UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF COLUMBIA

CARLY MICHELLE KURTH, also known as NGUYEN THI LAN, a minor who sues by and through her next friends and adoptive parents, RICHARD C. and MARGARET KURTH, 6428 Cranbrook NE, Albuquerque, New Mexico 87111; phone: (505) 821-2797; and by and through her guardian ad litem, CHARLES R. WORK and McDERMOTT, WILL & EMERY, Suite 500, 1850 K Street, N. W., Washington, D.C. 20006; phone: (202) 887-8030

Plaintiff

v.

LOCKHEED AIRCRAFT CORPORATION

Defendant and
Third Party Plaintiff

v.

THE UNITED STATES OF AMERICA

Third Party Defendant

New
Civil Action No.
80-3223

Old
Civil Action No.
76-0544-44

Deposition of:

DR. TA LAING

Wednesday, July 13, 1983

Washington, D. C.

ALBERT J. GASDOR
General Stenotype Reporting
(202) 546-6666 (301) 894-9157

Deposition of **DR. TA LIANG** was taken, pursuant to notice, before Albert J. Gasdor, a Notary Public in and for the District of Columbia, commencing at 10:10 a.m., Wednesday, July 13, 1983, in the law office of Finley, Kumble, Wagner, Heine, Underberg & Casey, 11th Floor, Bender Building, 1120 Connecticut Avenue, N.W., Washington, D. C.

APPEARANCES:

On behalf of the Plaintiff:

JOHN E. FRICKER, ESQ.
Lewis, Wilson, Lewis & Jones, Ltd.
2054 North 14th Street
Arlington, Virginia 22216
Phone: (703) 527-8800

On behalf of Defendant Lockheed:

JOHN J. CONNORS, ESQ.
THOMAS B. ALMY, ESQ.
Finley, Kumble, Wagner, Heine,
Underberg & Casey
11th Floor, Bender Building
1120 Connecticut Avenue, N.W.
Washington, D. C. 20036
Phone: (202) 857-4000

On behalf of the United States:

[Appearance waived.]

Biographical Summary of Ta Liang

Education	B.E. 1937, Tsing Hua University, China, M.C.E. 1948, Ph.D. 1952, Cornell University.
Professional Experience 1970 to date	Professor of Civil and Environmental Engineering, Cornell University, Ithaca, New York, teaching courses and directing research in Airphoto Interpretation, Remote Sensing, and Physical Environment Evaluation.
	Principal Investigator, NASA-sponsored Remote Sensing Program, Cornell University, 1972-date.
	Co-investigator, Puerto Rico Natural Resources Inventory Project, Cornell University, 1971-73.
	Visiting Professor, Colorado School of Mines, Golden, Colorado. Co-investigator, Colorado Natural Resources Inventory Project, 1970.
	Consultant to national and international governmental and industrial organizations in the use of airphoto and remote sensing methods in national inventory and planning, location for power plants, superport, Arctic gas line, transportation routes, and other engineering, agricultural and land development projects in the United States, Canada, Puerto Rico, Barbados, Chile, southeast, south and southwest Asia, China, and west Africa.
1963-1970	Professor of Civil Engineering, Cornell University.
	Visiting Professor, Cornell Aeronautical Laboratory, Buffalo, N.Y., 1966-67.
	Visiting Lecturer, Graduate School of Planning, University of Puerto Rico, 1965-66.
	Director, Tropical Soils Airphoto Research Project, Cornell University (sponsored by the Air Force Cambridge Research Laboratories) 1961-65.
	Consultant to governments and industries in engineering and airphoto projects, in the U.S., Canada, Caribbean area, Central and South America, the Middle East, Southeast Asia, North, West, East, and Central Africa and Western Australia.
1957-1963	Associate Professor of Civil Engineering, Cornell University.
	Consultant in engineering and airphoto projects in various parts of U.S. and abroad.
	Chairman, Photographic Interpretation Committee, American Society of Photogrammetry, 1960-61.

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1955-1957	Senior Soils and Foundation Engineer, Tippetts-Abbett-McCarthy-Stratton, New York. Airphoto and field investigation of soils, foundations and construction material sources in projects of dams, highways, railroads, airfields, and ports, in various parts of U.S. and abroad. Lecturer in Engineering Interpretation of Aerial Photography, City College of New York, 1957.
1954-1955	Field Director and Visiting Associate Professor, Cornell University Airphoto Team in Burma, sponsored by the U.S. State Department Foreign Operations Administration. The team was composed of experts in the fields of engineering, geology, agriculture, forestry, and city planning to train Burmese government officials.
1950-1954	Research Associate in Civil Engineering, Cornell University, conducted research projects sponsored by U.S. Navy, U.S. Army, and C.A.A. in the fields of soils and aerial photography. Did field work in the United States, Canada, Pacific area, and the Philippines.
1946-1950	Research and graduate work at Cornell University in Airphoto Interpretation, Soils Engineering, Engineering Geology, and Transportation Engineering.
1942-1945	Senior Engineer, U.S. Armed Forces in China-Burma-India Theater. Supervision of design and construction of roads, airports, and housing facilities. Awarded U.S. War Department Meritorious Civilian Service Emblem, 1945.
1937-1942	Highways and railroads survey, design, and construction, China and Burma.
PUBLICATIONS AND REPORTS	Analysis of Landfills with Historic Airphotos (co-author) ASCE/ASP Specialty Conference on Civil Engineering Applications of Remote Sensing. American Society of Civil Engineers, New York, N.Y. 1980. Airphoto Interpretation for Engineering Applications, Historical Perspective and Future Evaluation: V. Tropical Regions, invited paper, American Society of Photogrammetry symposium, Washington, D.C. 1979. Landslides: Analysis and Control, Recognition and Identification Chapter (co-author), Transportation Research Board, National Academy of Sciences, Washington, D.C. 1978.

PUBLICATIONS AND REPORTS (continued)

The use of Airphoto Interpretation and Remote Sensing in Soil Resources Inventories (co-author), invited paper, Soil Resources Inventory Workshop, Cornell Agricultural and Life Sciences College, sponsored by the U.S. Agency for International Development, Ithaca, N.Y. 1977.

