwin Max Patel inspected trees at east end of runway, advised he will have them cut down.

January 31, 1996: Daniel J. Wedo, Aero-Operation Specialist, Division of Aeronautics, stopped in, shown the trees at the end of the runway to be removed. "We'll look into getting them removed." He was advised of the October 30, 1995 inspection to get the trees removed and that nothing has been done.

I just thought I'd like to present those to you.

MR. YUDIN: So your basic thing you are talking to us about is you feel you have a safety problem on the approach of Runway 26.

MR. CHALOW: Well, the State made a hazard zoning law which would not permit any obstructions on the end of any runway. Here they create the obstructions, and you can't remove them. If somebody told me to go remove the trees, I'd gladly take them down. But I can't go on State property to do it.

MR. YUDIN: Well, we have a division of aeronautics here in New Jersey now. And your letters, I'm not -- I haven't seen them, but it would seem

to me that you should make an appointment. And I'm sure Jack can assist you on whom you should talk to and sit down with your correspondence. And, if in fact there is a safety hazard there, I'm sure the New Jersey Division of Aeronautics will assist you, after confirming the hazard, assist you in rectifying that hazard.

MR. CHALOW: Well, you're sure of that, but nothing has been done.

MR. YUDIN: Well, I'm explaining to you how to do this.

MR. CHALOW: I have done this already.

MR. YUDIN: To correspond or write or call the Division of Aeronautics, Jack, who would you suggest that he initially talk to?

MR. PENN: We're aware of this, and the trees will be removed. However, all tree removal programs have to be signed off by the DEP. The DEP has had this application since sometime in 1995. They will sign off on it. We are now working on a general agreement with DEP so we don't have to go to them anymore for obstruction or removal. But in the past time, each time we've removed any trees or topped trees, it has to go to the Department of Environmental Protection and get signed off by them. We don't want to have to go back and cut the trees every five years. We want to be able to either remove them completely or cut them a lot lower then what they'd like to see done.

So I will follow up on Rudy's letters. I have not seen the letters. But I'll follow up on them tomorrow when I go to my office. It'll get done Rudy.

MR. YUDIN: Great. There you go. When Jack says it's going to get done, it's going to get done.

MR. HINES: Don't believe it, do you Rudy? (laughter)

MR. YUDIN: Why don't you just be patient a little more. Here's a man that says it going to get done. He keeps his word. Okay.

MR. CHALOW: I have one more suggestion for the Committee, for the Bureau of Aeronautics, and anybody else involved. They should do something for airports in New Jersey to encourage heirs to keep them as airports. I have seen letters that they had sent out. I think there was 35 airports have closed. Reasons they closed was taxes was one thing.

I landed at an airport at another state here recently. The minute I looked around, boy, I say, how can they afford that airport in New Jersey -- the taxes. I asked the gentleman how are the taxes here. He said, not bad. Airports are taxed the same as public sports parks. And I think when a person has an airport, he keeps it for the community. We have put this airport together for the community. I cannot hard surface the runway because I would not be able to pay the taxes.

MR. YUDIN: Well, that's the purpose of this Commission is to come up with recommendations. We have a Constitution in the State of New Jersey that we have to abide by, and unfortunately, we can't just go out and reduce property taxes. You're not allowed to do that. But the purpose of this Commission is to make recommendations to the Legislature to suggest to them how to conserve to save the rest of the general airports that we have in New Jersey. That's why we exist. And that's what these hearings are all about.

MR. CHALOW: Well, I'm trying to point that out to you.

MR. YUDIN: We're aware of it.

MR. CHALOW: And another thing I would like, there's many things in New Jersey -- you spoke about Caldwell and all these places. I go back to when they were the aviation havens of the world. My theory is that usually airports are put in places where the ground is not worth anything else. It's either woodland, swampland, or something. So they put in an airport, And the first thing you know somebody else is buying a piece of property there around the airport because that's the cheap place, cheaper then somewhere else. My theory has been -- I think you suggested similar to that -- when that person buys a piece of property, in the deed should be put in there's an airport within--

MR. YUDIN: You're right, we did suggest that. We were thinking along those lines.

MR. CHALOW: I compliment you on that. You took that thought out of my head that I've had for quite a while.

MR. YUDIN: Okay.

MR. CHALOW: Thank you very much for being here.

MR. YUDIN: It's a pleasure.

Seeing no further witnesses, I'll adjourn this meeting.

MR. CHALOW: Thank you.

(HEARING CONCLUDED)