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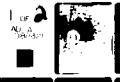

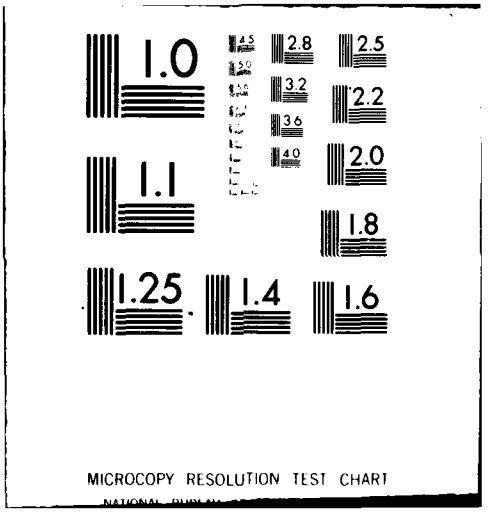
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This document presents the public comment and Air Force response to the Final Environmental Impact Statement on the Operation of the Pave Paws Radar System at Beale Air Force Base California.

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PUBLIC COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT, OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CALIFORNIA, AND AIR FORCE RESPONSE TO THE PUBLIC COMMENT

U.S. AIR FORCE

JULY 1980

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PREFACE

This attachment to the Final EIS provides the public and agency comments in response to the Draft EIS which was filed with the U.S. Environmental Protection Agency and made available to the public on 27 July 1979. Included are the transcript from the informal public hearing held in Marysville, California, on 20 September 1979; copies of all formal comments submitted to the Air Force; and the Air Force response to the comments.

The Air Force has used all of the public and agency comments as a guide in upgrading the Draft EIS to a Final EIS. Each comment requiring a response, whether the comment is reflected in the hearing transcript or in a separate submission, has the applicable response numbers annotated in the margin. The Air Force responses consist of the following:

(1) An indication is given that changes, that are believed to accommodate the thrust of the comment, are made in the EIS text. Plus (+) signs appear in the margin of the Final EIS text where a line has been revised or deleted. Where a whole paragraph or section has been extensively revised, a double plus (++) sign in the margin indicates that the revision begins at that point and continues to the end of the paragraph or section. Similar markings are used for tables and figures.

(2) An explanation is given to clear up a misunderstanding or to indicate the reason that the original (Draft) EIS text still represents the best judgment of the Air Force.

In addition to unique questions, there were many comments that addressed concerns that were common to several of the submissions. Some of those common concerns related to the reliability of the radar's beam control procedures; the need for additional radiation and public health monitoring; and the lack of absolute proof concerning the safety of RFR at the PAVE PAWS power densities (i.e., general public exposure at the submicrowatt/cm^2 level). In these cases of common concerns, each is annotated for a response; however, where applicable, common responses are referenced.

Although the specific comments and responses must be reviewed to understand the details of the Air Force position, the following is an overview with regard to the common concerns listed above.

(1) The triple-redundant procedures which control the positioning of the radar beam are adequate and secure. They have also been independently verified by a panel under the National Academy of Sciences.

(2) The calculations, actual measurements on the basic system, lack of significant variability due to environmental factors, and the radar's continual self-checking features, all support the conclusion that the EIS already properly presents the worst case PAVE PAWS radiation levels, including the possible "growth" system. Additional continuing radiation monitoring is not required. General public exposure from PAVE PAWS will be in the submicrowatt/cm^2 range even if the "growth" option is implemented. There is no evidence that such exposure constitutes any hazard; therefore, public health monitoring is not required.

(3) Absolute proof of safety is not possible with any factor; however, the EIS represents a thorough evaluation of the potential environmental impact of operating PAVE PAWS, and at the PAVE PAWS power densities no hazard is predicted from either the basic or "growth" systems. This conclusion has also been reached by a panel under the National Academy of Sciences.

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REPORT OF HEARING

This hearing proceeded at 1930, 20 September 1979 in Marysville, CA and was conducted by Colonel Allen C. Smith.

Colonel Smith:

On behalf of the United States Air Force, welcome to this public hearing on Draft Environmental Impact Statement on the operation of the PAVE PAWS Radar System at Beale Air Force Base. Our purpose here tonight is to provide information to the public regarding the project; and our secondary purpose is to record the opinions and comments of the public for consideration in connection with this project. Now, I'm Colonel Allen C. Smith. I'm a Military Judge assigned in Washington, DC. My function here tonight is simply to conduct the hearing. I have not had any part or any involvement whatever in the preparation of this project or the development of this project and I will not be making any determination, decision, or recommendation with respect to the project. As I state, my function is simply to conduct this public hearing. This hearing will be recorded verbatim by Sergeant Yolanda Rhoads over here, a qualified Air Force Court Reporter, and I'm also advised that a couple of local radio stations may be recording all or part of the hearing for possible later rebroadcast. As far as our agenda this evening, we'll start off with the presentation by the members of the Air Force team; after that we'll have a question and answer period for a period of forty-five minutes, hour, whatever seems to be appropriate. If you desire to ask a question, we have a microphone right here in the front of the room, and it would assist if you'd come down to the microphone, state who you are, any group that you represent, your address--if you care to give it--and ask the question from there so that everybody in the room including the court reporter over here is able to understand who's asking the question and get the question down correctly. After the question and answer period, why, I plan on having a recess or stretch period about that point for just a few moments. After that we will have statements from the public, and in connection with this I just indicated or mentioned the cards that are available in the back. Captain Hourcle down here at the table to my left also has cards. If you desire to make a statement, why, pick up a card, put the information that I requested down--name, organization you're affiliated with or representing, and your address, either business or personal residence. I plan to allow approximately ten minutes for statements. In the event that we have too many people, or time is running short, I may have to cut a little bit shorter than that, but so far we don't seem to have that problem. If you desire or if you're going to make a public statement, we'll have the podium up here by the microphone to my left. And it would be

probably best if you'd come up here and make a statement from that position. Now, this public hearing is designed to present information to you and for you to present information to the Air Force. We recognize that perhaps not every piece of information or comment that you might have can possibly be presented here tonight. You have until 2 October 1979 to submit any further statements or comments to the following address. To Dr. Carlos Stern, The Secretary of the Air Force, Assistant for Environment and Safety. The shorthand address is SAF/MIQ, Washington DC, 20330. I'll give that information later on or at least a couple more times during the course of the hearing, and as long as the information is postmarked by 2 October it will be included in the transcript of the hearing. So much for the introductory comments that I have. As I indicated, we'll start off with the presentations by members of the Air Force team. Our first speaker tonight will be Colonel Paul McEachern of the Electronic Systems Division. And Colonel McEachern is a former project officer on PAVE PAWS, He will be speaking on an overview of the PAVE PAWS system. Colonel McEachern.

Colonel McEachern:

Thank you, Colonel Smith, and good evening, Ladies and Gentlemen. I'm from the Electronic Systems Division of Air Force Systems Command. And I am now the North American Surveillance Systems Director-in-Chief and formerly was the program director for PAVE PAWS. I had the opportunity to give several presentations in the past in the Marysville-Yuba City area, regarding the various aspects of the PAVE PAWS radar's development status and related environmental issues. My presentation tonight will key on the mission of the PAVE PAWS radar, in the general description of how it's built and operates. As you may know, the PAVE PAWS radar is an important addition to our National Strategic Warning Systems. It is a deterrent system in that it provides a capability which prevents a potential enemy from surprising us and pre-empting our strategic forces. PAVE PAWS is a Sea-Launched Ballistic Missile Detection and Warning System. It will meet not only today's threat but that projected for the foreseeable future.

The primary mission of the PAVE PAWS system is warning. The radar however, will also function as a spacetrack sensor by tracking earth orbiting objects and providing data to the National Spacetrack Center in Cheyenne Mountain, Colorado. A missile that's launched at sea which penetrates the surveillance fence will cause a warning message to be released automatically. The system will track each missile that goes through the fence until enough information is obtained to determine the launch and impact points; and thus will serve to characterize the attack. the PAVE PAWS system today consists of two radars. One is at Otis Air Force Base in Massachusetts and the other here at Beale Air Force

Base in California. Each radar will have a detection range of three thousand nautical miles, and these surveillance zones will be established over each ocean. Missiles launched in the coverage areas will be detected, tracked and reported upon.

These are the principal technical parameters of the radar. It's a phased array, which means the radar scans electronically by phasing the signal to its transmitters. There are no moving parts as in conventional radars that most of us are used to. The PAVE PAWS beam steering is done by computer. The radar is all solid state and operates in the UHF frequency band, 420 to 450 megahertz. Since the radar is all solid state, it has a relatively low peak power of less than 600 kilowatts. The duty cycle, or the amount of time that the radar transmitter is actually on the air, will be a maximum of twenty-five percent per face. It will normally operate in the range of eighteen percent. The radar beam width is about two degrees and its accompanying sidelobes, or that energy outside the main beam, is at least twenty dB or one hundred times less than the power one would find in the main beam.

The warning message from the PAVE PAWS radars are transmitted automatically to the four command centers that are shown, namely the National Military Command Center and the alternate National Military Command Center, both of which are in the Washington area. It also goes to the NORAD Cheyenne Mountain Complex in Colorado and to the SAC, Strategic Air Command, Command Center. The warning information will permit the national command authorities--namely the President and the Joint Chiefs of Staff--to react to a sea-launched ballistic missile attack. Other information will be sent from the NORAD Cheyenne Mountain Complex periodically to update the data base of each radar.

What you see here is the main building. It's dual-faced and it's about 105 feet high, and it has more than 5,000 antenna elements on each face. This is a closer view of the face and its platform, which is used to maintain the face. Only about one-third of the elements on these faces are active. The others are dummies. Some of these dummies are inactive elements, help to form the beam, and also are available for future growth in case the threat may warrant it at a later date. Behind each active element is a solid-state transmit-receive module which I'll show you in a few moments.

Inside the main building, which you see in the center of this viewgraph, there are five floors which contain the radar electronics and the computer hardware, which have been developed and integrated to perform the PAVE PAWS mission. On the upper right hand corner you see the antenna elements. Over five thousand of these are installed in each face. It's a relatively

small unit, less than one foot long. Behind the element is a solid-state transmit-receive module which is the heart of the system; it also is a relatively small unit, a little bit over a foot. Now there are more than 1700 of these transmitters behind each face. The other radar equipment consists of the receiver-exciter equipment and the signal processor equipment, in which the information received by the radar is processed, and it's also readied for analysis by the main computers. On the lower left hand portion of the picture is the radar controller which controls the action of the radar unit. This is a separate computer which directs the radar to perform the functions needed to accomplish its mission. In the lower middle you see the central computer or the Cyber 174, two Control Data computers. This is the central processor or the central brains of the system in which the majority of the functions are performed. This computer works with the displays in the communications interface units to provide information to the onsite operators and to the operators and displays in the distant command centers.

Now that's a brief description of the equipment in the system. Before I leave the hardware area, I would like to show you a close-up of the solid state module--perhaps our most significant technical achievement in this radar. Transmissions from this unit are combined in space with those of other units to form a pencil-like beam which scans the ocean area. This is the heart of the radar system, it's relatively small, measuring only one foot and eight inches. If it weren't solid state, each one would have to be housed in a relatively large cabinet. This unit is mounted behind each active element and emits over 300 watts of power.

Going up to the tactical operations room, this is one of the 6 onsite displays in the tactical operations room. Operators man this room 24 hours a day and keep track on the operational status of the radar continually.

I'd like to conclude my briefing with a recent picture of the radar facility. In this closer view, you can see the power plant behind the radar, which is nearing completion. We now are operating a good percentage of the time and continue in a test status. We're completing the system performance tests and reliability tests which are necessary prior to turning the system over to the using command. The system is operating in accordance with the specification and is tracking targets. That concludes my presentation. Thank you, I'll turn the meeting back to Colonel Smith.

Colonel Smith:

Thank you very much, sir. Our next speaker is Mr. John Mitchell from the School of Aerospace Medicine. Mr. Mitchell was the Chief

of the Radiation Measurements team that's been here in the area for some time, and he will be speaking on the results of their testing in the area. Mr. Mitchell.

Mr. Mitchell:

Thank you, Colonel Smith. The formal radiation measurements for the PAVE PAWS at Beale Air Force Base were taken on 11 and 12 September, just last week, after a pretest briefing that was held at the Beale Officers' Club on Monday afternoon the 10th.

The purpose of the formal radiation measurements is really two-fold. One, to determine what the actual radiation levels are in the areas surrounding the system that represent a fully operational PAVE PAWS system. Secondly, and for the purpose here this evening, is to provide the opportunity for independent observers or local citizen representatives to oversee and participate in this activity. The test team that came out to do this work was made up of two persons from the Air Force School of Aerospace Medicine, located down at Brooks Air Force Base, and two persons from the 1839 EI Group down at Keesler Air Force Base, Mississippi. In addition to that, we have Mr. Mel Eckerstrom and Mr. Sam Sperbeck who served as coordinators for the local citizens' committee. They prepared and sent out, I believe, something over a hundred letters to individuals in the local area, and we were happy to have about fifty people that came forward and identified themselves to participate as independent observers on these tests; and we had a number of these people that stayed with us throughout all of the two days of testing, which I think was very good. It was two very warm days and rather long days but we did get that job done.

Now the instrumentation system that's used to measure these levels are enclosed in an Air Force van in a shielded enclosure. We drove this van around to the different test points and at each test point took about an hour's worth of measurements.

The system is made up basically of two parts. One part around a field intensity meter, which allowed us to measure the peak radiation intensity from the radar. And the second part around a power meter, which allowed us to measure the true average power density for the system. At each instance at a test location the antenna, a dipole antenna, was moved about the test location until the signal was maximized on the field intensity; because indeed, the radiation levels will change a little bit as you move around in the neighborhood of one or two wave lengths, which is about a meter, meter-and-a-half. So it's maximized to find the radiation levels, and then at that point we measured in three orientations so as to take up all the radiation field in that area. Same process was used for the average power, and the average power eventually was sampled at a rate of about 100 data samples per second so that we actually took, in about a 12 second run in each

orientation, we recorded about 1200 data points; and then these were processed in the computer to give us the true average value of the average power incident.

This next slide is a map of the area of the test locations. We started out with a potential of about 24 test sites and, recognizing that it would take about an hour per test point, we took this plan into the pretest briefing on Monday afternoon, discussed it with those present, and modified it slightly. The data points that were actually used in the test are shown here, with the exception of the points that are up close to the radar that were too close to plot. So all of the data points that were tested are shown on this map, with the exception of, I think, five sites that were within 3000 feet of the radar. For instance, we had the test point down at the Union High School in Wheatland. This, by the way, was a test point that was added at the suggestion of some of the people out here and we did put that in. We also were asked to--or such another point that was suggested was at the route of--on 65--that was a very good, clear line-of-site of the radar. We added that point. We also added a point up in Brown's Valley, and so, with the basis of that, we made eighteen measurements in the two day's time.

Now I have drawn on here the scans of the radar. Look at this portion here, that's the 120 degree scan sector of the South face and on the top the 120 degree scan sector of the North face. This test point 2 was the test point at the school on the base. That's the distance of about a mile-and-a-half,_2 miles from the radar. And at that point and also at the trailer park, test point 3, the radiational levels, the average power densities, were about .05 microwatts per centimeter squared. As we got out to about the four-mile point, at the control tower, the level was down to about .01, I believe. And by the time we got out into the community several miles away, the levels at that point were reduced to something less than .001 microwatts, average power density.

The next two slides summarize--they're really a tabular listing of all the data that was taken in the two days of testing. This tabular summary, as you can see--we've recorded the peak electric field intensity, 'cause indeed this is a--this has not been done for very many radars. We've done it for several, and our current thinking directs attention to a lot of pulse work so we are interested in that, and so we've measured the peak electric field and recorded in volts per meter. From that we've derived a peak power density in microwatts per centimeter squared. And then the last column is the average power density in microwatts per centimeter squared. Now this summary is the same table that was distributed in the community here the day after our testing was complete. Also, these numbers were provided to the independent observers that were with us at each test point.

We have found one error in our data and that is that this test point on the hilltop northeast of the radar, this distance is closer to 5,000 feet in place of 8,500. So to my knowledge that's the only error in this data chart. I would also point out that we have plotted this as a function of distance from the radar so that these points here were all actually less than 300 feet. They're right on the radar complex, right inside the fences. Then at the thousand foot fence which is another--we have a security fence out there about 120 to 150 feet, I believe, and then we have a second fence out at about 1000 feet--and so this is that thousand-foot fence. By the time we got out there, the average power densities were down to about one-and-a-half microwatts. Then as we went farther away from the radar, after we got out in the range of a mile, it became in the neighborhood of tenths of microwatts.

And then in the communities beyond that it became quite low, something less than .001 microwatts per centimeter squared. And it's about the limit of the accuracy of this kind of instrumentation and therefore we didn't record anything that was less than .001. This summarizes the results from the formal radiation measurements and during the question and answer period we'd be happy to entertain any questions on this part.

Colonel Smith:

Thank you very much, Mr. Mitchell. Our next speaker is Dr. Peter Polson from SRI International, and he will be addressing the bioeffects covered in the Environmental Impact Statement. Dr. Polson.

Dr. Polson:

Thank you, Colonel Smith. Good evening, Ladies and Gentlemen. As was just said, my name is Peter Polson. I'm a senior biomedical engineer in the Toxicology Laboratory, Life Sciences Division, at SRI International. I've been asked to summarize tonight the section of the EIS, Environmental Impact Statement, that deals with the probable impact of PAVE PAWS Radio Frequency Radiation, or RFR, on human health. This section of the EIS was originally prepared by a team from SRI comprising myself; Dr. John Krebs, a senior biophysicist in the Toxicology Laboratory; Louis Heynick, a staff physicist from the Radio Physics Laboratory in the Systems Research and Analysis Division; and Dr. David Jones, director of the Toxicology Laboratory.

In preparing this section, were aware of the fact that the subject is of very considerable interest and concern to a large number of people of widely different backgrounds, ranging from experts on the subject of biological effects of microwaves to people with little or no scientific background, but who are vitally interested in the problem. We therefore endeavored to produce a report that

meets the needs of this very different but concerned readership. To do so, we organized the report in two parallel formats. Appendix C of the EIS is concerned with human exposure to RFR; it contains eleven subsections, the first six of which are shown on this slide, and is written in the form of a detailed scientific review and critique of selected but representative articles, reports, and abstracts. Appendix C is oriented toward interested experts who are familiar with scientific language and technical terms, but who may wish to refer to the various scientific papers that are referenced to check on points for themselves. For the interested but not scientifically oriented reader, section 3.1.2.1 of the EIS contains the same information as Appendix C, organized in the same format, that is, Introduction, Present Climate and Context, and so on, but without the reference citations and in a more readable style. We hope that this approach has achieved the objective of providing a document that could be easily read by everyone who's interested. Because Appendix C does contain more references and details, I will discuss it, rather than discussing 3.1.2.1.

The first subsection is concerned with defining what the problem is--the exposure of humans to RFR from PAVE PAWS. Thus, the theoretically predicted values and the measured values of average and pulse power densities have been presented to you already by Mr. Mitchell. They are all quite low outside of the exclusion fence and even lower in regions where the general public would normally be. This section also describes how a variety of sources was used to acquire a working data base for this assessment. These sources included several referenced bibliographies, published proceedings of recent seminars and meetings, a computerized data base, compilations of articles collected by the Franklin Institute, and abstracts of recent symposia, whenever the abstracts contained sufficient detail for evaluation.

There are presently, by one count, approximately 6,000 references to articles that deal with the biological effects of nonionizing electromagnetic radiation. This indicates that a considerable amount of research has been done on this problem. Not all of it is directly relevant to PAVE PAWS, however. We therefore selected articles for detailed review by applying certain criteria, such as frequency band of the radiation, date of publication, significance to human health, and possible relevance to concerns expressed by citizens groups, among others. We looked at between 500 and 600 papers and selected approximately 250 for inclusion in the EIS. I believe that approximately 40 of these are from the Eastern European literature, and the rest from the Western publications.

The second section describes how the use of RFR-emitting devices has proliferated in recent times. It also points out the presence of many existing radar systems.

The third section, Problems of Risk Assessment, is intended to point out, for those who are not familiar with the problem, some of the facts associated with determining whether or not a certain level, a certain agent, is a risk to human health. This is a very complicated area. In addition to scientific and technical questions, there are problems of law, administration, feasibility of implementation, and social philosophy that must be considered and integrated.

The fourth section, Assessment of Scientific Information, deals with the more specific problem--assessing scientific information. This is not simple. Careful consideration has to be given to a number of points, such as the formation of theories and their refinement, or revision, as valid experimental evidence accumulates that is inconsistent with a current theory. There is the problem of the gathering of experimental evidence, the validity of the experimental design, whether or not the methods used were appropriate and correct, the problem that the results may have been incorrectly obtained because some unrecognized factor contributed to their generation, and finally, there is the problem of whether conclusions drawn from the data are truly justified.

The fifth section of the appendix describes Other Assessments and Reviews, on the subject of biological effects of microwaves. These are presented in the EIS to insure that appropriate articles were obtained that adequately characterize and represent the bioeffects literature. The conclusions and opinions of the authors of the assessments and reviews were considered and compared with those in the EIS. However, because each document was developed from a different viewpoint concerning RFR effects, the conclusions stated in the EIS and Appendix C were independently derived, explicitly considering the problems posed by the PAVE PAWS facility.

The sixth section of the appendix describes in considerable detail what is known at the present time of how RFR fields interact with biological materials and entities from the physical point of view. This information has provided us with a good understanding of the mechanisms of interaction, both those that are well-proven experimentally and also theoretical mechanisms that have yet to be validated by appropriate experiments. It has also given us a good grasp on the complicated question of dosimetry. That is, how much of the energy in an incident field was deposited in an exposed entity and in what proportions in specified locations. It has further allowed a start on the problem of scaling, both with regards to the effects of different frequencies on the same object and also the effects of the same frequency on different sized objects of different shapes. Much work still remains to be done in this area, and much is in progress. But, more importantly, we

do know quite a lot about the physical details of interaction of RFR with biological entities.

The other five sections of the appendix deal with present state of knowledge regarding biological effects, unresolved issues, PAVE PAWS and safety to human populations, other viewpoints, and, finally, the references themselves. I will now briefly describe each of these sections.

The seventh section, "Present State of Knowledge Regarding Biological Effects," is, of course, the main section of the review and critique. The section is organized such that reports of studies on humans are considered first, in the section entitled "Epidemiology." Then because of concern that has been expressed about the possibility of genetic effects and effects on developing organisms, the next two sections consider reports of studies that are related to these topics, "Mutagenic and Cytogenetic Effects" and "Studies on Teratogenesis," which is the development of birth defects while in the womb, and developmental abnormalities, that is, defects that develop after birth. In the past there has been concern expressed by some people that microwave radiation may cause cataracts. The next section, "Ocular Effects," considers reports of studies on this subject, with attention given to what is known about threshold average power density needed to cause cataracts. Another area that has received attention by our associates over the last 5 to 10 years is nervous system studies. In this section, attention is given to reports of work on the RFR hearing effect, which occurs with pulsed microwaves under certain fairly well-understood circumstances, but not with CW, that's continuous wave, RFR. Also discussed are studies reporting changes in calcium efflux in chick brains, resulting from sinusoidal modulation of a microwave carrier frequency--not pulse or CW. There have also been reports of alterations of blood-brain barrier permeability to certain substances under some conditions of RFR exposure, and these studies are examined. To complete the section, consideration is given to studies on histopathology of the central nervous system and to EEG, that is, brain-wave effects.

The next five sections deal respectively with effects on behavior, endocrinological or hormonal effects, immunological effects, biochemical and physiological effects, and cellular effects. In each of these, consideration is given to studies showing such effects and examining under what circumstances the effects are evident. The final section "Other Effects," deals with studies that are not readily categorized into any of the preceding sections. Such studies include those concerning the possible carcinogenic or cancer-causing properties of RFR, studies of the effects of RFR on the cardiovascular system, the heart and circulatory system, and studies on general health, particularly chronic or long-term studies. At the end of each of these

sections, "Epidemiology" through "Other Effects," the overall picture of the findings of the studies is examined in the light of the specific PAVE PAWS RFR characteristics and levels. Almost without exception, there is no evidence of any of these effects having been found at the levels of PAVE PAWS RFR outside of the exclusion fence. In those few instances where effects have been claimed, the claim is pointed out in the EIS, and it is stated that the findings are difficult to reconcile with the findings of the vast majority of other studies, and that such effects, even if they exist, do not appear to constitute a hazard because they appear to be transient or reversible.

Section eight, which is titled "Unresolved Issues," deals with some of the issues that have been identified as not yet resolved. These are: the problem of extrapolating the results obtained from experiments carried out on animals to determine what would be expected to happen to humans; then the problem that very few of the experiments conducted so far involved continuous exposure for the lifetime of the animals used; then finally, the absence of any prospective or forward looking human epidemiological studies. These points remain partly unresolved issues in the assessment of bioeffects of RFR and, indeed, in the assessment of any potentially hazardous chemical or agent. But they do not materially affect the conclusions reached in this EIS.

Section nine summarizes all of the information presented in the previous sections. Some of the important highlights are: that the vast preponderance of experiments that show effects, not necessarily hazardous, had used average power densities in excess of two thousand microwatts per square centimeter; further, most experiments involving chronic exposure either have shown no effects or reversible or noncumulative effects for average power densities in excess of two thousand microwatts per square centimeter; and in the few cases where irreversible adverse effects have been found, such effects were absent for average power densities below approximately two thousand microwatts per square centimeter. Then, also summarizing--the existence of the RFR auditory phenomenon, that is, the perception of short pulses of RFR individually as audible clicks in one's head without the use of any electronic receiver, is one area where pulsed RFR is known to differ from CW RFR in a significant manner. However, the experimentally determined threshold for this phenomenon is 300,000 microwatts per square centimeter, pulse power density, and this is, therefore, not of concern to the PAVE PAWS situation under consideration.

Modification of calcium efflux has been shown to appear under certain circumstances for sinusoidally modulated RFR. The power density "window" for the phenomenon is above those values that generally will be encountered outside the PAVE PAWS exclusion

fence, even though the modulation frequencies that caused the effect are comparable with the PAVE PAWS pulse repetition rates under normal operating conditions. Finally, the relatively few retrospective epidemiological studies done in the United States and the USSR are not considered evidence that the PAVE PAWS emissions are likely to constitute a hazard to the population.

The summary of this--the conclusion of this summary section is that there is no reliable evidence from our review of the scientific literature than any hazard will result from either short term or long term exposure of people to the RFR from PAVE PAWS outside the exclusion fence for either the basic or growth system.

The EIS recognizes that there have been many other points of view expressed on this subject. Some of these are outlined here. For example, it has been claimed by others that there's insufficient data from which to base an assessment of hazard. It's also been claimed by others that research on long-term, low-level effects is lacking. It's been claimed that we know very little about mechanisms of interaction, that more research is needed to define potentially hazardous areas of biological research. It has been claimed by others that specific studies exist that claim effects at less than 100 microwatts per square centimeter. It's also been claimed that those experiments that are cited as having found no effects may have found no effects because they were faulty experiments. This is continuing the opinion of others--other people have claimed that Soviet studies have claimed to show an effect called the microwave radiation syndrome. It's also been pointed out by others that perhaps ten years from now we may recognize new effects that turn out to be hazardous. But we don't know anything about these at the present time. It has also been claimed by others that the safety standards that exist are not legally binding in the USA. It has also been claimed by others that insufficient research has been carried out on alterations of genetic material and possible carcinogenic effects of RFR. As I said, these are the opinions of others, and they have been incorporated into the EIS in the section entitled "Other Viewpoints."

Many of the references that have been cited by persons expressing the above points of view are discussed in Appendix C, and treated in context with the other references that we have chosen as being representative of the literature as a whole. In conclusion, however, we see no evidence that the low levels of general public exposure to PAVE PAWS RFR are hazardous. We are supported in this conclusion by the study recently completed by the National Academy of Sciences for the Otis Air Force Base PAVE PAWS. Thank you very much.

Colonel Smith:

Thank you very much, Dr. Polson. We have now--what we anticipate next on the agenda is a question and answer period. In addition to the three speakers, we have five other persons here who will endeavor to answer any and all questions that you might have regarding this project. First we have Colonel George Mohr. Now, Dr. Mohr is a physician and he is the Vice Commander of the Aerospace Medical Division at Brooks Air Force Base, Texas. We then have Dr. Ron White, from SRI International; he is the Program Director for the Environmental Impact Statement under Air Force contract. We have Mr. Dick Moore, who is the present Director of the PAVE PAWS Project Office. And then we have Major Doug Kennett, who is with the Public Affairs Office of the Secretary of the Air Force. We have Mr. Jim Miller, Project Engineer from Keesler Air Force Base, responsible for radiation instrumentation. So these gentlemen, the eight of them over here on the right, will now endeavor to answer the questions that you might have. I believe that Mr. Mitchell is going to kind of serve as the moderator of questions and answers. If you have questions, we would appreciate it if you would step down here to the microphone right at the end of the table that the viewgraph is on, be recognized, and please state your name, any group that you might be representing, and then state the question right into the microphone. Do we have any questions?

Mr. Sowle:

My name is Hal Sowle. I'm just a concerned citizen. As I understand it, your beam does not go in a straight and level line as it goes out over the horizon, it goes at an incline. Could you explain that, and what it is when it hits Marysville or some of the other outlying areas? What's the altitude?

Mr. Mitchell:

Yes, I probably failed to mention that in the test conditions, but, the radar is set up to produce a surveillance fence at an elevation angle of +3 degrees up to +10 degrees, and then to carry out space-track and surveillance from 10 degrees on up to 85 degrees. So the beam does not go below +3 degrees in elevation angle and, therefore, at the base of the radar is at about three hundred and seventy-five feet. Most of the terrain in most of the sectors goes down beyond that, and so, for instance, down in this area, I think the elevation was about 60 or 70 feet, and the beam passes several thousand, the main beam passes several thousand feet over this area.

Mr. Sowle:

Thank you.

Mr. Mitchell:

I should say also that at--during the course of our testing we did operate with the radar in an enhanced surveillance mode so that the full 18% was applied to each face, and thereby--at three degrees--thereby producing the maximum radiation levels on the ground that we would ever have.

Dr. Loebner:

Good evening. I am Egon Loebner from Palo Alto. I represent the Citizens Concerned About PAVE PAWS. I have three questions I would like to ask; I ask them in sequence, they relate to the presentation. My first question is--what is the basis of using average rather than peak power criteria? Especially, the enumeration of--I would very much like to have the enumeration of the relative physical assumptions, which have to be satisfied, so that a time average of the exposure of the signal is a true measure of the heat burden of the biological matter. 1

Mr. Mitchell:

The basis of that standard goes back about twenty years. In about the mid-fifties the Department of Defense actually spent some 15 to 20 million dollars on research to set a safety standard for radio frequency radiation, in that time period decided on the ten milliwatt, or which is equivalent to the ten thousand microwatt per centimeter squared, average power density, primarily on the basis of an acute--acceptable acute thermal burden to man. Now that standard was picked up in 1966, is the consensus standard of the American National Standards Institute. Later on, it was reviewed again by--it was adopted by OSHA in 1972 as a radiation protection guide, again 10,000 microwatts on the basis of average power density. In 1974 it was again reviewed by the American National Standards Institute and again reaffirmed, and that's basically the basis of that standard that's used in the free world today.

Dr. Loebner:

I don't think it was quite an answer to my question, but, I'll go on to the next one.

Mr. Mitchell:

I'd be happy to try again, if you'll rephrase the question.

Dr. Loebner:

Okay, I asked specifically about what assumptions in physics, in terms of the height of the pulse, the width of the pulse, in terms of the properties--of the heat properties--in the dissipation in the material itself, are made in order to make it valid that an average can be used.

Mr. Mitchell:

Yes, the standard as I said is based on acute thermal burden. Now the question of pulse--of a pulse standard for peak power has been brought up in a number of studies in the last several years. As a matter of fact, at the School of Aerospace Medicine we've entered into a very significant program to investigate the relative biological consequences of pulsed fields, as you suggest, versus continuous wave fields on the basis of the average power density. And that work is being done under a number of contracts with private institutions, universities, et cetera. We're also developing a laboratory at the School of Aerospace Medicine dedicated specifically to that. I would also like to say, though, that for the PAVE PAWS system--the PAVE PAWS system operates at a very large duty factor--thereby, the peak--the real peak-to-average ratios for the PAVE PAWS system is only about a factor of 200, which is very low, so we have a very low peak field. Now, that can be contrasted with many standard radars, the kind of radars that, for instance, are used to monitor the paths of commercial aircraft throughout the world, where the peak-to-average ratio is in the neighborhood of 100,000 to 1. So in this system, you know we in the Air Force, while we're doing a lot of pulse studies for a lot of systems, we don't consider the PAVE PAWS to be the type of system with a high peak-to-average ratio.

Dr. Loebner:

Thank you very much. My second question is, how many of the references in the literature that have been studied are on work where solid-state sources rather than nonsolid-state sources are used? Specifically, how many have just the characteristic which you described PAVE PAWS, the low peak and long, large width of the pulses?

Mr. Mitchell:

I'm not sure I understand that question. There are about 10,000 references in the--as a data base, as Dr. Poison pointed out. We started with, I don't know, several thousand, it was selected down to a few hundred, and some of the review documents had larger numbers. But I'm not sure I understand the question you're asking.

Dr. Loebner:

Let me rephrase my question to you, sir. Was the criteria used--in selecting relevant literature--in using the height of the pulse and the width of the pulse, and are there any of the references where the studies have been made on all those things that we've seen in this Appendix C that relate to pulses that are comparable to those in PAVE PAWS?

Mr. Mitchell:

I'd be glad to let Dr. Polson comment on that.

The answer to that is that, as far as we know, there have been no studies with exactly the identical characteristics of the PAVE PAWS system, and this is stated in the EIS, in Section 4, I believe, C.4.

Dr. Loebner:

Thank you. I just wanted to hear that again at this hearing. My last question is directed to Mr. Mitchell. The question is--why were there no measurements made inside the various buildings--specifically, the hospital, the school, the guard room and some other public--of the structures--where the measurements have been done outside--why were there not made measurements inside these structures during the last week when you did the measurements?

Mr. Mitchell:

Primarily because the radiation levels were so low outside the building that there was--we felt there was not any need to measure inside the buildings. But, also I would say that in the course of the pretest briefing that you attended, and we had about 70 people at that time, had anyone brought for the the question of doing it inside any buildings we probably would have accommodated him. We were--we asked for any suggestions anybody had, and we actually readjusted our test program on the basis of that. So basically, for instance, at the hospital the levels were a tenth of a microwatt per centimeter squared outside, and that's considerably below what we consider to be hazardous, and so there was no consideration of measurement inside the building.

Dr. Loebner:

I find your answer quite correct, I was at that meeting. Unfortunately, I did not have the information that I have today, and therefore I did not ask what I was able to do at that time. If I would have known at that time what I know today, I would have

certainly asked that question. But I will bring it up later. Thank you.

Colonel Smith:

Thank you very much, Mr. Loebner. Are there any other questions that we have? You can step right down to the center or--yes sir.

Mr. Spies:

I'm Harold Spies, and I'm also just a concerned citizen, and what I would like to know is basically, where could we get ahold of a copy to study the EIR or the EIS? Is there one available, and will there be one available for quite some time?

Mr. Mitchell:

Yes...

Major Kennett:

They're in back of the room and you may pick one up right now if you'd like.

Mr. Spies:

Thank you very much. That was easy.

Mr. Mitchell:

We have a few copies. I don't know how many we--we did bring, I don't know, probably twenty or thirty copies. But I'm sure also some of the people do already have a copy.

Colonel Smith:

Yes, welcome ma'am.

Ms. Pearce:

May Pearce, a concerned citizen. I would like it explained again to me why PAVE PAWS was placed back inland instead of on the coast, as was Otis.

Mr. Mitchell:

Okay, I would like to ask Colonel McEachern to address that, please.

Colonel McEachern:

We've been asked that question several times, and in fact on the East Coast, they say why is it placed on the coast instead of inland, so we just turn our answer around.

When we sited these radars we had ten criteria which we used to find a suitable location. And it can't be placed just anywhere. You had to have the right look angle to the sea. We did extensive studies and analysis as to where our radar should be put in order to provide us with the best coverage in the main threat areas that we're looking at. And it turns out that this particular area of the country is the best for this type of a radar and we get an excellent look angle. In fact, this base here--this particular location was absolutely the best site out of 30 or 40 that we looked at. Placing it back inland is really an advantage. It's something we would--we prefer to do, and not place it on the coast as it is at Otis, because for one thing, it's much easier to protect it from jamming. If you place it right up on the coast of course it's--any radar is very sensitive to other signals--and as you place it too close to the coast you could get a jam much more easily. So if you put it back inland I think you're--you have a better chance of operating in an environment that is not exactly friendly. Does that answer your question?

Ms. Pearce:

No.

Colonel McEachern:

Perhaps not. It's, the reason it's much better placed inland--because we don't look close. What we're looking at is objects far away. The things that are in close, 20 or 30 miles, make no--we don't look at all. We're looking for missiles--that's the main object of this system. We're not looking for aircraft. So things that we're looking at are very high, and therefore it is actually better placed inland, that's why we've got it a hundred miles from the coast.