Image Interpretation (contributing author), Chapter in Manual of Remote Sensing, American Society of Photogrammetry, Washington, D.C. 1975.

Airphoto Analysis in the Tropics: Crop Identification (co-author), Proceedings, Tenth Symposium on International Remote Sensing of Environment, Ann Arbor, Michigan, 1975.

Land Inventory Systems - The Cornell Experience (co-author) invited paper in International Symposium on Aerial Inventory of Natural Resources, Mexico City, Mexico, 1973.

Remote Sensing of the Physical Environment, invited paper American Society of Programmetry national symposium, Washington, D.C. 1972.

Forest Environments in Tropical Life Zones (co-author), Pergamon Press Inc., Oxford and New York, 1971.

Airphoto Interpretation of Engineering Soil in Tropical Environments, Proceedings, Third Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, 1965.

Application of Airphoto Interpretation in Route Location (co-author), International Archives of Photogrammetry Vol. XIV, Delft, The Netherlands, 1963.

A critical Review of Engineering Uses of Airphotos in the Quebec Cartier Mining Railway Project, Canada (co-author), presented at the Semi-Annual National Meeting, American Society of Photogrammetry, New York, 1961.

Landslides and Engineering Practice (co-author of Airphoto Interpretation Chapter), Highway Research Board, National Academy of Sciences, 1958.

Technical Project Reports on national airphoto and remote sensing program; soil survey; railroad, highway, and pipeline route location; site evaluation; construction material search; and landslide investigation, in various parts of the world, 1955 to date.

Research Project Reports on: Remote Sensing Program, NASA, 1972-80; Natural Resources Inventory, Puerto Rico (co-author), 1973; Natural Resources Inventory, Colorado (co-author), 1971; Tropical Soils Airphoto Research, U.S. Air Force, 1964; Airphoto Interpretation, Burma, U.S. FOA, 1955; Long-Range Photography Research, U.S. Army, 1954; Soil Moisture and Density Research, CAA, 1952; Key to Aerial Photographic Determination of Ground Conditions, Landform Series, Six Volumes (co-author), U.S. Office of Naval Research, 1951.

PHONES: 607 256-5074
607 257-0484

TA LIANG
CONSULTANT
2 TRIPHAMMER LANE, ITHACA, NEW YORK 14850

April 26, 1982

Charles R. Work, Esquire
Peabody, Lambert & Meyers
1150 Connecticut Avenue, N.W., 12th Floor
Washington, D. C. 20036

Dear Mr. Work:

I have had the opportunity to review the deposition and trial testimony of Mr. Atkins, the computer-enhanced photographs he created and relied upon, the report of Dr. Welch, the photographs he relied upon, and two motion pictures (Tarbell-1 and 75 CRK-DC-2184). I have also reviewed the report of Dr. Morain and the photographs he relied upon.

I was asked to review these materials and determine the significance, if any, of computer enhancement and stereoscopic analysis by Mr. Atkins and Dr. Welch respectively to the issue of the lengths of the tracks of the troop compartment and the existence of a ground rise at the forward end of the troop compartment, at the point of last impact.

Upon review of these materials, and upon consideration of the task before me, I have an opinion regarding the use of the technologies employed by Mr. Atkins and Dr. Welch.

1. Regarding the use of computer enhancement techniques as employed by Mr. Atkins, I have the following opinion: Computer enhancement, an increasingly used technique, has not produced significantly different results in this case. The generally agreed-to continuous track by the troop compartment is clear in all original photographs. The cause of discontinuous "track" or disturbance is subject to debate and has not been enhanced convincingly. The use of computer enhancement, meanwhile, has its limitations and should be used with caution. In digitizing the original photographs (in contrast to the original data being digital), one always loses some information ("one generation away"). Furthermore, in computer manipulation, one may inadvertently overlook details in the photographs that might provide useful information. For practical purposes, given the quality of the original photo prints, the improvement, if any, of measurements by "pixels" is negligible.

2. Regarding the use of stereoscopic analysis by Dr. Welch, I have the following opinion: An attempt to create some stereo view for topography is always commendable. However, it could be misleading or even erroneous for visual analysis, particularly in not-rugged terrain, when the position and attitude of the camera for each photo is unknown. Thus, a small rise of the topography in front of the final resting place of the troop compartment, as suggested by Dr. Morain, (the evidence provided by several ground and air oblique photos is rather convincing) could possibly

be missed with the proposed "stereo" by Dr. Welch. In other words, without properly created stereo models, the terrain condition suggested by Dr. Morain cannot be disproved. Rigorous analytical solution in stereo would require such information as camera focal length, tangential distortion, and the like.

Altogether, the use of computer enhancement and stereoscopic analysis as employed by Mr. Atkins and Dr. Welch does nothing more to answer the issue of the length of the tracks, the severity of the impact, or the non-existence of a ground rise than do more standard methods. Further, their approaches could be misleading and confusing to the layman.

Finally, upon review of these materials, I find nothing to contradict the conclusions reached by Dr. Morain in his report. I believe there is sound photographic evidence upon which to base Dr. Morain's opinion regarding the impact of the troop compartment with the ground, and I concur with his findings.

Very truly yours,

Ta Liang

Ta Liang
Consultant

I N D E X

Wednesday July 13, 1983

Washington, D. C.

DEPONENT:	DIRECT EXAMINATION
DR. TA LIANG	4 - 64

E X H I B I T S

NUMBER		FOR ID.	TRANSCRIPT REFERENCE
DD-2741	Biographical Summary of Dr. Ta Liang	5	5, 6
DD-2743	Letter from Ta Liang to Charles R. Work, April 26, 1982	24	24, 28, 30, 31, 32, 62
DD-2744	Diagram from Morain report	54	53, 54

Request for Production of Documents: 27, 43

MR. CONNORS: John, the usual stipulations, and I assume you do not waive signing?

MR. FRICKER: I do not waive signing, and let me make sure I understand what you are talking about.

All objections are preserved except as to the form of questions. That is stipulated.

There was a third stipulation which, long ago and far away, was the presence of the Government would be waived. Is that one you are suggesting?

MR. CONNORS: Yes.

Whereupon,

DR. TA LIANG

was called as a witness and, having been first duly sworn, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CONNORS:

Q Would you state your name, please.

A My name is Ta Liang.

Q What is your home address?

A [redacted]

Q Your office address?

A 453 Hollister Hall, Cornell University.

Q Is it Doctor Liang?

A Yes.

Q Doctor, I would like to show you a document of three pages which we will mark as Defendant's Exhibit DD-2741 and I will ask you if you can identify that.

A Yes.

[Biographical Summmary of Ta Liangwas marked DD-2741 for identification.]

BY MR. CONNORS:

Q What is this document?

A It is a biographical summary.

Q Is this document which is dated August, 1980 your current curriculum vitae?

A Essentially, yes.

Q Are there any changes?

A Essentially what is there stands.

Q Would a change be additional publications?

A I think it is fine.

Q Doctor, have you ever been in military service?

A Not directly. I was a civilian engineer for the U. S. Army during World War II, but that is not strictly military.

Q You have never been in the uniformed services?

A No.

Q Have you ever done any photogrammetric or photo interpretation work for the military?

A Yes.

Q What was that?

A I think if you will refer to my biographical summary, during 1946 to 1950, I did work for a research project for the Office of Naval Operations, and then in 1960 -- maybe the last paragraph of my summary would reflect these facts -- Director, Tropical Soils Airphoto Research Project for the U. S. Air Force, 1961 to 1965, and then long-range photographic search, U. S. Army, 1954; and then the Key to Aerial Photographic Determination of Ground Conditions for the Office of Naval Research, 1951.

Those are mainly the ones related to the military.

Q Have you done any photogrammetric or photo interpretation work for the military which is not reflected in your curriculum vitae, DD-2741?

A I don't think so.

Q Have you any training or experience in the design or operation of aircraft?

A No.

Q If I use the term "trafficability analysis," do you understand what I am talking about?

A Yes.

Q Would you define for the record what a trafficability analysis is.

A In my area in particular, it is the study of the ability to travel primarily by vehicles but sometimes by foot soldiers.

Q Have you personally done such analyses?

A Some.

Q Dr. Liang, what methods are used in such trafficability analyses?

MR. FRICKER: I will object on possible vagueness grounds. You are asking what are used today? You have not identified when he performed these analyses.

MR. CONNORS: My question related to whether he understood the term, and I will take whatever are the standard methods used in such analyses.

THE WITNESS: Beach trafficability for the Navy.

BY MR. CONNORS:

Q Dr. Liang, what methods would a photo interpreter

or photogrammetrist use in making such analyses?

A By using air photos plus ground verification, ground operations.

Q How would the air photographs be used? What techniques would be employed in interpreting the air photographs?

A In trafficability?

Q Yes.

A There are many visual methods.

Q Do you ever do your own photo reconnaissance?

A Could you clarify what you mean?

Q Do you ever take your own pictures of the areas you are going to analyze?

A Occasionally I take pictures, but normally I rely on professional photographers.

Q Have you ever done your own aerial photographic reconnaissance?

A Taking aerial photography?

Q Yes, taking your own aerial photographs from the air.

A No, only in sort of a supplementary way.

Q You said you use commercial photographers to take your photographs?

A Yes.

Q What instructions do you usually give those photographers when they are assigned to do a project for you?

A This is a general question, but I try to sum it up in a way, telling the scale, the flying height, the focal length of the camera; if possible, the time of the year, the time of day.

Q Do you have any particular commercial photographers which you use for such photography?

A Not consistently. I probably deal with quite a few air photo companies.

Q What would be an example of an air photo company you might use on a project for the survey of a gas pipeline, which I believe you have done?

A Makhurd Aerial Survey is one major company, and Aero Surface used to do a lot in past years. Aero Surface has changed their name several times now. I don't know what their present name is. Also, there is a British company overseas.

Q What is your current employment?

A I am a professor at Cornell University.

Q What photogrammetric or photo interpretation project

are you currently involved in?

A Do you mean inside the university or outside?

Q Anywhere.

A I just returned from China two weeks ago where I spent time discussing with the Ministry of Railroads how to use air photos and remote sensing in the construction of new lines in Western China.

We did generally air photo projects for NASA for trying to expand the use of remote sensing in New York State in particular and the northeast in general. This has been going on for more than ten years, and now it has come to some conclusion, and it is phasing out; and, in that work, we primarily use air photos.

Also, I do consultations for the government, international agencies, and the like.

Q What type of projects are you doing for either NASA or these other government agencies that you are referring to?

A Mostly in connection with using air photos, remote sensing devices for engineering and agriculture.

Q What sort of engineering projects?

A Railroad locations, gasline location, pipeline

location, soil, geologic evaluations.

Q Would these be studies of large tracts of land to determine the various paths of the proposed railroad or pipeline, and that sort of thing?

A We primarily study the geologic conditions, where they might have landslide problems, major geologic problems.

Q What are you doing for the university now?

A I teach courses in photo analysis.

Q How many courses are you currently teaching?

MR. FRICKER: Do you mean currently the summer session?

BY MR. CONNORS:

Q Let's take the last academic year.

A In the fall term, I taught what is called image analysis, and then, besides, I direct student theses, and things like that.

This coming fall semester, I will be teaching the same course and, in addition, Image Analysis 2 which is a follow-up course.

Q What textbooks are used in those courses?

A I do not used fixed textbooks. I use notes, publications by me and by others, so there is no text, so to

speak, but there are some references.

Q Could you give us some examples of standard text-books in the field of photo analysis?

A There is a Manual for Photo Interpretation published by the American Society of Photogrammetry which is old but is still a pretty good reference. It was published in 1960, and then there is a manual Remote Sensing published by the same American Society of Photogrammetry, published in 1957. It is a very good general reference which is being revised, and the Second Edition is supposed to come out next month.

Q Doctor, periodically during the deposition I may ask you for a definition. I do not intend by that to either confine you or to invite you to give a lecture on a particular subject but, rather, to give us some reference which the layman reading this text can use. If at any time after you have defined something you feel you have to supplement it because of another issue we have gotten into, please feel free to do so.