Colonel Smith:

Next question. Gentleman coming down, come ahead, sir.

Mr. Ingram:

My name is Peter Ingram. I'm also a concerned citizen and I'm a resident of Brown's Valley. I don't understand the exact projection of the radar. Does it follow the course of the land or does it project in a straight line? Could somebody answer this question?

Mr. Mitchell:

The radiation levels that we measure on the ground are a part of the sidelobe structure. And--I might get some engineers here to correct me if I go astray on this, but the sidelobe structure from any radar--you try to get as much power as you can in the main beam to do the main job. But there is a certain amount of energy that spills off in what is called a sidelobe, and that does follow somewhat the ground terrain. It's scattered and attenuated as it goes along, so that as it gets out farther away it's lower. But that is the component of the radiation that we were able to measure at the greater distances. 2

Mr. Ingram:

For instance, somebody has stated to me that this radar is capable of seeing a Piper Cub fifteen feet off the beach in the vicinity of Mendocino. Is that true?

Mr. Mitchell:

No.

Colonel McEachern:

Let me answer that question. No, that's absolutely not true. In answer to your first question directly, the radar--the main beam of the radar is off the ground, it's directed straight up and it's line-of-sight. It doesn't bend at all. What John was talking about is that some of the energy in the sidelobes gets spilled out into the ground area, a very small portion of that. But this is a line-of-sight radar, and the only thing we can see, which is--if you could see three thousand miles of what your eye could see--it goes straight up, so that by the time it's up three thousand miles, it might be a thousand miles up off the floor of the ocean. Off the earth is where our radar beam is, and it's a narrow beam, only a two-degree beam.

Mr. Ingram:

Okay, well my property is located, as I understand it, probably right at the far face of where the beam will hit. I'm expecting my first child, and my wife is seven months pregnant at this time, and I'm very concerned. Is there information available from the Air Force that would indicate what the exact route of the beam would be? For instance, there is a mountain between Beale and myself. If the radar will not come over that mountain and will pass by my place, then I'll keep it and stay a resident of Yuba County. If, on the other hand, the radar trails off and causes direct radiation on us when we're no more than about twelve miles

from the point, I'll be forced to sell. Is there a chance that the public could see such a diagram? 3

Mr. Mitchell:

I don't know exactly, of course, where your place is, but--in Brown's Valley--but I would suggest--is Brown's Valley area--is that the general area? I would suggest that you identify that to us and I think we could give you a very good answer on what the radiation levels would be in that area.

Mr. Ingram:

Are your charts available for the public in all of the outlying areas? Exactly what areas will be hit at what elevations?

Mr. Mitchell:

Yes, the diagram that I showed in--for instance, by the time you're in that vicinity, and that sector, the beam is raised up considerably, and the levels, all of the levels, outside of that area were down considerably below 0.01 microwatts. And that's a--that is in our opinion an extremely low level and non-hazardous.

Mr. Ingram:

Is it true though that that level is approximately one thousand times more than what the Russians have designated as being safe?

Mr. Mitchell:

No, no, it's not true. The Russian--the lowest level that we know of, that the Russians have published, and this was published by Dr., or presented by Dr. Shandala at a meeting in Helsinki in August of last year--and he presented, at the PAVE PAWS frequency, a level of five microwatts per centimeter squared. The levels that I would judge that are in the vicinity of your place would be a thousand to ten thousand times lower than that.

Mr. Ingram:

I have one parting comment and that is that I believe, as any concerned citizen would be, after reading the papers and studying reports that come in, national defense seems to be something that is falling behind on an international level in this country. And I'm pleased to see that the Joint Chiefs of Staff have seen fit to come forward and start implementing a better program for detection; and yet it seems to me that, by placing a PAVE PAWS unit at Beale Air Force Base, it doesn't serve as a diversification of targeting or--whatever enemy the United States

might have. It combines strategic wings and important radar sites, and I question the logic of placing this unit combined with the SR-71 wing and other reconnaissance gathering information. And there's no answer to that question that I'm sure you could give me, so thank you very much.

Mr. Mitchell:

Thank you for your time, comments, and questions.

Colonel Smith:

Yes sir.

Mr. Pearce:

I'm Arthur Pearce and for those, if it's permissible, for those that are concerned about their area, we have some maps that, if they wish, they can circle or draw on the maps their ranch, and put their name on it and the--any flight patterns or thing they have for crop dusting, or anything like that.

Mr. Mitchell:

Thank you very much.

Mr. Spies:

I'm Harold Spies again, and I just have one more question. Can you give us a comparison of power of, say, a police radar that we would be exposed to, or the FAA system that's out on Northfield Road, I believe there's one out there that spins, and as we pass by, we come pretty close to that? I'm wondering if you could give us a comparison with some known risks in the area already versus what you're proposing.

Mr. Mitchell:

The speedguns that--I'm just aware of one type of speedgun--it's made by Kustom Electronics or something and it's a--operates up around twenty-two GHz. Okay, yes, I do have a viewgraph that might shed some light on that.

Mr. Spies:

I'll just go ahead and sit back down. Thank you very much.

Mr. Mitchell:

These are typical--there are many things one could look at--but these are typical radiation levels from things that you'll recognize, for instance, the public building with an antenna for an FM radio--characteristically you can have levels anywhere from 10 to 200 microwatts per centimeter squared in those buildings. All of these references are from current documents that are publicly available through the Environmental Protection Agency. For instance, fifty percent of the urban population of this country--just from FM and TV broadcast sources--are regularly exposed to levels of .005 microwatts per centimeter squared. This was the basis of the Environmental Protection Agency that made measurements in about a dozen metropolitan areas. I also have a slide that shows what levels in what cities but, for instance, I recall the first one on the list was Boston. Fifty percent of the people in Boston are regularly exposed to levels of 0.018 microwatts per centimeter squared. That's fifty percent of the population, so these are numbers that have been generated over several years of measurements by Environmental Protection Agency. A CB transmitter--you know you probably--everybody's familiar with CB radio--there are about--something like 30 to 35 million of these in use in the United States today, I'm told. And that the radiation levels inside a vehicle--when you key that CB mike--is something in the neighborhood of 20 microwatts per centimeter squared. And if you were to be standing by your antenna--within three feet of the antenna of that system, the levels could be up to several hundred microwatts per centimeter squared, so does that give you some feel for them?

Colonel Smith:

Do we have any other questions? Yes sir, come right up.

Mr. Dreisbach:

My name is Ron Dreisbach and I am a concerned citizen. I don't represent any groups. And I'd like to know if the PAVE PAWS radar beam or tracking system reaches down to the ocean levels or just above the ocean.

Mr. Mitchell:

The main beam and then the tracking sector continues to rise at an elevation angle of close to three degrees.

Mr. Dreisbach:

Okay, then couldn't a low flying missile go underneath that tracking beam?

Mr. Mitchell:

This is to detect submarine launched ballistic missiles and the nature of a ballistic missile is that it would have to--it would have to go through the surveillance fence and it would be detected.

Colonel McEachern:

Let me answer that question. You know we have all types of radar systems and we do have a radar system that does perhaps what--we have an over-the-horizon radar system. It serves a different type of mission. Naturally, its a different frequency band than we are--because of the ionosphere and the nature of this type of a system, it bounces off the ionosphere, and comes down two thousand miles away, and you may be able to see large aircraft over the ocean. We do have a system that does that. This, however, is a line-of-sight system; it doesn't bend, it goes straight through and straight up. It goes in the--as I said before--whatever you can see, that's where that beam goes--if it's above three degrees above the horizon. So, it does not detect anything below that particular point. For example, if you get out about five miles away then you might find that beam--if you look up, it'll be perhaps a thousand feet off the ground. And then it'll have a small two-degree wedge up a thousand feet up off the ground. If you go ten miles away it'll be up another couple of thousand feet, it'll be three thousand feet high, and that's how it goes.

Mr. Dreisbach:

Well, how close can a missile get before it got into that range of the climbing angle, before you could detect it in that angle?

Mr. Mitchell:

In other words, you couldn't detect a cruise missile, for instance.

Colonel McEachern:

Well, you--the missiles that we detect, of course, are far away. They're out several hundred, and maybe several thousand, miles. That's what we're looking for. You cannot--if you launch a missile it has to be far out to sea, for several reasons, and it'll be several hundred miles out at the closest point.

Mr. Dreisbach:

Okay, I have a second question, and that is in--I believe it was in your points, I don't remember what it was on the board--you said that certain other studies could be due to faults. Well, how come your studies may not have been reckoned to be faulty, and why

did you choose these other ones that weren't optimistic about PAVE PAWS to be faulty?

Mr. Mitchell:

Are you speaking about the measurements now or about bioeffects studies?

Mr. Dreisbach:

I'm speaking about--I believe it was bioeffects studies.

Mr. Mitchell:

Do you want to just--Dr. Polson will comment.

Dr. Polson:

I'm not quite sure what you mean by that. Do you mean did we select only studies that were favorable to PAVE PAWS?

Mr. Dreisbach:

No, I realize you showed some that weren't. However, you said these studies that weren't in favor of PAVE PAWS may have been due to faults. And I'm wondering if that was...

Dr. Polson:

I didn't say that all of them, not all of them were. There were some that, we believe, used incorrect technique, for example, using implanted metal electrodes in rats that cause a field enhancement inside the brain, and these will show effects at very low levels. But if the electrodes are removed then the fields will not penetrate into the brains, and you won't see the effects that these authors claimed.

Mr. Dreisbach:

Okay, then how is that related to humans? 'Cause you also stated you had trouble with those experiments related to humans.

Dr. Polson:

I'm still not quite sure what...

Mr. Dreisbach:

What I'm trying to ask you is, if you did experiments on animals...

Dr. Poison:

Yes?

Mr. Dreisbach:

...what problems are involved in converting those to humans?

Dr. Poison:

Well, there are many problems involved in going from animal studies to human studies. There's first--there's the problem of scaling that I indicated--the effect of a certain frequency like PAVE PAWS frequency on a rat may not be the same thing as that frequency on a human, because the wave length is large compared to the rat, but small compared with the human. So we have what's called a frequency scaling problem. The other point that I alluded to in the section on "Unresolved Issues" is, if you see an effect in a rat, that rat may not be the same physiologically in its ability to dissipate heat or in its biochemical makeup, in its ability to cope with certain--the release of certain stress chemicals--or things like that. So there is the double problem of going from animal experiments to humans.

Mr. Dreisbach:

Okay, then I have one last question. And that would be--can the beam cause any radioactive problems to, perhaps, birds flying overhead?

Dr. Poison:

Not radioactive. This is not part of the radioactive problem.

Mr. Dreisbach:

The radiation?

Dr. Poison:

The radiation?

Mr. Dreisbach:

Yes. If a human were to go out and hunt, you know, in fields, would that pose any problem eating those animals after they've been near those things?

Dr. Polson:

Definitely not, definitely not, no.

Mr. Dreisbach:

Okay, thank you.

Mr. Nelson:

You brought up a point that the--there was trace elements of radiation found in the test areas. In fact, you quoted a measurement of approximately one hundred to one hundred--to one thousand centimeters...

Mr. Mitchell:

Yes, in the local areas the low levels were in the neighborhood of .001 microwatts per centimeter squared.

Mr. Nelson:

Is that just a trace, or is that at full power and full strength of the beam?

Mr. Mitchell:

That's the highest that we believe that level could ever be, on the basis that we were operating the radar in a maximum radiation mode to produce the levels at ground.

Mr. Nelson:

You did all of your tests at ground level?

Mr. Mitchell:

That's correct.

Mr. Nelson:

Were there any airborne tests?

Mr. Mitchell:

No. Not in this series.

Mr. Nelson:

Okay. The reason I ask is I'm employed as a full time flight instructor--which is hazard enough. And I would like to know if I spend most of my day in the air, in and out of your beam, what effect will that have on myself and my students, and what problems will that cause to the navigational equipment? 4

Mr. Mitchell:

Well, let me ask Ron White to answer that. It is addressed in the EIS, and we're confident that the levels would be extremely low.

Dr. White:

Yes, we've looked specifically into aircraft and noted the fact that there's a lot of volume up there, and the beam is moving around a lot. So we looked at the average levels that would be found in an aircraft as a function of distance, and that is adequately treated in the EIS. And more than about a mile away or so we should be--even a mile would be long on reservation--the levels are--would be very comparable to those that were measured on the ground. That is to say, the average levels would be very low. The peak levels, of course, are higher because on that relatively infrequent occasion that the main beam did strike, it would be a higher peak but the average would be very low.

Mr. Nelson:

So being in the direct concentration of the beam itself would be approximately the same exposure level as on the ground.

Dr. White:

Average level, yes, average level. And there are, again, values given in the EIS, there're equations, for example, and there're also charts which would give those values. Just name the distance, and get the number right out. If you're interested afterward, we can go over some numbers and I can tell you what they are and how they would compare in more detail. I'm not giving you specific numbers right now; I can't get them out of my head.

Mr. Nelson:

Another question I have is, you say that the slant elevation of the beam is about three degrees above the surface, right?

Dr. White:

Yes, the center line of the main beam.

Mr. Nelson:

What is the width? I didn't get a distance on that.

Dr. White:

Well, it's nominally two degrees. Most of the energy is contained within two degrees--but the very edge of it goes out a little bit farther, as high as like 2.6 degrees. So they're very well...

Mr. Nelson:

At projection site it could be as small as a hundred feet, but at three thousand miles, what would be the width at that point?

Dr. White:

It's very wide.

Mr. Moore:

About one twentieth of the range.

Dr. White:

It's a very large number out there.

Mr. Nelson:

I see. It seems like this is just a beam going in a certain latitude across the earth. Are you only looking for submarines and missiles in one particular area, or is that a multi-directional beam?

Mr. Mitchell:

No, this is--it's a dynamic situation. This beam is electronically steered, and therefore, it is pulsed at all of those--over that total surveillance volume. From 240 degrees in azimuth and +3 to 85 degrees in elevation angle. So it's constantly pulsing to fill--for instance, it fills a surveillance fence, and it also has--it will also do--track space objects simultaneously--so it's doing that all the time. So, the dynamics of an aircraft problem are that the likelihood--since you're moving and the beam is moving--the real likelihood of being in that is probably--is very small.

Colonel McEachern:

It looks like a windshield washer. You see--your car? That's what it does, just like a windshield washer.

Mr. Nelson:

Is there any problem with reflective properties in this--from the atmosphere back to a broad spectrum on earth?

Colonel McEachern:

No, we have done some studies on that, and there are no problems unless we were transmitting the main beam below one degree. Since we are not transmitting the main beam below one degree, the probability of anything reflecting is extremely low.

Mr. Nelson:

Thank you very much. One question I would like to ask the gentleman there--of your biological studies.

Dr. Poison:

Yes?

Mr. Nelson:

How long were these projects going under research? I know that you were taking effects--you said were calcium things formed in brains and stuff like that. How long did your research go on?

Dr. Poison:

We didn't...

Mr. Nelson:

Two days, someplace for about two days, didn't it--of the PAVE PAWS--the actually testing?

Mr. Mitchell:

The testing of the radiation measurements were conducted over a two-day period. The biological effects that we're talking about is work that's been on-going for a number of years. So there're about 300 active scientists in the world today that are studying biological effects.

Mr. Nelson:

But at no point on earth was there ever a test or research taken at these levels--of PAVE--such as PAVE PAWS?

Dr. Poison:

There hasn't been any research at the levels of PAVE PAWS--that is below one microwatt per square centimeter--because, people don't expect to see effects--they haven't seen effects at levels below 100 microwatts. In fact, as we said, the vast preponderance of the experiments where they do see effects are at 2,000 microwatts per square centimeter and up. There have been some long-term experiments carried out, but as I said, these aren't really continuous exposures. They are exposed to maybe 8 hours a day or 12 hours a day, and then repeated the next day. But there have been some...

Mr. Nelson:

Well, the logical assumption would be that--since these, since PAVE PAWS will be operating at a lower level than what has already been tested, then the exposure hazards would be less, right? But there again, it's only an assumption and not substantial evidence.

Dr. Poison:

Well, we said there was no evidence. There are no experiments. There is no real hard experimental evidence of anything.

Mr. Nelson:

Will the people of this community be afforded the opportunity to see the research going on?

Mr. Mitchell:

You're interested in getting papers on this test?

Mr. Nelson:

Yeah, something on the test...

Mr. Mitchell:

Yes. Like I say, there's an active group of scientists that--we have at least one international meeting every year--where they present--like in June, we had one at the University of Washington in Seattle. And at that meeting alone there were something like 140 research papers--and so that's readily available through that

organization, the Bioelectromagnetics Society. Also the National Telecommunication and Information Administration has just published a summary of the research work that was conducted in the United States by all of the different agencies over the past two years. And that generally is an annual report. In fact, the people from SRI have had a major role in pulling that report together on several occasions.

Mr. Nelson:

So the...

Mr. Mitchell:

There is a lot of information available.

Mr. Nelson:

Yes, my understanding is then that you will have a research project going on in measuring levels while the system is being used.

Mr. Mitchell:

No. We're not going to have experiments set up in the vicinity of PAVE PAWS. That's not in any plans. We--the Air Force and other agencies, the Army, Navy, many other agencies--have ongoing research programs. And, for instance, the Air Force is--about a year ago--just entered into a quite extensive contract with the University of Washington School of Medicine, where we're doing the long-term low level study. So we have a study underway now that will take animals, expose them--it'll be a large number of animals--they're all in their individual circular wave guide exposure systems--they will be pulsed, similar power of duty cycles for PAVE PAWS.

Mr. Nelson:

But you'll have nothing...

Mr. Mitchell:

We're not going to use PAVE PAWS to--for any experimental work, that's right.

Mr. Nelson:

So laboratory animals in Washington will be used as a criteria for the citizens of this community. Is that what I'm led to believe:

You will not have any doctors or scientists...in this area?

Mr. Mitchell:

Well, we could talk at great lengths with this, so--I'm not sure how to grasp your specific question, but, almost all avenues, including epidemiology studies, you know, are being considered.

Mr. Nelson:

Well, thank you very much.

Mr. Helder:

Yes, I'm Jan Helder. I'm representing my U.S. History class at Marysville High School, and I have one major question to ask. What are the advantages of the PAVE PAWS system over present radar systems?

Colonel McEachern:

This--I'll address it to the particular mission that we have to perform--there are many different types of radar with many different types of missions. Our mission is to track sea-launched ballistic missiles. So what we're looking for is a system that will be able to track any missiles from enemy submarines that might want to attack this country. So what we have to do is have a system--a missile system--tracking system set up that will be able to see these. The advantage over the present system is that the present system is very limited in tracking capability. This system that we have can track multiple missiles at one time. We also have an advantage of four-to-one on the range. Today's systems are able to track out to about 700 or 800 miles--which isn't far enough--because the threat that we have to counter--we may need to track out to 3,000 nautical miles. The main advantage I think would be down to--system and orbital target tracking--no, excuse me--multiple target tracking and distance, those are the two main advantages.

Mr. Helder:

Okay, but, what about when you consider satellites and things of that nature? How much faster will you know when a submarine missile is coming? How much faster will you know through PAVE PAWS than through the present satellites and any other radars?

Colonel McEachern:

Well, I can't get into warning times. Those are classified areas.

Mr. Helder:

Why is it classified? What difference does it make?

Colonel McEachern:

It makes a big difference. Then you're giving the--if you tell your friend next door the speed of your bicycle, and you're in a big bicycle race with him, you're giving him an advantage, so you'd just as soon not let him know the speed of your bicycle before you start the race.

Mr. Helder:

So it is a sufficient amount faster, then...right? You can say that?

Colonel McEachern:

It's faster.

Mr. Helder:

Okay, on the biological studies, when you're talking about radiation and things like that, aren't there studies that say that it is not the amount of radiation going through you at the time, but it's the amount of radiation that is accumulated in your body? Aren't there studies which say that?

Mr. Mitchell:

We found no evidence to support the theory of cumulative effects in the work that's reviewed for this EIS. We are doing a large number of studies. We were attempting to expose animals over a longer period of time to determine the effects of long-term, low-level--but, I think Dr. Polson correctly identified in his--in the EIS--that we have determined that the effects are not cumulative.

Dr. Polson:

I think what you're referring to is the effects of ionizing radiation. The sort of thing that you get from x-rays, from radioactive substances. They are cumulative. But there is no evidence that seems to indicate that microwaves, nonionizing radiation, produce any sort of cumulative damage to the body.

Mr. Helder:

Yes, but are there any studies--all throughout this I've heard of--likely, no, we don't know of any others. But can you actually state, by proven studies, that there is going to be no problem in ten years, or things of that nature? Why are we talking about this now? Why wasn't this talked about ten years ago before the system was built?

Dr. Polson:

The point you are making there is a very good one, and lots of people have raised this point. We can't make any absolute guarantees about the safety of this--because, exactly as you say, ten years from now we'll know a lot more than we do at the present time. But what we are saying is that there is no evidence in the literature, in the studies that have been conducted up until now, that there is a hazard at this time, and we are, we believe that it is likely to prove--it is likely that there will not prove to be any hazards in the future.

Mr. Helder:

Okay, thank you.

Colonel Smith:

Thank you very much. Do we have any other fast questions here before we take a recess? Here comes one right now.

Mr. Young:

My name is Martin Young, and I'm one of many concerned citizens, and my question is about whether the standard of 10,000 microwatts per square centimeter currently used in the United States is giving us adequate safety? Dr. Mitchell mentioned at the briefing on the 10th of the month that there was talk of this being lowered--it might be lowered to 1,000. And a couple of years ago when the suit was underway on the matter of PAVE PAWS--in Dr. Loebner's deposition, he expressed an opinion that maybe it should be as low as 75 or 100. If the laboratory tests are conducted at 2,000 microwatts per square centimeter, and our standard--I believe that's an occupational standard--that would be allowable in a factory--is ten thousand, that seems like it might be a little hazardously high. And the difference between ours and the standard in the USSR, and I believe in some Scandinavian countries--their's is very much lower. Is it true that their standard is 10 microwatts per square centimeter, occupational, and even lower for people in the homes...

Mr. Mitchell:

Yes, let me show you what their standard is. This represents the range of the standards in the world today. The U.S. standard--this is plotted in microwatts per centimeter squared--so that 10,000 microwatts, that's the standard that's been used by ANSI, OSHA, DoD, for a long time. Now, the Russian occupational level is a frequency-dependent standard, and this is about the frequency of PAVE PAWS--it's a 420 to 450 megahertz band, in here. And so at the frequency of PAVE PAWS, the Russian standard, for occupation, is 10 microwatts per centimeter squared, and for non-occupational, Dr. Shandala at Helsinki, is proposing the number of 5 microwatts. We have that in writing, but we don't know if its going to be adopted in Russia yet. Now, we've pointed out that the levels that we're talking about are down here in the .001 level. So they are considerably below even the Russian standard for most of the public exposures. Now, the American National Standards Institute and a number of others are looking at the revision of standards today--on the basis of the same world data base and current research that Dr. Poison was talking about, and the data that was used in this Environmental Impact Statement. Sweden, who adopted a set of new standards in their country just a year or so ago, took a 1 and 5 milliwatt standard or 1,000 and 5,000 microwatt standard. Canada has just come out with a standard in the same area, that is, 1,000 and 5,000. And the American National Standards Institute draft--which, by the way, the shape of this curve came out of the laboratory of the School of Aerospace Medicine. So we've been working on a number of committees for a lot of years, and the proposal of this committee has been to lower it--the lowest level that has been discussed in the most recent draft is 1,000 microwatts per centimeter squared. Now, that's not to say that it may not be lower--I think Dr. Loebner has said 75 microwatts which would be somewhere in here, so--and we're not sure where that will settle out, but there are--OSHA could adopt the standard. In the Air Force, as a matter of fact, and I think PAVE PAWS shows this--that we have always taken a very conservative approach in terms of radiation safety. We have a very active radiation safety program--and have had for a lot of years, and the fact that we could be siting this system, based on current guidelines, up around 10,000 microwatts over the fence or in that vicinity, and indeed we're, you know, 100,000 times lower than that. So I think the range of standards--or the answer to your question is that the American National Standards Institute has a draft that would be 1,000 microwatts--then it may vary around that somewhat. Also, the National Institute of Occupational Safety and Health has a criteria document--where they also have put together something very similar to that.

Colonel Smith:

I think at this--excuse me, do you have a queston, sir? All right, come right ahead, sir.

Mr. Rafferty:

I'm Bill Rafferty, Electronics Technician, and I've participated in the monitoring of the testing, and I, myself, am thoroughly convinced that there is no hazard. But, in my family in particular, I'm the only one that believes that. It would help tremendously, I think, if the chart that you just had up there reflected the levels that you were--this is just a suggestion. It would probably alleviate some of the fears in the public. If you used some kind of a chart like that to show the levels that you actually measured, it would show people the levels that we're dealing with instead of the tremendously large levels that they heard about. And also, there should be some explanation of the difference between this kind of radiation and the hard radiation. I think that's one of the great fears in the public. So I think the Air Force has done a commendable job in trying to alleviate the fears of the public, and, thank you.

Mr. Mitchell:

Thank you very much. Let me have that previous slide back on for just a minute. Put that back on. Bill, this--what you suggest is probably a very valid suggestion and I should point out I was--when I said down here 10 to the minus 3 I'm talking about the levels that are down in this community. Now, the highest level that we measured during our test was like 100 microwatts, so it would fall right in here, too, something like that. So, what you're suggesting is that those be plotted in this format, so it can be adequately compared, and that's probably a good idea. Now the next slide--we had several questions tonight that deal with the possible confusion between ionizing radiation and nonionizing radiation. This is a spectrum plot of the electromagnetic spectrum, and most everyone is familiar with gamma rays and x-rays that are used in diagnostic work. Nuclear radiation, that's all up in this area, and that is ionizing radiation--very high energy levels--photons of that kind of energy can create ionization. Then you come down to--this is the visible light spectrum, that's what we actually see. Ultraviolet, infrared, and then it's down at the very low part of the frequency spectrum where we have the radio frequency radiation. And PAVE PAWS, on a frequency basis, operates just about right in here. So this is all essentially nonionizing radiation--transient phenomena. This would be the ionizing radiation.

Colonel Smith:

I think at this point we'll take a 10-minute recess and after...

Mr. Mitchell:

You just got one comment there.

Colonel Smith:

Excuse me, I keep trying...

Major Kennett:

You asked that--you would hope that we would get these results out to the people. As a matter of fact, as soon as they were available and verified, they were provided to all the news media in central California. They were provided to all three TV stations in Sacramento and they've used them. They were provided to the Sacramento Bee and Union and they've reported them. They were provided to the local newspaper here, I believe they also used them, too, and they were also--been widely covered by the radio, and have been on the Associated Press and UPI lines. So we've tried to get the information out.

Mr. Rafferty:

Yeah, could I comment on that? I think that one of the problems with the method in which it was put out is that people were dazzled by the numbers. There's an awful lot of people that don't have any background whatsoever in dealing with numbers, and they don't understand the point zero zero relationship to what they're actually being exposed to. To put it into layman's terms and display it on the chart like that would be a lot better.

Major Kennett:

Well, the charts were provided as they were.

Mr. Rafferty:

Well, they're still using numbers...

Mr. Mitchell:

I understand your question in comparing with the standards, I think--because it's a guideline, and that's all we have to go by--and there is a range of difference between the U.S. and USSR, and all the other standards fall in the middle there.

Colonel Smith:

All right, at this time I think we'll take a 10-minute stretch period, here. After the stretch period, we'll have the statements from interested people in the community, and if anyone desires to make a statement, and they have not yet filled out a card, the cards are available down here at this table and the table in the back of the room. Let's take 10 minutes.

(The hearing recessed at 2103 and resumed at 2115.)

Colonel Smith:

Dr. Loebner indicated earlier that he had considerable information to put into the record, so we have agreed to have Dr. Loebner speak again after all other persons who desire to have a statement, or make a statement, have had an opportunity. Dr. Loebner? For the statements, if we could--wherever it's most convenient--up here on the podium is probably best.

Dr. Loebner:

Thank you very much, Colonel Smith. My appearance here tonight on behalf of the Citizens Concerned about PAVE PAWS is not connected with my position and employment at Hewlett-Packard. I do not represent the Hewlett-Packard Corporation. The views which are expressed are my own, and not those of Hewlett-Packard or, for that matter, of any other organization besides Citizens Concerned about PAVE PAWS. I arrived at them after careful study over hundreds of hours, devoted to many dozens of complex aspects raised by the size and intricacy of this installation, and the potential environmental issues it raises. I've had the opportunity to discuss these issues with experts and officials in many places. I received a vast amount of information from many sources, the U.S. Air Force included. The judgments and beliefs I express are my own. They have been arrived at, to the best of my ability, subject only to constraints of time and limited financial and manpower resources. It would take a long time to thank all the individuals and organizations that helped me in this effort. I do want to state my appreciation to Hewlett-Packard for their noninterference with those of their employees who, like myself, wish to get involved in matters relating to public issues and common concerns. I also want to thank, at this point, the U.S. Air Force, who have been extremely helpful in making it possible for me not only to give this 10-minute introduction, but also to give you a presentation afterwards that is going to back up the statements that I'm going to make now.

As you've heard, I've asked a few questions after the presentations. I've asked these questions because it's only in the very last few hours that I've finally been able to come to grips with something that bothered me all along for the two years. Now, one has to be very careful if one comes up as a scientist with a result that is very recent. It needs caution. But I have spent time with many individuals--I've checked it, and I think the issue is of great concern, and, therefore, I think this is the time and place to make the presentation that I am going to make.

I'm going to start from my recommendations. I'm going to state that I've come to the conclusion that it is not possible to use

average values for the type of signal that we face in PAVE PAWS. You've heard that there was no evidence of any concern. But you've also heard that there are no measurements that duplicate the situation at PAVE PAWS. That, in itself, wouldn't mean very much. Because I've had discussions with these gentlemen before. But I think there are good reasons that come from thermal transfer, from physics, from knowledge of biology, to show that, indeed, there is going to be a very preferential deposition of the energy in the human body, and, therefore, that the standards that we have right now, that we are using, in terms of averaging over six minutes, are grossly inadequate under certain physical conditions. These physical conditions are unique for PAVE PAWS. Thus far, we've heard that this is a situation of this particular kind, and I'm going to then introduce guidelines. I'm going to say that occupational 8-hour exposure should be somewhere between 75 to 150 microwatts per square centimeter. I'm going to say that the general public for 24 hours should be 25-50 microwatts per square centimeter. And I'm going to say susceptible individuals, who are vulnerable to things, should be below 5 microwatts per square centimeter, and I'm introducing this particular guideline--proposed guideline--for long pulse biological effects, on estimated internal stresses for which there is no standard at this particular time, and which I only say should be done in the frequency range and for the pulse conditions at PAVE PAWS, into the record, please.

Furthermore, you have heard that there is--that there was no concern on the part of Mr. Mitchell of making measurements inside the buildings. In my presentation afterwards, I will introduce evidence, a letter from Chief-of-Staff, asking to make these measurements inside the hospital; and I will introduce a letter by Colonel McEachern saying that he will do so. I will also introduce into the record references from the National Academy of Science report that states that there is concern that the energy inside the building under certain conditions could be 100 or 1,000 times larger than outside, and I'm also going to suggest that this may not be so, but that measurements have to be done in order to ensure that.

I'm further going to introduce two letters from the White House--that I've received from the White House--that clearly state the intent of the White House to have certain studies done, and another letter showing that after a year these studies are still not done--even a plan for these studies isn't there. And I'm going to discuss the relevance of the biological literature--that is in the Environmental Impact Statement, and I'm going to show that there is almost none for this particular study--and that some studies can be made--that some thoughts are available as to what to do, and that the bureaucracy today--17 agencies that I just can't get together to even talk to each other--have--didn't get up to the start. And finally, I'm going to suggest that something be done. I'm going to suggest that, until some of these things are

settled, that certain measures be taken at the base. I'm going to suggest that the people in the hospital be given the freedom to decide, and be given an opportunity to move to another place, if they wish to. I'm going to suggest that the school children and their parents decide, that until this thing is settled, be given an opportunity to move to some other site and not use that school until the information is settled. Thank you, sir.

Colonel Smith:

Thank you very much. I have at this time only one exhibit, and that is the proposed guideline. Dr. Loebner, I assume that these other documents that you referred to--you will be offering at a later time in your presentation.

Dr. Loebner:

That is correct, sir.

Colonel Smith:

Fine. At this time, then, we have the one exhibit, Exhibit Number One, which will be attached to the record. Our next speaker is Lala Cade, I believe the name is. She also is representing the Citizens Concerned about PAVE PAWS. Ms. Cade, welcome.

Ms. Cade:

I simply want to express--first, our appreciation for the Air Force's kindness in asking us out there. They were extremely courteous to us, and we do appreciate it. And we did follow the testing through to the very end on the hot days and went all the way. But we felt if we opened our mouths and said something, we should show up to show them we really were still concerned. The second thing I want to say is that--I'll tell you just this very short history of why we did and what we did from the beginning.

In the beginning we were suddenly made aware that something tremendously big was being built out at the Air Base. We had no forewarning of this. No--the citizens of the community never were told about it--no expression was ever given to us that there was--what was being done out there. So we became concerned. We organized a little group. Just a small group of us got together, and we decided we were going to try to get some answers. That naturally was technical. So, Irene Krepps got in touch with Dr. Loebner and some other people, and we started from there to try to find some answers to some of the things that we didn't know--which was most of the things. And that is how we started to--in our discussion here. We did ask then for an EIS, and were told it wasn't necessary, but finally we had the EIS. We also asked that 12 13 26

a monitoring system be provided in the areas here, a number of them or at least one, and that additional studies be continued, immediately, into the various phases. We were also told these couldn't be done. One was that there was no such animal. The second that--we found out afterwards that we could get one, there was such a possiblity, but they still don't, I guess, care to have the monitoring system--this is a recording monitoring system. So, we are still interested in having that, and we still want them to go on and do a lot more investigation. We do not, of ourselves, our little group, we do not say we know this isn't safe, we know a lot about it. We don't. But we do defer our knowledge to Dr. Loebner and his associates, which gives us a very good background for finding out what really is the case, and what needs to be done initially; and in my estimation, I might be wrong, but I believe that the Air Force is interested in getting these answers. I hope they are; and we're going to see that they do, but I think they'll help.

Colonel Smith:

Thank you very much, Ms. Cade. Now, our next speaker is May P. Pearce, and she is representing herself. Ms. Pearce.

Ms. Pearce:

Yes, I already asked my question. I didn't realize it--that there were going to be two sections to it. I was concerned about why they placed it here, and I got another answer to why they placed it here. Thank you. I won't take any time up then.

Colonel Smith:

Okay, right, I apparently didn't make it clear enough in the beginning.

Ms. Pearce:

I'll talk to you later.

Colonel Smith:

Fine. Our next speaker is Mr. Peter Ingram, and he is representing an organization, his family. Mr. Ingram.

Mr. Ingram:

Is Dr. Loebner going to speak again?

Colonel Smith:

Dr. Loebner will speak. We've asked, though, or I've ruled, I guess is the appropriate thing to say, that we limit everybody to 10 minutes that desires to make a statement and after everybody that desires to speak has had an opportunity, the remaining time, whatever Dr. Loebner would like, we'll give him.

Mr. Ingram:

Would it be possible after Dr. Loebner's speech to ask him some questions in front of the people assembled here?

Colonel Smith:

To ask Dr. Loebner questions?

Mr. Ingram:

Correct.

Colonel Smith:

That's kind of contrary to--well, let's see how much time we have at that point. We're here primarily to get the questions that the people of the community has for the United States Air Force rather than for Dr. Loebner. As far as thoughts that may assist in his presentation and so forth, let's look at it after we get to that point. If we have time, why, I'll grant that. It could be beneficial--helpful to all of us. I take it then, Mr. Ingram, that you do not desire to make a statement at this time, is that correct?

Mr. Ingram:

Well, the only statement that I wish to make is that, so far, the evidence that has been presented has been for--what has been seemingly established scientifically to be in the safe realm, although the various testing modes that are being used--the subject of cataracts and also the subject of long term exposure, has not at all really been touched upon, because these are things that seem to be of the nature that need years and years of testing. So, I am not entirely satisfied as to the safety, although, if it's true that the count is .001 per centimeter, is this correct in most of the areas? 14

Colonel Smith:

I am unable to answer this question. The panel indicates affirmatively, yes.

Mr. Ingram:

If that is true, then it would seem to me, to the public, at least in my eye, that it would be a relatively safe issue unless a long-term program proved otherwise.

Colonel Smith:

Thank you very much, sir. Our next--or the next card that I have for a speaker is a Mr. Bernie Olson of Motorola C&E, I believe it is. Mr. Olson.

Mr. Olson:

Thank you. There will be two of us.

Colonel Smith:

Would you like to step over here? Is that what--fine, there if you like. Whatever is most convenient, sir.

Mr. Olson:

Okay.

Mr. Falkenberg:

Yes, thank you. My name is Gerry Falkenberg. I also represent Motorola. We operate a communications facility on Sutter Mountain, and we--and this is Bernie Olson, out of our engineering staff. We are here addressing, or presenting, information which is, in effect, on behalf of the commercial and public safety business community that utilize two-way radio communications. We prepared a statement which indicates the results of some measurements that we have made within the last several days on Sutter Mountain and in Yuba City that indicate severe levels of radiation--or interference--to commercial radio. Included in this engineering report is some pictures that we took in the field on spectrum analyzers. Also included in the report is a list of about 120 business radio users on our site on Sutter Buttes which would be very useful for contact on your behalf to assure--report what we're saying. 15

Colonel Smith:

All right, this document then will be marked as Exhibit Number Two and attached to the transcript of the hearing.

Mr. Olson:

My name is Bernie Olson; I am the Manager of Engineering Services for Motorola in Foster City, California. I, tonight, received my copy of the Environmental Impact Study, and in reviewing the section on mobile--land-mobile communications I found some discrepancies in the statement over the results that we have measured here in the field. And first, I would like to say that what we are talking about is the sensitivity of a land-mobile receiver which is extremely sensitive. We are looking for very, very weak signals. We're not talking about anything that is harmful to the human being. So this is not the issue of radiation to people, this is about the effect of a very sensitive receiver trying to listen to a specific frequency. We have found that the levels coming from the PAVE PAWS to Sutter Buttes site are much higher than predicted in the Environmental Impact Statement, and are already having a detrimental effect upon some of our users. Another thing I noticed quickly in looking through here--there was a--it indicated that there would be no pulsing heard in land-mobile stations--that it would not open up the squelch. That is an incorrect statement. We have already had cases here in Yuba City and on Sutter Buttes of this occurring, and, interesting from our point of view, is that they spoke to the fact of users in the business radio community, and they looked at frequencies from 450 megahertz up to 457 megahertz. This is not the band where the business users are located. They are located up a little bit higher than that, and there are literally hundreds of users right out here in the valley. We have many, many users on Sutter Buttes as well as on Mt. Vaca, Bald Mountain, and on the different mountain ridges along the valley here. It was also interesting to notice that they indicated that no users were found in a spectrum of 840 to 900 megahertz, where indeed we have 10 repeater units, with an average of 8 customers per repeater, located on Sutter Buttes, or 80 different businesses involved in that. So, we are looking forward to working with the Air Force and resolving these problems. We have a lot of customers--people that are trying to make their businesses more effective so that they can stay in business through the use of radio, and we want to see that they are not deprived of that. Thank you. 15

Colonel Smith:

Thank you very much, sir. Our next speaker is a Mr. Arthur W. Pearce--that I have a card for. And, apparently...

Mr. Pearce:

It has to do with the maps. I have the maps where they could mark out the area where their ranch is, and if they have any crop dusting or overflights, they can mark that on it too.

Colonel Smith:

All right, in effect then, the matter that Mr. Pearce had has already been presented through the question and answer period. Our next speaker is a Mr. Martin F. Young, again representing the Citizens Concerned about PAVE PAWS. Mr. Young.

Mr. Young:

My point on the adequacy of the U.S. safety standard has been covered.

Colonel Smith:

Thank you very much, sir. Do we have any other individuals who desire to make a statement here tonight, representing any groups or representing themselves?

(Pause)

Apparently not. One matter--I think that a couple of topics were addressed. Do any members of the panel have any responses to the statements made by individuals so far?

Colonel McEachern:

I did want to point out...

Colonel Smith:

Colonel McEachern, could we get you up to the mike, please?

Colonel McEachern:

I just wanted to make a couple of items--I know Mr. Loebner mentioned something about measurements inside the buildings and he mentioned my name as signing the letter. As you probably know, in my particular job, I sign hundreds, maybe thousands of letters over a two or three year period. I don't know what the date of that letter was. It could have been three or four years ago, and almost anything that you said was in a letter that I signed, I could not deny it, because I can't remember them all, or quite a bit of it. But there are probably reasons why we did not measure inside the buldings, and the reason is--at the time that we did our early studies, as you recall, we were looking for much higher levels than what we actually ended up with. Those of you who have read our Environmental Assessment which preceded the Environmental Impact Statement, you can see that we were looking for much higher values on the ground than we actually ended up with. Our calculations were very conservative at that time. We found, 16

however, that when we did take the readings outside the building--that they were so low, extremely low, that even if you did get an enhancement of the signal, which is, I assume, what Mr. Loebner was looking for, possibly happening, and certainly that does happen, that even with an enhancement it still would be an extremely low signal, so that we did not measure inside the building. But, if anybody had brought it up at that particular time and requested it, we certainly would have measured inside the building.

The other item, Ms. Cade--I just wanted to remind you that back in '75 we did do a--came out and gave a briefing to the public and to the Chamber of Commerce on the radar system, and what we were going to put out here. This was in June of '75, and there was an excellent story in the paper that was headlines, with a picture of the proposed radar. You probably don't remember that, but we did that.

Ms. Cade:

I remember a good many of them you had, but it was after we got started.

Colonel McEachern:

Yes, it was--right--it was before you got started--about two years before.

Ms. Cade:

So far before I don't remember.

Colonel McEachern:

The other item I just wanted to mention was that on the frequencies, the Motorola frequencies, frankly I am surprised, although when it comes to interference I'm really not surprised, because it's very subtle. Sometimes you can relate it to black magic how these things do interfere. We did do extensive studies though. You may have read the one done by the National Telecommunications and Information Agency people. They actually went into the plant, had the radios on the bench, and measured the potential interference with mobile radios. I assume you are talking about mobile radios. Is that right?

Mr. Olson:

Yes.

Colonel McEachern:

...and found that there would not be any interference except something very close to the 450 or 420 area. As it turns out, we did have some interference on Cape Cod with mobile radios that we did not expect either. And we had to take some extraordinary action, and we are certainly willing to work with you folks to try to work that out if at all possible.

Mr. Mitchell:

I would like to just add one thing in regard to comments that Dr. Loebner was making about levels again inside the hospital. Specifically in regard to problems that--questions that had come up over possible interference with physiological monitoring. We do have with us another Air Force physician tonight. Dr. Stanley Pala, who is the Commander of the Hospital at Beale, and we visited with him this morning, and went over these kinds of questions with him, and the radar has been on for some time and he has had absolutely no problems with any interference with his medical services in the hospital.

Colonel Smith:

Any other comments from panel members over here as far as statements already made?

(Pause)

Apparently not. Dr. Loebner, we have time for additional statements.

Dr. Loebner:

Colonel Smith, and the public here, I very much appreciate this opportunity to do this. I had opportunity to talk with a man who works for one of the government agencies, and he pointed out to me that the thing that is happening here in Marysville is somewhat unique, that it hasn't happened before, that we have a group that is deeply concerned, is not an emotional group of environmentalists, and who is really trying to get at the facts, and this is what is happening here tonight. I am going to try to put together to the degree of my ability what I understand the situation to be, what the facts are, what I have been able to find, and I have stopped at Question 25, that I am going to leave at the end for the stenographer because I think these questions have to be answered. Maybe there will be more of them. I just know that actually, from a technical point of view, there ought to be at least a hundred questions that have to be answered, because, in my opinion, contrary to the opinion of most of my colleagues, I

mean, I want you to know that I really have a hard time convincing people. I am starting to make some headway. People just didn't want to believe that one ought to be looking at this. And what I'm going to try to explain to you—that why they believed that, on the basis of their past experience, and what's different here in this installation, so that we really should be looking at it. Now, my presentation, I think, should be orderly. It may mean that I am going to say some of the less interesting things in the beginning, and then get to it, but I feel that otherwise if I jump around, it's not going to be very easy to follow. I will also apologize to some degree that it has to be technical, because there are technical questions here. And the only thing that one can ask are technical questions of people who are dealing with technical subjects and scientific subjects.

The outline is that we first have to deal with a source of the EMR—PAVE PAWS. What does it do? What do we know about it? We then have to talk about what it is intended to do, what it can do, and then what it's intended to do in terms of the UHF power delivered. We then have to find out what the terrain and surroundings can do to it, that it's not anticipated to do, but could do. And we then have to consider the human absorbers that are around. I'm not going to be talking about sensitive equipment, I'm really only concerned with the biological effects. I think the job on the other thing has been done. I'm quite satisfied it is quite okay. I'm then going to repeat and explain how I arrived at these recommended levels of exposure in a rational fashion, in a scientific way. And then I'm going to give my conclusions about the impact. And finally, I'm going to repeat and go in some detail on the recommendations that I have indicated that I am going to make.

Now, we are starting out with something that has been--and let me also state, because I think this is important, it has been stated here before that there is a vast, vast literature on the subject. There is. But believe it or not, only a very tiny portion of it is relevant to what we are talking about here tonight, and I think a disservice is being done in creating thicker and thicker documents that are harder and harder to read, and one gets lost in them even if one is scientific, that the job should be to boil it down to the essentials so that we can get answers to the questions that we are asking, so that everybody can clearly see what the issues are. And I think that the job of making a--er, I mean, an Environmental Impact Statement, should not be the one of the boilerplate that the community has gotten used to, but one of substance. And that's a recommendation to the people who are doing the job. I know they are following past procedures, but I think, in a technical job where the thing is so vast, it really overpowers you, and it takes a tremendous amount of energy to just get to those things that mean something.

What do we have? We have basically 1,792 elements in each face, and the Air Force tells us that they may, but they are not sure of, make 3,584 in the future. Now, they also tell us that the module is 322 watts apiece. Now, the power that they are talking about is really determined by multiplying a power of a single module by the number of 1,792. If the power in a single module goes up, the total power and everything that we heard of is going to go up. The question then is, what do we know about what's going to happen to these types of modules in the next 20 years, as the process goes on. Are they going to stay being 322, or are they going to go up to something larger? Now, we've got a problem because the reports that I've been looking at don't agree. There is another one--that you calculate back from the power that they give you, to get the number of 328 watts. Have they gone up? By 2% already? What is determining the power? It's actually the quality of the semiconductor and the cooling and the ability to deliver this power, and as we know technology progresses and it gets easier and easier. Are we going to know when, for instance, a higher power type of module is being introduced and the power is going to go up? Those are some of the questions. 17

Now, the maximum pulse length is 16.2 milliseconds. But actually that signal is really very complicated. First of all there are those 24 different frequencies that you can switch between--the 320--I mean the 420 and 450; on top of it there is a modulation of .1 megahertz for the search, of 1 megahertz for the track. In addition to these there are all kinds of pulses. There is a frequency of--there is a repetition rate of 54 milliseconds, and it has been pointed out in one of these reports that that leads to an 18 point something hertz power line spectrum that happens to be in resonance with brain waves. One of the people put that into the reports. So we are really dealing here with an extremely complex wave. That wave is so complicated that it hasn't been tested under these circumstances. And so, we have questions here as to whether these things are relevant or not. And the whole power source has not been quite adequately discussed. There is one part of it that I have not read anything about--that I am asking questions, and I hope answers are going to be given, because there is a third operation, which is in testing, that happens every so often, where a beam is generated by just one of the subarrays in sequence, and it's quite well known, when the subarray and the number of these elements is less, then the beam is going to be much wider. And there is no information as to the width of that particular beam, and how it is being done. So, there is not even sufficient information of all the operating conditions, if one wanted to calculate. Now, you may say that one may not want to, and you may possibly be even right, but the fact is that the Environmental Impact Statement does not tell you all of the things that sometimes you would like to know. It tells you other things that may not be--or at least that some people worry 18 19

about. Now, I'm coming now to the intended and nonintended power delivery. That's my second point.

We've been hearing all about the direction of the beam. But what bothered me a little bit and still bothers me, is that a beam has a width, and the width of the beam is something very important because you don't--it's not just infinitely thin. And the width really is going to determine what is going to happen below the normal direction that the beam is directed to. Now, the full width of that particular beam of the present kind is 5.2 degrees. Which means that actually this is measured up to the point where it starts coming up again into the cycle, where it actually goes down to near zero. That point is only .4 degrees above horizon. Now, you don't want to probably use that, but at the same time the other number that was given which is the 50% half-width, I think is too narrow. That is 2.2 degrees. That gets you 1.9 degrees above the horizontal line. Now the problem that you have to face, and I think I'm suggesting and I'd like to have some help, is that 10%--10 dB down looks like the most reasonable thing. Now, I cannot really find that type of information when I look at the plots in the Environmental Impact Statement. There is this big gap in many of those figures that I won't quote, because it's going to take a long time, but you can find, and I'm sure the people who wrote the EIS will find, that should be indicated a little bit more what it is we are talking about. And then when we come to the full width, full--the growth thing--we find that in the growth version, the full width is going to go down to 3.6 degrees. The 50% width is going to be 1.5 degrees, and then we find that the 10% which is not given, I have calculated and estimated, I don't know whether it's going to be 2.5 degrees. But in this situation then, what we have is, that we have instead of .4 degrees we have 1.2 degrees, which is much, much higher for the full width. We have 1.75 for the 10% which is much higher than 1.2. We have 2.25 which is much higher than 1.9. The importance of this queston is this: it just does not look reasonable to me that if the new version is going to go in, if the growth is going to get introduced, then the importance of that question right now here is because the Air Force has stated in the document that this particular hearing and that this particular document applies to both the present and the growth version. And therefore we have to discuss both of these things, and we have to concern ourselves with the consequences of both of these versions. Then I am asking the question, if the beam is so much higher from the ground, isn't it really from a defense point of view--and I would like you to know that I'm really very interested in having this place defended as best as possible, that I am really very much interested in having the Air Force carry out its mission to the best of its ability--isn't it really a good thing to bring it down? And what is going to happen then? How are we going to recalculate and how are we going to remeasure, and especially if we don't have another

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EIS. If we won't go through some of these measurements again. These are then the questions that come up when one is dealing with the nonintended power delivery.

Are we going to have another EIS at that time? I think we have to know. Because if not, then we need a little better determination than what we have, what is going to happen. Because the people who have done the study, and let me get now to some of the important documents--I said there are a lot of nonimportant documents--but the Air Force has really done a fine job. They have asked themselves the right questions. And they have said that they needed really experts that are disinterested and have nothing to do with the Air Force to go and take a look at this. And they have given a contract to the National Academy of Sciences which is the most prestigious scientific body in this country. This contract is number F4962078C0118. It is referenced in the EIS, and there are two such reports--one called an engineering report, and the other one called the biologic report. I read these very carefully because they were the best documents available. And I think that they are very relevant to the situation here, because they are telling us a lot of things that we didn't know before. Unfortunately, the second document that I have mentioned, the biologic one, is not of the same high quality as the engineering one. And there appears to be some difficulty of the engineers and biologists to talk to each other and understand each other as to what is going on. But there is a major problem. The major problem is that both reports state rather clearly that they are only concerned with the Otis site and they have absolutely nothing to say about the Beale site. Now this may not be as important for the engineering one, but it is quite important for the biological one. And I'm going to show you why. I would like to--and I hope I can find it in a hurry, I marked up these copies to do that--I would like to read to you from a page in this biologic report, because it does relate to what we have been discussing here. It's on page 47. It says, "enclosed structures such as rooms may act as lossy resonators with electromagnetic fields being coupled from the windows. If such structures have highly reflecting walls, field enhancements by one or two orders of magnitude may indeed be possible. However, because walls typically encountered are not very reflective, power density increase by a factor of more than about 5 to 10 may not be realistic. Further research into the reflection characteristics of the structures is indeed in order to describe precisely the nature of field enhancement." Now, these people didn't know anything about this particular hospital, and they put it in. I actually--not only that I have done the things that SRI told you they were doing, but I decided it's not enough to read the literature. It is sometimes very important to clear up some misunderstanding, and it's important to pick up the phone and call up the people who write these things and talk to them. I

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have spoken to the chairman of the panels, and I have spoken to the panels, and I was not satisfied. And I called up the National Academy of Sciences, and I spoke to the President's office, who gave me the name of the chairman of the review board. I've gotten the names of the four reviewers and I spoke to two of them. One of them, a physicist who understands me better than the biologist, was Edward Purcell, who received the Nobel Prize in 1952 in physics, and we spent about 30 minutes talking on the phone about certain issues in this particular report. And, in most cases, he agreed with my viewpoint that I have brought forth.

I am also quoting on page 81 from the same biologic report. It reads here, special attention should be given to the evaluation of the effects of PAVE PAWS radiation on electronic devices used for medical monitoring or health evaluation, because there is evidence that such devices may be sensitive to such exposure. I was glad to hear here tonight, just before, that apparently there is no problem. The thing that is most disturbing to me is the discrepancy that looks like a complete contradiction to me unless somebody can explain that to me. I have been trying to get an answer to this from these people, and I have not really gotten an answer. Let me read to you those two parts that doesn't seem to fit together. There is a preface by Stephen F. Cleary, Chairman, Panel on the Extent of Radiation from PAVE PAWS Radar System, and this preface--it states the panel did not address the question of the desirability or adequacy of the anticipated exposure control procedures, nor did it make a judgment concerning the relative safety or hazard of exposure to PAVE PAWS emission. They are saying they have not done that. But then you go to page 6 which is the bottom of the summary, Executive Summary of the same document, and I am not going to read the whole thing, but I'm going to just read three sentences. The premise, the major premise, and minor premise, and then the conclusion. Now logically, I'm going to show that I find it very difficult to even see what the conclusion is, and the conclusion happens to be in contradiction to what is said in the preface. And I read: "In conclusion, the PAVE PAWS radar may be anticipated to expose a limited number of members of the general public intermittently to low intensities of pulse modulated microwave field, with maximal instantaneous intensities of 100 microwatts per square centimeter or less and time average intensities lower by two orders of magnitude." Now, it's very important to keep on remembering that the time average intensities are about 50 to 100 times less than the nonaverage intensities. And that no proof has been given that—in this particular case, and I'm going to give an argument to the contrary--that this is allowed, that the physics and the thermal engineering allows you to use this type of an averaging under these conditions. I have asked the question, and I did not receive an answer. You all heard that.

"Now, it is improbable that the exposure will present any hazard"--did I read the conclusion here? Oh, not yet? Okay, I have to read that. "In conclusion, the PAVE PAWS radar may"--I read this. "But there are no known irreversible effects of such exposure on either morbidity or mortality in humans or other species."

Now, that's just not true because nobody has really gotten that wide of a pulse to be tested, as we heard. That statement is incorrect. I mean, you cannot just talk about intensities, you've got to talk about pulse shapes--and you've got to talk apples and apples and oranges and oranges and this is just not being done here, and so--and on top of it, the final conclusion, which says--thus it is improbable that exposure will present any hazard to the the public--it doesn't even follow because there are other health hazards than morbidity and mortality--any hazard--and on top of it, it's contrary to what it says in the preface. That it's going to say. Now, I don't think that type of a document has been carefully reviewed. I think it--at least on the surface to me and with some discussion with the people--appears to be full of inconsistencies.

I am troubled by something else. And it even came up at this particular meeting. There is a sort of a very tight definition of public. Apparently the Air Force is--and I think outsiders, rightfully so--concerned about the public outside of PAVE PAWS. But, I as a citizen, I as a Foreign Service officer in Moscow, am interested also about the dependents of the Air Force on the base. And I'm also concerned about the Air Force people on the base, and not just the public. And I think an Environmental Impact Statement should say so. Now, it has been--the whole conclusion--and you go through them everywhere, is only related to the public. These reports say nothing about what's happening there to the Air Force personnel or what could be happening to the Air Force personnel or to their dependents. It talks about public. Now, exposure standards inside are treated like they are occupational. I find it very difficult, in a maternity ward, with newborn babies, to apply occupational standards. And so, I would like to see a different application of standards for the comparison of exposures in doing that. And I know that this is the feeling of the Citizens Concerned about PAVE PAWS, because they came to me with these questions. So, it becomes now clear that these reports that we have, that are being referenced as proof, and being used as independent judgment, are really, unfortunately, not applicable to this particular case. We are also finding that the particular signals that we are having here are not--it is a new kind of a phased array thing. It's a new kind of a solid-state thing. It operates with different pulses width. We've pointed out--and it's true, that these peak pulses are so low; but there is a trade-off in physics. If you go down

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this way, you've got to make it wider in order to do the same job, and so they are much longer. Does this really buy you something? Or are you going to pay the price somewhere else? Dr. Mitchell told us, and he was right, you know, that these standards are so old, but the phased array system is not so old and the solid-state elements are not so old, and while these standards make a lot of sense because the pulses were very narrow and you can do the averaging, I have reasons to believe that they may not make any sense when they are so wide--to do the averaging in this particular way. So, I want to raise this particular question. And I think I would like to get some answers to it. Now, here is the physics of the situation. Here I am a little bit better on my own ground. In physics we have two ways of transferring heat. And you can learn that in your undergraduate physics. And there are textbooks that go back to the '30s that make this very clear distinction. There is heat transfer that is called isothermal, and there is heat transfer that is called adiabatic. What is an adiabatic transfer? It means that you are not in thermal equilibrium. I can tell you, for instance, what it is, because if you go to a microwave oven and you take a dish, and you put a meatball in the middle of it, and you turn it on, the meatball gets hot and the dish stays cold. There is no thermal equilibrium between the dish and the meatball. The RF energy has gotten into the meatball but it has done nothing to the dish. Therefore, it's possible to take different material, which has different internal properties, which has different absorptivity, and differentially heat it up if the material is not uniform. What you want to know in order to do that is very complicated. It is not a simple matter. I am not able to sit down and do these calculations overnight, when I started worrying about them. This just couldn't be done even if I stayed up all night. I know what has to be done, but I haven't done it. There is a temperature gradient, there is heat flux, there is time, there is heat conductivity, there is density, there is heat capacity, and there are other physical dimensions. But there are certain things as a physicist that I know. I know that if I have an object of very small dimensions, then I know that this object can be heated up in a great hurry. It doesn't take much time. And I can easily say that in my judgment, in my professional judgment, especially based on what I know about other fields in semiconductors, PN junctions that are very narrow, and so on, that it is not going to take very long in comparison to the 16 milliseconds to heat up small objects inside of cells. A cell itself is made up of many objects. A human body is very inhomogeneous. It is not just like a piece of silicon or a piece of iron. It's got many different parts. Just like this meatball and the dish, the heating is going to be quite differential in the human body. And so what we have to worry about when we look at these things--there are 3 different dimensions, all of them have to be handled differently. One is the total dimension of the body, and there are people like

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Om Ghandi who have done a fairly decent job in doing--calculating the standing waves and finding out that a human head at 450 megahertz will enhance the radiation inside from the outside by a factor of 3. That is, if a human behaves like his material that he calculates and that he models.

I had an opportunity to talk to Om Ghandi and I had difficulty trying to understand, when he upscales his animal, that the cell size doesn't change the way that the size of the whole body does. And then while his arrangement by changing the frequency adjusts for his standing waves, it gets him completely out of whack as to what the frequency is going to do to the comparable size of those cells. Then he comes down now to the molecular level, then things are very constant because the molecular material is really the same in every piece of living thing. This is what we've been saying. The DNA--RNA molecules really don't change very much going from animal to animal except for the message that you have there. So the problem is, and it's a very severe problem, that we have these inhomogeneous microscopic things, and we have even molecular things, and each of them has to be treated in their own right in what this radiation is going to do. Now, you take a human cell. It's got the nucleus, it's got the cytoplasm, it's got organelles, it's got a cell membrane, and then there are further subdivisions of the nucleus into a nuclear membrane, into a chromatene, into a nucleus, and it's only possible, but very likely, that differential thermal and UHF absorptive properties lead to significant inhomogenieties in each generation and that substantial thermal gradients and stresses will occur if you heat something here and not there. Now, the important thing is that if the heating takes place much, much faster--and it can take place, with these dimensions, in microseconds rather than milliseconds, then the heat is up right there, the other thing is cold, and then you have these heat stresses that are going back and forth. Under these types of conditions you cannot--you possibly cannot use averages. And suddenly all the numbers that you've seen on the paper have to be multiplied by 50 and 100 in order to start making sense. Now, it is true that you still have to take out the time that is not being done; so, for instance, if you would use an energy, and people have done, to heat up parts of the body and the cell to 43 degrees, for instance, when it dies; if you measure under normal CW it'll take 15 seconds, and if you then measure it under these possible conditions of PAVE PAWS, it's going to take something like 10 or 11 minutes. I'm not saying that this is happening. I'm just trying to make a comparison here. But what I'm suggesting is, and I don't know what the answer is, but what I'm suggesting is that certainly this particular document that we are here to talk about today does not give the answer, does not give a critical review of the subject. It limits itself to what has been done. These people have not sat down and pushed a pencil and said can we get answers to some of these questions as

physicists and engineers ought to do. And I'm saying that they are very capable of doing it. I also want to say that it's not the way that it's been done until now. That's why we have the hearing here. Because I think the citizens have a right to understand what is being done, and to demand that certain standards are set in trying to look at the job to be done from a scientific and technical point of view, in order to get complete answers to questions that are very important questions if we introduce a new technology that has not been here around, and if they are new things. Every little thing that is new, has to be looked at and asked: Is this going to have a new effect or not? Are the old assumptions that we were using, like for instance averages, still valid, or do we have to start from scratch? I do not find that type of a care in this type of a document. And I am here tonight to tell you that I don't, to tell the Air Force, that has the capability, and I'm sure has the desire, to go back and take another look at it. I hope I am wrong. I don't think so. I've had a past history in finding these things in many other places, and that's why I have my confidence. I don't want to bother you with historical stories of what type of things I found. I will just mention to you that when I worked in Buffalo, and I was designing the aeration tank for the sewage treatment plant in Elmira, New York, I saved that town $40,000 because I found, which nobody wanted to believe, that the main sewage pipe went smack through the place that they were going to dig up. And it is my habit to be looking at these questions in some detail. So, I have spent quite a bit of time. Now, you have a right to--and I think I should give you--some report as to who is doing what? Where are we here? How is this being done? Now, what I want to do is to specifically share with you--I hope I have it here--can one of the Citizens people hand me over those two--they might have with them--the two letters from the White House because I can't find them here. Here they are. I want to share with you two letters, on this particular subject, written about a year apart. And I'm going to introduce those two letters in the evidence. The letters are written on the stationery of the Executive Office of the President, Office of Science and Technology Policy. The letter is written and signed by Frank Press, who is the science advisor to President Carter, and it's written to Henry Geller, Assistant Secretary for Communications and Information, Department of Commerce. The letter says: "Dear Henry"--The letter that I have is dated March 13, '78--it says: "Dear Henry: As Chairman of the Federal Coordinating Council for Science, Engineering and Technology, I am writing to inform you that the new agency which you will head in the Department of Commerce will have the responsibility for coordinating all federally-supported research activities in the wide field of investigation of biological effects of nonionizing electromagnetic radiation. Research objectives should be consistent with needs the National Telecommunications and Information Administration

(NTIA) identifies in the development and regulation of electromagnetic radiation and telecommunications. You will have the authority to draw together experts from the various agencies of the government, and from the outside, on interagency committees and panels of your choosing. In a number of ways, OSTP will be able to provide oversight and assistance for your activities, but the responsibility will be lodged clearly with you. I trust that the ad hoc working group, which we have set up, will provide you with an up-to-date assessment of research activities and objectives."

There is another letter a year later, March 14, 1979. It says: "Dear Henry: Nearly a year has passed since the transfer of the Office of Telecommunications policy functions to the Department of Commerce National Telecommunications and Information Agency and the publication by OSTP of a technical review of the biological effects of nonionizing electromagnetic radiation (NEMR). While the utilization and expansion of the Electromagnetic Radiation Management Advisory Council is an encouraging sign, on the whole, the government's activity with regard to this area of growing concern is quite disappointing. As I indicated to you, and a number of other government officials last year, when transmitting the review prepared at OSTP's rquest, I expected NTIA to update the annual survey (last prepared in June '76)"--I have it here with me in a big box--there is a lot of other documents that anybody who wants to see after I will show--"and to prepare a detailed plan for a federal program on understanding the biological effects of NEMR. Neither of these activities has occurred, and we have lost the opportunity to influence FY 1980 budget levels. Unless they are undertaken immediately, we will not impact the FY 1981 budget either.

"I am willing to seek increased support for R&D in this area, if needed, if there is a federal program which lays out the research needs in the area along the lines of the priorities recommended by the OSTP working group. Such a program, and related budget requests, must, however, include all on-going work. I look forward to hearing from you regarding this matter as soon as possible. Yours sincerely, Frank Press."

I am introducing this material, please, into the record.

Colonel Smith:

The Exhibit Number Three.

Dr. Loebner:

Let me say this. In the middle of February, of '78, I was able to talk with Dr. Frank Press and raise my concern about the situation at Beale Air Force Base, here. I think he was already informed, but he assured me that he was going to do something. And he did something. He created a panel. I have the report of the panel of May 15, of 1978, with me here. I will not go into detail to quote from it. I will say that I am pleased with the criteria that they set up to select--and I'm not in agreement at all with the selection that they have made. But that happens. And they may be right and I'm wrong. But at least they did a job. They tried to do something. And it went into the ballpark of the next agency.

Now, let me say, I have worked for the federal government, and I have had experience to deal--because I was working with the State Department--with very many agencies that had to be coordinated. And it is not an easy job. If you think it's difficult to talk the same philosophy and the same language from one science to the other, I would just like to read you the letters of those agencies that are involved in this particular thing, and I'm not going to go into detail. Air Force--I did it in alphabetical order, so I don't have any problems--Air Force, Army, BRH (that's the Bureau of Radiological Health), CIA, DOA, EPA, FAA, FCC, NASA, Navy, NBS, IPS, NIEHS, NIOSH, NTIA (which is the head agency for this job), USIA, and VA.

Now, I think that the public does deserve some consideration. I do think that the job could be done faster, and I'm going to propose, when I'm finished with the presentation that deals with the base here, that I still want to say, I'm going to just very briefly tell you where--what should be done and where the basis of what should be done is, and I also promise to submit this to Dr. Press's office, and I will do so after I return from an extended trip next month to Europe, and when I come back. It's for this reason that I was not able to have it all typed and prepared, and the Air Force was extremely accommodating to make it possible for me to get my thoughts, and my work, that I have done on this, into the record in this particular way, and I certainly very much appreciate the opportunity to do so.

Now, I want to get back to the Air Force a little bit, because I think they do deserve a little bit to be looked at. I have here the following documents that I do want to introduce into this particular thing and wanted to do--deal with it--because they deal directly with the base here. They do deal directly with the hospital. I do want to state the following, and I'm agreeing here with Paul McEachern--I don't know whether I pronounced your name quite properly--I have signed very many papers myself. I had to handle 70 telegrams a day and 300 letters a day when I was at the

Embassy in Moscow, and I couldn't certainly remember every letter that I've signed. But I think it's interesting that these things do get lost sometimes in the shuffle, and I think it is sometimes useful to bring them out in this way.

The first letter that we have here is a transmission letter dated April 14, '77, the subject is Environmental Assessment for Phased Array Warning System, Beale AFB. I should say how we got these letters. This was from the suit in court, when I signed the affidavit and Lala Cade started the group here to do this work. Part of the thing was proceedings to get the Air Force to give us all of the materials. There were about 4,000 pages that I read at that particular time. We stashed away some of the thing, and I just went through this Sunday to see whether there was anything useful for this hearing, and I picked up a number of things--I just selected these to get across that really there is a mountain of work that these agencies do. And it's sometimes very difficult to always do the right thing. And I don't think anybody should be blamed. I think the thing is that we ought to finally settle down and do a job together.

This particular letter is to ESD/OCL, and they want the reply to SDE, whatever that means, because I am not knowledgeable with all those things. "Air Staff comments contained in the attached letter are provided for your consideration. Please advise this office by 15 May '77 of any action taken or required relative to the attachment." And it is signed for the commander by David H. Thomas, who is Lt Col, USAF, and I won't give his titles.

Now, the letter itself is 4 April '77. It is the same subject, but it is to HQ AFSC/DEV and is to be replied to PREV, again whatever that means.

"1. The following comments are forwarded to AF/PREV following the recent security review for release of the subject document and are provided for your consideration:" (That was a document that was at issue at that time--whether it was adequate or not to be substituted instead for the Environmental Impact Statement that we are meeting on here tonight.)

"a. Notwithstanding the fact that the main beam will not impact on the hospital, and that sidelobe emissions are low-powered, concern continues to exist on possible adverse EMI/induced EMF effects on sensitive areas of the hospital, therefore:

"(1) Monitoring equipment should be located in sensitive areas of the hospital, once the radar is installed, to ensure that medical instrumentaton located in Coronary Care Units (CCU), catheter laboratories, operating suites (OR), etc., are not being impacted.

"(2) Possible adverse effects of radar on externally mounted cardiac pacemakers should be fully evaluated (utilized in CCUs and during transport of some cardiac patients from the CCU to OR).

"(3) Possible impact of radar emissions on the hospital's paging system should be evaluated.

"b." (And then it goes into air flights, and I'm going to skip that.)

The answer came with a submission letter dated May 23, '77, but the letter--I didn't say whose signature it was--it just said for the Chief of Staff and I cannot read the signature on the April 4 letter, but the submission letter came on May 23rd, and the letter itself, the answer was written on May 13, which met the May 15 deadline, and it was signed by Paul T. McEachern, and it reads as follows, and I will read it to you:

"1. Attachment to subject letter including Air Staff comments on Beale Air Force Base Environmental Assessment and requested compliance with these comments by the System Program Office.

"2. The following refer to paragraphs in Air Staff's letter of 4 April '77:

"1.a. Monitoring equipment will be located in sensitive areas of the base hospital as well as other areas on the base when the radar is capable of transmitting on full power. This will occur about the first quarter CY 1980. These measurements (radiated field strength) will be performed by AFCS (1839th Keesler AFB) and assisted by SAM/RAP. If sensitive areas are found to exist within the hospital, they will be evaluated with respect to the medical electronic equipment affected and corrective measures made. In particular, the cardiac telemetry equipment which operates between 180-200 MHz and the externally mounted cardiac pacemaker equipment will be fully monitored for any possible interference. It is predicted that the PAVE PAWS will not affect the page system..."

I'll stop right here. I mean, the point I'm trying to make, and I'm introducing now these letters into evidence, sir...

Colonel Smith:

It'll be Exhibit Number Four.

Dr. Loebner:

The point is that while we have heard here tonight, and I'm sure the gentlemen are sincere, that they feel that there is no problem

and that the energy is going to be lower inside than outside, I am not assured by that, for two reasons: First, there is this report that says it could be higher inside, and it could be higher by a very large amount. And then there are some additional problems. Inside a room it can vary by very large factors. The thing that is really at issue are metal objects that are large enough to be larger than a quarter wave length, which in this case is about 60 cm--the wave lengths--so about 15 cm larger, and in the vicinity of these objects the energy that is delivered to an object next to them could be many times, even a hundred times larger. So what really has to be done, I think, to assure everybody, is to go through these rooms, and especially look for these corners and the metal things, take the equipment in, and measure what really the energy is. I spoke to, for instance, a man who does these measurements for the EPA, Richard Tell, and he told me that he found many times that this happens and that energy is up. You can't predict how it's going to happen. It may be quite all right, but it could happen. And I think in view of the fact that the Air Force did write a letter to itself saying that they are going to do it, I think they should do it. And I'm telling the Air Force here that they should do it, because there is another reason for it--by which they should do it. And the reason is that I do not believe that one can, and I don't believe as a physicist, who understands heat transfer to some degree, who realizes that he may be wrong and that there may not be a problem, but it's just too much of an issue. It's for the first time that we are doing it, every time you do something for the first time it's hard, it's difficult, but it should be done, and so my conclusion basically is that we cannot rely on judgments of people that can be wrong, that are quite good intended, but still can be wrong.

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Now, what are we going to do? I would like to introduce, just so that people can do that and without me talking too long, because the hour is really late and everybody has been very patient, I will, just for those who want to read the final things, introduce into evidence here--or into the report that is going to be issued, two documents that were produced by the group of Concerned Citizens.

One was my affidavit in which I stated all of the reasons why the Environmental Assessment at that time was not satisfactory. There are 20 reasons here, and I think about three of them the Air Force has done something about. And the 17 are still not answered even though they were written here on August 5, 1977. Now maybe, maybe they are--not have to be answered, but I think one way of getting them answered is to introduce it into the group and see whether they can answer them. Because under their own regulations they have to do that. The other document here is something that was to be negotiated with the Air Force, and has to do with another subject that I'm coming to, which has to do with monitoring.

There is concern here--what is actually going to happen to the beam? How is the beam going to operate? One way of finding out whether it is going to do what the Air Force does, not only today, and not only tomorrow, but five years from now, ten years from now, when all these things change, is to have permanent monitoring stations that will record any excess of energy about a particular place. This is standard practice in the radiation field. If there are any questions, maybe this is all okay. But if you find out ten years from now that something has happened, you should have a record of how much energy there was, who received it, and how this was done. And so I'm introducing also the documentation, the proposal that we made to the Air Force at that particular time to do monitoring equipment--so that it can be read in the documents. I'm finally coming to the end of my presentation with just two things. 13 26

I'm calling attention to you an article that you can buy on the stands--Scientific American, August '79, one-month-old issue. I am calling attention to the article there by Raymond Deverett, called "Bacterial Tests for Potential Carcinogens." I'm not saying there's any knowledge or any reason even to believe that microwaves have anything to do with this subject. I'm doing it because this article says that there is a beautiful test to test the effect of agents, physical agents, and I believe that this test should replace the tests that are being made in the field of microwave investigations of electromagnetic radiation that are being done now, and I'm just going to read one paragraph from this article, because I think it tells you the advantage of this test over other tests that were mentioned in this report that you heard from Dr. Polson. In all of these papers, there's 300 papers that he had, and some of them had to do with bacteria but none of them were done with the most advanced techniques that are available today in 2,000 laboratories throughout the world, SRI being one of them. 27

"One of the great advantages of assays done with bacteria is the enormous biological amplification implicit in bacterial manipulations. It is easy to grow as many as a billion (10^9) bacteria per millimeter of culture medium. A mutational event such as a change in a single base pair in the bacterial DNA, which is impossible to detect by standard biochemical methods, will be revealed as a new type bacteria. That single bacterium can be selected from among 10^9 cells because its daughter cells, and only they, will proliferate and form a colony visible to the unaided eye on an agar nutrient plate. Since a colony consists of about a million (10^6) bacteria, a rare single mutation event with a probability of say 1 in 100,000,000, the probability of 10^{-8}, will thus be amplified by a factor of 100 trillion (10^{14})."