Doctor, could you define for us the term remote sensing?

A In the broader sense, remote sensing means contact. You are sensing me; I am sensing you; non-contact sensing.

Traditionally, we start with air photos. In recent years, it expanded into using platforms by satellite and by high-level flying aircraft.

So, in the broad sense, remote sensing included air photos. Sometimes in a narrow sense in the professional groups, they tend to limit remote sensing to a more recent development like satellite use, and things like that.

So, generally, I would say remote sensing covers the whole range of efforts, the methods of data collection. I would consider air photos as part of remote sensing.

Q You mentioned photographs as an example, but remote sensing is not confined to just the visual spectrum, is it?

A Right.

Q It can be any type of remote sensing?

A Non-contact.

Q What areas are subject to remote sensing analysis?

MR. FRICKER: Geographical areas?

BY MR. CONNORS:

Q Subject areas, military, agricultural, military-industrial?

A I would say it is an almost unlimited situation.

Q Remote sensing is a rather broad area, is it not?

A Yes.

Q What is your particular area of experience in training within the remote sensing field?

A I start off as an engineer, so my basic training is in geology, engineering, soils; sensing is used to determine those conditions. As you just mentioned, remote sensing is sort of a multidisciplinary area. I am gradually getting educated by all these different professional people and, in particular, the agriculture people which I have a lot to do with.

Q Have you ever been to Viet Nam?

A Yes.

Q When was that?

A The last time, I believe, was 1962 or 1963. This was in connection with the tropical soil research for the Air Force.

Q How many times did you visit Viet Nam?

A Professionally, only once, only that time, but I passed through that area before.

Q On what occasion was that?

A Just traveling, passing through.

Q You didn't stay and visit?

A No; but in 1962, I believe, I did this tropical soils study for the Air Force. That is on the last page in the last paragraph of my summary, and then on the first page, 1963 to 1970, Director, Tropical Soils Airphoto Research Project for the Air Force, Cambridge Research Lab.

Q So, you were involved with photo interpretation with regard to Viet Nam?

A Yes.

Q That related to soil survey only?

A It related to the characteristics and subtropical soil.

Q During that particular visit or any visit to Viet Nam, did you ever have occasion to visit what we now know to to be the site of the C5A accident?

A No.

Q What part of Viet Nam was that study involved with?

A It is still in the so-called Delta area near Saigon. At that time, travel was quite limited, so it is not possible to go into many of the areas that we would like to go to.

Q Have you any training or experience in aircraft accident investigations?

A No.

Q Have you any training or experience in aircraft accident reconstruction from photographs?

A No.

Q Have you had any training or experience in the identification of aircraft or aircraft parts from photographs?

A Not specifically.

Q Do you regard yourself as an expert in aircraft identification?

MR. FRICKER: Do you mean being able to look up and say that is a B-52?

BY MR. CONNORS:

Q Do you regard yourself as an expert in aircraft identification from an aircraft?

A If I wanted to be modest, I would say no. If I wanted to extend myself a little bit, I would say we train people from CIA and others in schools, but I cannot go much further.

Q You train them in the techniques but not in the specifics of aircraft identification; is that correct?

A I would rather not answer, if I may.

Q Do you have a problem with classification?

A Yes.

Q Do you regard yourself as an expert in aircraft accident reconstruction from photographs?

A No.

Q Have you ever testified under oath before, either at a deposition or at trial?

A I think I did, but I am not 100 percent sure. It was many years ago that I did testify about landslide problems in Pittsburgh, but it is so long ago I must say most probably, I did, but that was such a long time ago.

Q Have you ever prepared any reports or advised any lawyers regarding photo interpretation matters other than in this lawsuit?

A I must say that I do not know because, in my consulting practice, I have prepared reports. How many of them eventually end up in the courtroom or the legal offices, I really do not know. But directly with a law firm, I don't recall.

For instance, right now, I have a couple of things going on that I am sure will end up in court, but I can't say this directly.

I do not know if I mentioned in here, most of the time I work for the engineering companies. I think most of those reports eventually go to court.

Q Have you ever been asked by attorneys to prepare any reports for them or to provide them any advice with regard to the interpretation of photographs?

A To my recollection, no.

Q Prior to your involvement in this lawsuit, had you ever met or known Dr. Stanley Morain?

A Yes, I have known him professionally for quite some time.

Q What sort of professional contact did you have with him?

A We are members of the American Society of Photogrammetry. He also worked with me on a project for the State Department, AID.

Q Do you have a personal relationship with Dr. Morain?

A In what way?

Q Personal way, beyond your professional relationship.

A Friends. If you mean as a friend, yes, as a professional friend.

Q Prior to your involvement in this litigation, had you ever met or known Dr. Robin Welch?

A I have heard of his name, but I do not know anything specific.

Indeed, the other day I was looking at a chapter article I wrote and found we are officers of the same chapter. This professional circle is rather small. You generally know people by name.

Q Prior to your involvement in this litigation, had you ever met or known Mr. Arlen Atkins?

A No.

Q Prior to your involvement in this litigation, have you ever had occasional to use the services of the Itek Corporation?

A No, I don't think so.

Q Are you familiar with the Itek Corporation?

A By reputation, yes.

Q What is their reputation in the field?

A They have done a lot of optical work for the military.

Q Are they respected in the area?

A Yes.

Q Are you familiar generally with the reputation of Dr. Morain in the area of photogrammetry or photo interpretation?

A Yes.

Q He is not regarded as an expert in aircraft accident reconstruction, is he?

A He has a general reputation as a photo interpreter, but for aircraft, no, I don't think so.

Q His general area of expertise relates to agriculture, is that right, and agricultural studies?

A I believe it is in geography and agriculture.

Q Are you familiar with the general reputation of Dr. Robin Welch in the area of photogrammetry or photo interpretation?

A Only in a very general sense.

Q Doctor, the next series of question will relate to your contact with this litigation. If I ask for information you have provided, so John understands, he will tell you this any way, I do not want any trial strategy or anything like that. What I will be asking for will be mostly factual information.