Now, these are beautiful tests that I think should be used to look at what can be done in order to speed up the investigation here. And let me finally close with a quote from a paper--that I think states why I am here. This quote was written by me in 1976 when I was at the American Embassy in Moscow, and appeared in a publication called IEEE Transactions on Electron Devices--of which one gentleman here was the editor. It was a special issue, historical notes on important tubes and semiconductor devices, and I had to honor to be invited to write one of the papers. And this is what I said:

"Each of us individuals appears in history's branching points by chance. We do have the power and ability to speed up or slow down the natural evolutionary process and leave an irreversible trace in the network of events that posterity will chart. What matters is not whether we reach the end, but that we know that our presence was felt, that we did what we considered was ours to do at the appointed time and place, using all of the physical and mental tools we could muster. In this game, I believe everybody alive has a role, and everybody gets a chance to play. For my part, greatest thanks go to those gentlemen who nearly 200 years ago played their roles so well that they gave many of us, writers, editors, and readers of this special bicentennial issue, the opportunity to live, or to struggle to live, not only in freedom but also in dignity." Thank you, sir.

Colonel Smith:

Thank you very much, Dr. Loebner. The last two items that were introduced will be attached to the record as Exhibits Number Five and Six. Do we have any other people that desire to make a statement at this time? Does any member of the panel over here desire to respond specifically to any comments or any portions of Dr. Loebner's speech?

Mr. Mitchell:

We know it is getting late and we won't take very much of your time, but there are just a couple of points we might respond to briefly. I would like Colonel McEachern to respond to the questions raised on the growth option, about radiation levels on the ground due to the growth option, and somewhat about the test pulse, radiation contributions due to the test pulse. And you may have some others if you want to add them while you're there.

Colonel McEachern:

I must say, Dr. Loebner, I enjoyed your last three sentences. They were very good. Very eloquent. And I must say also that Dr. Loebner did his review, and his statement did reflect a very comprehensive and keen analysis of some of the radar's

components. I'd like to address, however, myself to a few of those items.

One was the module. You mentioned in the beginning that the module had different values as you go through the paperwork. Over the years, of course, we developed that module and it was in a development status--as we analyzed it, the average power changes so it might be 330 watts one month, and the next month, well, they changed some of the components, and they did change components as the development proceeded, and it would change the average power. We finally did stabilize our average power at 322 watts, and it is true, if that basic average power in the module changes, of course, it changes the power output of the radar itself, because it is calculated directly by using that as a main factor in determining the power of the radar. However, the radar power, and I must say that it is an average power, some of those modules might be 328, other modules may be 319. That is an average that we use. But it is a good average and there's no reason to believe now that we'll change the transistors' specifications--they are pretty well stabilized and they're--transistors are basically what determine the power of the module. So we have no reason to think that will change.

There was a question, I believe, regarding the subarray, the measurement of each subarray. That's true. We have 56 subarrays on each face. And as you may know or you may not, we have a system to check that array every 30 seconds to determine that it is doing what it is supposed to be doing. If we don't do that, then we cannot be sure that what the radar detects is there. So we have to know that each subarray is operating properly. In order to do that, we use a near field horn which is about 200 feet out in front of each face. We direct power from each subarray to the near field horn, and that horn picks up the signal and brings it back into the unit and we use some computations inside the unit to determine the health of each subarray. And we do direct that beam down toward that subarray, each one in sequence--as directed; then the operator will know the health of the subarray. If one of the subarray's power goes down, it will be reflected to the operator in the maintenance room, and he will then put a diagnostic program on the computer that checks each element of the subarray, and then he will know which transmitters may not be transmitting. We'll take them and we change them out. As the radar is operating, we'll remove them and put the new transmitters in. So that's the reason for them.

I don't believe it's significant what the width of the beam is. It's a very small pulse that we use. Very small. And it's very short in time duration, and the--when you compare the power put into the system from that small pulse and compare it to the main beam, it's insignificant.

I also want to address myself to the possibility of lowering the beam below 3 degrees. I thought I detected a concern in that area. Is that true? Yes. The beam is going to stay at 3 degrees. There is no real advantage for the primary mission of the radar, the warning mission, to lower that beam. It's going to stay where it is. It's--the hardware and software is fixed to keep it that way. If we had to change it, it would require an extensive engineering change to do it, and there is no plan to do it. Have I answered the questions?

Mr. Mitchell:

The growth option doesn't increase radiation on the ground. Did you cover that while I was reading?

Colonel McEachern:

No, I didn't.

There is a possibility--the radar has been designed so it could grow to double the power in case the threat changes in the future, and if you read the Environmental Impact Statement or the Environmental Assessment that preceded it, it is covered very clearly in both of those documents, that the radar could grow. And all the calculations for the power densities on the ground are contained in that area also. There, however, would be no significant increase in the power levels on the ground if it did grow. Although the power will increase--the beams--the sidelobes tighten up. They come up off the ground as there is more power, so that there is somewhat of a trade-off in that area. So that even though you may get some increase, it would not be significant at all. If we did grow, however, as was mentioned, I believe, in the impact statement and other documents, that we would go ahead, as we would normally do in other radars, when we make major modifications, we would then measure around the radar again to determine what the levels would be in the vicinity.

Mr. Mitchell:

Just a couple of other points. The point was made about the concern for people on base as well as off, and certainly, we would not leave the meeting without restating that the Air Force position on safety is concerned with all people that are affected by radars. And I think the fact that most of our test points were on the base illustrates our interest in knowing about the radiation levels to the people that are on the base as well as those off, so that was addressed.

In regard to the possible enhancement in the hospital, a lot of words were mentioned about that. This work comes out of the

engineering group at the University of Utah. They have been under contract to my organization at the School of Aerospace Medicine for several years. And the work on enhancement by corner reflectors is a well known phenomena--with plane wave association--is a very specialized condition. I think as you talked about numbers of 10 to 100 enhancement, but then I believe I heard you say that it's really Dr. Ghandi's opinion, when you come right down to it, that it's not more than maybe a factor of 2 to 10, somewhere in there, and so we still say that if you were to add those kinds of enhancements on fields that are tenths of microwatts to begin with--and added also with the fact that as this energy does go into the structures you do get some attenuation--the degree of attenuation is dependent on the material that is superimposed. But there is some attenuation. So if you add those enhancements, we still feel the levels are quite low, and that is the reason why we didn't measure them. I would also say again, though, that had we been, had that been brought up during the course of our testing, we would have done those for you. 28 11 25

Also, on the--back to the hospital problem, in the letter you referred to back in '77, actually that letter is about 2-1/2 years old, if I heard the date right, and I do barely recollect that those things did transpire. Well, the fact is that we've made a lot more progress in 2-1/2 years than we anticipated, and the problem, for instance on cardiac pacemakers--you're aware, but some of the other people may not be aware, that we had a very active role in the solution of that problem, and, in fact, we have very few problems in this country today with cardiac pacemakers, because the manufacturers have really improved the product. They took the interference data that was generated several years ago. They are building a much better device today. Medically it is better. It is certainly better from the standpoint of interference, and the thresholds for the interference of any current state of the art device today is certainly much higher than the kind of levels we were talking about in the hospital. I also understand from the Hospital Commander that they don't implant pacers down there.

Col. Pala:

Neither do we have a coronary care unit, and only have a very rudimentary monitoring capability.

Mr. Mitchell:

Yes, and we already covered the monitoring thing. So, I think with that--certainly we will answer all of the points that were raised by Dr. Loebner in the responses to the questions raised in the hearing here this evening.

Colonel Smith:

Members of the panel, anything further? Apparently not. Are there any questions from members of the...Dr. Loebner?

Dr. Loebner:

I just would like to clarify one point here, because I think that either Dr. Mitchell didn't quite understand and I'd just like to make it quite clear that we understand, both, what I'm talking about. We may disagree as to whether it's right or wrong, but I think we ought to understand what it is that we mean.

The measurement outside the hospital was around 19 microwatts per square centimeter, peak. My point is that actually I'm not even looking at--and I would like you to translate all the numbers that you have in the report from averages to peak. I stated 90 microwatts per square centimeter measured outside, which I already say is above the five that I say should be for patients in hospitals. Now if you add anything, a factor of three or five to the 19, we are then coming to a number, you know, that is somewhere between 60 and 100 microwatts per square centimeter, peak power. This is just too much for any circumstance, if it should happen, and certainly much too much for patients if I happen to be right. Now, I may be wrong. But the way that I see it, my numbers tell me that we are talking 19 outside, and if Ghandi is right, and I don't know whether he is or not, I would like to find out, we are going to talk 100 microwatts per square centimeter inside, even with very conservative figures. So, I just cannot go and agree with you to keep on quoting those low average figures of 50 and 100 below, since I'm just paying no attention to them, I am ignoring them. I'm saying that until you show me that you really can do this averaging from the physics and a transference of calculations and arguments, I'm going to stick to the others—not forever if you can show me that it is right, but until this shows up, that this is what it has to be, at least in my mind.

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Mr. Mitchell:

Yes, I quite fully understand, and the point that you've made about the 100 microwatts peak, so your concern is over a hundred microwatt peak level. I understand.

Colonel Smith:

Ladies and Gentlemen, it's getting to be rather late and I think that it's time that we finished this hearing. I'd like to remind everybody that you have until 2 October 1979 to submit any further statements, data, or comments to Dr. Carlos Stern, Office of the

Secretary of the Air Force, Assistant for Environment and Safety, and the address: SAF/MIQ, Washington, D.C. 20330. We thank you very much for attending here tonight. We hope that we have fulfilled the purpose that we laid out in the beginning. We appreciate your interest. Thank you very much. Good night.

(The hearing adjourned at 2245, 20 September 1979.)

Proposed Guidelines
for Long pulse biological effects
based on estimated thermal stresses

Occupational (8hr)	75 - 150 $\mu w/cm^2$
General Public (24hr)	25 - 50 $\mu w/cm^2$
Susceptible & vulnerable indiv	below 5 $\mu w/cm^2$

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Marseille, Sept 20, 1979

Igor B. Lebner

Ex #1 -

MOTOROLA

Address Reply to:
1170 Chess Drive
Foster City, CA 94404
(415) 349-3111

September 19, 1979

Motorola evaluation of PAVE-PAWS System tests

The attached engineering report covers the results of PAVE-PAWS tests on the 450 - 512 commercial radio spectrum. As a result of our findings, we feel that if PAVE - PAWS goes into operation it will be totally destructive to all such commercial radio usage in the Yuba City to Oroville area. The private radio user operating in the 450 to 512 spectrum, representing about 50 % of all business users, are utilizing narrow band commercial receivers with a typical sensitivity of -117dbm (-147dbw). The RF levels present in this area during PAVE-PAWS transmission are reducing receiver sensitivity of business users equipment to a point of inoperative. 15

We submit that this would be an unbearable burden on the areas business community and its public safety activities. If Motorola can be of any further assistance in evaluation or clarification, please contact one of the undersigned.

Gerald Falkenberg
Manager, Antenna Site Dept.

Bernie Olson
Manager, Engineering Services

Theron Smith
Manager, Field Services

GF/cc
cc: B. Olson
T. Smith

To Whom it May Concern:

On 9-18-79 Motorola C & E, Inc. conducted a series of tests to determine the effects of PAVE PAWS radar on 2-way Land Mobile communications.

Of particular interest was the effect on Land Mobile communications receivers in the 450-512 MHz spectrum.

The majority of our tests were conducted at the Motorola Service Center located at 445 Palora, Yuba City, CA. This location is 10 miles due West of Beale AFB.

Measurements were made with an HP8554 spectrum analyzer connected to a DB436 10dB gain antenna located on the roof of the service center (approx. 25')

The results of the test are as follows:

1. Average level of the radar spectrum 420-450 MHz measured -20dBm.

2. Measured level of spurious emissions 450-470 MHz spectrum -80 to -90dBm.

3. Spurious emissions occurred randomly across the 450-470 MHz spectrum at a rate of 5-10 pulses per second.

4. Verified complaints from existing Land Mobile users indicate a larger number of pulses than observed. The sensitivity of our analyzer limited our measurements to -95dBm vs the sensitivity of a typical Land Mobile receiver of -113dBm.

Further test were conducted from our communications site on Sutter Buttes. Sutter Buttes is located 21 miles WNW of Beale AFB at an elevation of 1980'.

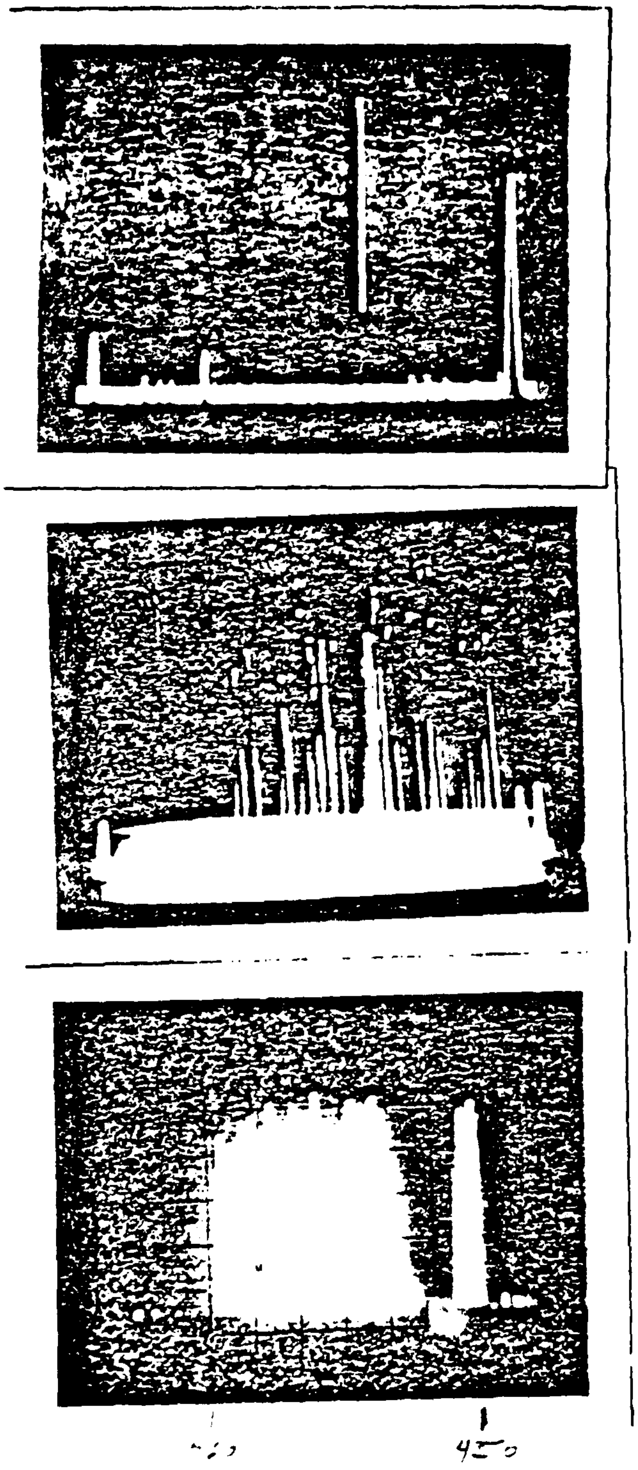
Shortly after arrival on the site the radar either failed or was shut down. This limited the amount of test we were able to conduct. The measurement we did obtain was the average power of the radar within its assigned spectrum. This measurement was equal to the measurement taken in Yuba City (-20dBm) indicating this site is closer to the main lobe of the radar.

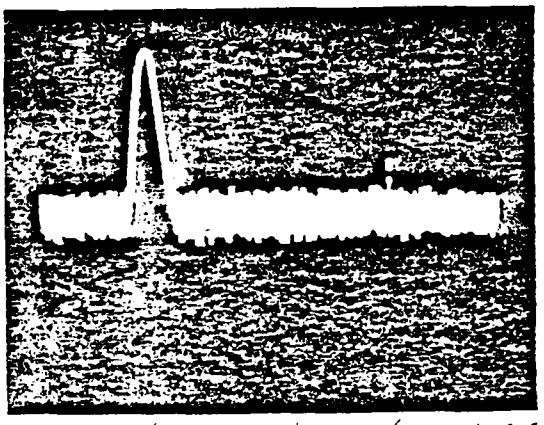
It is my considered opinion that spurious emissions from PAVE PAWS radar will cause harmful interference to Land Mobile receivers. This interference will appear in two ways:

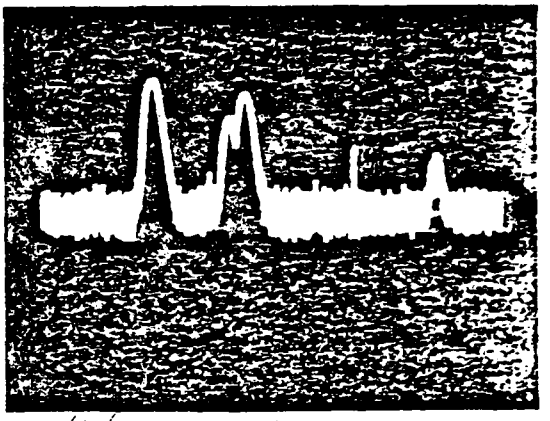
1. Audible noise burst coming through the speaker.

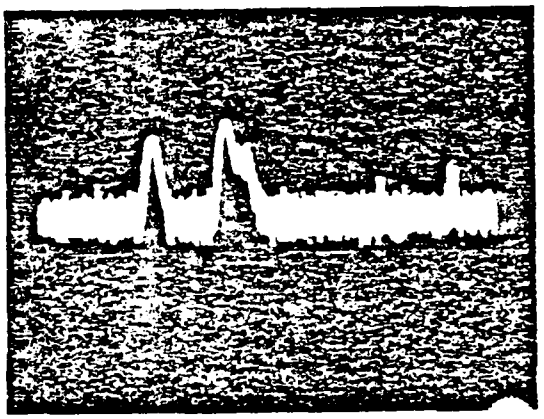
2. Receiver desensitization resulting in reduced coverage.

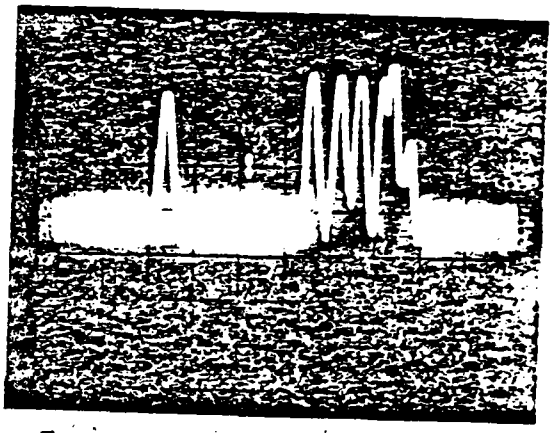
Joel A. Adams
Field Services District Manager
Motorola C & E, Inc.

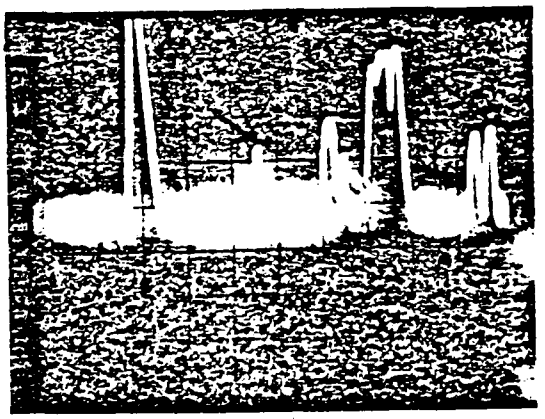












SUTTER BUTTES RADIO USERS

Taylor Fertilizers
P.O. Box 15289
Sacramento, CA. 95813

Lyman AG Service
P.O. Box 276
Walnut Grove, CA. 95690

Reigels Roy Chemical
Woodland
P.O. Box 15289
Sacramento, CA. 95813

Sunsweet Growers Inc.
P.O. Box 232
Yuba City, CA. 95991

Western Pacific Railroad Co.
R.E. Enger
526 Mission Street
San Francisco, CA. 94105

Tenco Tractor
P.O. Box X
Sacramento, CA. 95813

Pure-Gro Company
1052 W. Sixth Street
Los Angeles, CA. 90017

Operating Engineers
474 Valencia Street
San Francisco, CA. 94103

Western Pacific Railroad Co.
R.E. Enger
526 Mission Street
San Francisco, CA. 94105

Shifflet Bros Inc.
P.O. Box 206
Gridley, CA. 95948

Regents of Univ of
California
Material Managmt Off
University of Calif
Davis, CA. 95616

Agriculture Advisors
P.O. Box 952
Yuba City, CA. 95991

Butte Co Rice Grower
P.O. Box 128
Richvale, CA. 95974

Oxychem Stockton
Associated Farm Supplies
P.O. Box 427
Orland, CA. 95963

Inouye & Tsuji Ranch
5301 Carlson Road
Yuba City, CA. 95991

Giusti Ranch
P.O. Box 277
Robbin, CA. 95676

Sutter Butte Dusters
P.O. Box 213
Live Oak, CA. 95953

Spencer Trucking, Mike
P.O. Box 996
Yuba City, CA. 95991

Assoc Calif Loggers
Central Valley Radio
555 Capitol Mall
Suite 745
Sacramento, CA. 95814

Oroville Bus Lines
1825 Montgomery
Oroville, CA. 95965

Shell Oil Company
P.O. Box 1017
W Sacramento, CA. 95691
Attn: Norman George

Johnson Trucking
Joe Johnson
P.O. Box 1169
Tracy, CA. 95376

Emergency Services Office
Sutter County
P.O. Box 1555
Yuba City, CA. 95991

Hunt Wesson
Box 1029
Yuba City, CA. 95991

Robinson Construction
P.O. Box 1620
Orville, CA. 95965

Angel Farms
P.O. Box 8
Butte, CA. 95920

Bercut-Richards
P.O. Box 2470
Sacramento, CA. 95811

Sheet Metel, Heating
3126 "O" Street
Sacramento, CA. 95816

Robinson Construction
P.O. Box 1620
Oroville, CA. 95965

Paddison Trucking
2950 Merced St.
San Leandro, CA. 94577

Valley Products
717 Bridge St.
Yuba City, CA. 95991

Glen Fertilizer
200 Garden St.
Willows, CA. 95988

Union Oils Co.
427 14th St.
Marysville, CA. 95901

Continental Grain Co.
740 N. George Washington
Yuba City, CA. 95991

Stohlman & Mallory
2291 ArcherAve.
Yuba City, CA. 95953

Boeger Brothers
P.O. Box 367
Gridley, CA. 95948

Banes Land Leveling
P.O. Box 730
Oroville, CA. 95965

Micheli Bros.
6005 HWY 99
Live Oaks, CA. 95953

Harland, Howard
2179 Franklin Rd.
Yuba City, CA. 95991

Alsco Inc.
P.O. Box 1330
Red Bluff, CA. 96080

Jaeger Construction Equipment
P.O. Box 1300
Yuba City, CA. 95901

Aloyo Hodges
8727 Sheldon Ave.
Live Oak, CA. 95953

Ron Harrington
P.O. Box 497
Live Oak, CA. 95953

Ray Paoletti Trucking
6893 E. Wat
Stockton, CA. 95206

Port Huggins Construction
P.O. Box 3419
Chico, CA. 95927

(KRA Equip.) Pro AG North
P.O. Box 668
Gridley, CA. 95948

Danna & Danna Inc.
P.O. Box 5428
San Jose, CA. 95150

Kentwood Moblie Homes
2635 Esplanade
Chico, CA. 95926

Helena Chemical Co.
1630 E. Shaw Ave.-STE. 130
Fresno, CA. 93710

Mariani Farms
P.O. Box 426
Cupertino, CA. 95014

Doug Schohr Elna Inc.
P.O. Box 785
Gridley, CA. 954964

Morehouse Air Cond. Svc.
1109 Walnut Ave.
Orland, CA. 95963

Circle G Ranch
Route 1, Box 908
Woodland, CA 95695

Kilby Mfg. & Farming
Rt. 2 - Box 413
Gridley, CA 95948

Jo M. Fenn
9601 Sirnard
Live Oak, CA 95953

Huggit & Electrical
1076 East 1st Ave.
Chico, CA 95926

Yuba City Roto-Rooter
356 N. Walton Ave.
Yuba City, CA 95991

Perma-Tite Roofing
919 Garden Highway
Yuba City, CA 95991

Caldwell Flying Service
P O Box 895
Williams, CA 95987

Codspenatich
4916 Mananita Ave.
Carmichael, CA 95608

Shinicle Realty
P O Box 317
Browns Valley, CA 95918

Sierra Gold Nurseries
5320 Garden Hwy.
Yuba City, CA 95991

Traynham Ranch
Rt. 1 Box 91
Arbuckle, CA 95912

Indian Hill Land Co.
Rt. - Box E
Biggs, CA 95917

Carter, Walter & Elinor
2740 Encinal Rd.
Live Oak, CA 95953

Holly Sugar
P O Box 517
Hamilton City, CA 95951

Valley Truck & Tractor Co.
1545 Colusa Hwy.
Yuba City, CA 95991

Ybanez Orchard, Inc.
P O Box 34
Chico, CA 95927

Bradford, Peter B.
Rt. 1 - Box 170
Arbuckle, CA 95912

Quality Built Fence
800 A Onstott Rd.
Yuba City, CA 95991

McCullough, Victor
Box 69
Dunnigan, CA 95937

Puba Ricer Sand Co.
P O Box 307
Marysville, CA 95901

Alexander Plumbing & Heating
5854 Rose Bud Lane
Sacramento, CA 95841

Goodmundson, Robert
717 - 5th Street
Oakland, CA 95963

Piret Tire Center
99 Park Ave.
Chico, CA 95926

Oroville Pump
P O Box 271
Oroville, CA 95965

Seman's Trucking
7400 San Joaquin
Sacramento, CA 95820

Still's Welding
2689 State Hwy. 20
Marysville, CA 95901

G & W Consulting
2426 Glendale Lane
Sacramento, CA 95825

Sacramento Salvage
11335 White Rock Rd.
Rancho Cordova, CA 95670

Del Monte Corp.
P.O. Box 351
Yuba City, CA. 95991

Harry Johnson
941 Barry Rd
Yuba City, CA. 95991

Yuba Trucking Inc.
P.O. Box 1-28
Marysville, CA. 95901

Simlick Pest Control
P.O. Box 1327
Yuba City, CA. 95991

Dan Bayles
P.O. Box 367
Biggs, CA. 95917

Cumpton Trucking
Rt 1A - Box 467
Red Bluff, CA. 95917

Continental Courier
1012 N. "C" St.
Sacramento, CA. 95814

C.H.B. Foods Inc.
P.O. Box 71
Yuba City, CA. 95991

Bob Bassett Welding
P.O. Box 494
Biggs, CA. 95917

A.D. Richens
Rt 3 Box 124
Gridley, CA. 95948

Ben Toilet Svc.
Rt 2 - Box 603D
Gridley, cA. 95948

Matsummura Inc.
1250 Walnut Ave.
Yuba City, CA. 95991

Davis Aviation
P.O. Box 28
Colusa, CA. 95932

Howe, John A & R Cecil Dan
3621 Oswald Rd.
Yuba City, CA. 95991

Niell R. Mitchell
1900 Feather River Blvd.
Marysville,CA. 95901

Komatsubaru Farms
1483 S. George Washington
Yuba City, CA. 95991

Reggie Dewshup
Rt 2 - Box 20A
Gridley, CA. 95947

Diamond, Anthony
6480 Madden Ave.
Live Oak, CA. 95953

Boone James Keith
6738 Larkin Rd.
Live Oak, CA. 95953

No. Valley Electric
P.O. Box 911
Gridley, CA. 95948

Newhall Land and Farm
Rt. 1 - Box 82A
Meridan, CA. 95957

Dave Lewis
Star Route
Kingts Landing, CA. 95645

Western Concentrates
P.O. Box 1626
Woodland, CA. 95695

John Flores
Rt. 2 - Box 196
Gridley, CA. 95926

Dibble Inc.
P.O. Box 2361
Marysville, cA. 95901

John Taylor Fertilizer
P.O. Box 15289
Sacramento, CA. 95813

Visa Concrete
1573 Jones Rd.
Yuba City, CA. 95991

Yuba Feather Rural Health
P O Box 142
Brownsville, CA 95919

Carrico & Carrico Farming, Inc.
58 Clark Ave.
Yuba City, CA 95991

Smith, Gerald
4417 Marioni Ave.
Sacramento, CA 95821

Herr, Ted
2410 Tuscan Rd.
Yuba City, CA 95991

Hirai Farms
3835 Carlson Rd.
Yuba City, CA 95991

Mariani Land Company
P O Box 428
Cupertino, CA 95014

Atmos Air & Electric
P O Box 2533
Marysville, CA 95901

Allstate Realty
1511 Butte House Rd.
Suite A
Yuba City, CA 95991

Spaich, Gav
2200 Encinal Rd.
Live Oak, CA 95953

Garcia Enterprises
P O Box 237
Clarksburg, CA 95612

Munger & Sons Farms
5952 Carlson Rd.
Yuba City, CA 95991

Tri County Applicators
2863 Carmelita Dr.
Yuba City, CA 95991

Daryl Morrison
P O Box 89
Yuba City, CA 95991

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20500

March 14, 1979

Henry Geller
Assistant Secretary
for Communications and Information
Department of Commerce
Washington, D.C. 20230

Dear Henry:

Nearly a year has passed since the transfer of the Office of Telecomunications Policy functions to the Department of Commerce's National Telecommunications and Information Agency and the publication by OSTP of a technical overview of the biological effects of nonionizing electromagnetic radiation (NEMR). While the utilization and expansion of the Electromagnetic Radiation Management Advisory Council is an encouraging sign, on the whole the Government's activity with regard to this area of growing concern is quite disappointing. As I indicated to you and a number of other Government officials last year when transmitting the review prepared at OSTP's request, I expected NTIA to update the "annual" survey (last prepared in June 1976) and to prepare a detail plan for a Federal program on understanding the biological effects of NEMR. Neither of these activities has occurred and we have lost the opportunity to influence FY 1980 budget levels. Unless they are undertaken immediately we will not impact the FY 1981 budget either.

I am willing to seek increased support for R&D in this area, if needed, if there is a Federal program which lays out the research needs in the area along the lines of the priorities recommended by the OSTP working group. Such a program, and related budget requests, must however include all on-going work.

I look forward to hearing from you regarding this matter as soon as possible.

Yours sincerely,

Frank Press

cc: Honorable Juanita M. Kreps
Stuart E. Eizenstat
Honorable James T. McIntyre, Jr.

Ex #3

THE WHITE HOUSE

WASHINGTON

MAR 13 1978

Dear Henry:

As Chairman of the Federal Coordinating Council for Science, Engineering and Technology, I am writing to inform you that the new agency which you will head in the Department of Commerce will have the responsibility for coordinating all federally-supported research activities in the wide field of investigation of biological effects of non-ionizing electromagnetic radiation. Research objectives should be consistent with needs the National Telecommunications and Information Administration (NTIA) identifies in the development and regulation of electromagnetic radiation and telecommunications.

You will have the authority to draw together experts from the various agencies of the government and from the outside on interagency committees and panels of your choosing. In a number of ways, OSTP will be able to provide oversight and assistance for your activities, but the responsibility will be lodged clearly with you.

I trust that the ad hoc working group which we have set up will provide you with an up-to-date assessment of research activities and objectives.

Yours sincerely,

Frank Press
Science and Technology
Adviser

Mr. Henry Geller
Office of Telecommunications Policy
Room 770
1800 G Street, N.W.
Washington, D.C. 20550

File 5-C

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE SYSTEMS COMMAND
ANDREWS AIR FORCE BASE, DC 20334

REPLY TO ATTN OF: SDE

14 Apr 77

SUBJECT: Environmental Assessment for Phased Array Warning System (PAVE PAWS), Beale AFB CA

TO: ESD/OCL

Air Staff comments contained in the attached letter are provided for your consideration. Please advise this office by 15 May 77 of any action taken or required relative to the attachment.

FOR THE COMMANDER

DAVID H. THOMAS II, [illegible], USAF
Chief, Communications [illegible] Div
Directorate of Electronic Systems
DCS/Systems

1 Atch
HQ USAF/PREV Ltr, 4 Apr 77

Cy to: USAFSAM/RZ (Mr. Mitchell)

Ex 14

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330

REPLY TO ATTN OF: PREV

4 APR 1977

SUBJECT: Environmental Assessment for Phased Array Warning System (Pave Paws), Beale AFB, CA

TO: HQ AFSC/DEV

1. The following comments were forwarded to AF/PREV following the recent security review for release of the subject document and are provided for your consideration:

a. Notwithstanding the fact that the main beam will not impact on the hospital and that sidelobe emissions are low powered, concern continues to exist on possible adverse EMI/induced EMF effects on sensitive areas of the hospital, therefore:

(1) Monitoring equipment should be located in sensitive areas of the hospital, once the radar is installed, to ensure that medical instrumentation located in Coronary Care Units (CCU), Catheter Laboratories, Operating Suites (OR), etc. are not being impacted.

(2) Possible adverse effects of radar on externally mounted cardiac pacemakers should be fully evaluated (utilized in CCU's and during transport of some cardiac patients from the CCU to the OR).

(3) Possible impact of radar emissions on the hospital's paging system should be evaluated.

b. You should coordinate the proposed aircraft flight track changes with HQ SAC/DEPV to ensure that they are included in the Air Installation Compatible Use Zone (AICUZ) Study.

c. Indicate on page 10, the status of endangered flora, if any.

d. Indicate on page 25, paragraph 3C(1), whether any of the land outside the seven acre site may become sterilized or made unusable.

FOR THE CHIEF OF STAFF

Cy to: HQ SAC/DEPV

Mr. Rogers

Mr. Ocker

Mr Rogers/DEV/6341/23May77/ali

MAY 23 1977

DEV

File #

Environmental Assessment for Phased Array Warning System (Pave Paws), Beale AFB, CA (Your Ltr, 4 Apr 77)

HQ USAF/PREV

The attached letter provides the answers to questions posed by your

4 April 1977 letter.

FOR THE COMMANDER

SIGNED

MARLAN J. HUMERICKHOUSE, Lt Col, USAF BSC
Director, Environmental Protection
DCS/Engineering & Services

1 Atch
ESD/OCL Ltr, 13 May 77

MR: Major Lennox (SDE) stated that Major Wooten (AFCEC) performed the survey for endangered flora.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ELECTRONIC SYSTEMS DIVISION (AFSC)
HANSCOM AIR FORCE BASE, MASSACHUSETTS 01731

MAY 13 1977

REPLY TO ATTN OF: OCL

SUBJECT: Environmental Assessment for Phased Array Warning System (PAVE PAWS), Beale AFB, CA, (DEV ltr of 11 Apr 77 to SDE)

TO: AFSC/SDE

1. Attachment to subject letter included Air Staff comments on Beale AFB Environmental Assessment and requested compliance with these comments by the System Program Office.

2. The following refer to paragraphs in Air Staff's letter of 4 Apr 77:

a. 1.a.(1) (2) Monitoring equipment will be located in sensitive areas of the base hospital as well as other areas on the base when the radar is capable of transmitting on full power. This will occur about the first quarter CY 1980. These measurements (radiated field strength) will be performed by AFCS (1839th Keesler AFB) and assisted by SAM/RAP. If sensitive areas are found to exist within the hospital they will be evaluated with respect to the medical electronic equipment affected and corrective measures made. In particular, the cardiac telemetry equipment which operates between 180-200 MHz and the externally mounted cardiac pacemaker equipment will be fully monitored for any possible interference.

b. 1.a.(3) It is predicted that PAVE PAWS will not affect the hospital paging system providing the page receiver is not closer than about 1730 ft from the radar along its azimuth radiation sector. The paging system is a Motorola, Page Boy II operating on a carrier frequency of 148.095 MHz. A 45 watt transmitter is located at the hospital. The paging system operating frequency is a third sub-harmonic of the PAVE PAWS frequency band. The radar emission at this frequency is highly attenuated resulting in very low field strengths at or near the radar site. More significant however, is the fact that the pagers are coded by a two tone system by modulation of the carrier. This code is completely unrelated to the pulse transmitted by the radar. Consequently, a pager will not become activated unless it receives its particular code or a general call code transmitted from its own transmitter. Although there is very little likelihood of operating the pager within 1730 ft of the radar along its radiation sector, the effect would be temporary and would tend to distort an audio message coming in at that time.

c. 1(b) No changes are anticipated to aircraft flight tracks as a result of PAVE PAWS. Any changes that do occur will be coordinated with Hq SAC/DEPV.

d. 1(c) An ecological study performed at Beale AFB by the Environics Branch of AFCEC has determined that this area is covered almost exclusively with annual grass and is outleased to ranchers for grazing. Although a list of endangered flora has not been officially designated by the State of California, there are no known endangered species at the site.

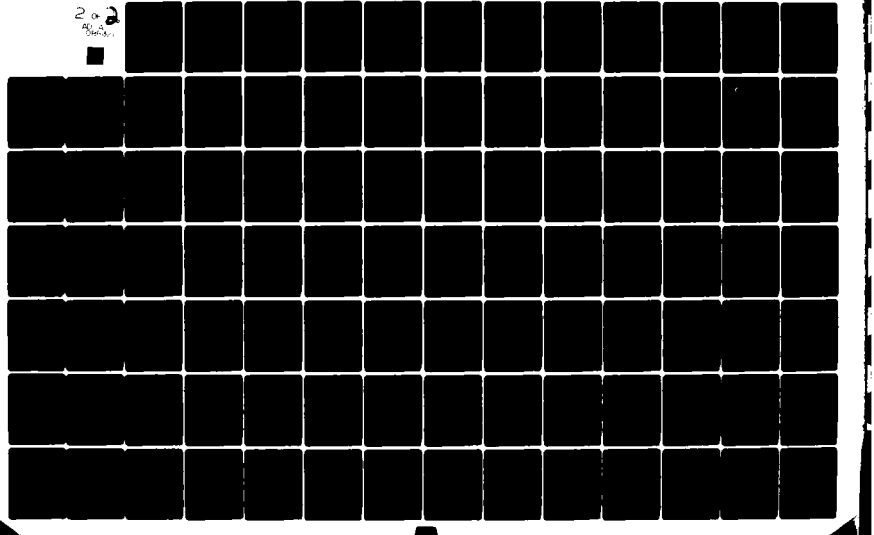
e. 1(d) The land outside the seven acre site will not become sterilized or made unusable since there will be no harmful radiation or discharge from the installation that would create any deterioration of the land. The same can be stated for the land inside the seven acres. It is noted however, that a 1000 ft hazard fence will be installed around the radar site to insure that the minimum safety distances are maintained. This will restrict access to an additional 50 acres.

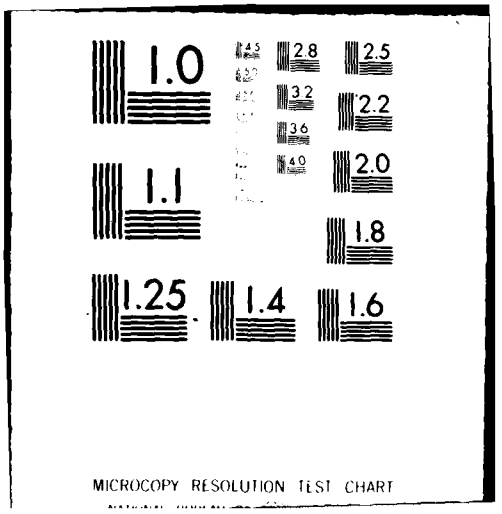
Paul Eachern

PAUL T. McEACHERN, Lt Colonel, USAF
System Program Director
PAVE PAWS SPO

2

AD-A088 321 SRI INTERNATIONAL MENLO PARK CA F/G 17/9
OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE--ETC(U)
JUL 80 F08635-76-D-0132
UNCLASSIFIED AFSC-TR-80-10 NL




1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART

LUKE, LIBICKI & PERRY
Attorneys at Law
847 Fifth Street
Santa Rosa, CA 95404
(707) 544-6942

Attorneys for Plaintiffs

UNITED STATES DISTRICT COURT OF THE

EASTERN DISTRICT OF CALIFORNIA

CITIZENS CONCERNED ABOUT PAVE PAWS, an unincorporated association, LALA CADE, MAY P. PEARCE, HAROLD DAWSON, LABELLE B. PIERSON, MABEL McFARLAND and [redacted],

Plaintiffs,

vs.

JOHN C. STETSON, Secretary of the United States Air Force, Colonel FRANK SMITH, Lieutenant Colonel PAUL T. McEACHERN, Colonel ROBERT BECKEL and Colonel JOHN J. TOBIN,

Defendants.

CIV. S- 77 -413 pcy

NO.

AFFIDAVIT OF EGON LOEBNER

STATE OF CALIFORNIA)
) ss:
COUNTY OF SANTA CLARA)

EGON LOEBNER, being first duly sworn, deposes and states as follows:

1. I was born in Czechoslovakia and came to the United States in 1947. I became a naturalized United States Citizen in July 1952. Generally, I have done research in the areas of physics, chemistry, electronics, metallurgy, psychology, biophysics, cybernetics, and mathematics.

2. I received a four year degree in mechanical engineering training at a technical school in Czechoslovakia. Thereafter I received a Bachelor of Arts and a Doctorate from State University of New York in the field of physics. The Doctorate was awarded

Exhibit C

Ex "5"

in 1955. My educational emphasis was in the area of solid state physics and my dissertation on X-ray structure and electronic structure of carbon and graphite.

3. From 1952 to 1955 I was Senior Engineer at Sylvania's Electronic Products, Inc., in Buffalo, New York and Boston, Massachusetts. I specialized in the field of opto-electronics. I also spent time developing microwave devices and materials. From 1955 to 1961 I was a member of the technical staff of RCA Laboratories, Princeton, New Jersey. From 1961 to 1974 and from 1976 to the present, I have been employed in various management and research positions with Hewlett-Packard. The bulk of my professional career from 1952 has been work in the area of electro magnetic radiation and its interaction with matter.

4. In 1974 I took a two year leave of absence to accept an appointment from the United States State Department as science counselor at the United States Embassy in Moscow. During my presence the embassy was being irradiated by Soviet sources, which became a widely publicized issue. For the last eighteen months I have actively studied world literature dealing with the biological of low level microwave radiation. I became familiar with the state of the art and literature in this area and discussed these issues with many experts in the field. I am well familiar with the electrical and electro magnetic affects in living systems at micro and macro molecular levels and to some extent at cellular levels.

5. During the late 1950s and early 1960s I was a member of the New Jersey State Commission on Radiation Protection. I participated in the setting of standards for exposure to radiation, promulgating regulations and laws, and passed on variances and exemptions.

6. I have registered approximately forty patents in the field of opto-electronics. Further, I have published numerous

papers in the fields of physics, computer sciences, biophysics and neurophysiology. For eight years, I taught at Stanford University.

7. I have been asked by the plaintiffs in the above-entitled action to review the Environmental Assessment (EA) which has been prepared by the United States Air Force for the PAVE PAWS project at Beale Air Force Base. Specifically, I have been asked to render a professional opinion with regard to this document's completeness, its accuracy and the validity of the conclusions reached therein. Further, I have been asked whether, in my expert opinion, this project could have a significant effect on the quality of the human environment. I have examined the contents of the EA, reviewed the current literature in the area of microwave radiation and discussed this matter with my colleagues.

8. It is my opinion that the EA is substantially incomplete, in that, it does not contain sufficient information to allow independent review of crucial data or review of its conclusions. Further, the EA contains misstatements. It lacks specific mention of assumptions and relevant considerations as the levels to which living human and animal tissue could become exposed. Finally, it cannot be said that this project will not have a significant effect on the human environment.

9. The EA states that the standard for health safety in the United States is ten milliwatts per square centimeter ($10mw/cm^2$). What the EA fails to state is that there is significant controversy in the United States and the world with regard to the adequacy and enforcement of this standard. There have been studies and papers in the United States in which it is suggested that the permissible guidelines may have to be revised downward. Further, the scientific and regulatory community is not a stage where a steadfast standard can be set. There is reason to believe that the suggested permissible level of $10mw/cm^2$ will change in the

foreseeable future. This controversy arose approximately four years ago and has become increasingly deepened. The general concensus at this time appears that considerable research will be necessary before this controversy will be resolved. Further, it is false to assert that there is a definite generally applicable boundary beyond which no biological effects will occur.

a. It is stated in the EA that scientists in the Soviet Union have advocated a value of $1mw/cm^2$ for biological effects. This is misleading. In fact, the Soviet Union has actually set standards for biological effects from microwave radiation. Also, the standard set in the Soviet Union for non-occupational exposures to microwaves is one microwatt per square centimeter. This standard is 10,000 times smaller than the level suggested in the EA as the safe level.

b. The EA fails to state that other countries have set or suggested guidelines significantly below that used by the EA herein. In addition to the well-known extremely low standard in the Soviet Union, Poland and Czechoslovakia, I have reason to believe that Sweden has recently established a standard of $1mw/cm^2$. Further, I have reason to believe that Canadian scientists intend to propose a standard of 100 microwatts/cm^2 for Canada, which is 100 times smaller than the guideline set in the EA.

c. The EA fails to state that, although the majority of American scientists believe that biological effects cannot occur below the criterion established in the above-mentioned United States guidelines, there is controversy as to what the actual electromagnetic fields are inside and outside the living body, and the specific effects of frequency.

d. It is my opinion that the foreseeable future permissible levels of exposure to microwave radiation to be promulgated by United States regulations could reach a value as low as 75 microwatts/cm^2 at some specified frequency range, for

some specified areas of the human body. The EA fails to recognize this present level of uncertainty in the field of microwave radiation hazards assessment.

e. The EA fails to discuss and examine the possibility of microwave radiation hot-spots in the vicinity of the radar installation.

10. In my opinion, the EA is incomplete in that I cannot ascertain from the data contained therein what the level of exposure to microwave radiation will be at any particular point. Without further information, I can neither refute nor verify the assertions made in the EA.

11. The EA states at page 3 of Appendix III that "The beam will be controlled by a computer program which will not allow main beam operation at an elevation angle lower than that required for operation. A monitoring system in the radar will automatically shut off radiated power if for some reason the beam is pointed below the minimum elevation and an alarm will be activated requiring corrective action by operating/maintenance personnel." The EA does not make it clear as to the time elements involved following the accidental pointing of the main beam below the minimum elevation as mentioned and the corrective action to be taken. While it is recognized that the system is not designed to operate in that manner, the cardinal question avoided in the assessment is how much radiation could be received by objects such as individual rooms within the base hospital. Thus the EA avoids a worst case analysis of events and incidents which it postulates as possible.

12. It is stated in the EA that effects of microwave radiation are not cumulative. There is no mention of the fact that this point is open to controversy and that there are reputable American scientists who believe the effects of microwave radiation may be cumulative. In fact, at the time of the writing of this

EA such information had been published by scientists of impeccable repute.

13. In conclusion, it is my judgment that this EA indicates a lack of attention to potential hazards under worst case conditions on and in the immediate vicinity of the Air Force base.

DATED: August 5, 1977.

Egon R. Loebner

EGON LOEBNER

Subscribed and sworn to before me,
this 5th day of August, 1977.

Linda A. Wygren

Notary Public in and for said
County and State

OFFICIAL SEAL
LINDA A. WYGREN
NOTARY PUBLIC CALIFORNIA
SANTA CLARA COUNTY
My comm. expires MAY 7, 1979

1501 Page Mill Rd., Palo Alto, CA 94304

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LUKE, LIBICKI & PERRY
Attorneys at Law
847 Fifth Street
Santa Rosa, CA 95404
(707) 544-6942

Attorneys for Plaintiffs

IN THE UNITED STATES DISTRICT COURT FOR THE

EASTERN DISTRICT OF CALIFORNIA

CITIZENS CONCERNED ABOUT PAVE PAWS, an unincorporated association, LALA CADE, MAY P. PEARCE, HAROLD DAWSON, and MABEL McFARLAND,

Plaintiffs,

v.

JOHN C. STETSON, Secretary of the United States Air Force, Colonel FRANK SMITH, Lieutenant Colonel PAUL T. McEACHERN, Colonel ROBERT BECKEL and Colonel JOHN J. TOBIN,

Defendants.

PACIFIC LEGAL FOUNDATION, a nonprofit California corporation,

Defendant-Intervenor.

CIVIL NO. S77-413-PCW

(PROPOSED) STIPULATED JUDGMENT

30

IT IS HEREBY STIPULATED by and between plaintiffs, federal defendants and intervening defendants, through their respective counsel, that judgment may be entered in the above-entitled cause on the following terms and conditions:

A. Plaintiffs have maintained this action in an effort to compel the United States Air Force to prepare and circulate a draft and final Environmental Impact Statement on the PAVE PAWS project, located at Beale Air Force Base, California. The primary

-1-

Ex 6

concern of the plaintiffs is the possibility of harmful health effects resulting from exposure to electromagnetic radiation which will emanate from said project. The defendants have maintained and asserted that the actual power density exposure levels created by PAVE PAWS will be extremely low and that, therefore, no Environmental Impact Statement is required. Plaintiffs will, and hereby do, waive any right they may have to further challenge the adequacy of the defendants' environmental review or to require the defendants to prepare an Environmental Impact Statement in exchange for defendants' agreement to comply with the provisions contained herein. By entering into this stipulated judgment, the defendants do not concede or admit that exposure to microwave power densities up to and including 10 mw/cm^2, and/or the equivalent free space electric field strength of 200 V/m, the 1974 ANSI recommended guide for exposure of personnel under normal environmental conditions, is or may be harmful. Likewise, by entering into this stipulated judgment, the plaintiffs are not admitting or conceding that the defendants have adequately complied with the provisions of the National Environmental Policy Act.

B. IT IS HEREBY ORDERED THAT:

(1) The actual time-averaged electromagnetic radient power densities and peak power densities emanating from the PAVE PAWS installation shall at no time exceed the following levels:

(a) At a distance of approximately 3400 feet the power density shall not exceed 0.027 mw/cm^2 time-averaged over one second, and/or 0.11 mw/cm^2 peak and the equivalent free space electric field strength of approximately 7.4 V/m for each plane polarized component of the circularly polarized radiation.

(b) At the closest physical and populated structure, which is at a distance of approximately 7800 feet the power density shall not exceed 0.0056 mw/cm^2 time-averaged over one

second, and/or 0.022 mw/cm^2 peak and the equivalent free space electric field strength of approximately 3.3 V/m for each plane polarized component of the circularly polarized radiation.

The aforementioned levels are based upon predicted values of radiation for this particular radar at this particular location, and defendants do not admit or concede that said levels represent a health or safety standard or have any clinically significant effects.

(2) (a) The defendants shall periodically survey the vicinity of the PAVE PAWS installation for the electromagnetic power densities emanating from said installation. Said survey shall be initiated during the system test and shall continue thereafter, at least annually, throughout the entire operating life of PAVE PAWS. Prior to making said survey, defendants shall notify plaintiffs of the date and time of the planned surveying. Plaintiffs, the EPA, or the California Department of Health may accompany the survey team and observe and record its procedures and results. Details of the tests will be unclassified and a copy of the report of survey results will be furnished to plaintiffs, Region IX, EPA, and the California Department of Health within sixty days of the survey.

(b) Measurements shall be taken at the following points as a minimum:

1. One measurement at a point on the base property line which is 3400 feet north from PAVE PAWS;

2. One measurement at a point on the base property at the closest physical and populated structure which is approximately 7800 feet south from PAVE PAWS.

(c) The primary measurement system will consist of calibrated antennas connected through appropriate attenuators to a field intensity meter and/or a spectrum analyzer. It is recognized that in recording measurements at the low levels specified, particularly in an uncontrolled environment,

inaccuracies within the metering or recording devices could occur. Therefore, the plaintiffs and defendants agree that the validity of the measurements taken at the levels stipulated are recordable reliably only to within an accuracy of plus or minus 1.5 db. Defendants shall be permitted to utilize advanced equipment as such equipment thereafter becomes available and appropriate at the time the measurements are made.

(d) Defendants will take measurements to determine the ambient radiation on a one-time basis prior to the addition of radiation from PAVE PAWS at the following locations as a minimum:

1. One measurement at a point on the base property line which is 3400 feet north from PAVE PAWS;

2. One measurement at a point on the base property at the closest physical and populated structure which is approximately 7800 feet south from PAVE PAWS;

3. One measurement within the corporate limits of Marysville and Yuba City, California.

(e) Defendants shall, prior to the operation of the radar, install and operate a permanent monitoring and recording device at a point on the base property at the closest physical and populated structure which is approximately 7800 feet south from PAVE PAWS. This device shall be capable of detecting and recording individual PAVE PAWS radar pulses of peak power densities between 0.025 and 25 mw/cm^2 in at least 256 logarithmic steps. Each of the pulses should be labeled by its relative time of arrival within 0.1 seconds and so recorded. A permanent readable record of electronically recorded radar pulses shall be generated at least twice a month. (See Attachment A for two suggested designs).

Defendants shall provide to the plaintiffs, at least once every three months, a record of all measurements which exceed 0.025 mw/cm^2, with the time and level of each such measurement.

Further, the defendants shall provide the plaintiffs with a record of all measurements, if any, exceeding 0.075 mw/cm^2 within two weeks of the measurement and shall include the time and level of each such measurement.

(3) The United States Environmental Protection Agency, the California Department of Health, and/or a measurement team appointed by plaintiffs shall also be allowed independently to measure power densities at the above-mentioned points and distances, and shall be allowed to enter the base for this purpose upon proper identification. Access to secure areas will be allowed only to persons with suitable security clearances. Representatives of defendants will accompany the independent monitoring team and observe and record its procedures and results. Plaintiffs will furnish copies of any independent monitoring team's observations which they receive to the U.S. Attorney, Sacramento, California, and to the Commander, Beale Air Force Base, within sixty days after receipt of the measurements.

(4) (a) The federal defendants, their successors in office and their respective employees, servants, attorneys and agents thereof, and all other persons, in active concert or participation with them shall immediately cease operation of the PAVE PAWS installation if the actual power densities emanating from PAVE PAWS, as measured by any of the above-mentioned monitoring teams or devices at any of the above-mentioned locations, exceed the then-applicable national standard. However, if the Commander-in-Chief, North American Air Defense Command, the Operations Officer in charge at the NORAD Combat Operations Center at the time, or the successors in interest of either of them, determine in good faith that unusual national defense considerations preclude such action, transmission may continue. This decision must be made pursuant to said unusual national defense considerations and shall not be a standing order

or be made in advance of the circumstances giving rise to unusual national defense considerations. In such event, defendants will immediately notify plaintiffs that such a decision has been made and take all feasible steps to minimize the excess emissions and prevent exposures to levels in excess of the then-applicable national standard pending completion of permanent reduction measures. Further, if a decision is made to continue transmission in excess of the then-applicable national standard, the defendants shall immediately notify, in writing, the Secretary of Defense, the President of the United States and the Court, that they are operating the installation in a manner that poses serious health and safety threats to persons on and around Beale Air Force Base, and that the decision to so operate was made because of unusual national defense considerations. Such unusual national defense considerations shall be given in detail, along with reasons why the installation cannot be operated at or below the levels specified in this judgment and an estimate of the time necessary to bring the installation into compliance with the levels specified in paragraph B.(1)(a) and (b). All information which is not classified shall be made available to the plaintiffs and in no event shall the information related to the causes of improper operation or the estimated time required to bring the installation into compliance be classified.

(b) The federal defendants, their successors in office and their respective employees, servants, attorneys and agents thereof, and all other persons, in active concert or participation with them shall immediately cease operation of the PAVE PAWS installation if the actual power densities emanating from PAVE PAWS, as measured by any of the above-mentioned monitoring teams or devices at any of the above-mentioned locations, exceed .1 mw/cm^2 time-averaged and/or .4 mw/cm^2 peak power. However, if the Commander-in-Chief, North American

Air Defense Command, the Operations Officer in charge at the NORAD Combat Operations Center at the time, or the successors in interest of either of them, determine in good faith that unusual national defense considerations preclude such action, transmission may continue. This decision must be made pursuant to said unusual national defense considerations and shall not be a standing order or be made in advance of the circumstances giving rise to unusual national defense considerations. In such event, defendants will immediately notify plaintiffs that such a decision has been made and take all feasible steps to minimize the excess emissions and prevent exposures to levels in excess of .1 mw/cm^2 pending completion of permanent reduction measures.

(c) In the event that time-averaged or peak power emissions emanating from PAVE PAWS, as measured by the Air Force or other concerned agencies exceed the levels specified in paragraph B.(1)(a) or (b) above, the defendants will conduct an investigation to determine the cause or causes of the excess and, in cooperation with plaintiffs' representatives, will identify a course or courses of action which, if taken, would reduce the levels to those specified in paragraph B.(1)(a) or (b) above. Within a reasonable time, the defendants will take the corrective actions indicated by its investigation unless the Commander-in-Chief, North American Air Defense Command, makes a good-faith determination that to do so would be incompatible with unusual national defense considerations. This decision must be made pursuant to said unusual national defense considerations and shall not be a standing order or be made in advance of the circumstances giving rise to unusual national defense considerations.

(d) (1) If, pursuant to paragraph (4)(a) a decision is made to operate the radar installation in excess of the then existing national standard and the time estimate for such

continued operation exceeds thirty days or if in fact it takes more than thirty days to bring the installation into compliance with the levels contained in paragraph B.(1)(a), or if the decision is made to operate the radar installation in excess of the then existing national standard more than three (3) times in any twelve (12) month period, then the defendants shall immediately prepare and circulate, in conformity with the then applicable provisions of the National Environmental Policy Act, a draft and final Environmental Impact Statement on the decision to so operate the installation, and defendants will pay to plaintiffs, through their attorney of record herein, all attorneys' fees and costs incurred in bringing this action in the sum of $12,000.

(2) If, pursuant to paragraph (4)(c) a decision is made not to undertake corrective actions or if, as revealed by any of the monitoring devices provided for herein, it is determined that the radar installation has operated in excess of the levels contained in paragraph B.(1)(a) or (b) on sixty (60) occasions in any twelve (12) month period, then the defendants shall immediately prepare and circulate, in conformity with the then applicable provisions of the National Environmental Policy Act, a draft and final Environmental Impact Statement on the decision to so operate the installation. It is understood that the reason for preparing an Environmental Impact Statement under these circumstances is the controversial nature of such operation and by so agreeing herein the defendants are not admitting or implying that such operation will or might substantially effect the quality of the human environment.

C. In the event that the defendants should increase the power output of the radar installation over and above what is denominated in the Environmental Assessment as the Growth Option by a factor of 15% or more, then the defendants shall, prior to any financial or physical commitment to such an increase,

prepare and circulate a draft and final Environmental Impact Statement on such an increase. Said Environmental Impact Statement shall conform in all respects to the then existing National Environmental Policy Act and any regulations pertaining thereto.

As soon as practical after entry of judgment herein, but not later than twenty-four (24) months after such judgment, the defendants shall:

(1) Commence studies by instituting in-house and/or contracted research programs of high quality designed to establish the threshold power densities at which low-level, long-term exposure to radiation pulses of 8-20 m-sec wide, 0.01-1 pulses per second at frequency ranges of 375-500 MHz can contribute to clinically significant biological effects in humans. The above parameters were selected to simulate frequency and time dependent characteristic of radiation produced by Air Force solid state module phased array radars. In accordance with the published 1973/1974 recommendations of ANSI C95, describing twenty research needs the Air Force will emphasize in its studies at least one-fifth of those which are particularly relevant to and identified as research needs for PAVE PAWS as follows:

(a) Effects on differentiating cells, especially sensitive to UHF radiation during fetal development and reproductive processes (research need No. 5);

(b) The time delayed appearance of effects produced by low-level, long-term UHF exposure (research need No. 7);

(c) Quantification of local field distributions and absorbed power patterns in realistic models of parts of the human body (research need No. 10). (It is suggested that the work of J. C. Lin on interaction of two cross-polarized electromagnetic waves with cranial structures needs extending to lower frequencies and to a range of sizes from new-born to adult humans and the work of C. M. Weil needs refining to eliminate uncertain-

ties due to the lack of knowledge of dielectric properties of various human tissue such as the brain in order to establish the absorption characteristics of human heads and to determine the location and extent of internal "hot spots";

(d) Epidemiological studies of persons exposed to radiation from the upper VHF to the middle UHF range (see research need No. 19).

The above-mentioned studies will be conducted as part of the overall Air Force Radiation Bio-effects Research program. They will be conducted by researchers with strong biological and electromagnetic engineering competence and shall employ state-of-the-art instrumentation. The research will be funded and manned in a manner which will avoid discontinuities that could reduce the validity of those experiments that span long time periods. The results of the above research programs will be reviewed by disinterested peers and will be made available to national, state and professional bodies concerned with the development of nonionizing radiation exposure guidelines and/or standards. The results of the research will be submitted for publication to discriminating journals of high standing and integrity.

(2) The Air Force will fund research and development projects needed to implement the recommendations of J. Mitchell from the School of Aerospace Medicine regarding interference with cardiac pacemakers. (Reference page 5 of Attachment 2 of the Environmental Assessment prepared for PAVE PAWS, Beale Air Force Base.)

E. The Court shall retain jurisdiction to enforce the terms and conditions of this judgment.

DATED:_____

_____
UNITED STATES DISTRICT JUDGE

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ATTACHMENT A

1. This measuring and recording device could consist of the following components:

(a) One to three antennas suitably positioned in front of the above-mentioned building to intercept the "near horizon" radiation directed in a southerly direction from PAVE PAWS,

(b) A logarithmic output receiver, temperature balanced and stabilized, spanning 3-4 decades,

(c) A threshold detector,

(d) A leading edge detector,

(e) A sample hold circuit,

(f) An a/d converter (at least 8 bits),

(g) A 24 bit output clock timing the arrival of the radar pulses (triggered by the output of the threshold detector),

(h) A 16-32 k-bit buffer memory to store the information about the pulse height and time of arrival of the intercepted radar pulses,

(i) A programmable digital recorder to record the radar pulse time and height coordinates for later print-out or plot-out and

(j) A suitable power supply equipped with a battery backup.

2. The requested monitoring could be accomplished by an HP8581A automatic spectrum analyzer with the addition of a digital output clock and backup battery.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

AUG 2 6 1983

Project #D-UAF-K11018-CA

Major Wall
Department of the Air Force
Headquarters Air Force Systems Command/SDED
Andrews Air Force Base, DC 20334

Dear Major Wall:

The Environmental Protection Agency (EPA) has received and reviewed the draft environmental impact statement (DEIS) titled OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CA.

The EPA's comments on the DEIS have been classified as Category LO-1. Definitions of the categories are provided on the enclosure. The classification and the date of the EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

The EPA appreciates the opportunity to comment on this draft environmental impact statement and requests three copies of the final environmental impact statement when available.

If you have any questions regarding our comments, please contact Susan Sakaki, Acting EIS Coordinator, at (415)556-6695.

Sincerely yours,

Carl C. Kohnert, Jr.

Carl C. Kohnert, Jr., Director
Surveillance and Analysis Division

Enclosure

EIS CATEGORY CODES

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

Project #D-UAF-K11018-CA

SEP 19 1979

Major Wall
Department of the Air Force
Headquarters Air Force Systems Command/SDED
Andrews Air Force Base
Washington DC 20334

Dear Major Wall:

The Environmental Protection Agency (EPA), Region IX sent a comment letter to you on 8/30/79 for the Draft EIS titled OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CA.

This is to confirm the conversation of 9/18/79 with Jim Zenner of my staff indicating that additional comment from the EPA's Office of Radiation Programs may be forthcoming on the above mentioned Draft EIS. These comments may reflect a change in rating on the Draft EIS. 31

If you have any questions on this matter please contact me at (415)556-6695.

Sincerely yours,

Susan Sakaki
Acting EIS Coordinator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Environmental Research Center, Research Triangle Park, NC 27711

DATE October 25, 1979

SUBJECT Review of Draft Environmental Impact Statement for the Operation of the PAVE PAWS Radar System at Beale Air Force Base, California

FROM Daniel F. Cahill, Director
Experimental Biology Division (MD-71)

TO Mr. Joe McCabe
Office of Environmental Review (A-104)

On February 16, 1979, the Experimental Biology Division of the Health Effects Research Laboratory/RTP provided an extensive review of the draft EIS for operation of a PAVE PAWS system on Cape Cod to the Office of Federal Activities. These extensive comments and suggestions were largely incorporated into the Final EIS published by the Air Force in May 1979 (HQ AFSC TR 79-04). The present draft EIS for a PAVE PAWS system in California is essentially a companion piece since only the locale has changed.

We have completed a review of those sections of the present EIS which are within our areas of competence. Specifically these are: Chapter 3: Probable Impact of the Proposed Action on the Environment through Section 3.1.2.3; Appendix A: Radar and Antenna Characteristics; Appendix B: Electromagnetic Radiation (EMR) Field Measurements and Comparison with Calculations; and Appendix C: Human Exposure to Radio-frequency Radiation (RFR).

Our overall impression of the draft document and specific comments are attached.

Attachment

cc: Dr. Huster (MD-51)
Dr. Mills (ANR-460)
Mr. James (ANR-460)
Ms. Hill (RD-683)
Dr. Polson (SRI)

EPA Form 1320-6 (Rev. 3-76)

REVIEW OF THE U.S. AIR FORCE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR OPERATION OF THE PAVE PAWS RADAR SYSTEM AT BEALE AIR FORCE BASE, CALIFORNIA

Prepared by
Experimental Biology Division
Health Effects Research Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

A. Overall Impression

This draft California EIS is a direct descendent of the Final Cape Cod EIS which benefited from the extensive review solicited by the Air Force for the first document. Consequently, in our opinion, this is a comprehensive, readable and quite accurate assessment of the potential environmental impact of the operation of PAVE PAWS.

B. Specific Comments

Appendix A - The PAVE PAWS system in California is said to be identical to the one installed at Cape Cod. The operating characteristics, therefore, would be identical and our previous comment on the appropriateness of the use of predictive methods for establishing a model of the EMR field distribution is applicable.

Appendix B - Although no ambient EMR field measurements have been made at the California site; it is our opinion that because of the identical nature of the units, that the field measurements made on Cape Cod which appear consistent with expected values will also be applicable to this case. 32

Appendix C -

Page C-8 - The Shandala (1978) reference which provides the data on Soviet population exposure standards is not included in the Reference section. 33

Page C-15 - In paragraph 2 of Section C.6.1 "classical thermodynamics" should read "statistical thermodynamics." The latter is the discipline that relates thermodynamic quantities to molecules. Classical thermodynamics speaks only of energy flow in macroscopic systems. 34

The third paragraph discusses in more detail the phenomenon presented in paragraph 2, i.e. the random speed or change in disorder of molecules is accomplished by absorption of quanta. Therefore, the first sentence of paragraph 3 should be revised to read: "The 35

increase of kinetic energy or disorder of molecules takes place by absorption of energy at specific discrete frequencies in the form of..."

Page C-18 - Last paragraph - A sentence should be added indicating that the ground plane condition is the most likely one for human environmental exposure. 36

Page C-19 - Third paragraph - Another sentence should be added recognizing the possibility that localized body temperature increases may occur at peak powers as high as 1400 $\mu W/cm^2$ (and power 90 $\mu W/cm^2$), whichare the maximum uncontrolled exposure conditions. 37

Page C-22 - Second paragraph - The mechanism for "microwave hearing" may be re-evaluated in terms of Frey's latest paper [Science 206: 232 (1979)] which claims that transduction does not occur at the skull. 38

Last paragraph and Page C-23 - It is not clear on Page C-22 that the 700 and 1400 $\mu W/cm^2$ figures are peak power densities. This is important because Adey and Blackman have shown the Ca efflux effect (discussed on C-23) at 700-800 $\mu W/cm^2$ average power density. This is a possible point of confusion. Also, Blackman (1977) should be referenced as the discoverer of the power "window" on line 25, page C-23. 39

Page C-37 - Last paragraph - The criticism is made of the techniques of the experiments conducted by Varma, where the body temperature altering effects of anesthesia are used to possibly disclaim Varma's results. The use of anesthesia was purposeful, allowing the exposure of the testicles only. The changes in body temperature "thermostat" by anesthesia would play little if any part in temperature adjustments in the testicles. Previous criticisms of Varma's analysis of data is more appropriate than criticisms of his exposure technique. 40

Page C-39 - Paragraph 2 - The main paragraph on page C-39 ignores the rather consistent results of increased resorptions and decreased fetal weight seen in rodents after microwave exposure (and also seen by Hamrick, 1977, in older birds). The author should deal with these effects because of their consistent occurrence, even though they are seen at over 10,000 $\mu W/cm^2$. 41

Page C-40 - Paragraph 2 - The last sentence is inappropriate. The possibility that handling may cause teratogenesis is only minimally contributory to the studies cited. In any case, such handling exists in control animals as well and the experimental design should factor out such contribution. To retain this sentence, as an inference of general doubt about the results of the cited studies, would not be appropriate. 42

Page C-40 - Paragraph 3 - The last sentence of the last paragraph of the same section is not true in part. The cited studies did not directly investigate the effects in the pregnant dams, only in their offspring. The phrase "... to pregnant women or ..." should be deleted. | 43

Page C-44 - Paragraph 3 - The RF hearing, especially Lin's explanation may need to be re-thought in light of Frey (see page C-22). | 38

Page C-46 - Paragraph 2 - We are not aware that Bawin (1975a) and Adey (1978b) represent replicate experiments. This should be confirmed. | 44

Pages C-52 through 54 - EEG Studies. A reference should be added; Takashima, S., Onaral, B., Schwan, H.P. Effects of Modulated RF Energy on the EEG of Mammalian Brains. Radiation and Environmental Biophysics 16: 15-27 (1979). | 45

Page C-61 - Section C.7.8.3 - The changes in the primary immune response reported by Czerski following exposure of mice to 2.95 GHz at 0.5 mW/cm^2 are compared to Krupp's results in which mice were exposed to 2.6 GHz at power levels which produced a 3°C rise in rectal temperature. There is no similarity between these two experiments except as the author states in "the results... " | 46

Page C-63 - Paragraph 1 - The author also fails to mention that in the experiments reported by Prausnitz and Susskind, an increase in the incidence of leukemia was observed in the microwave-exposed mice despite the fact that exposure " ... was found to protect mice against a pneumonia infection..." | 47

MARIN MUNICIPAL WATER DISTRICT

August 22, 1979
File 515.1 and
238.1.3 and
515

Office of the Assistant Secretary
of the Air Force (SAF/MIQ)
Washington, D.C. 20330

Re: Draft EIS for Pave Paws Radar System at Beale Air Force Base, California

Dear Sir:

As a responsible agency relative to the action of the above referenced project, we are taking this opportunity to respond to the Draft EIS.

We find the data in the Draft EIS to be correct to the best of our knowledge as it relates to our watershed and Mill Valley AFS. As stated on page 4-16, if PAVE PAWS did move to Mill Valley AFS, a significant adverse visual impact is expected. Any increase in traffic would also have a cumulative adverse impact since the access road to Mill Valley AFS presents problems of poor visibility due to its circuitous nature and it has a relatively narrow pavement cross-section with no shoulder.

Thank you for the opportunity to respond to the EIS and if you have further questions, please contact Eric McGuire, our Environmental Services Coordinator.

Very truly yours,

J. Dietrich Stroeh
General Manager

EM:mb

FROM: See return address on reverse.	DATE 5 Sept 79
WRITER'S NAME/TELEPHONE NO.	
Mr. Brian W. Doyle, (916) 440-3557	
☒ YOUR ☐ OUR COMMUNICATION (Kind, reference symbol, date, subject, or other identification)	
Letter, dated 27 Jul 79, subject: Draft Environmental Impact Statement regarding operation of the PAVE PAWS Radar System at Beale AFB, CA.	
ACTION TAKEN OR REQUESTED	
☐ REPLY WILL BE FURNISHED ON OR ABOUT _____	☒ RECEIPT ACKNOWLEDGED
☐ REQUEST DATE WHEN REPLY MAY BE EXPECTED	☐ FOR DIRECT REPLY
☐ WE HAVE SENT YOUR COMMUNICATION TO (See below)	☐ TO OBTAIN INFORMATION
We have reviewed the report, and the work as proposed will not conflict with flood control or other programs within our jurisdiction.	
☐ OTHER INFORMATION ☐ SUPPLIED OR ☐ REQUESTED	
TYPED NAME, GRADE, AND TITLE GEORGE C. WEDDELL Chief, Engineering Division	SIGNATURE George C. Weddell

DA FORM 209, 1 Jan 70 REPLACES EDITION OF 1 NOV 65, WHICH WILL BE USED.

DELAY, REFERRAL, OR FOLLOW-UP NOTICE (AR 340 15)

DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814
PENALTY FOR PRIVATE USE, $300

SPKED-W

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

U.S. MAIL

Office of the Assistant Secretary
of the Air Force (SAF/MIQ)
Washington DC 20330

Sacramento Regional Area Planning Commission

Suite 300, 800 "H" Street, Sacramento, California 95814
(Mailing Address: P.O. Box 808, Sacramento, California 95804)
(916) 441-5930

NOTICE OF COMMISSION ACTION

September 26, 1979

Carlos Stern, Ph.D.
Department of the Air Force
Washington, D.C. 20330

Dear Dr. Stern:

RE: Department of the Air Force; Draft EIS-Operation of PAVE PAWS Radar System at Beale Air Force Base

The Commission has completed its review of your Draft Environmental Impact Statement (EIS) regarding the operation of the PAVE PAWS Radar System at Beale Air Force (AFB), California. The review was conducted by the Commission in accordance with its Areawide Clearinghouse responsibilities for the Sacramento Regional Area.