When were you first contacted with regard to the

litigation arising out of the C5A accident on April 4, 1975?

A I don't think I have a record of that, but I think it must be early April, sometime early in 1982.

Q Who was it who contacted you?

A I believe it was Dr. Cohen.

Q How did he contact you?

A I think it was either Dr. Cohen or someone in the firm that called me and asked me if I cared to come to Washington and review some of the materials pertinent to this case.

Q At the time of that first contact, what factual information were you given regarding the accident itself?

MR. FRICKER: Do you mean if it was, in fact, by a telephone call, what he was told over the phone?

MR. CONNORS: That is correct.

THE DEPONENT: It is really hard to recall. I was given a brief description of the accident and asked if I could come to review materials. I don't think until I came to Washington I really knew the case. This is my recollection.

BY MR. CONNORS:

Q Was that your next contact with regard to this litigation when you came to Washington?

A Yes.

Q When was that?

A I would have to go back to my report. This must be around April 26th or shortly before then. I remember I spent just a short time in the office going over the material and this was in late April.

Q At that time, what were you told about the accident? That was April of 1982; is that correct?

A 1982.

Q At that time, what facts were you told about the accident?

A I was told about the tragedy, of the failure of the aircraft, and that many children were killed, and the children who survived had health problems. And then there are movies there and photos there and Morain's report, the Welch report, and I can report that I was asked to review the material, give an opinion, in particular, related to the Atkins report and Welch report, and they asked me if I had any opinions.

Q What were you show at that time in terms of material related to the accident or this litigation?

A The movies, the reports, the photographs.

Q What photographs were you shown?

A I do not have a complete list, but it was all the materials that were mentioned in the reports that were given to me as well as the movies.

Q I understand that the only photos you were shown at that time were the ones that were mentioned in the reports of the other three experts; is that correct?

A Yes.

Q In addition to the movies and photographs, were you shown any other materials?

A I don't think so.

Q At that time, were you shown the reports?

A Yes.

Q Whose reports were you shown?

A The Morain report, Welch report, and Atkins' report.

Q Were you shown any trial or deposition testimony?

A I believe there was one deposition. I think I saw the deposition testimony and trial testimony of Atkins and the report of Dr. Welch.

Q You have been referring to a document which is in front of you. I would like to show you a two-page document

apparently on your letterhead which we will mark as Defendant's Exhibit DD-2743 and ask if that is the document you have been referring to?

A Yes.

[Letter from Ta Liang to Charles R. Work, April 26, 1982 was marked Defendant's Exhibit DD-2743 for identification.]

BY MR. CONNORS:

Q What is that document?

A That is my report to the law office.

Q This document which you say is your report to the law offices is dated April 26, 1982; is that correct?

A Yes.

Q Does this report list all of the materials you reviewed for the preparation of this report?

A Yes.

Q How long were you in Washington in April of 1982 for purposes of this litigation?

A One day.

Q Did you review the materials referred to in your report during that day?

A Yes.

Q Did you prepare the report at that time?

A At the end of the day, yes. I believe I drafted the report, and then finally I went back and sent this back. I don't remember if I sent it back from Ithaca.

Q Did you show the draft to anyone?

A Yes.

Q Did you receive any comments regarding the draft?

A No.

Q Does your final report reflect the draft which you prepared at that time?

A Yes.

Q Were there any substantial changes between the draft and the final report?

A No.

Q Who did you speak to while you were in Washington for that visit?

A Dr. Cohen.

Q Anyone else?

A Could I check with Mr. Fricker about the person's name?

MR. FRICKER: Do you have any objection?

MR. CONNORS: No.

[Deponent confers with counsel.]

MR. FRICKER: I don't know who he is referring to.

BY MR. CONNORS:

Q Peter Butt?

A Yes.

Q Doctor, did you prepare or take any notes in connection with the preparation of your report?

A Do you mean in the office?

Q At any time.

A Could you ask your question again, please?

Q Did you make any notes at all with regard to your involvement in this litigation?

MR. FRICKER: That is a different question. That is much broader.

MR. CONNORS: Let's go with the broader question.

MR. FRICKER: You are asking up to today whether he has made any notes?

THE DEPONENT: I think so, yes. Usually when I look at things, I jot down a few notes.

BY MR. CONNORS:

Q Do those notes still exist?

A I would have to check. I am not sure. Usually when I write a final report, I usually either destroy the notes, or sometimes I might file them away, but I don't know for sure.

Q Did you keep a copy of the draft report which preceded the final version we have seen here today?

A I do not know. I could check.

MR. CONNORS: We will call for the production of any notes or drafts of this report.

BY MR. CONNORS:

Q What precisely did you understand your capacity to be with regard to this litigation?

A I believe, as I stated in my report, at the time, there seems to be two arguments -- maybe not arguments but opinions about Morain's conclusions and the differing opinions with this computer enhancement technique used by Mr. Atkins, and then also the stereoscopic analysis by Mr. Welch. In my case, I was essentially asked to give an opinion, what would be my opinion about those things.

Q The task was addressed to the methodology employed; is that right?

A Yes, and may I add the result might affect the

conclusion.

Q Doctor, are you receiving a fee or compensation for your work with regard to this litigation?

A Yes.

Q What is the rate of that compensation?

A $75 per hour.

Q Approximately how many hours have you accumulated to date?

MR. FRICKER: Doctor, if you don't know and if it is going to take some time to come up with a guess, I don't know that that is what he wants.

THE DEPONENT: About 18 hours.

BY MR. CONNORS:

Q Doctor, after you visited Washington in April of 1982, you said you returned to Ithaca and prepared the final report which we have marked as DD-2743?

A Yes.

Q And you then sent that to the law firm; is that correct?

A Yes.

Q Who did you send that to?

A Dr. Cohen.

Q Between the time you left Washington and the mailing of that report, did you have any further contact with anyone regarding this lawsuit?

A No.

Q Since the mailing of that report, have you had subsequent contact with anyone regarding this lawsuit?

A Not until they asked me to come for this deposition.

Q Approximately when was that?

A Last week.

Q So, between April of 1982 and early July of 1983, you had no contact with the litigation?