At its meeting on September 20, 1979, the Commission decided to not comment on this application.

If we may be of further assistance, please let us know.

Sincerely,

JOSEPH E. SHEEDY
Vice Chairman

JES/JMH/rr

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814

(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Navigation and Ocean Development
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

Mr. Carlos Stern
U.S. Department of the Air Force
Washington, D.C. 20330

OCT 2 1979

Dear Mr. Stern:

The State of California has reviewed the report concerning the operation of the PAVE PAWS Radar System at Beale Air Force Base, submitted through the Office of Planning and Research. The State's review, which fulfills the requirements of Part II of Office of Management and Budget Circular A-95, was coordinated with the Departments of Conservation, Fish and Game, Parks and Recreation, Water Resources, Food and Agriculture, and Health; the Air Resources, Solid Waste Management, and State Water Resources Control boards; and the State Lands Commission.

The Department of Fish and Game (DFG) comments that although the impact of the PAVE PAWS system appears insignificant to terrestrial animals, the EIS should discuss possible impacts on the navigational ability of migrating birds. The radar system would be active over the major migratory route of the Pacific Flyway, used by four to five million waterfowl annually. These birds are usually active up to 1,000 feet in elevation. The normal migration corridor divided by a north/south line places the eastern half within the 25-mile zone mentioned in the report. The Sutter National Wildlife Refuge (NWR), the Gray Lodge State Waterfowl Area, the Butte Sink, and District 10 seasonal marsh are within this sector. The Sutter NWR and District 10 areas are also within the 19-mile category mentioned regarding Radio-frequency Radiation. 48

We appreciate having been given an opportunity to review this report.

Sincerely,

for JAMES W. BURNS
Assistant Secretary for Resources

cc: Director of Management Systems
Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814
(SCH 79080302)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

OCT 9 1979

Carlos Stern, PhD.
Deputy for Environment and Safety
Office of the Assistant Secretary
Department of the Air Force (SAF/MIQ)
Washington, D.C. 20330

Dear Dr. Stern:

Thank you for the opportunity of reviewing the PAVE PAWS Environmental Impact Statement.

The attached comments were provided by the Public Health Service. Any questions relating to suggestions or viewpoints expressed by them may be addressed to this office or directly to the Public Health Service.

Sincerely yours,

Charles Custard

Attachment

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION

TO : Special Assistant for Scientific Affairs
Bureau of Radiological Health

DATE: SEP 2 8 1979

FROM : Director
Division of Electronic Products, BRH

SUBJECT: Review of PAVE PAWS Environmental Impact Statement

We have reviewed the PAVE PAWS EIS and have noted the following points:

1. The system is considered in two parts: the "basic" system (580kW, 1792 active antenna elements) and an expanded "growth" system (1160kW, 3584 active antenna elements). The EIS tends to concentrate on exposures resulting from the "basic" system, while relegating the "growth" system to a more parenthetic treatment which tends to suggest it as an improbable eventuality. In fact, the "growth" system hardware is apparently now being built into the original system, and it is rational to expect it to become operational once the whole system goes "on-the-air". Consequently, it is the exposures from the "growth" system which should be emphasized in hazard evaluations (~90μW/cm^2 at the exclusion fence, 1μW/cm^2 out to ~ 1.15 miles at ground level, time-averaged). Moreover, even those levels may be too low. While an 18% duty factor is repeatedly cited in the text, Appendix A (p. A-9) shows that this can rise to 25%, which would apparently increase the levels still further (~125μW/cm^2 at the exclusion fence, 1μW/cm^2 out to ~ 1.4 miles at ground level). 49 50

There are additional ambiguities surrounding the peak power density levels. For the "growth" system, an average power-density of 90μW/cm^2 is cited at the exclusion fence. The 18% duty factor claimed leads to a computed peak of ~520μW/cm^2. However, the report cites 1400 μW/cm at one point (p. 3-18) and "less than 2400 μW/cm^2" at another (p.3-32). 51

2. The EIS refers to WHO as the sponsor of the 1973 Warsaw Conference. In fact, the conference was jointly sponsored by WHO, HEW, and the Scientific Council to the Minister of Health and Social Welfare, Poland. (p. 3-20, p. C-5). The report also notes that BRH has "a set of standards" for microwave ovens (p.3-21). This should say "Performance standard". 52

3. The EIS ignores quantum interactions, noting that hydrogen-bond disruption ostensibly requires 0.08eV (which corresponds to lower frequency IR radiation). Such a consideration does not preclude quantum interactions. | 53

4. The treatment of biological hazards is sometimes cavalier, and tends to disregard or "explain away" inconvenient findings. A number of examples may be noted:

- In referring to RF/microwave biological research programs of BRH, EPA, NIOSH, and DOD, the EIS states "none of the results of this surveillance gives any cause for alarm." This is especially ironic since it notes elsewhere that Blackman of EPA has corroborated Adey's findings of disrupted brain-calcium metabolism at frequencies and modulations which closely model PAVE PAWS at levels down to 100$\mu W/cm^2$ (which is similar to levels expected outside the exclusion fence for the "growth" system). | 54

- The report sometimes tends to rather sweeping generalizations, for which empirical support is marginal: "Continuous-wave RFR has no effect on the brain until the average power density level is well above the threshold for thermal effects" (p.3-45). Further a consensus of the scientific community is frequently ascribed to thermal explanations of biological effects (e.g. microwave "hearing", lymphoblast transformations) where the existence of such a consensus is, in fact, problematical. | 55

- In discussing reported immunological effects including exposure levels down to 10$\mu W/cm^2$ in the USSR, the EIS arbitrarily attributes the findings to heat stress, or to artifacts such as handling (p.3-52). | 56

- The EIS twice refers to a study by Prausnitz (p.C-60, C-69) but never mentions the paper's unexpected finding of increased instance of leukemia in exposed mice. | 47

- There are repeated references to 300mW/cm^2 as the (peak) threshhold for microwave hearing. Examination of the cited reference reveals this work to have been done at 3.0GHz. Its relevance to 450 MHz exposure (PAVE PAWS) is problematic. | 57

Roger H. Schneider

cc:
W.A. Herman

9/29/79

Dear Dr. Stern,

I am very concerned about the Pave Paws facility being built at Beale Air Force Base. Much has been said in favor of it - but much has not been said about the safety of it over a period of time. More studies need to be made - This was quite evident at the recent Public hearing in Marysville.

Our defense system needs to continue to improve - but not at the expense of harm to the citizens. Let be sure of the safety before we use it -

Thank you for your interest in my opinion.

Dale + Kaye Lee
3703 Oswald Rd
Yuba City, Ca
95991

58

Dr. Carlos Stern

I'm writing you to alert you that there are many people in the Yuba City Marysville community and surrounding area. who would be greatly disturbed if Pave Paws is allowed to go into operation without a more thorough Environmental Impact Report. In this day of technological wonders we too often downplay technological danger. So with that in mind I'm asking you to do what you can to spur action towards justice. Justice being knowing to the highest degree possible the side affects to the people and environment and making them aware of it. After this has been done the pros of PAVE PAWS can be weighed with the CONS and justice can be found. However the community must be made aware. Few people are aware now and it is truely an injustice for people to be in doubt ↓

about what may hamper their existence. Or if I must say ingnorant. Please help !!

Eric Challis
271 'B' Street apt. C.
Yuba City Ca. 95991

Dear Doctor stern

My name is Heidi Perkins
I Live at 711 B street Yuba-
City. And I Think YOU
Should wait And Think About
what it could ~~Use~~ do TO US.
IT could give us Canser.
PaveBaws is very dangerous.
Pave Paws could make us
very sick. Itcould even Kill us.
Pave Paws is Almost Like
A Disease to us.

Your's Truely Heidi Perkins

89

9/30/79

Dear,

As a concerned resident of Butler County I appeal to you for more opportunity for public discussion of the PAVE PAWS facility at nearby Beale Air Force Base. The effects of such a nuclear facility should be presented publicly and in more depth than has been the case. The long range effects of PAVE PAWS on this community, the environment and its inhabitants could be awesome. To ignore this could prove disastrous. I feel that there must be more dialogue before PAVE PAWS is put into full operation. Surely something with the potential to alter our environment and our health for perhaps generations demands much

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59

more time and attention than has been shown. It's only fair, we are after all guardians of the future so let us act now to insure a safe one.

Sincerely,
Judith Hurley

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER-79/795

OCT 3 1979

Office of the Assistant Secretary
of the Air Force (SAF/MIQ)
Washington, D.C. 20330

Dear Sir:

The Department of the Interior has reviewed the draft environmental statement for the PAVE PAWS Radar System at Beale Air Force Base, California. We have the following comments.

Operation of the radar system as proposed would not appear to have any adverse effect on natural resources of concern to this Department. However, the document does not contain a discussion or analysis of possible impacts to the cultural resource base of the area. 61

Pursuant to the National Historic Preservation Act of 1966 and Executive Order 11593, the Air Force has not yet fulfilled its responsibilities concerning archeological and historic resources. These laws require Federal agencies to adequately survey and inventory areas to assess what effects the proposed project would have on cultural resources listed in or eligible for listing in the National Register of Historic Places and also as mandated by the National Environmental Policy Act.

We suggest that the Air Force contact the California State Historic Preservation Officer (SHPO) who will be able to provide guidance and assistance in meeting these responsibilities. The SHPO is Dr. Knox Mellon, Office of Historic Preservation, California Department of Parks and Recreation, P.O. Box 2390, Sacramento, California 95811. The phone number is (415) 445-8006. All correspondence with the SHPO should be documented in the final statement.

We hope these comments will be of assistance.

Sincerely,

LARRY E. MIERZOTTO

Assistant SECRETARY

THE AMERICAN RADIO RELAY LEAGUE, INC

[illegible] NEWINGTON, CONNECTICUT

September 28, 1979

Deputy for Environment and Safety
Office of the Secretary of the Air Force (SAF/MIQ)
Washington, DC 20330

Dear Sir:

Enclosed are the comments of the American Radio Relay League, Inc., on the Draft Environmental Impact Statement (EIS) regarding the operation of the PAVE PAWS Radar System at Beale AFB, California. These comments are modeled after the League's comments submitted February 27, 1979 concerning PAVE PAWS at Otis AFB, Massachusetts, but there are significant differences necessitated partly by certain unique characteristics of the Beale AFB system and partly by changes during the past several months in the fast-growing Amateur Radio Service. 62

The League appreciates the opportunity to participate in this proceeding on behalf of the Amateur Radio Service.

Sincerely yours,

Richard L. Baldwin
General Manager

RLB:llg
Encl.

SINCE 1914 - [illegible]

Draft Environmental Impact Statement (EIS)
Regarding the Operation of the PAVE PAWS
Radar System at Beale Air Force Base,
California

COMMENTS OF THE AMERICAN RADIO RELAY LEAGUE, INCORPORATED

The American Radio Relay League, Inc., is a nationwide, non-profit membership association representing licensed radio operators in the Amateur Radio Service. Approximately 150,000 licensed radio amateurs are members of the League. The League also serves as the administrative headquarters of the International Amateur Radio Union, a worldwide federation of 105 national amateur societies. The League is pleased to have the opportunity to participate in this proceeding.

The Draft EIS contains references to a letter from Mr. Richard L. Baldwin, General Manager of the League, to the Air Force (September 1, 1978), a letter from Mr. Baldwin to the Assistant Secretary of the Air Force (SAF/MIQ) commenting on PAVE PAWS at Otis AFB (February 27, 1979), and also references several League publications in evaluating the interference potential of the PAVE PAWS system to the Amateur and Amateur-Satellite Services. In general, the League is appreciative of the attention given in the report to the requirements of these services. These comments are intended to update the information contained in the report where newer or better sources of information are now available; to clarify the impact on future amateur operations which PAVE PAWS might have; and to make some observations concerning the secondary status of the Amateur Service in the 420-450 MHz band.

The Amateur Service is discussed in Appendix D, section 3.1.1., beginning on page D-20. By beginning with a definition of "secondary service," the section leaves unanswered the question of why spectrum is made available to amateurs at all. This question is perhaps best answered in the document entitled, "Discussion of the Various Radio Services and the Need for Allocation Change," which is being used by the Department of State in explaining to the administrations of other countries the U.S. proposals to the 1979 ITU World Administrative Radio Conference. A portion is quoted below, and is suggested as an introduction to section 3.1.1. 63

AMATEUR

The amateur service is perhaps the oldest form of radio service. Early radio experimenters exploring the techniques of communication without wires would have been "amateurs" if such a service were established at that time.

Communications in the amateur service provides the opportunity for people in all countries of the world to talk with one another directly, personally, and in friendship. These person-to-person links help to improve understanding between countries and individuals.

The amateur service, however, assists mankind in more direct ways. One of the most well known is in the area of disaster relief communications. Amateurs are often among the first to arrive at the scene of disasters, such as earthquakes, floods, tornadoes, or hurricanes. By establishing communications to replace facilities disrupted by the disaster, they assist the government, the Red Cross, and other officially recognized agencies in coordinating emergency medical aid, relief supplies, and personal calls from victims and survivors to worried relatives. Such amateurs are highly trained individuals cooperating as a team without cost to the government or individuals assisted.

Amateurs have made many technical contributions through the years. They studied propagation in the early days of radio, and were the first to discover and demonstrate the usefulness of short wave. Amateurs pioneered the development of frequencies above 56 MHz. These efforts uncovered previously unknown modes of propagation such as sporadic-E, tropospheric ducting, tropospheric scatter and transequatorial propagation. They adopted single sideband suppressed carrier radiotelephony as a replacement for double sideband. Recent innovations by the amateurs include slow-scan television and narrow-band voice modulation. All of these techniques were developed by the amateurs to improve communications in general and reduce spectrum occupancy. Their achievements have benefited all users of radio frequencies.

In addition to their technical contributions, the amateurs form a well-trained group of established operators, technicians, and electronic experts. Experience in this technical field often leads to worthwhile careers in communications, electronics, and other engineering or professional fields.

Spectrum allocated to the amateur service can be available for other uses in times of national emergency. Amateurs are disciplined and responsible radio operators, and when called upon, will relinquish use of their frequencies to meet other national needs. Thus, each country has additional resources available to call upon in times of national emergency.

Amateur Satellite: The amateur satellite service performs many of the same functions as its terrestrial counterpart. Amateurs have made many technical advances in their operation of the OSCAR (Orbiting Satellite Carrying Amateur Radio) satellite program. A total of eight satellites have been launched, and some of the more recent provide reliable communication over distances as great as 7250 km (4500 miles).

Some of the technical contributions of amateur satellites which may be applicable to other services are as follows:

(1) The first spacecraft to utilize digital store-and forward message systems to

provide non-realtime communications between two distant points on earth.

(2) The first demonstration of random-access, Earth-space-space-Earth intersatellite relay of communications between two ground stations.

(3) The first use of unattended, automated telecommand stations to control spacecraft.

(4) The first application of the envelope elimination and restoration principle in satellite transponders, demonstrating the practicality of this technique to improve communications satellite efficiency.

(5) The first spacecraft designed to use the sun as a means of sustaining its spin.

(6) The first practical demonstration of two-way communications using satellites in conjunction with truly low-cost ground terminals.

(7) The first use of space communications techniques in a number of developing countries.

The amateur satellite service has grown considerably in the past seventeen years and has increasingly become a practical means for reliable long-distance communication. Future plans call for satellites to be placed in higher orbits, and ultimately in geostationary orbit. This will lengthen both the distance and time available for communication by the amateur satellite users.

While it is true that the Amateur Service enjoys only secondary status with respect to radiolocation in the International Table of Frequency Allocations, it does not necessarily follow that the same status must apply domestically. For example, in 1976 the FCC authorized a system

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of pulse-ranging non-government radiolocation known as HIRAN to operate in the 420-450 MHz band subject to the following restrictions (Section 91.604(b)(20) of the Commission's Rules):

> Non-Government pulse-ranging radiolocation stations in this band are secondary to the Government Radiolocation Service, the Amateur Radio Service and the Amateur Satellite Service. Stations authorized pursuant to this footnote must cease operation on or before January 1, 1981. All power and antenna height specifications shall be made on a case-by-case basis.

The status of the Amateur and Amateur-Satellite Services in the International Table is primarily of significance in cases of interference across national boundaries. The question of possible interference to amateur operations by PAVE PAWS cannot simply be dismissed on the basis that amateurs are "...not permitted...to claim protection from interference caused by government radars." (Draft EIS, page 3-68.) The public-interest benefit which would be lost if amateur operations had to be curtailed must be considered. 65

On page D-21 there begins a discussion of FM repeaters. The 1977-78 edition of the ARRL Repeater Directory lists 50 repeaters in California as operating in the 442-450 MHz band. The 1978-79 edition lists 67 such repeaters. This is in accordance with the general trend toward greater utilization of the band by amateurs. Further, as of May 15, 1978 the FCC permits repeater operation anywhere in the 420-450 MHz band except 431-433 MHz and 435-438 MHz. These segments are protected for weak-signal and satellite communication. 66

On page D-29, there is a discussion of the level of activity which takes place using the OSCAR satellites. Activity has increased significantly since the sources cited in this discussion were written. The OSCAR 8 Mode J transponder is in operation for 96 hours per week on the average: Tuesdays, Fridays, Saturdays, and Sundays UTC. This is a 33 1/3% increase in activity since the League submitted its comments on the Draft EIS concerning the PAVE PAWS operation at the Otis Air Force Base in Massachusetts in February 1979. More equipment is available, and more amateurs are availing themselves of the communications opportunities presented by the satellites. See Glassmeyer, "The Easy Way to OSCAR 8 Mode J," QST, for December 1978, page 50, and January 1979, page 56. The satellites are an essential element in the OSCAR Education Program, which, in cooperation with NASA, is demonstrating satellite communications techniques to tens of thousands of students. 67

The first of the amateur "Phase III" satellites is scheduled for launch in early 1980. The Draft EIS dismisses this activity rather briefly on page D-29 with the statement, "Another satellite is planned for launch early in 1980 (King, 1977; Baldwin, 1979)." The subject deserves more thorough discussion. This satellite will have a high elliptical orbit and will use an uplink passband in the 435-438 MHz range. The hardware for this satellite already has been developed and cannot be changed if the launch date is to be met. Because of the nature of the orbit, the satellite will be within view of PAVE PAWS for approximately 20 hours each day. A cooperative education project utilizing the Phase III satellite for communications between 68 69

classrooms on opposite sides of the African continent is now under development by UNESCO.

In discussing interference to television, on page 3-71, the draft EIS states: 70

> The channel-10 interference would be caused by only 6 of the 24 PAVE PAWS frequencies -- those from 431-437 MHz. This band includes the frequencies used by the Hams, in their satellite work. If operational requirements permit, discontinuing use of those six frequencies would eliminate problems with both Ham satellites and with TV. Experiments could determine whether discontinuing the use of fewer than six frequencies would accomplish the same end.

The League recommends and requests that this course of action be followed. If this is done, the impact of PAVE PAWS upon present and future amateur operations can be substantially reduced. Of course, in the event of national emergency the full complement of frequencies could be used immediately and without necessarily giving advance notice.

The League stands ready to cooperate in any way it can in minimizing the conflict between national security requirements and the requirements of the Amateur and Amateur-Satellite Services. The League is grateful for the opportunity to comment in this proceeding.

Respectfully submitted,

RB Baldwin

September 28, 1979

Richard L. Baldwin
General Manager

The American Radio Relay League
225 Main Street
Newington, CT 06111

E Davis
6738 Sutter Ave.
Sutter, Calif 95982

Mr. Carlos Stern — Sept. 25 79
c/o of the Air Force
Environmental Dept

Sir,

After attending the meeting where the
Air Force made public the Environmental
Impact Report for PAVE PAWS. I, 49
as many like yourself, am 59
concerned with its thoroughness.
Especially in areas of its potential
growth and the radiation levels
in the immediate area.

Although we are around this 71
type of radiation, we are not accustomed 14
to it as far as it is one more type
of radiation that we place upon
the body that we must maintain
and that is accumulative.

The areas as important as this 72
extreme caution should be exercised
for not only does it effect us
but the life that is to come.

Thank you for your attention.

Sincerely,
Ezzie Davis
Dicky Davis

LAW OFFICES OF
LITTLEJOHN & WESTFALL
P. O. BOX 937
810 JAY STREET
COLUSA, CALIFORNIA 95932

DONALD W. LITTLEJOHN
FLORENCE WESTFALL LITTLEJOHN
D. WILLIAM ADEL

TELEPHONE
(916) 458-4844

October 1, 1979

Carlos Stern, Ph.D.
Office of Assistant Deputy
for Environment and Safety
Washington, D.C. 20330

Re: Draft Environmental Impact Statement
Operation of the Pave Paws Radar System
At Beale Air Force Base, California

Dear Dr. Stern:

This office represents TOR Broadcasting Corporation, and we have been requested to provide the following written comments relative to the Operation of the Pave Paws Radar System at Beale Air Force Base, California.

TOR Broadcasting Corporation is a California corporation that has significant leasehold interests located atop the Sutter Buttes in Sutter County, California. These leasehold interests are used for the installation, operation and maintenance of two-way radio equipment including base stations, towers, antenna poles or masts and other related equipment.

This letter is to advise you that TOR Broadcasting's radio operations at the Sutter Buttes site are being seriously interferred with during the operation of the Pave Paws System at Beale Air Force Base. 73 15

The Draft Environmental Impact Statement indicates that only minimal radio interference from Pave Paws is possible; however, it is now clear that the interference with the radio operations at the Sutter Buttes location is extremely serious and potentially totally destructive of the entire radio operation at the Buttes.

Accordingly, it is recommended that the final Environmental Impact Statement direct further attention, study and mitigating measures or alternatives to the planned operations of the Pave Paws System as it relates to the radio operations at the Buttes location. Further effort in this area is essential if our client's interests are not to be destroyed by the Air Force Pave Paws System.

It is requested that you keep this office fully advised in regard to future progress and developments regarding this new system. TOR Broadcasting Corporation will be happy to cooperate with the Government in resolving this extremely serious problem.

Very truly yours,

S. William Abel
of
LITTLEJOHN & WESTFALL

SWA/je

cc: Mr. Lee A. Otterson

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and
Information Administration
Washington, D.C. 20230

October 5, 1979

Dr. Carlos Stern
Office of the Assistant Secretary
of the Air Force (SAF/MIQ)
Washington, D.C. 20330

Dear Dr. Stern:

This Office appreciates the opportunity to review and comment on the Draft Environmental Impact Statement (EIS) regarding the operation of the PAVE PAWS Radar System at Beale Air Force Base, California.

The jurisdiction and interest of this Office in the PAVE PAWS radar installation stems from a) the authority of the National Telecommunications and Information Administration (NTIA) to authorize Government radio stations to utilize the radio spectrum and b) the ongoing effort of NTIA to coordinate government research in the area of biological effects of electromagnetic radiation (EMR).

It is felt that the Air Force has done a commendable job in preparing the EIS. The document is sufficiently comprehensive and in adequate detail in its treatment of both the spectrum management aspects of this PAVE PAWS installation and the discussion of the biological effects from EMR. The portion of the EIS relating to human exposure to radio frequency radiation was reviewed with the assistance of some members of the Electromagnetic Radiation Management Advisory Council (ERMAC).

Thank you for the opportunity to review the EIS. I appreciate this creditable effort in this area of mutual concern.

Sincerely,

Leo A. Buss
Director
Spectrum Plans and Policies

Oct 2 - 1979

In accord with the public hearing, September 20 - 1979 in Marysville California we are submitting this statement from the committee concerned about PAVE PAWS

Our consultant, Dr [illegible] has assisted us in its preparation

Respectfully

[illegible]
Mabel McFarland
[illegible]
[illegible]
[illegible]

Citizens Concerned
about PAVE PAWS
12419 Krosen Rd
Marysville Calif.
95901

October 2, 1979

We, the Citizens concerned about PAVE PAWS hereby express our continued great concern about (1) the continued noncompliance by the AIR FORCE SYSTEMS COMMAND with Federal Laws and the detailed provisions of the Air Force's own regulations; (2) the disconcern indicated by the actions of the SYSTEM COMMAND, the AEROSPACE DEFENSE COMMAND and the SCHOOL OF AEROSPACE MEDICINE for the health, lives and well-being of the Air Force's own personnel, their dependents and of the people living in or traveling through twenty-four counties of the State of California (See Attachment 1); (3) the inability of the HEADQUARTERS AND CHIEF OF STAFF OF THE US AIR FORCE to enforce compliance with said above laws with the Air Force's regulations and with written commitment, by above Air Force organizations. 74

The above, Air Force organizations, have not filed an Environmental Impact Statement prior to commencing construction of PAVE PAWS at Beale AFB in or about April 1977 as they were required to do by law and regulation. They are in noncompliance because:

(1) They made a decision before the environmental consequences of constructing PAVE PAWS could be assessed; 75

(2) Operating PAVE PAWS generates microwaves, UHF and electromagnetic radiation at 24 frequencies between 420 MHz and 450 MHz, said frequencies being in a range of the frequency spectrum that has a great efficacy for absorption by human bodies; uses pulse bursts of the above frequencies with a time duration that is substantially longer than the thermal relaxation time of subparts of human cells; 24

(3) Operating PAVE PAWS without taking reasonable measures to neutralize or mitigate the effects of any of the above adverse actions, as Air Force regulations state that the Air Force must do; 76

(4) They operate PAVE PAWS without giving Air Force dependents the option to use other facilities than the present school and hospital structure or without providing screening to mitigate the effects of microwaves;

(5) They operate PAVE PAWS without providing fences to keep humans and animals out of areas where there are known or potential biological effects whose health effects are either uncertain or known to be detrimental;

(6) Operating PAVE PAWS creates electromagnetic radiation (EMR) pollution over a geographical scale which extends to 24 counties in the State of California and could interfere with air traffic over this area; 77 100

(7) Operating PAVE PAWS causes potential biological effects for occupants in aircraft within the airspace traversed by the main beam up to a distance of 4 miles from PAVE PAWS (See Sacramento Valley and Yuba River AAA maps); 78 88

(8) Operating PAVE PAWS causes potentially unsafe exposure of humans to EMR in agricultural and training aircraft flying within less than 10 miles of PAVE PAWS;

(9) Operating PAVE PAWS creates radiation levels at the Beale AFB hospital and the school which can cause potential irreversible biological effects in patients, dependents, students and workers in those structures with reflecting reinforced concrete containing unsurveyed radiation levels and long pulse bursts of potentially very high magnitude; 79 59 28

(10) Operating PAVE PAWS with measured levels of peak values of 3.8 mwatts/cm^2 at the guard tower and 3.3 mwatts/cm^2 at the guard house, these levels being in excess of those considered the limit of occupational exposure standard by industrial organizations such as Bell Labs and Raytheon. 80

PAST AND PRESENT AF ACTIONS

The action which some Air Force organizations took was to reject the proposal of Citizens Concerned about PAVE PAWS to set up a permanent monitoring station at the hospital. These Air Force organizations were not willing to recognize the exposure of humans on the Beale AFB to microwaves as a potential problem area which must be evaluated fully and whose potential detrimental effects should be recognized throughout the whole Environmental Impact Analysis Process. They have shown a remarkable disconcern for the Beale AFB personnel and dependents. They have focused on the probable exposure of the public and estimated that this probability is very low. These actions of these Air Force organizations are contrary to AF regulation 19-2. All the concern in Exhibit #4 is about equipment - not people. Throughout the entire Environmental Impact process that we followed closely for over two years we saw no evidence that biological effects on dependents were ever considered as a major issue. The bottom lines on Page 3-60 of the DEIS summarize this fully: "We see no evidence that the low levels of general public exposure to PAVE PAWS are hazardous. We are supported in this conclusion by the study recently completed by the National Academy of Sciences." In fact, the peak bursts are 3.82 mw/cm^2 at the guard house, 63,000 times those in the referenced NAS report. How could this be cited in support? And how can there be evidence of no hazard if there are absolutely no data? We strongly reject such sophistry in an EIS which must evaluate fully potential problem areas. 74 81

One of our major criticisms of some Air Force organizations is their noncompliance with the requirement to carry out a systematic interdisciplinary study to evaluate the environmental consequences and alternatives of actions they were proposing to take, have taken and are still proposing to take. Specifically, they had arranged with the National Academy to do two separate studies; by isolating the work of the Engineering and Bio-effect Panels the AF and NAS organizations insured that interdisciplinary interaction does not take place. The consequences of missing a key issue in the assessment of potential effects is outlined in Attachment 4. The result is an hundredfold underestimation of the potential biological effects to do harm to the human body. A third major failing of the Air Force organizations is their consistent tendency to displace the concept of potentiality with that of probability when dealing with Bio-effects. In scientific and technical contexts, probabilities require numeric quantifications. No numbers are offered to back up the use of probable, unlikely, etc., in the DEIS. The only conclusions ~~X~~ the DEIS should have drawn is that there are no data to base judgement on exposure of biological materials to PAVE PAW signals on. Simulation at different frequencies and at different pulse widths may not be adequate to obtain relevant data for the task at hand. (See University of Washington and University of Utah reports.) 82 83 24

While rats may offer a downscaled model of standing wave patterns, they cannot very well simulate effects on cellular and molecular levels.

Finally, Exhibit #4 is a clear indication of AF Headquarters' not being able to enforce compliance of the commitments made by AF Commands. 74 16

The work of SRI on the DEIS needs also scrutiny. A literature survey should not become a substitute for detailed analysis, especially if the connection between the literature and the problem on hand is as tenuous as that in the draft EIS. Important papers and issues that have a direct bearing on the problem on hand are missed. (See Attachment A.) The gap between the present DEIS and the desired FEIS is so large that it cannot be bridged without a second draft EIS. 84 86 85

PROPOSAL

We propose the following sequence of actions for consideration by the US Air Force: 86

(1) Check the measurement taken on September 11 and 12 for accuracy and verify their internal consistency.

(2) Carry out a detailed survey of field measurements inside the a) guard tower; b) guard house; c) base hospital and d) base school.

(3) Give an opportunity to dependents to select another hospital and/or school if they so wish.

(4) Publish the report of the Hearing, Formal Comments and Response to Comments, but not a final EIS.

(5) Reconstitute the NAS panels as a single interdisciplinary group with additional disciplines covering subfields in biology dealing with molecular, membrane, subcellular and cellular phenomena with a task assignment including Beale AFB, pulse bursts and a broader charter to study biological effects.

(6) After completion of (4) undertake a second DEIS.

(7) Hold a second hearing.

(8) If there are no Federal or State standards establish by then a special standard for nonionizing radiation between 375 and 500 MHz, for pulse bursts longer than 2 milliseconds will be set up for PAVE PAWS.

(9) Rearrange occupancy of buildings in accordance with the above newly-to-be standards.

(10) Relocate fences in accordance with the above newly-to-be standards.

(11) Install monitoring equipment at suitable locations to protect AF against future liability.

(12) Reassess research contracts to study biological effects of PAVE PAWS in light of new information.

(13) Keep Citizens Concerned about PAVE PAWS informed of the progress made by the US Air Force and its various organizations.

Lalia Cade
Mabel McFarland
Mary P Pearce
Arthur W Pearce
Gary R Cade

ATTACHMENT A

ESSENTIAL BIBLIOGRAPHY MISSED IN

THE DEIS AND THE BIO-EFFECT REPORT

1. William H. Orttung of UC Riverside on "Direct Solution of the Poisson Equation for Biomolecules of Arbitrary Shape, Polarizability Density, and Charge Distribution," pp. 22-37, (General Properties). 86

2. Fumio Oasawa of Institute of Molecular Biology, Nagoya, Japan on "Fixed Fluctuation in Ionic Solution and its Biological Significance," pp. 38-46, (Response of the membrane to the electric field in elementary process of excitation of living cells).

3. Of utmost importance is Walter Scheider's (University of Michigan) "Real-time measurement of dielectric relocation of Biomolecules: kinetics of a protein-ligand binding reaction," pp. 47-56, (A relaxation time of 10^{-6} seconds has been measured for Human Serum Albumen).

4. Robert M. Cole (Brown University), "Dielectric Theory and Properties of DNA in Solution," pp. 53-73, (Treats effect of electrostatic dipole forces on static dielectric constant, Kerr effect response of a polar liquid).

5. Schwann (University of Pennsylvania) on "Field Interaction with Biological Matter, pp. 198-213, (Bound water relaxation is around 300-500 MHz.)

6. Yuzuru Husinu, et. al. (University of Tokyo) on "Subsecond Measurement of Dielectric Dispersion," pp. 90-106.

7. M. Mandel (University of Leiden), "Dielectric Properties of Charged Linear Macromolecules with Particular Reference to DNA," pp. 74-87.

8. Of major importance is: Warner L. Peticolas (University of Oregon) "Mean Square Amplitudes of the Longitudonal Vibrations of Helical Polymers" in Biopolymers, Vol. 18, pp. 747-755 (1979), since it provides the bridge between biochemistry and microwave spectroscopy of hydrocarbon chains in membrane bilayers and of alkyl chains of fatty acids lipid bilayers.

9. The 1977 Special Supplement of Radio Science marks the breakthrough of radiobiology into the mainstream of biology and medicine. One of the papers is: A. T. Huang, et. al, (Duke Universiry), "The Effect of microwave radiation (2450MHz) on the morphology and chromosomes of lymphocytes," pp. 173-177.

10. Raymond Devoret, "Bacterial Test for Potential Carcinogenes," Scientific American, Vol. 241, pp. 40-49, August 1979. 27

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ATTACHMENT 1

ELECTROMAGNETIC RADIATION POLLUTION

OF THE AIRSPACE

The following 24 counties will be affected by Electromagnetic Radiation Pollution (EMR) in their airspace by virtue of PAVE PAWS' operation: Alameda, Amador, Butte, Calaveras, Colusa, Contra Costa, Glenn, Lake, Lassen, Marin, Mendecino, Nappa, Placer, Pluma, Sacramento, San Joaquin, Shasta, Solana, Sonoma, Stanislaus, Sutter, Tehama, Yolo and Yuba. This determination was made by establishing 94 miles as the growth version distance from PAVE PAWS (see California map) at which the so-called peak value of the main beam falls down to 5 microwatts/cm^2. Sacramento, which is about 54 miles south of PAVE PAWS, will have its airspace polluted to a level of about 30 microwatts/cm^2 for "peak" values. It remains to be determined by the FAA what possible enhancement factors various airplanes and their orientation with respect to the beam direction can lead to for humans and equipment inside the aircraft. The EMR threshold elevation can be calculated approximately as a function of distance from PAVE PAWS to be 100 feet/mile. From this it is quite clear that agricultural aircraft servicing crops in the eastern directions surrounding Marysville will be significantly affected by the main beam. At 10 miles from PAVE PAWS the peak values are estimated to be 440 microwatts/cm^2. At 5 miles distance they would be 19,500 microwatts/cm^2, a value which should not be considered to be safe. It is recommended that the FAA investigate this matter further. This recommendation is based on the belief that the unprecedented nature of the solid-state PAVE PAWS radar, with pulses up to 16 msec wide may have undesirable biological effects.

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ATTACHMENT 2

ORGANIZATIONS PARTICIPATING WITH AIR FORCE

ENVIRONMENTAL ANALYSIS PROCESS

NAS Contract: F49620-78-C-0118

Report #1: Engineering

Radiation intensity of the PAVE PAWS System.

Report #2: Bio-Effects

Analysis of the exposure levels and potential biologic effects of the PAVE PAWS Radar System.

SRI Contract: F08635-76-D-0132-0008

Draft environmental impact statement for the PAVE PAWS System at Beale Air Force Base.

UNIVERSITY OF WASHINGTON Contract: F33615-78-C-0631

Effects of long-term low-level RFR exposure on rats.

ADL Contract F1926 5-78-C-0 56

~~[redacted]~~ PAWS, ~~[redacted]~~ AFB.
Design study — Pave Paws electromagnetic radiation monitoring system —

UNIVERSITY OF UTAH

EMR energy in animals and models of man.

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ATTACHMENT 3

PROPOSED GUIDELINES
FOR LONG (GREATER THAN 2 msec) PULSE BIOLOGICAL EFFECTS
BASED ON ESTIMATED THERMAL STRESSES

APPLIES ONLY TO 375-500MHz

Occupational (8 hour)	75 - 150 $\mu w/cm^2$	10
General Public (24 hour)	25 - 50 $\mu w/cm^2$	
Susceptible and Vulnerable Persons	Below 5$\mu w/cm^2$	

Marysville, September 20, 1979

Egon E. Loebner

Introduced as EXHIBIT #1 at September 20, 1979
Marysville Public Hearing on PAVE PAWS

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ATTACHMENT 4

CRITIQUE OF NAS REPORTS

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1. Both PAVE PAWS Reports (Engineering and Bio-effects) fail to consider the Beale AFB site and restrict themselves solely to the Otis AFB site even though their task statements do not mention this restriction. This is unfortunate because Beale contains a school and hospital while Otis is unoccupied. Even though the Base Hospital at Beale is more than twice the distance from the radar than the point of nearest public approach at the Massachusetts site, its average power density is twice as large than that of the Otis site measurement. However, the guard tower and guard house have reported measurement values of average power density of .126 and .111 mw/cm^2 respectively. These represent measured average power density values for non-occupational occupants 2,000 times higher those at Otis. It was pointed out at the public hearing that using average power values is not appropriate and that peak values of 3.8 and 3.3 mwatts/cm^2 have to be considered instead. Thus, the bio-effects relate to power densities which are 63,000 times higher at Beale than those the panel considered at Otis. However, consideration cannot stop here since there are structures capable of resonances, a situation not at all present at Otis. It has to be concluded that the restriction by the NAS Engineering Panel to the Otis site is a very serious matter that could have very serious health consequences to humans exposed non-occupationally to EMR on the Beale AFB.