A Right.

Q Have you ever had occasion to contact either through written or oral communications any other expert or fact witness related to this litigation?

A No.

Q Have you had any professional contact with Dr. Morain during this period that you have been working on the C5A litigation?

A No.

Q Since April of 1982, have you received any additional materials with regard to the C5A litigation?

MR. FRICKER: Exclusive of materials which I have already indicated to you he has reviewed in his most recent trip here?

MR. CONNORS: That was said off the record, and I am trying to get it on the record now.

BY MR. CONNORS:

Q You have indicated that in the preparation of your report dated April 26, 1982, you reviewed various materials which are listed in that report. Since the preparation of that report, have you been shown or received or had an opportunity to review any additional materials related to the C5A litigation?

A The only thing that I had was yesterday. I was in the office and I saw volumes of photos, and I leafed through most of those available in the conference room there. There is nothing that occurred to me that would add or change my earlier findings.

MR. FRICKER: If I may, at this point, I would like to indicate on the record that the materials or the volumes of materials that the doctor refers to were virtually all the additional photographic materials that our firm has obtained to date from either the Government or Lockheed,

including all the black and white and color photographs, the slides, the movies as well as the Atkins and Welch materials. All of that material was laid out and he had free access to it. He was shown the films, the slides, the stereoscopic materials yesterday and again this morning.

BY MR. CONNORS:

Q In addition to the photographic materials, have you been shown or had an opportunity to review any additional deposition or trial testimony relating to the C5A litigation other than as stated in your reported dated April 26, 1982?

A No.

Q Have you been assigned any new tasks with regard to the C5A litigation other than as previously described?

A By the law firm?

Q Yes.

A No.

Q Have you completed the review of the materials necessary for the task, as you understand it?

A Yes.

Q Would any opinions you have rendered with regard to them today be your final opinions regarding this material?

A Yes.

Q In connection with your task for the law firm, did you do any independent research regarding the geographic area or the aircraft involved, maps, anything of that sort?

A No.

Q Did you prepare any calculations?

A No.

Q Have you been told that you will be expected to prepare any calculations?

A No.

Q Other than the report dated April 26, 1982, which we have marked Defendant's Exhibit DD-2743, have you prepared any other documents with regard to this litigation?

A No.

Q Have you been provided any instructions with regard to any contacts relating to any expert or fact witnesses involved in this litigation?

MR. FRICKER: I object. I don't understand the question.

BY MR. CONNORS:

Q Have you been, for instance, told to contact or not to contact Dr. Morain?

MR. FRICKER: I will object and advise him not to answer, because I think that would be getting into a trial strategy, or something like that, or advice he has been given by any attorney. Feel free to ask him who he has been contacted by, but I think you already have that.

BY MR. CONNORS:

Q Dr. Liang, could you contrast for us, please, a photogrammetrist and a photo interpreter?

A Traditionally, a photogrammetrist is one dealing with measurements, geometric aspects of photos as such. So, it is dealing with quantity measurements.

The photo interpreter deals with the quality determination, be it vegetation, soil, geology. In other words, it is a quality determination of things on the air photos.

Now, in some cases, the two might merge; the two subdivisions might merge. If you ask am I a photogrammetrist, quickly I would say no. But if you ask someone who is preparing topographic maps, doing those things, and you ask if he was a photogrammetrist, he would probably say no.

Q In the areas of remote sensing or photo analysis, how would you characterize yourself in describing your own experience and training?

A I would consider it interpretation.

Q What are the standard tools employed by a photo interpreter?

A There are many, but the simplest one would be a pocket stereoscope.

Let me take that back -- just by eye mainly, and then pocket stereoscopes, and then by more elaborate type of stereoscope, and then color additive viewers, and then you go into all sorts of relatively sophisticated and complicated equipment.

Q That was color additive?

A Yes.

Q What are the standard methods employed by a photo interpreter?

A It depends on the task at hand. I imagine it could be from the very simple to the more elaborate methods.

Q Let's confine it to a task such as given to Drs. Morain and Welch. What would be the standard methods that would be employed in a task such as that?

A I would think just looking at the photos and using their experience in terms of the topography, drainage, vegetation, erosion patterns, the color or the various grades

and sum this up together to determine what is at hand, determining what is the answer to the question at hand.

Q You mentioned that a photo interpreter would start by just looking at the photographs?

A Yes.

Q What would he be looking for in the case of an accident reconstruction such as we are involved in now?

A Simply the topography, and by topography I mean the change of the land, change of elevation, surface, drainage, whether there is water standing or draining, the drainage channels and erosion, as I mentioned, and also the color or the grade holes, the vegetation, and then any other man-made features. Those are pretty much the standard elements.

Q What would a photo interpreter use a pocket stereoscope for in this sort of task?

A I think this may probably get involved. You may have mentioned Dr. Welch's use of the pocket stereoscope in this case. Its use is limited because there is no dependable stereo photograph available. Therefore, I think the pocket stereoscope has to be used with extreme care.

Q Is there any reason to believe that Dr. Welch did not use it with extreme care?

A I cannot tell.

Q Do you know what equipment Dr. Welch used?

A I would probably have to refer back to his report. Offhand, I would not know. The recollection was he tried to create a stereoscopic view of the area.

Q You also mentioned that a photo interpreter might use color additive techniques. What would be the purpose of that?

A Those are generally in connection with spectral photos when you have photographs taken at different spectral intervals so that you could look at several spectral photos taken at the same time with different color filters to create either a natural color or false color; but it does not apply in this case.

Q That is a standard technique?

A When you have spectral photos.

Q Where you create them through the use of filters?

A Yes.

Q In this particular case, both Dr. Morain and Dr. Welch made measurements. What would be the standard for making measurements from a photograph?

A One way of doing it would be you get all the photos

at hand and by your judgment you select the ones that you believe represent the best available picture, and then use some scale -- either man, a house, a highway of known dimensions, or aircraft in this case and do the best you can to use those as scale and then measure the dimensions you want to find out. You try to see if there are contradictions, whether there is other evidence, and so on.

Q How does a photo interpreter confirm or test his findings and conclusions?

A If you can do some field study, but in this case you cannot do that, so I don't know how.

Q In a field study, you would use the term ground truth?

A Yes, ground truth.

Q Can you define that perhaps for us as to what ground truth might include?

A Ground truth traditionally was something you found out from the ground, so you collect it out in the field. Recently, sometimes it is used more broadly, like you have satellite images and you would use air photos as ground proof.

Q Do you mean once a photo is established as accurate,

you could use it in other photos?

A You could use it for satellite pictures. This is sometimes used.

Q General ground truth refers to checking out something at the actual location where the photograph was taken?

A Right.

Q Could you define stereo photography or stereoscopic? Could you define what that is for us?

A A stereoscopic view is a view of an object or a scene that was taken. Photos were taken from two different positions, and you view the two pictures at the same time with or without the aid of a stereoscope to get a three-dimensional view.

Q Stereoscope can go from the very simple pocket stereoscope through the mirror stereoscope up to sophisticated magnification?

A Yes.

Q How long has stereo photography been in use?

A I wouldn't want to say that as an academic thing, but certainly it has been used since World War II.

Q It is regarded as a generally accepted method in the photo interpretation field?

A If this is done correctly. Maybe instead of taking your time to question me on this, may I explain a little bit why I question this stereoscopic view of Dr. Welch?

Q We will be getting there. My question now is whether the use of stereo photography and analysis is generally accepted in the photo interpretation field?

A Within limits, yes.

Q What would those limits be?

A The limits that the stereo pair has to be done with no focal-length cameras, the set positions and the exact locations of the camera while the object was taken. In other words, the geometric relations of the two cameras with the object -- the primary geometric requirements.

Q How is stereo photography taken?

A Air photos?

Q Yes.

A Let me start with air photos.

The most dependable stereoscopic photos have been done by an airplane because of a stable platform. For example, you take a picture of Washington from this position, and you move to another position and take another picture of Washington, and you take a look at the two pictures and you

get a 3-dimensional view of Washington.

So, they are under very rigid conditions of camera focal length, the fine height, the relationship of the two camera stations and then, under such circumstances, you could correctly measure everything being taken not only in the horizontal directions but also the vertical directions as well. Most of the topographic maps of this country are done by those methods.

Q Stereo photography requires a certain overlap of the stereo pairs of pictures, does it not?

A Yes.

Q Is there any limitation on the amount of the overlap?

A The area in which you could get a stereoscopic view is only the area that is overlapped. So, in other words, if you have 50 percent overlap, you could see 50 percent of the stereoscopic view. If you have 10 percent, then you can see 10 percent of the overlapped area.

Q So the percentage of overlap only affects the portion of the picture that would be viewed in 3-dimension?

A Right.

Q Are there any specific performance standards set

forth in any standard reference texts or perhaps in the manual of the American Society of Photogrammetrists that relate to stereo pairs?

A I have not gone through the whole volume. I happen to have one right here. I have faith in that manual. It is pretty straightforward.

Q What is the actual purpose of viewing a scene in stereo? What does it do for the photo interpeter?

A Primarily to get a 3-dimensional view of the scene.

Q Once a 3-dimensional scene is viewed, is that useful for both measurements and analysis?

A Within limits.

Q Those are the limits you mentioned previously?

A Yes.

Q Have you ever used it yourself?

A Yes.

Q You apparently have had an opportunity to view the pictures that were used by Dr. Welch?

A Yes.

Q Have you attempted to view those by using a stereoscope?

A I believe so. I couldn't swear to that. If not,

I would answer this way: I believe so, but, if not, at least I view those with the naked eye.

Let me substantiate this to you. This is one capability we generally train ourselves to have. If I am given a pair of stereoscopic pictures, I do not need a stereoscope to look at it to get a 3-dimensional view. Anyone can do it with a little bit of exercise. This is one of the first few things we ask students to develop. You look at one picture with your left eye and the other picture with your right eye and you fuse them together.

Q You are saying persons with some experience can see the 3-dimensional image without necessarily having to use a stereoscope?

A Right.

Q However, the stereoscope is a standard tool, is it not?

A Yes.

Q You do not recall, in fact, whether you view them through a stereoscope?

A I did see a 3-dimensional view.

Q You did see a 3-dimensional view?

A Yes.

MR. CONNORS: Let's take a brief recess.

[Brief recess.]

MR. CONNORS: We have just come back from a break, and I will use this opportunity to request also that the Plaintiff's counsel produce a syllabus of the courses with any text documents that Dr. Liang is using in his courses at Cornell.

MR. FRICKER: Would you follow up your requests in writing.

MR. ALMY: Certainly we can put it in writing if it is not covered by additional requests.

BY MR. CONNORS:

Q Dr. Liang, can you describe or define for us what is involved in the computer processing of remote sensing information?

A There are many but, in general, the remote sensing data comes in two modes. One is in digital mode originally, such as the data we get from the satellites that are used worldwide, and the original data come in in digits and on tapes. So, you could use the computer to manipulate the original data because they come in in different spectral bands, so you could make a lot of manipulations among the different

bands to try to get the best result you can get.

The other type of data comes in as photography. This is what I believe was the material they used in these cases.

In order to do the computer enhancement, I believe one needs to digitize the original photography which shows up in the enhanced photos, and then you try to, shall we say, enhance the color grade values of the individual digits and to emphasize certain features in the photos.

Q Are both of these modes generally accepted methods of processing photographic materials today?

A If the original data is digital, then this enhancement is going into the very bottom of the source of information. In other words, you get back to the individual digits and then do something about it. So, this is generally accepted.

The other source, the other mode of information comes from the photos. They are debatable. Not everybody agrees it is useful in that sense. Maybe I shouldn't say useful but improving it. If the original source of information is a photo and the original source of data is there and you start to digitize it, your information is sort of

one generation off from the original. This is as you are trying to dissect the original photo. It is quite different from your original digital. There is a problem that you lose some of the original fine points of the original photo, and this is one thing I usually advise against the students going out to various agencies. I say, "You be careful. If you start with a photo and start to digitize it, you are going to lose something, and you are one generation off."