2. The task statement of the Engineering Panel is restricted to an objective, scientific assessment of the PAVE PAWS radar design relative to predicted levels of radiofrequency radiation and does not explicitly mention the pulse characteristics of the radiation. As a matter of fact, the unprecedented, unique feature of PAVE PAWS, the third generation of US phased array warning system is its solid-state construction and concomitant lower peak and longer width of the pulse. While the lower peak has been recognized as beneficial in reference to Bio-effects, the potential detrimental effects due to the much greater width of the pulse have not.

3. The task statement is further restricted by the qualification of "that might possibly expose the public." This is improper on several grounds. No such restriction appears in the Bio-effect Panel statement. Under Federal Law as well as AF regulation, 19-2 such restriction is not legal. Thus, all humans, whether occupational or non-occupational have to be considered.

4. The restriction to Cape Cod, mentioned in the preface of the Engineering Panel, stems from an understanding the Panel had that the Otis AFB was the subject of intense public concern. The Panel apparently was not informed officially that a similar controversy had existed even at an earlier date in California. Apparently, Beale AFB in California with much higher levels of non-occupational exposures of wives and children of Air Force personnel and guards not directly engaged in PAVE PAWS activities, were overlooked by both AF and NAS.

5. It appears that the most crucial deficiency of the NAS study under the above AF contract is the decision to have a separate Bio-effect Panel established. This decision was contrary to the requirement of "using a systematic interdisciplinary approach" of the AF regulations when evaluating "the environmental consequences" of PAVE PAWS. The braking up of the study into separate efforts inhibited the communication between the biologists and the engineers who, even though not required by the above task statement, have familiarized themselves with the nature of the radar and the pulses. In their report, Table I on Page 10, shows T=16 msec. On Page 21 they state, "The minimum duration of any pulse emitted is 0.016 seconds (16 ms)." Nevertheless, they failed to single out this feature as being a novel feature of the new type solid-state radar. One skilled in the art might have deduced this fact from the first two lines of Table II which compares the solid-state PAVE PAWS radar to its two non-solid-state PAWS predecessors PAR and FPS-85. However, it is unlikely that the biologically oriented members would be motivated to do this on their own when relying on such distinguished experts in radar. On the other hand, not being part of a single interdisciplinary team and not being exposed to detailed discussions of heat generation and transfer in cells and biological membranes, not knowing that the time constants are less than 10^{-4} seconds, the engineers were not likely to put much significance into the fact of a width of 16 msec. Furthermore, both groups were under the influence of past practice to average pulse bursts. (See reply given by Mitchell to Loebner's first question.)

6. The composition of the Bio-effect Panel was not as fortunate. It could have benefited by adding strength to it in areas of molecular and membrane type of phenomena. Individuals of backgrounds similar to Britton Chance, Warner Peticolas and James Frazer would have provided a better balance.

7. While effects of large buildings, size and shape of human bodies were treated satisfactorily, phenomena of cell and molecular dimensions were not sufficiently represented. The work of Peticolas on "Longitudonal Vibrations of Helical Polymers" leads to insights which eventually will provide a key to the experimental and theoretical study of polymers in cell membranes. The spectacular success of the Ames test (See

Reference 10) in assaying carcinogenicity and replacing initial tests on expensive animal and epidemiological studies should be examined for its usefulness to make forays into the pristine forest of EMR frequencies. The Guy system of exploring cell cultures should be adapted to allow the merger of these two remarkable techniques.

8. The Bio-effect Panel report suffers from the same tendency of confusing potentiality with probability as the DEIS does. The NAS panels were not responsible to make judgements as to relative safety and should have refrained from doing so.

9. One of the major failings of the Bio-effect and DEIS documents is the confusion about occupational and non-occupational exposure standards. There are clear precedents for this: Only the workers directly concerned with operating PAVE PAWS should be considered subject to occupational standards. Hospital patients, workers and visitors are not. Neither are guards in towers and guard houses. (See Proposed Preliminary Standard for PAVE PAWS.) The identification of 0.1 mw/cm^2 as a level above which irreversible changes in the central nervous system can set in is considered to be a good choice.

10. In summary, the Otis only, public only, occupational standard only, level only, restrictions of the NAS reports have to be rejected as guidelines for the filing of the Environmental Impact Statement. New reports have to be generated. There is, however, valuable information in those reports. It is of general utility and should be used.

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ATTACHMENT 5

CRITIQUE OF THE DEIS FOR BEALE AFB

1. Siting of PAVE PAWS was a mistake which appears to have been based on economic and logistic considerations. Environmental health and safety were secondary considerations. First, the choice was limited to Federal land. However, the logistics further restricted the choice to the eight Air Force properties on the West Coast, Beale AFB became the only candidate. | 92

2. The strategic needs and the mission of the Air Force are not questioned in this critique.

3. The need to dip the main beam below 3° does not exist for the primary search function of the radar but may exist for the secondary track function. | 20

4. In order to avoid a primary beam in the vicinity of the hospital (it would result in a peak burst density of 22 $\mu w/cm^2$) a ROM with a horizon-type notch could be constructed, but other considerations speak against this. | 93

5. Radiological safety of the 225 operating and maintenance personnel in the main PAVE PAWS building should be addressed in the DEIS. | 94

6. The replacement procedure of modules has not been discussed and poses some safety and health questions which should be answered. | 95 94

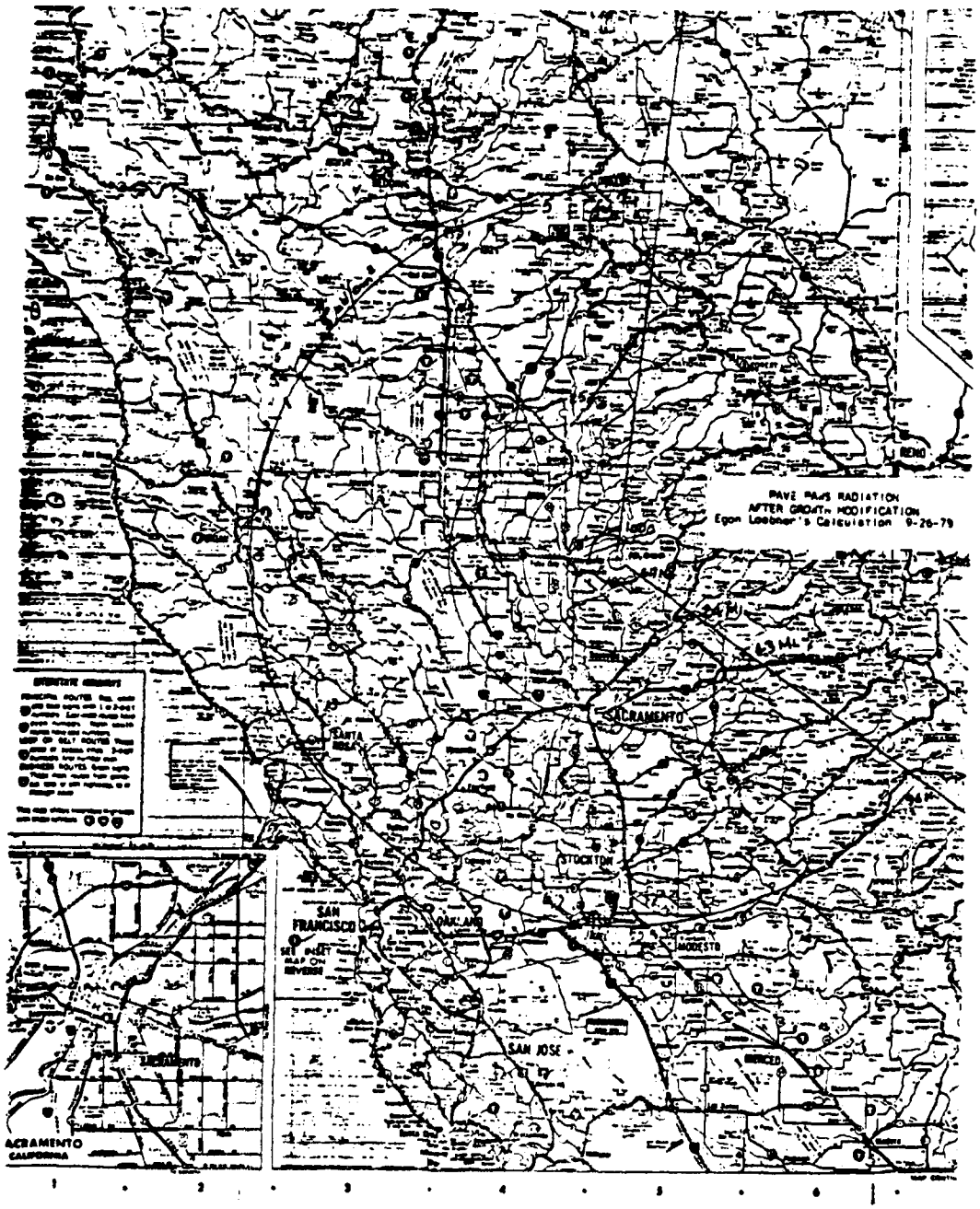
7. The SYSTEM COMMAND's argument that incremental growth of the power generated per module is not contemplated, is weak and gives further credence to the need for permanent monitoring of non-ionizing radiation. | 17 13 26

8. The EIS mentions only one hillock NE from PAVE PAWS where the main beam approaches the ground. There is another hillock SE (about 760 feet above sea level) where the beam hits the ground inside the base. Such spots must be prevented by a fence so that neither animals nor people become injured. | 96

9. EMI is not commented on here.

10. The proposed DEIS action for pacemaker owners is not sufficient. The AF should advertise the existence of the problem in the local newspapers, and replace old models where necessary. Also, all public roads should be posted with appropriate signs in places where the peak density exceeds 5 $\mu w/cm^2$. | 97

11.	The investigation of the potential adverse effects on human health was not carried to sufficient depth. A new draft Environmental Impact Statement should be prepared and a new hearing instituted.	85
12.	The critical review of the literature should be restricted to frequencies between 100 and 2,500 MHz. Only documents describing pulses longer than 75 microseconds should be considered.	98
13.	The discovery procedure used as evidence to indicate ill effects from long-term exposure is considered faulty.	99
14.	The DEIS does not address the presence of dependents and other non-occupationally exposed individuals to non-ionizing radiation.	22
15.	The FAA should be notified about the extent and nature of the main beam emanating from PAVE PAWS.	100 77
16.	Twenty-two California Counties need to be informed about EMR pollution in their airspace.	77
17.	The question of justification of the common averaging procedure has to be studied with high priority, especially with respect to rapid heat transfer mechanisms in human bodies.	24
18.	Ames-like bacterial test assays should be undertaken immediately using microwave irradiation.	27
19.	A temporary standard for the special cases of Western and Eastern PAVE PAWS installation should be set.	101 10
20.	Relocation of base hospital and base school populations should be added to the possible alternatives.	85 59
21.	Redoing the draft statement should be added on to the alternatives in the EIS.	79
22.	A study of possible modifications to mitigate the present and potential problems posed by PAVE PAWS should be instituted.	
23.	Research should be initiated into novel techniques to reduce cost of experimentation with the Bio-effects of 450 MHz radiation.	102
24.	The Air Force should inform The Citizens Concerned about PAVE PAWS of all major actions relating to the PAVE PAWS matters.	103


PAVE PAWS RADIATION
AFTER GROWTH MODIFICATION
Egon Loebner's Calculation 9-26-79
SACRAMENTO
STOCKTON
SAN FRANCISCO
OAKLAND
MODESTO
SAN JOSE
FRESNO
SACRAMENTO
CALIFORNIA

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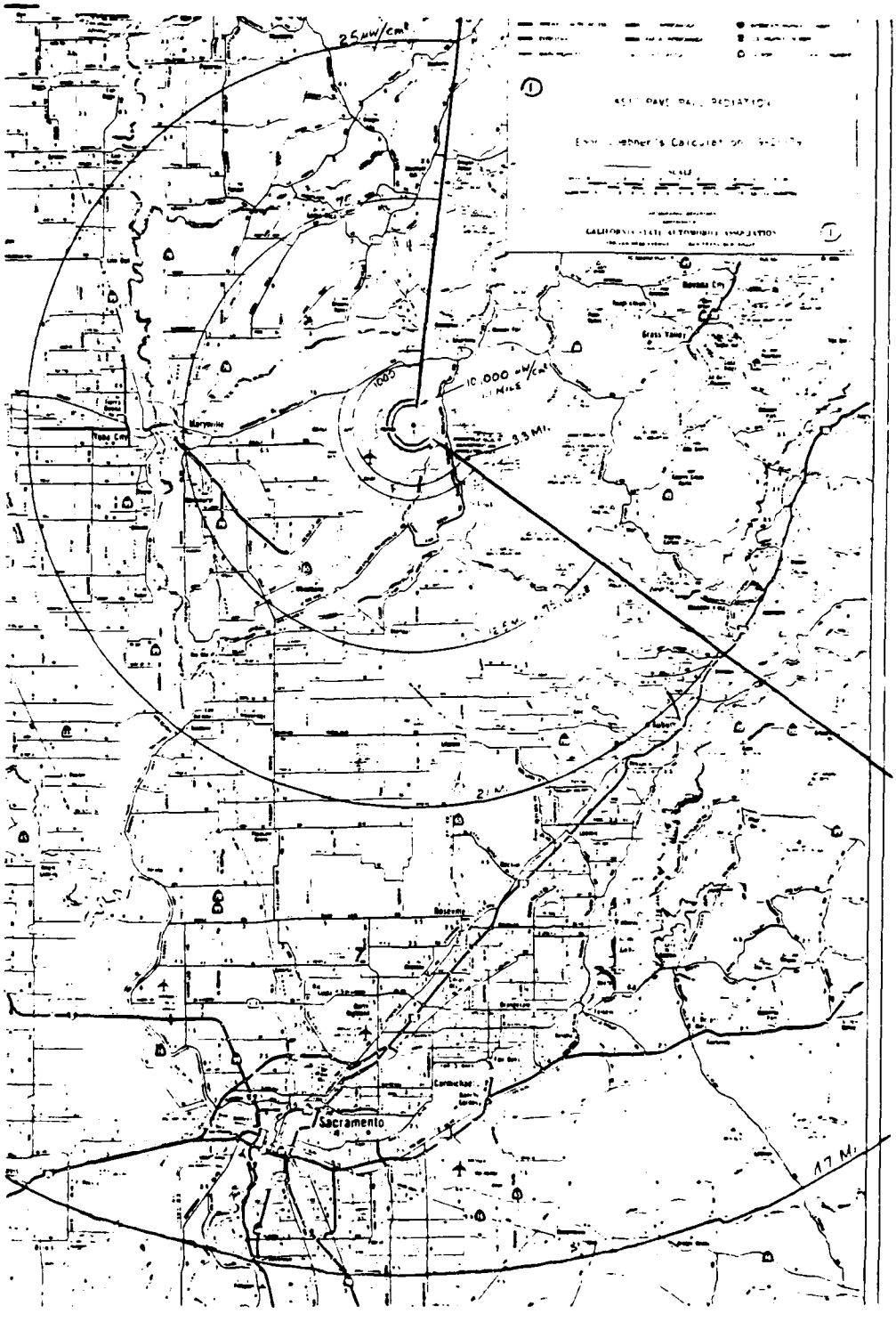

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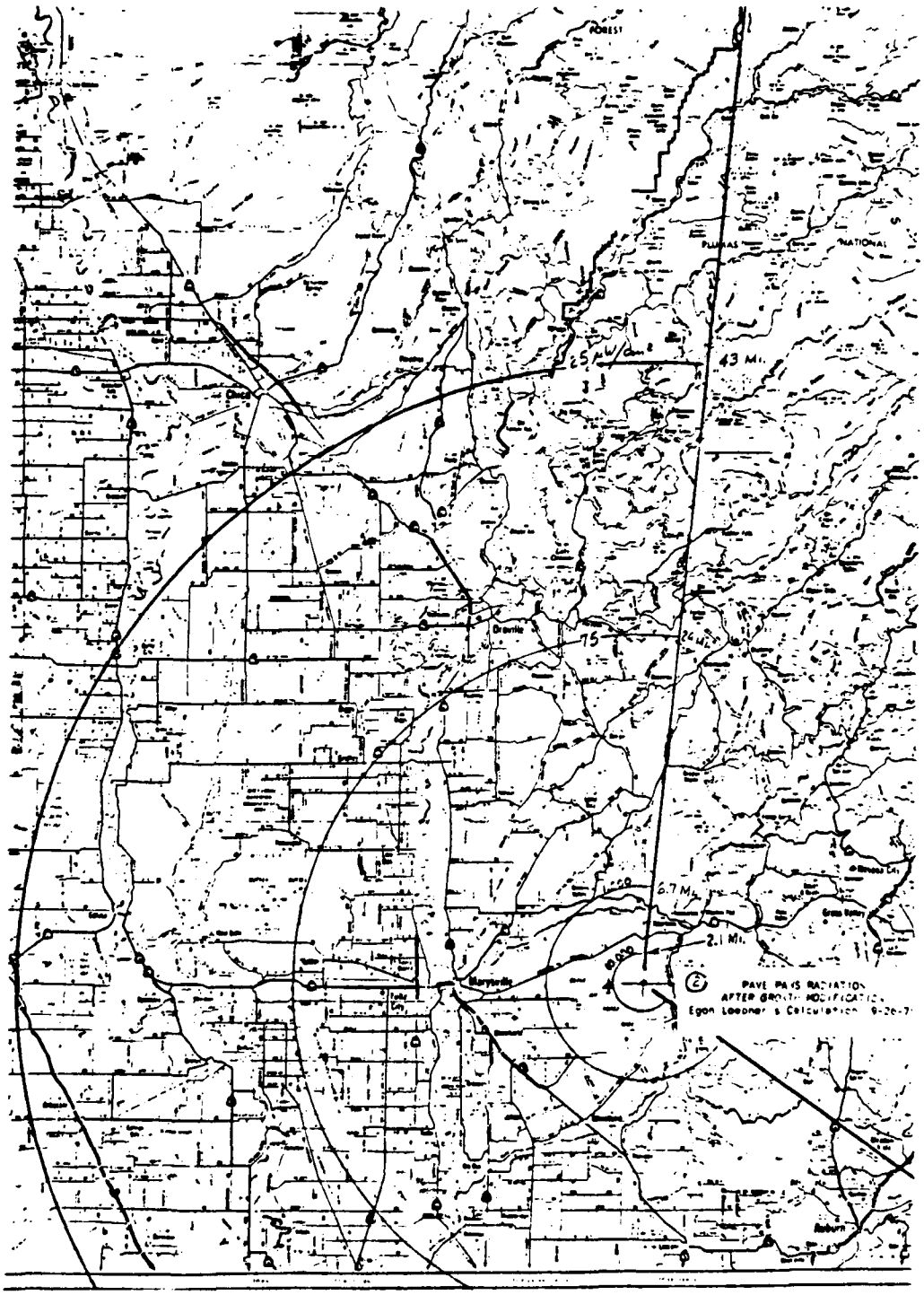
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RESPONSE TO COMMENTS

1 In the EIS, both peak and average power densities, rather than the latter alone, are considered in assessing the possible biological effects of PAVE PAWS (see Section C.6.1, p. C-15). Regarding time averages of energy absorption in the form of heat, the use of Specific Absorption Rates (SARs), defined on p. C-17, to relate energy absorption rates to incident average power densities is based on experimental data as well as on the actual considerations of dielectric constants, electrical conductivities, and heat exchange mechanisms. In addition, researchers who used both pulsed and CW RFR, at the same average power densities and otherwise similar conditions, generally found no differences in thermal effects for the two classes of RFR (see Section 3.1.2.1.9, p. 3-60).

2 Because the operation of PAVE PAWS is very complicated, the cited statements may not represent a complete response to the questions. We emphasize that power from the radar is propagated along straight lines and that it does not follow the course of the land. The elevation of the center line of the main beam is never less than 3 deg, and at least three-fourths of the radar power is always radiated at an angle above the horizontal. The remaining power is spread over such a large area that its average density is very low.

The earth is a very effective shield against microwaves, which are scattered and absorbed by it. The difference of elevations and the presence of a large hill between PAVE PAWS and the Browns Valley residential area provide assurance that the incident power levels will be negligible. Additional information on these points is provided in pages 1-7, 3-10, 4-24, A-4, and A-13 of the EIS.

3 Figures 3-1 through 3-10 and 3-13 through 3-17, pp. 3-3 through 3-14 and 3-92 through 3-96 in the EIS, indicate the calculated power densities of EMR from PAVE PAWS at various locations and elevations for distances up to approximately 5 miles. Beyond that point, the power density is less than 0.09 microwatts/cm^2 at all ground levels and locations. These power densities apply to direct line-of-sight locations; intervening vegetation, structure, or terrain would reduce the incident power density by a factor as large as 10 to 100.

4 Section 3.1.2.3.2.1.1, p. 3-70, and Section D.3.1.5, p. D-64, of the EIS consider airborne systems and conclude that equipment found in aircraft would not be adversely affected by PAVE PAWS. Average power densities incident on aircraft, which partially shield the occupants, can be obtained from Section D.2.6.4, p. D-18, of the EIS. For aircraft in the vicinity of the Yuba County Airport, approximately 12 miles from PAVE PAWS, the power densities in the surveillance volume and tracking volume for basic and growth systems are given in the following tabulation:

Average Power Densities Above Ground Level

(microwatts/cm^2 at ft above MSL)

	Surveillance Volume	Tracking Volume
Basic System	0.83 at 2,500-4,900	0.031 above 4,900
Growth System	3.3 at 2,900-4,500	0.10 above 4,500

Below the surveillance volume, power densities quickly approach values characteristic of ground level, given for the airport in Tables A-5 and A-6, pp. A-31 and A-32. Power densities at all altitudes are well below the maximum levels on the ground just outside the exclusion fence, which were used as the basis for the assessment of biologic hazards.

5 Exposure of aircraft is discussed in Section D.2.6.1 (beginning on p. D-13 of the EIS). Illumination of aircraft by the main beam is infrequent, and an aircraft is never tracked by the radar.

6 Even though Col. McEachern intended to refer to an automobile's windshield wipers rather than the washer, the statement may still cause confusion. It was meant to illustrate the fact that, during surveillance, the two beams--one from each face--radiate synchronously. However, they do not literally sweep back and forth together as do windshield wipers; the beams are switched rapidly from one azimuth to another (not necessarily adjacent) in a complicated but predetermined manner, which is identical for each of the two faces (see Section D.2.3.3, p. D-6).

7 Preferential depositions of energy in various species, including the occurrence of internal "hot spots" and other regions of relative SAR maxima, are treated comprehensively in Section C.6.1.1, p. C-16.

8 As stated in Section C.3, p. C-9, the EIS does not use existing or contemplated exposure standards as the basis for any conclusions or recommendations regarding the safety of humans exposed to the RFR from PAVE PAWS.

9 The PAVE PAWS does have some unique aspects, but it resembles two earlier phased array radars that have larger antenna arrays and higher peak power. Of these, the FPS-85 went into operation in 1965, and the PAR radar about a decade later. The maximum pulse length of PAVE PAWS is indeed greater than that of previous high power radars to compensate for the lower voltage and lower peak power available with solid state equipment; it is 16 ms, compared with 2 ms used by the BMEWS radars (which operate in the same frequency band and for the purpose of early detection of ballistic missiles).

10 The purpose of this EIS is not to judge whether radiation protection guidelines ("standards") are defensible, but rather to examine whether there is scientifically credible evidence that the RFR power densities from PAVE PAWS are likely to have a significant, identifiable impact on the health of populations in the vicinity of the facility (see Section 3.1.2.1.2, p. 3-22). The need for an environmental (in contrast with an occupational) RFR standard or guideline is presently under consideration by the U.S. Environmental Protection Agency. Also, see p. 35 of the hearing.

11 This reference is from page 47 of the National Academy of Sciences biologic effects report. While correct, the quoted statement is not entirely relevant in the present context.

An enclosure with highly reflecting walls and one or more openings (windows) acts as a cavity resonator and is capable of enhancing the intensity of electromagnetic fields by as much as two orders of magnitude. However, such enhancement is possible only when the entire cavity is free from material that absorbs microwave power. Most ordinary objects and particularly the human body are such absorbers. Thus, the highly enhanced fields do not exist simultaneously with the presence of an absorber, here conjectured to be a hospital patient.

Cavity resonance does not present a real threat of field enhancement because, in a shielded room with openings, the total power absorbed by all objects therein cannot exceed the power that enters through the windows. If one attempts to increase the absorption by enlarging the windows, the cavity resonance effect would be destroyed and the free-field, no-walls case would ultimately be reached.

12 See p. 47 of the hearing, responses of Col. McEachern. Also, between June 1975 and September 1979, the Air Force informed the public of PAVE PAWS activities through approximately 36 public meetings, submissions to news organizations, briefings, and interviews with Air Force officials.

13 Separate radiation monitoring is not considered necessary for the following reasons:

(1) The radar was operating with a representative maximum strength during the 11-12 September 1979 measurements described in Appendix B

(2) Because the foliage in the area is sparse, seasonal variation is not anticipated to have a significant effect on the radiation levels

(3) Atmospheric factors have been shown to have negligible effects on the local radiation levels

(4) Beam control precautions have been independently verified

(5) The self-checking routine discussed in Section A.2.5, p. A-6, continually monitors the radiation levels from the radar (as well as confirming beam control integrity). In addition, the tracking of known objects in space provides a continual check the accuracy and consistency of the radar.

14 The subject of microwave cataractogenesis is covered in Sections 3.1.2.1.7.4 and C.7.4, pp. 3-42 and C-40, on ocular effects, where it is concluded that prolonged exposure to RFR from PAVE PAWS outside the exclusion fence would not cause eye damage.

To correct a possible misconception, we emphasize that the microwave radiation under discussion is quite different from ionizing radiation in its biological effects. The units of power density for microwave radiation that are used in the EIS are microwatts/cm^2. The term "count" suggests the measurement or counting of the discrete quanta of ionizing radiation.

15 See the letter from Mr. Bernie Olson, dated 13 November 1979, attached at the end of these responses, p. 180.

16 In summary of Col. McEachern's response, the Air Force originally considered measurement inside the building when the best information available at the time indicated that power densities would be much higher than subsequent refined calculations showed. Actual measurements have confirmed the lower estimates resulting from the later, refined calculations (see Appendix B).

17 Such a change is not contemplated in this EIS, nor do any plans exist to modify the system in this way. If there were such a plan, under current law and regulation, the Air Force would be required to review that proposal for its environmental significance. If the proposed change were determined to affect significantly the quality of the human environment, we would under current law be required to prepare a new or supplemental EIS. Also, see p. 65 of the hearing.

18 Section C.7.5.2, p. C-45, refers to the fact that the pulse rates of PAVE PAWS are approximately the same as the modulation frequencies employed by Bawin and Adey in their studies on changes of radioactive calcium ion efflux from chick and cat brain preparations. However, average and pulse power densities of PAVE PAWS RFR for exposure outside the exclusion fence will be lower than the threshold average power density found by Bawin and Adey.

19 Page A-7 of the EIS states that the test pulses occur once every 30 seconds, and have a duration of 50 microseconds. It states that the beam of each subarray is much wider than the main beam, but does not attempt to give a specific number because the different subarrays are not alike. It also notes that all the resulting test beams strike the ground within the exclusion fence and that the power devoted to such testing is negligible compared with the total radiated (40,000 times smaller). Also, see p. 65 of the hearing.

20 Several questions are raised concerning the shape of the beam, the use of an angle at which the beam power has decreased to 10% of its maximum value to define beamwidth, coverage of the growth system in the EIS, and the use of minimum elevation angles below 3 deg in the event that the growth option were exercised at some future date.

The beam width corresponding to 10% or any other relative power is easily obtained from Figure A-4, p. A-13, of the EIS, which fully covers both the basic and the growth systems. The 1% relative power point (an off-axis angle of about 2.2 deg for the basic system) is of some interest because it represents the situation in which the main beam power density equals the maximum of the first sidelobe.

The 3 deg minimum elevation angle is based on propagation conditions, such as ducting, that sometimes exist at distances many miles from the radar. These considerations are independent of the radar beamwidth. Therefore, the growth option does not create a temptation to lower the beam. Also, see p. 66 of the hearing.

21 Both reports note the installation of PAVE PAWS at Beale AFB as well as at Otis AFB, and observe that the designs are identical. Although both reports assert that the Otis AFB site (the first constructed and the subject of detailed field measurements) is the subject of analysis, neither report asserts that it has "absolutely nothing to say" about the Beale AFB site. The analysis of both engineering design (EMR field patterns, beam control, propagation anomalies) and potential biological effects would not differ substantially for Beale AFB. The maximum average and pulse powers just outside the exclusion fence are actually slightly lower at Beale AFB because of slightly different fence placement at the Beale site. Moreover, calculated EMR fields at Beale have been confirmed in actual measurements (see Appendix B).

22 Air Force personnel and dependents are not excluded by the term "general public" in the EIS. For example, detailed EMR exposures for the developed areas near PAVE PAWS are calculated and presented in Section 3.1.1.2, p. 3-11, and the associated

Figure 3-10 and Table 3-2, pp. 3-14 and 3-15. As Table 3-2 indicates, the base hospital, clubs, family housing areas, mobile home areas, and cantonment areas, among others, are considered in detail, because the developed areas near PAVE PAWS happen to be those on the military reservation. This consideration, as well as repeated references in the EIS to maximum public exposures outside the exclusion fence, clearly indicate that any person denied access by the exclusion fence is a member of the general public, and is not occupationally exposed to PAVE PAWS. Also see p. 66 of the hearing.

23 Long pulses are appropriate in radars that use solid state amplifiers because the output of such devices is more seriously limited by peak than by average power. Therefore, it is advantageous to use long pulses and a higher duty cycle to obtain sufficiently high average power within the peak power capability of the devices. The pulse lengths and duty cycles used in radars have steadily increased since the development of radar systems in World War II.

24 Absorption of RFR as heat in any local region of a live animal and removal of heat by blood flow and heat exchange with neighboring regions are indeed complex processes, especially when governed by the animal's thermoregulative mechanisms. A representative treatment of the subject is given by K. R. Foster, H. N. Kritikos, and H. P. Schwan, in "Effect of Surface Cooling and Blood Flow on the Microwave Heating of Tissue," IEEE Trans. Biomed. Eng., Vol 25, No. 3, pp. 313-316 (1978). However, at the highest average power densities from PAVE PAWS to which people may be exposed, the temperature rises in any region within the body are negligible. The increases are considerably smaller than random temperature fluctuations due to body movements, changes in blood-flow rates, or other normal physiological factors, even if the heat removal and thermoregulatory mechanisms are not considered. For average power densities and exposure durations sufficient to cause an appreciable temperature rise in a region of a carcass or physical model, heat transfer processes can be analyzed by conventional thermodynamic methods and the validity of such analyses can be verified experimentally. Such results constitute the basis of the concepts of local and mean SARs, discussed in Section C.6.1.1, p. C-16.

In addition, thermal relaxation times of isolated cells or parts thereof do not determine how high the temperature rise would be in a tissue specimen comprised of many cells and extracellular fluids, when such a specimen is exposed to a given power density. Physically separating and thermally isolating cells prevents the interactions among cells and the extracellular fluids that provide for heat exchange. In essence, because of the presence of such heat exchange mechanisms in tissues, their thermal relaxation times are of the order of minutes, i.e., longer than the maximum

pulse durations of PAVE PAWS. Thus, the individual pulses from PAVE PAWS would produce a negligible temperature rise in a tissue specimen and in the individual cells. Possible effects of RFR on cells and cell cultures are treated in various sections of Appendix C of the EIS.

25 The exterior resonance of solid metal objects such as rods, balls, or cubes differs from the interior resonance of hollow metal cavities. The presence of metal objects within a hollow metal cavity affects the field distributions and resonant frequencies but does not add power or contribute substantially to localized power enhancement. The total effect of such a combination is governed by the principles explained in response No. 11.

26 Field monitoring is standard practice in the field of ionizing radiation. It is appropriate because the transport of the radioactive materials emitting the ionizing radiation is subject to varying meteorological conditions. Moreover, the release rate of the radioactive materials may not be known beforehand. In contrast, RFR power densities and field distributions are well defined. We know of no case where continuous monitoring of RFR power densities is carried out as a standard practice.

27 The Scientific American article entitled "Bacterial Tests for Potential Carcinogens" is a compact account of a large number of recent studies on the biochemistry of mutation and its relationship to cancer induction by chemical and physical agents. Among other things, the article discusses the use of bacterial mutation as a means of detecting potential cancer-inducing agents, and in particular the use of histidine-requiring strains of Salmonella typhimurium (the so-called "Ames test").

Mutation-type tests are, indeed, quite useful for screening purposes, but they do not detect cancer-causing agents; they indicate agents that might cause cancer. If the ordinary probability that a randomly-chosen agent causes cancer is 1 in 200, then a positive outcome in the Ames test raises the probability to about 1 in 23, and a negative outcome reduces it to about 1 in 1,800. Thus, the most important use of the Ames test is in deciding which agents should be tested for cancer induction properties. The statement in the article concerning the power of the Ames (or other bacterial) tests also needs clarification. In the most sensitive Ames test strain (the TA-100), there are approximately 140 spontaneous mutants per bacterial plate scored. A positive result is scored only when one finds not just one, but at least 24 ($\approx 2 \times (140)^{1/2}$) additional mutants. Actually, more than 24 additional mutants would have to be found because of unavoidable errors in experimental technique. Thus, the test is probably between one and two orders of magnitude (factors of 10) less sensitive than the article seems to imply.

For the EIS, more than a dozen papers dealing with mutagenicity of RFR were reviewed. Only studies involving high power density levels of RFR, where heat was induced in the test subjects, gave positive results. Among the studies reviewed was one using a mutation-testing strain of Escherichia coli (strain WWV). The results with RFR irradiation were negative, although a positive control experiment with ultraviolet light gave positive results. No reference could be found applying the Ames test to RFR.

28 Mr. Mitchell's response here is closely related to responses No. 11 and 25. However, an ideal reflector, especially a concave one, can substantially enhance local power density as well as field strengths, whereas the cavity resonance effect does not. Fortunately, real life situations involving reflections lead to only modest increases, such as a twofold increase in field strength, as noted by Mr. Mitchell.

29 The EIS gives both peak and average values for both measured and calculated field densities in Appendices A and B.

30 As indicated, this document is a proposed stipulated judgment. It was proposed by "Citizens Concerned About PAVE PAWS" in their suit against the Air Force on siting the PAVE PAWS at Beale AFB. No settlement was ever agreed on by the parties or approved by the court. Rather, on 8 March 1978, Judge Philip C. Wilkens of the United States District Court for the District of California dismissed the "Citizens Concerned" suit.

31 No additional comments or notice of a change in rating were formally submitted to the Air Force. We have undertaken to respond to informal comments from the Environmental Research Center of EPA, shown on pp. 108 through 111.

32 EMR field measurements were made subsequent to the distribution of the DEIS and are now included in Appendix B. The prediction that the field measurements would be consistent with calculations was confirmed.

33 The reference has been added.

34 The difference in terminology is essentially one of definition. The adjective "classical" as used in the EIS refers to non-quantum thermodynamics, including the statistical treatments of Maxwell-Boltzmann and Gibbs.

35 The intent of paragraph 3 is not to elaborate on the classical interactions discussed in paragraph 2 but to introduce the concept of quantum emissions and absorptions that may not necessarily alter the kinetic energy or disorder. An example of

such "nonthermal" processes is the excitation of a molecule from its ground state to a higher electron level by one interaction mechanism and the subsequent decay of the molecule to its ground state by the emission of a photon. Therefore, the suggested revision does not clarify the text, as does paragraph 4 in relating classical and quantal concepts.

36 Inclusion of the proposed statement may be too much of a generalization. Although the ground-plane condition is certainly applicable to humans standing out in the open with no nearby structures, this condition may not be the most likely one if consideration is given to the relative numbers of people within buildings, vehicles, or at outside locations near buildings, other structures, trees, or other shrubbery.

37 The section that includes this paragraph is primarily concerned with the effects of average power density, not effects of pulse power density per se, which are treated in Section C.6.1.2. Regarding the 90 microwatts/cm^2 average power density cited in the comment, the calculated value of 0.02 deg C mean body temperature rise given in paragraph 2, p. C-19, for 100 microwatts/cm^2 at resonance in the absence of any cooling or thermoregulatory mechanisms, is much too low to imply that significant localized heating would occur at the PAVE PAWS frequencies. In addition, the 1,400 microwatts/cm^2 maximum pulse power density at the same location is also unlikely to cause any significant localized heating because the thermal time constants of tissues are much longer than the maximum pulse durations of PAVE PAWS.

38 In the recent paper of Frey and Coren cited in this comment, experimental evidence is presented to indicate that transduction of RFR pulses into sound waves may take place in the cochlear apparatus rather than elsewhere in the head (followed by bone conduction of the sound to the cochlea). Such results may weaken the acceptance of prior theoretical and experimental work on the location of transduction sites. However, the main issue regarding the RFR auditory phenomenon is whether the effect is induced by direct RFR stimulation of the auditory nerves or the brain. Our conclusion, stated in the last sentence of paragraph 2, p. C-22, is not altered by these recent results of Frey and Coren.

39 The last paragraph on p. C-22 explicitly states that the values are pulse power densities, a term consistently used in the EIS for the root-mean-square power density occurring when a pulse is present. The term "peak," implying instantaneous maximum value, is avoided. However, for modulated RFR such as used by Bawin, Adey, and coworkers, and by Blackman, the "average power density" is conventionally the root-mean-square value averaged over the entire modulation period.

Regarding the comment on the power density window, we were unable to determine priority of discovery, nor is it a purpose of the EIS to do so. The calcium efflux work discussed in Section C.6.1.2 (citing only Bawin and Adey) was presented in that section solely to illustrate one class of interaction phenomena. More detailed treatment of this phenomenon, including citation of Blackman's work, is given in Section C.7.5.2, p. C-45.

40 We disagree. In anesthetized animals where only the testes were exposed to RFR, the temperature rise in the testes will almost certainly be greater than would be found in unanesthetized animals that were exposed to RFR over the whole body. In the two experiments, mutagenic effects were found in the anesthetized animals but not in the the unanesthetized animals. This suggests that anesthesia (and probably lack of temperature control) contributed materially to the effect found. The previous criticisms on analysis of data also apply.

41 We agree in part, though the effect of RFR on the weight of chicks subsequent to hatching was noted in the previous paragraph. Some authorities on teratogenesis object to classifying fetal death and resorption as instances of teratogenesis (see, for example, Becker, B.A., "Teratogens," in Toxicology, L. J. Casarett and J. Doull, eds., pp. 313-332, MacMillan Publishing Co., Inc., New York, 1975). However, because the question has been raised, the text is revised in Section C.7.3, p. C-39.

42 The sentence is not intended to cast doubt on any particular study, but merely to point out a potential source of experimental variation that must be considered in experimental design and performance. Because exposure to high RFR levels may also be stressful (i.e., cause a rise in adrenal steroids in blood), the contribution of the handling factor must be considered carefully.

43 We agree. The text is revised on p. C-40.

44 Presumably the comment refers to Bawin (1978a) rather than to Bawin (1975a), because the list of references in the EIS does not include one designated as 1975a. To respond to the question raised, the 450 MHz data cited in Adey (1978b) are the same as those in Bawin (1978a). However, these data are different from the 450 MHz data in Adey (1977a) and Bawin (1977a).

45 Adding this recent reference to those already cited in the EIS will not materially alter the conclusions in the EIS regarding the effects of RFR on the EEG.

46 The EIS does not compare the experiments, nor does it imply that the experiments were similar.

47 The citation refers to evidence of immunological stimulation by RFR as an effect potentially beneficial to health. The report of alleged leukemia induction by RFR is reviewed in Section C.7.11.1, p. C-67. By modern standards of diagnosis, the symptoms found do not constitute evidence that leukemia was induced in the mice in the study by Prausnitz and Susskind.

48 Please see pp. 1-12 and 1-13 and pp. 3-61 and 3-62 of the EIS. The text is revised in Section 3.1.2.2.1.1, p. 3-61, specifically noting the waterfowl areas within the 25-mile sector from PAVE PAWS. However, no substantial impacts on migrating birds, including effects on their navigational ability, are anticipated even in this zone, because of the low power densities from the main beam as discussed in this section.

49 The EIS fully addresses the impact of operating the radar at the higher power levels that would occur in many areas for the growth system. Additional hardware needed to implement the growth option would require funding by Congress.

50 Unlike older radars, the duty cycle of PAVE PAWS is not a single fixed number. Under all normal operating conditions the duty cycle has a fluctuating value of about 18%. This value, which is limited by the cooling capabilities of the heat exchangers, is appropriate as a conservative measure for all long-term exposures. Under conditions of heavy tracking assignment the duty cycle of either face can be increased to a maximum of 25%, but only at the expense of lowering the duty cycle of the other face to 11%. Such heavy tracking assignments are expected only during a missile attack (see p. D-11). The power associated with this maximum 7% transfer is always used for tracking, which typically occurs at elevation angles that are larger than 3 deg (see p. D-11 as well as p. A-9 of the EIS). The peak values at ground level are unaffected by such operation, and the average values are increased only during the brief interval of such special tasking and by no more than the ratio 25/18.

51 The process of obtaining peak power (520) by dividing 0.18 into 90 is not valid. The 90 microwatts/cm^2 figure represents a long-term average taking into account the entire scanning process as well as the 18% duty cycle. The 1,400 microwatts/cm^2 pulse power, given on p. 3-19, is correct for the growth system, and correct values for both basic and growth systems are given on pp. 3-18, 3-19, C-4, and C-22. The text has been amended on p. 3-32 to conform. (The values on p. 3-32 of the DEIS apply to PAVE PAWS at Otis AFB, where the exclusion fence is slightly closer to the antenna in the fringe areas, defined in Figure 3-9, p. 3-12.)

52 The suggested changes have been made.

53 On p. C-16, the EIS distinguishes between "short-range" and "long-range" quantum interactions. On p. C-20, only the short-range interactions, exemplified by hydrogen-bond disruption, are discounted as a probable basis for biological effects; the theoretical and experimental evidence for long-range quantum interactions is discussed on p. C-21.

54 The calcium efflux phenomenon is an example of an effect with no evidence of hazard at present. Moreover, the average power densities to which the general population would be exposed from the growth system, if implemented, are much less than the 100 microwatts/cm^2 lower limit of the power density window reported by Bawin and Adey. Thus, the existence of this phenomenon, and of the other effects discussed in the EIS, is not cause for alarm unless further surveillance clearly indicates the phenomenon has clinical significance.

55 The intended meaning of the sentence quoted from Section 3.1.2.1.7.5.1, p. 3-45, was that the RFR auditory effect is unlikely to be due to direct RFR brain stimulation. The section has been revised accordingly. Regarding lymphoblast transformations, Section 3.1.2.1.7.8, p. 3-51, indicates that positive, negative, and equivocal results were reported; hence, the text of this section has been revised to clarify this point.

56 The EIS acknowledges the existence of immunological effects and considers the mechanisms through which they could be mediated. Stress is one possible mechanism. Indeed, in one study reviewed (Krupp, 1977) the immunological effect that was found could be elicited by injection of cortisone instead of exposure to RFR. This finding suggests that stress may play a role as a mediator of immunological effects.

57 The results of Cain and Rissman are cited as a representative example, and the fact that this work was performed at 3 GHz is explicitly stated on pp. C-22 and C-43. Moreover, based on the work of Lin, cited on p. C-44, the EIS states that the threshold for perception of the pulses in the 420-450 MHz range is higher than at 3 GHz.

58 During the past year, the Air Force has initiated a study of long-term effects. Other agencies are also studying RFR effects. The Air Force study is designed to provide additional information about Air Force radar systems. The first phase will serve to develop an animal exposure system and will establish the biomedical procedures. The follow-on effort will include the exposure of 100 rodents for a major part of their lifetime. The studies focus on radiation levels that are significantly above the sub-microwatt/cm^2 levels that are typical of the public exposure from PAVE PAWS. We see no adequately demonstrated need to study the sub-microwatt/cm^2 levels.

59 We believe that the EIS adequately addressed the known and postulated effects of RFR, appraised the environmental impact of operating the radar, and found no health hazard. If it should be established at any time that the operation of PAVE PAWS is harmful to humans, the Air Force would take action to protect the public health.

60 In the entire process of preparing this EIS, inviting independent observers to witness the RFR measurements, holding the public meeting in Marysville, and responding to the oral and written questions and comments, the Air Force has endeavored to provide to the public the pertinent information in considerable technical depth regarding the possible effects of PAVE PAWS RFR on the nearby population. These activities have been thoroughly documented and the documents are available to any member of the public. We believe that holding additional public meetings on PAVE PAWS would not yield any significant new information that would materially alter the conclusions in this EIS. In particular, based on our current knowledge of the biological effects of RFR, we believe that neither the present population nor the future generations will be harmed from exposure to the RFR from PAVE PAWS.

61 Any impacts on the cultural resource base would have occurred during the construction phase of the project. Because the EIS covers only the operation of PAVE PAWS, discussion of construction impacts is not within its scope. However, the State Office of Historic Preservation has been contacted to determine current requirements for compliance.

62 The PAVE PAWS radar system at Beale AFB is an exact duplicate of that at Otis AFB.

63 Although the Amateur Service is not a secondary service in other parts of the radio spectrum, in the 420 to 450 MHz frequency band in the United States the Amateur Service is secondary to the Government Radiolocation Service (e.g., to PAVE PAWS), but not to the Nongovernment Radiolocation Service. It is not within the scope of the EIS to discuss spectrum allocation policies.

64 This secondary status definitely does apply domestically (see response 63). Also note that Section 3.1.2.3.2.1.1 (p. 3-68 of the EIS) stated only that the Amateur Radio Service was secondary to government radiolocation.

65 A more complete quote from p. 3-68 of the EIS reads that amateurs in the United States are "permitted to operate but are not permitted to interfere with the operation of any government radar or to claim protection from interference caused by government radars." Hence, the present status of primary and secondary services in the 420-450 MHz band is clear--government

radiolocation is the primary service. Regardless of status, possible effects on the amateurs from operating PAVE PAWS were analyzed and reported, beginning on p. D-20. Moreover, the Air Force will cooperate with the amateurs. The radar has the ability to avoid operation on selected frequencies, and to the extent that doing so would be beneficial to the amateurs, but would not interfere with the radar's mission, the Air Force would consider that option.

66 We believe that our analysis and discussion of the number and locations of amateur repeaters operating in the 442-450 MHz band (pp. D-21 and D-22 of the EIS) was thorough. The 1978-79 edition of the ARRL Repeater Directory was not yet available when the Draft EIS was first written, but a preprint of the page listing the 67 California repeaters was furnished by ARRL General Manager Richard Baldwin in his referenced personal communication of 12 December 1978. However, that list includes repeaters from throughout California--some as far away as San Diego--whereas only those in northern California are at any risk to interference from PAVE PAWS. With the help of the Northern Amateur Relay Council (NARC) (referenced personal communication with P. Fennacy and S. Hanselman, Section D.4, p. D-94), a list was developed showing more than 300 amateur repeaters in the PAVE PAWS band in northern California alone. After further investigation, we found yet another repeater close to PAVE PAWS but not listed by either the AARL or by NARC (see p. D-22). The recent expansion of repeater operation within the 420-450 MHz band is not reflected by listings in the 1979-80 ARRL Repeater Directory. The directory mentions only that plans for the use of this additional spectrum are not yet complete.

67 The increased availability of OSCAR 8 has been noted in the revised text on p. D-29.

68 The EIS references all three of King's QST articles on the Phase III satellites. Two transponders will be on the first Phase III satellite, but only one will operate at a time. Although the uplink passband on one transponder is to be between 435.150 and 439.290 MHz (and therefore susceptible to interference from PAVE PAWS), the downlink passband on the other is to be in that same frequency band, where it may cause interference to PAVE PAWS. When the satellite becomes operational, the Air Force will consider frequency age schedules to minimize harmful interference between the radar and the satellite.

69 Discussions with ARRL have indicated that this figure of "approximately 20 hours each day" was based on some early concepts of the satellite's orbit and does not apply to the satellite as currently conceived. It is now felt that the satellite will be within view of PAVE PAWS for various intervals, for a total of

from 10 to 16 hours per day. King (June 1977, p. D-95) states that "Most Northern Hemisphere stations will 'see' the spacecraft for 14 to 16 hours each day...."

70 The Air Force will seriously consider that course of action. PAVE PAWS is, however, a primary user of the band, and would not be required to give advance notice of changes in frequency usage within that band.

71 For the levels of RFR from PAVE PAWS to which the general public may be exposed, the temperature rise and the corresponding stress in the body would be negligible, and therefore would not add to any possible stresses from other agents.

72 In studying whether the RFR from PAVE PAWS can have any effects on the nearby general population, we believe that we have taken a most cautious approach. Our conclusion that harmful effects are most unlikely to occur applies to the unborn generations as well as to the present population.

73 This complaint of interference to radio systems is related to the complaint voiced by Mr. Olson of Motorola at the 20 September 1979 hearing in Marysville (p. 45) and described in the Motorola letter of 19 September 1979 that was provided as Exhibit Number Two at the hearing (p. 71). The same radio systems are the subjects of concern in both cases. Motorola is the manufacturer and supplier of the radio systems, while Mr. Abel represents the owners of the mountaintop land upon which the radio repeaters are situated.

Mr. Abel's 1 October 1979 letter was followed by another from him dated 8 November 1979, in which he states:

"Subsequent to the date of that (1 October) letter, TOR Broadcasting has been advised by the leasehold interests utilizing TOR Broadcasting facilities at the Sutter Buttes site that the initial interference, which was attributable to the PAVE PAWS System, has diminished to the point now where it is not a significant problem. In fact, it would appear, at this point in time, that the interference will be minimal at the most."

74 We disagree. The Air Force commitment to following the law and regulations and our commitment to the health and well-being of Air Force personnel, their families, and the people of the country as a whole are and always will be among our foremost concerns. In regard to compliance with Air Force commitments (specifically the comment referenced on p. 143), the concern expressed in the 1977 letters related to possible interference with hospital equipment caused by levels of EMR then predicted to be much higher than subsequent calculations showed. As PAVE PAWS was developed, it became clear that actual levels in the vicinity of the hospital would be far lower than those expected in 1977. The later

predictions were confirmed by the measurements taken on 11 September 1979 outside the hospital, indicating a maximum reading of 19.1 microwatts/cm^2 pulse power density and 0.132 microwatt/cm^2 average power density. Considering these low confirmed readings, and the lack of any meaningful radiation enhancement due to reflectivity or other such phenomena (see responses to comments 11 and 25), further measurements inside the hospital were considered unnecessary. Also, see pp. 46-47 and p. 66 of the hearing.

75 An Environmental Assessment of the construction of PAVE PAWS at Beale AFB was completed in February 1976 and approved on 3 March 1976. An Environmental Determination in the negative, that an EIS was not required, was made and signed on 12 March 1976. The subsequent decision to proceed with the project took full account of the findings in the Environmental Assessment.

76 The Air Force has carefully considered the effects of operating PAVE PAWS, and by system design (beam interlocks, frequency selection) and site planning (fence location, remoteness) has taken all reasonable measures to mitigate known or potential adverse effects at the school, hospital, and all other locations outside the exclusion fence. Chapter 5 in the EIS discusses probable unavoidable adverse environmental effects and mitigation measures.

77 The electromagnetic fields from PAVE PAWS, like those from any other radio, TV, or radar transmitter, propagate through the space above many political jurisdictions. Licensing and control of all such transmitters in the United States, however, is a matter reserved strictly to the Federal Government. The Federal Communications Commission controls radiating systems (radio, television, and radar transmitters and their antennas) used by all nonfederal government entities; federal government usage of radiating systems is under the control of the National Telecommunications and Information Administration (NTIA). The Air Force's application to operate the radar was approved by NTIA's Interdepartment Radio Advisory Committee (IRAC), a body that includes representatives from various government agencies, including the FAA. There is no indication that PAVE PAWS would interfere with air traffic over the 24-county area or even with the normal air traffic at Beale AFB itself. See Section D.3.1.5 (p. D-64 of the EIS). Both the FAA and California State agencies have received copies of the Draft EIS (see Distribution List, p. S-5).

78 See Sections 3.1.2.1.1.2, p. 3-17, and C.1.2, p. C-2, for a discussion of airborne exposure, for which the human health hazard was assessed to be negligible.

79 Calculated and measured power densities at the hospital and school are given in Table B-2, p. B-9. All values are well below the maximum levels used as the basis for the assessment of biologic hazards.

80 Comparison of peak values to a standard expressed in terms of average power density is inappropriate. Bell Laboratories and Raytheon have no peak power density standards for occupational exposure of their staffs.

81 Pages 3-35 through 3-56 of the EIS and pages C-27 through C-96 of Appendix C review in detail the results of more than 200 studies of the biological effects of RFR. The quoted statement was arrived at after extensive analysis of the data and results of these studies. The quoted statement (...no evidence that the low levels...are hazardous) is not the same as the paraphrase "...evidence of no hazard...." The general public includes all those not occupationally exposed by PAVE PAWS; specifically, it includes dependents of Air Force personnel. Site measurements (see Appendix B) confirm the fact that these people will not be exposed to significant levels of RFR. The 3.82 mW/cm^2 number cannot be compared in any way with the number 63,000 times smaller, 0.06 microwatts/cm^2, mentioned in the referenced NAS report. The 3.82 mW/cm^2 measurement is a maximum pulse power density made in the near field at PAVE PAWS Beale AFB, at a guard tower 150 ft from the radar. The 0.06 microwatts/cm^2 measurement is an average power density, made in the far field at PAVE PAWS Otis AFB, near route 6 and 3,450 ft from the radar. Because the radiation patterns of the two radars are identical, measurements at the two radars of field points comparable in distance and elevation would be substantially the same except for attentuation caused by intervening terrain.

82 The studies referred to here were done by the Assembly of Life Sciences and the Assembly of Engineering of the National Research Council. The studies were funded through a contract with the National Academy of Sciences, which is part of the National Research Council.

The purpose of these studies was to furnish an independent analysis of PAVE PAWS free from any Air Force bias or control. The decision to create two panels was made by the National Academy of Sciences and the National Research Council. (See Preface to reference (NAS, 1979), p. A-36.)

As the reports are solely the product of the National Academy of Sciences and National Research Council, it is inappropriate for us to reply to these criticisms in the comment. We do, however, believe that the studies reaffirm that PAVE PAWS will not significantly affect the human environment and specifically will not injure those persons who live and work near the system.

83 In the context of hazard evaluation, a probability statement considers the mechanism of biological effect, the intensity of concentration of the agent, the range of human susceptibility, and the possible medical significance of the effect. Because this process usually involves guessing at the values of many poorly known parameters, the result may not be reliable. In the EIS, judgments of the lack of hazard of RFR are based largely on four considerations: (a) absence of any demonstrable effect; (b) dependence of the observed effect on power density levels leading to heat production; (c) dependence of the observed effect on special experimental circumstances that are irrelevant to normal exposure; (d) general instability, impermanence, or reversibility of the effect. With regard to thermal effects, the degree of validity of frequency and SAR scaling from one species to another, which provides far more than "a downscaled model of standing wave patterns," is carefully considered in Section C.6.1.1, p. C-16, of the EIS. Also, the question of possible nonthermal effects is discussed in Sections C.6.1.1 and C.6.2.1, p. C-21.

84 The biological sections of the EIS are based on detailed and balanced analyses of representative research results in the literature. The bibliographic items listed in Attachment A have been examined. Adding them to those already cited in the EIS will not alter the balance, the representative nature, or the overall conclusions of the EIS.

85 The actions already taken by the Air Force are sufficient to ensure compliance with all applicable laws and regulations, and to discharge the responsibility of the Air Force to ensure that any unavoidable adverse environmental effects of PAVE PAWS are mitigated to an extent both reasonable and consistent with operational needs.

86 References 1 through 7 of Attachment A are all papers from a conference entitled "Electrical Properties of Biological Polymers, Water, and Membranes," held by the New York Academy of Sciences on 26-28 January 1977. The papers were published as Volume 303, Annals of the New York Academy of Sciences (30 December 1977). All of these papers were reviewed in the initial stages of writing the EIS. Reference 5 is already included in Section C.11, "References," p. C-92, of the EIS. The other six references were not included for various reasons related to the criteria of selection of references discussed in Section C.1.4, p. C-4.

Reference 8 is concerned with a theoretical analysis of a simplified model for longitudinal acoustical vibrations of helical polymers. Although the theoretical modelling described in the paper is of interest, inclusion of this reference would not materially alter the conclusions of the EIS.

There are a number of interesting articles on biological effects of RFR in Reference 9, in the 1977 Special Supplement of Radio Science. They reflect the continuing research programs and publications on biological effects of RFR sponsored by various agencies of the U.S. government, but they are not widely regarded as a "breakthrough of radiobiology into the mainstream of biology and medicine." The EIS reviews a number of papers on effects of RFR on lymphoblastoid transformation both in vivo and in vitro (see Sections C.7.8.1 and C.7.8.3, pp. C-60 and C-61), so the paper by Huang et al. adds no significant information to that already reviewed, except possibly for the interesting evidence of a "power window" for the effects between 5,000 and 45,000 microwatts/cm^2. This latter effect may provide some significant clues to the nature of biological adaptation to stress, but the evidence from the publication is that it could not occur at the power density levels outside the PAVE PAWS exclusion fence.

87 The pulse power density in the center of the main beam of the growth system will indeed have a value of 5 microwatts/cm^2 at 94 miles from the PAVE PAWS site. But the map (p. 154) indicates a distance of about 43 miles to Sacramento, rather than 54 miles. At 43 miles the pulse power density in the center of the main beam (about 12,000 ft above Sacramento) of the growth system would be about 24 microwatts/cm^2.

In response No. 11 we have noted that cavity resonance does not enhance the power density within structures such as hospital rooms or airplane cabins. In particular, the occupied cabin of a metal airplane will experience low values of EMR because the total area of absorbing surface is large compared to the area of the windows.

88 A threshold elevation increase of 100 feet/mile corresponds to approximately 1 deg. However, the pulse power densities cited correspond to the beam axis, which has a minimum elevation of 3 deg. A 3 deg elevation corresponds to about 275 feet/mile.

For the growth system at a distance of 10 miles, the pulse power density in the center of the main beam would indeed be 440 microwatts/cm^2. At 5 miles (half the distance) the power density quadruples to only 1,760 microwatts/cm^2, not 19,500 microwatts/cm^2.

At a distance of 5 miles the center of the lowest main beam (3 deg) rises to about 1,385 feet. Adding to this value the 420 foot elevation of the center of the PAVE PAWS array, and noting that the elevation of the terrain west and south of the radar is about 200 feet (see Fig. A-7, p. A-23), the center of the main beam is about 1,600 feet above the surface at 5 miles distance. As a matter of normal operating practice, agricultural aircraft rarely climb to altitudes that far above ground level. In any event, the likelihood of a biological health hazard to persons in aircraft is assessed to be negligible (Section 3.1.2.1.1.2, p. 3-17).

89 Although the pulse durations of PAVE PAWS (up to 16 milliseconds) are longer than those of other radars, no experimental evidence exists that such longer pulse durations would be harmful at the corresponding pulsed and average power densities to which the general public may be exposed.

90 There is no confusion regarding occupational and non-occupational standards in the EIS. Sections 3.1.2.1.3 and C.3, pp. 3-25 and C-8, clearly indicate that the present U.S. standard of 10,000 microwatts/cm^2 is an occupational one. Transients and personnel residing or working within the boundaries of Beale AFB who are not directly involved with the operation of PAVE PAWS are regarded as members of the general population not occupationally exposed to the RFR from PAVE PAWS.

91 The identification was not made in the EIS. Indeed, there is no evidence that irreversible changes in the central nervous system can set in at levels below 1,000 microwatts/cm^2 (1.0 mW/cm^2). This fact is clearly described in the EIS in Section C.7.5, "Nervous System Studies," where it is further indicated that the effects observed (below 1,000 microwatts/cm^2) are reversible in nature, e.g., Albert's studies on blood-brain barrier permeability (p. C-49).

92 Choice of a site for PAVE PAWS (West Coast) was made after an extensive comparison of proposed sites using ten valid siting criteria. Of the ten criteria, four involved safety considerations. Two of these, "safe radiation hazard distances for people," and "safe distances for persons wearing cardiac pacemakers," were among the five minimum characteristics a proposed site was required to meet to be considered further. This process is described more fully in Section 4.3, p. 4-2, of the EIS.

93 A read-only memory (ROM) could be added to PAVE PAWS to generate an inverted notch in the scan fence, thereby raising the main beam in the vicinity of the hospital. Such a notch is indeed undesirable because it compromises the prime function of the radar. The "peak burst density" of 22 mW/cm^2 (22,000 microwatts/cm^2) is the pulse power density that would exist at the center of the main beam at least 500 ft above the hospital if the growth option were exercised. The EIS (Section A.2.3, p. A-2) notes that a triply redundant system, including an ROM, already exists to prevent transmission of even a single pulse at elevations below 3 deg. Therefore, the safety goal has already been reached without addition of a notch or an extra ROM.

94 Occupational safety standards and reporting requirements are addressed in laws and regulations (e.g., AFOSH 161-9, October 1978) separate from those addressing environmental impacts. Although all applicable occupational safety procedures have been followed by the Air Force, and all requirements satisfied, it is not the purpose of the EIS to address those issues.

95 The replacement of solid-state modules is made from within the PAVE PAWS structure, separated from the outside radiating antenna array by a metal shield that provides attenuation by a factor of 100,000,000 (80 db). An average power density in the range of several microwatts/cm^2 has been measured in the area near the modules; there is no evidence for a health hazard at that density.

96 The cited hillock, southeast of the radar at an elevation of 760 feet, is grazed by the main beam of the basic (not the growth) system. The text is revised on pp. 3-1, 3-2, 3-7, 3-8, 3-61, 3-67, 3-72, 3-91, 3-93 through 3-97, A-12, A-21, A-29, and D-15 to recognize that case and others. However, the calculated field intensities for all such sites are lower than for site 12 (see Table A-5, p. A-31). Although some higher sites intercept a slightly larger fraction of the main beam, all are sufficiently more distant to reduce the net effect. At no site is the level of EMR sufficiently high to justify an exclusion fence.

97 The EIS does not propose any action with regard to pacemaker owners. In the EIS it is recognized that electromagnetic fields from radars can affect pacemakers, and while it points out that effects are possible, it also makes clear that they are by no means probable. This is an important distinction. (See Sections D.3.2.1.3, p. D-82, and 3.1.2.3.2.2.1, p. 3-72). The Air Force does not believe that there is a problem to be advertised. Neither does the Air Force suggest that any present pacemaker owners be subjected to the surgical procedures required to replace existing pacemakers.

Pacemaker owners, providing they stay outside the exclusion fence, are very unlikely to be adversely affected by the radar's fields. The maximum pulse field strength to be found at ground level at the 1000-ft exclusion fence is about 42 V/m, about one-fifth the design susceptibility threshold suggested in the FDA/AAMI draft standard. The base hospital is the closest point of casual approach to the radar; the maximum field strength that could be expected there is only about 10.3 V/m (see Table A-5, p. A-31, and Table A-6, p. A-32).

There are no plans to erect the requested warning signs for pacemaker owners. The Food and Drug Administration has rejected the concept of such warning signs for microwave ovens, stating in part:

> "(ii) The proposed labeling requirements would be misleading. It would tend to focus attention on a particular source of electromagnetic interference and would fail to warn the pacemaker wearer of other, equally important, sources of interference that could not be effectively singled out. Other potential sources of electromagnetic interference for which such warning

labels also are not appropriate, include electric tools, household and industrial appliances, ignition and lighting systems, radio, television, and radar systems.

(iii) All pacemakers are not equal in their susceptibility to electromagnetic interference. The proper approach to potential problems is through advice to the patient by the physician and pacemaker manufacturer of all sources of possible pacemaker interference. Many pacemaker manufacturers have eliminated interference problems through improved designs."

(See Federal Register, Vol. 39; No, 105, pp. 18797-18800, May 30, 1974.)

98 Most of the research results cited in the EIS were obtained at frequencies between 100 MHz and 2.5 GHz. Results at other frequencies were cited primarily to indicate frequency dependence and scaling aspects. Except for the discussion of the RFR auditory effect, which is explicitly dependent on pulse duration, the EIS considers other effects without regard to restrictions on pulse durations. There is no experimental evidence of possible harmful effects due to long pulse durations per se, and no reason to assume that effects found using shorter pulses have no relevance to PAVE PAWS.

99 Assuming the phrase "discovery procedure" refers to the adequacy of the published research on possible effects of long-term exposure, the positive and negative aspects of such research are also adequately treated in various sections of the EIS.

100 The FAA is aware. The PAVE PAWS radar system at Beale AFB is identical to that at Otis AFB, and the descriptions of the radar's operation are the same in the EISs written for both radars. The FAA received copies of both Draft EISs, and reviewed the Draft EIS for the Otis AFB PAVE PAWS and commented in depth.

The FAA is active in investigating potential problems in air navigation. Flights were made on 9 and 10 February 1979 to test the effects of the Otis AFB radar on several air navigation instrument types. Special attention was given to the operation of cockpit instruments; no abnormalities were noted. The FAA trip report concludes that, "Since the radar's burst of RF energy occurs for only a fraction of a second on a specified frequency, and appears to occur only one time in several minutes, it is concluded that the radar does not present potential interference to our navigational facilities." (See Federal Aviation Administration, "Trip Report - Interference Investigation of the Otis AFB Missile Tracking Radar," Flight Standards National Field Office, Oklahoma City, OK, 14 February 1979.)

101 The EIS is not the appropriate vehicle for recommending a standard. As a matter of interest, however, the PAVE PAWS radar does not expose the general public to RFR at a rate exceeding any known actual or proposed standard of any nation or government agency in the world. For comparison, see Attachment 2 to these responses, p. 183, and the text discussing this attachment on p. 35 of the hearing.

102 The Air Force does have such research in progress at this time, and devices are being developed for use at 450 MHz.

103 The Air Force will continue to make available through its public affairs offices any and all unclassified information about PAVE PAWS.

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November 13, 1979

Dr. Carlos Stern
Secretary of the Air Force
Assistance For Environment and Safety
SAF/MIQ
Washington, D.C., 20330

SUBJECT: PAVE PAWS Impact on Land Mobile Spectrum

Dear Dr. Stern,

On September 20, 1979, Motorola presented a statement by Mr. Gerald Falkenberg and myself, Bernie Olson, expressing our concern over the high RF levels measured in Yuba City and on Sutter Buttes. Further tests have been conducted which has decreased our concern.

On September 26 through 27, 1979 personnel from Motorola's Engineering Services Department conducted tests on Sutter Buttes and on selected customer's equipment around Yuba City.

On Sutter Buttes, we were unable to identify any harmonic radiation in the 800-900 MHz band from PAVE PAWS. This seems consistent as we measured -20dBm directly from the primary frequencies and harmonics are specified to be 80dB below that. The losses should be 6dB greater such that a -116dBm or approximately 0.35 uV signals would be a worst case prediction. Our spectrum analyzer limited measurements to -95dBm.

Effective 800 MHz receiver sensitivity measurements were taken with no evidence of receiver degradation found. We therefore feel the PAVE PAWS will not cause harmonic interference to Sutter Buttes.

Effective receiver sensitivity tests were made on two 450 MHz repeater, a Micor repeater receiving on 469.125 MHz and a Motrac repeater receiving on 456.575 MHz. In neither case were their effective sensitivities degraded. However when a weak signal was applied, to produce a 10dB Quieting, audio "pops" were detected in the speakers. The PAVE PAWS pulses were not responsible for squelch breaks (opening) but would momentarily capture the receiver from the weak desired signal. Even with higher desired signals, providing 30dBQ,the pops remained audible.

Attachment 1

1301 East Algonquin Rd., Schaumburg, Illinois 60196 (312) 397-1000

On September 27, 1979 tests were conducted on selected control stations and mobiles located in the Yuba City - Marysville area.

Yuba gold field - H74BBY3001AT - 469.500 MHz (receive frequency). This repeater was located approximately 4.5 miles north of PAVE PAWS. The antenna (9dB omni) was located on an 80 foot tower. No degradation was observed, however audiable "pops" were heard as previously described on Sutter Buttes.

Yuba City Service Center - D24TRA6000 (DPL Maxar mobile) - 469.125 (receive frequency). This mobile was connected to a 10dB yagi on the shop roof pointed at PAVE PAWS. Tests were conducted for effective sensitivity and DPL desensitization. No evidence of degradation was observed in either test.

Lumber company located approximately 2 miles south of Yuba City Service Center. L34AAB3130B (Mocom 10 base) - 451.525 MHz (receive frequency). No degradation was found other than the audiable "pops".

Thiara residence approximately three miles NW of Yuba City Service Center - C64RCB6105AT (Micor repeater - T1507 duplexer) - 469.675 MHz (receive frequency). This was a previously reported case of PAVE PAWS interference. Closer investigation revealed customer complaints of reduced coverage were due to his relocation of the repeater with an accompanying 20 foot reduction in tower height.

Based on these data, Motorola no longer feels that the impact of the PAVE PAWS on the Land Mobile Spectrum will be harmful. It will occasionally produce annoyance type interference. The magnitude of the interference at present is such that user acceptance will not be compromised. It takes a trained ear to detect PAVE PAWS from noise spikes normally present under weak signal conditions.

Our reserved concerns are for portable receivers which have much less preselector filtering due to size and weight limitations. This should be of particular concern to the Air Force itself as they no doubt will be operating portables on Beale AFB.

Motorola fully intends to continue monitoring all reported cases of UHF and 800 MHz interference and/or range reductions in the PAVE PAWS influence area.

Sincerely,
MOTOROLA COMMUNICATIONS
AND ELECTRONICS, INC.

Bernie Olson

Bernie Olson
Manager, Engineering Services

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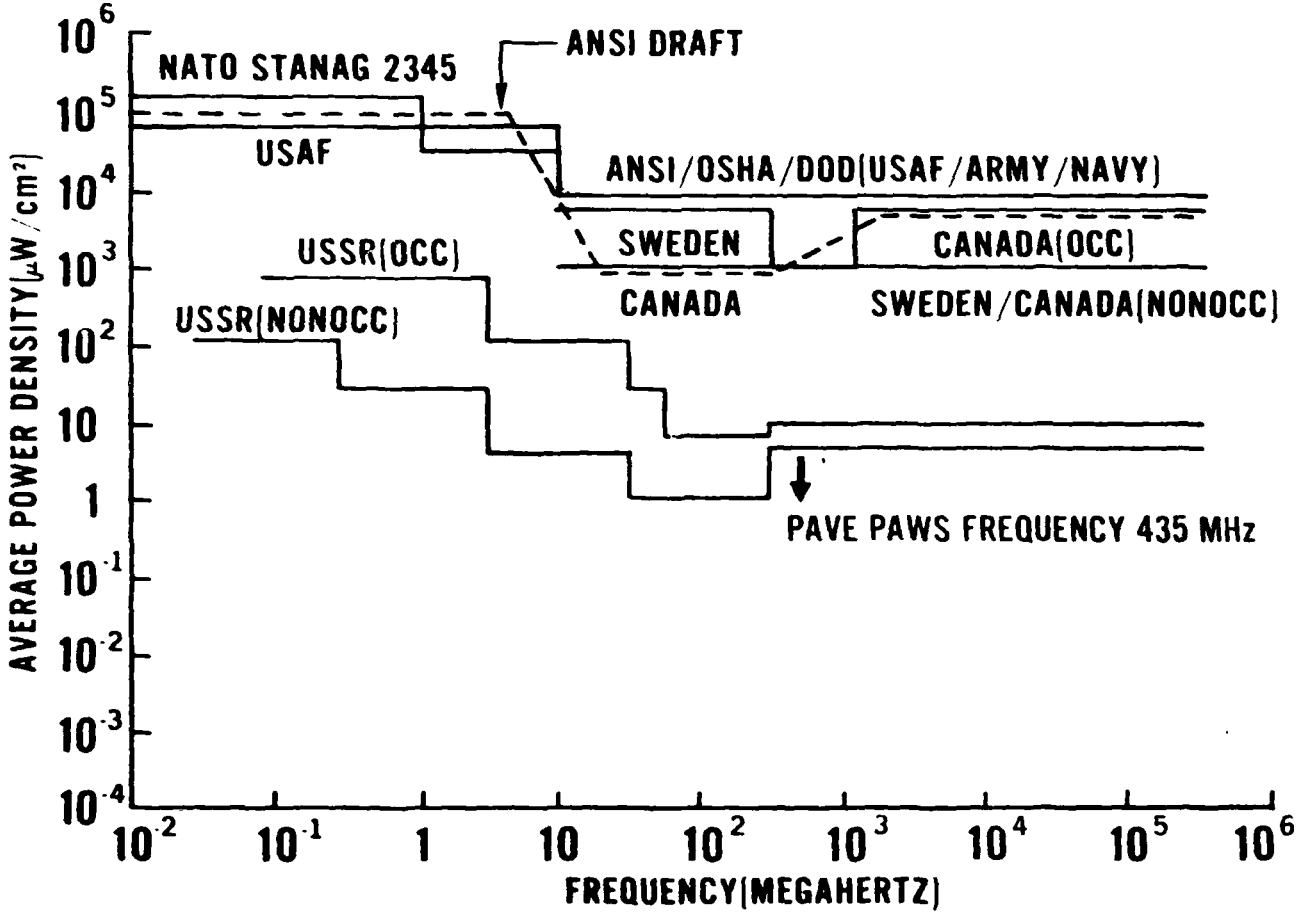
RADIOFREQUENCY RADIATION EXPOSURE STANDARDS



Attachment 2