The other consideration is that enhancement also has its limits. Assuming that you do not lose anything, this one generation is beside the point. You start to filter out some of the noises, so to speak, the background noises. This is almost like radio. You try to filter out the undesirable noises so you hear things more clearly. Many professionals have some misgivings about these, in that you emphasize certain points. Usually you would lose some details in others.

In other words, the idea is you try to emphasize certain color tones, and so on. In so doing, generally, you would lose some of the details in the other ranges of tones and colors, so much so that in recent days, like NASA, I wouldn't say doctor but try to enhance some of the products as they come back from the satellite. This is besides the

one generation, the original digital data, and they try to process it so that it would be easier and nicer to look at. Many professionals are against that. They are telling NASA, "Look, don't bother to make it look nicer here." We could interpret what we would want from the original information, and we could do it better." Maybe I have expanded on this line.

So, my feeling is that, one, in principle, you digitize a photo when the original photo is not digital information to begin with, thus making it one generation off from the original; and, two, by enhancing elements, you might decrease the clarity of the other telltale information. This is one principle.

Then, specifically, in this case, I look at the pictures used by Morain and the enhancement photo by, I believe, Atkins, in this case, and it does not convince me of an improvement in terms of what we can interpret. That is my observation.

Q Doctor, other than this litigation, have you ever had occasion to digitize or use digitized information derived from a photograph?

A Yes.

Q Are you able to work with that material?

A Yes.

Q Does it provide you with useful information, given your level of expertise?

A I generally think it is not useful.

Q Then why do you use it?

A I run all these projects and all the data comes through and people use different things.

Q Do you also use photography that has been enhanced?

A Yes.

Q What precise mechanism did Arlen Atkins use in terms of the computer enhancement of the programs?

A I would have to go back to their reports. Offhand, I do not recall the details.

The basic principle is that you digitize and then try to manipulate the grade or color of the objects that you are looking at.

Q Given a person who is familiar either through training or experience with photogrammetric and photo interpretation techniques, does the ability to digitize a photograph provide an opportunity to get additional information from a given photograph?

A Could you try that again, please.

MR. CONNORS: Why don't we have it read back.

[The pending question was read by the reporter.]

THE DEPONENT: Sometimes.

BY MR. CONNORS:

Q Does the ability to enhance a particular photograph through any of the known and accepted computer processing techniques allow a skilled or experienced interpreter to gain additional information from a photograph?

A Sometimes.

Q Are you familiar with the technique of viewing a digitized image from whatever source on a high-resolution CRT as opposed to a paper image?

A Could I have that read back, please.

[The pending question was read by the reporter.]

THE DEPONENT: Yes.

BY MR. CONNORS:

Q Does the ability to use such an image on a high-resolution CRT enable the interpreter to see more detail than would be available in the paper print of a picture?

A Not necessarily.

Q Can it?

A Could I answer in a supporting way?

Q Surely.

A It depends on how good a paper printer you have and whether you have a facility to magnify to the degree that you would want to.

Q So, the degree to which magnification was required would play a significant part in determining whether you would get any useful information from the CRT image as opposed to the paper image?

A I go back to my explanation. If I understand it, you are talking about the original paper print, whereas with the CRT, you are talking about the digitized information?

Q That is correct.

A So, you could lose some of the original information when you digitize your high-quality prints. Even with low-quality prints, when you digitize, you are not really any better.

Q Do you know if Dr. Morain used the computerized data from Arlen Atkins?

A I do not know.

Q Would you expect Dr. Morain to have had occasion to use computer-processed photographic information in his

work generally?

A I would think so.

Q Would you expect him to have used techniques such as stereo analysis for this type of study?

A I would not know, but I would expect so.

Q You stated that the task which you were given was to examine the methodologies of the experts employed with regard to the photo interpretation of the photographs involved in this litigation. How did you approach or go about this task?

A I studied the first Morain report, I believe, and then in sequence I went to the other two reports. Now, I have forgotten which one I looked at first. I concentrated on my tasks of evaluating the idea of the enhancement and the stereo view first to assess whether they are applicable, useful in a specific case and, too, in particular, how does it affect the outcome of the results.

Q To what extent did you examine the particular photographs which were referred to or appended to the reports of Dr. Morain, Dr. Welch or Mr. Atkins?

A I looked at each of the photos and compared the end products of the enhanced ones and the original ones,

and then I also tried to see stereoscopically Dr. Welch's examples and then compared them to some of the photos that Dr. Morain used based on his conclusions about the topography.

Q Dr. Morain's conclusions differ considerably from those of Dr. Welch and Mr. Atkins both as to the length of the total slide of the aircraft parts and also the interpretation of the given features, specifically whether there is a hill, whether there are track marks, et cetera.

Did you make any attempt to resolve in your own mind which of the reports or conclusions were correct?

A First, about the topography, as I examined the photos, I am convinced that there is a rise in topography in front of the final resting place of the troop compartment. The various photos I saw all appear to me to point to this conclusion.

As far as the track, in general, I am in agreement with Dr. Morain's finding that the track was discontinuous until the final track which was only a short distance from the final resting place of the troop compartment. The enhanced photos shown by Mr. Atkins do not persuade me to believe otherwise. This is why I said the results have not been convincing to me.

Q Dr. Liang, you mentioned that you had concluded that there was a rise in front of the troop compartment. Did you make any determination as to whether the troop compartment was in contact with that rise?

A Yes.

Q Is your opinion that it is?

A Yes.

Q How high a rise are you talking about?

A I may have to go back, but I was thinking about this a few weeks ago.

Q 2, 3, 4, up to 5 feet?

A I have to go back to my records, but it is more than 2 feet.

Q Over what distance does that rise in elevation take place?

A Do you mean the distance? What I saw was the troop compartment against the rise area into this rise.

Q The question was, you have described what you believe you have seen as a rise in the ground, in the elevation. Now, a rise can either appear immediately and look like a step or it can appear gradually like a hill going up. The question is, over what distance does this elevation

or rise occur?

MR. FRICKER: Do you understand the question?

THE DEPONENT: Yes. What is the length of the troop compartment?

MR. FRICKER: Do you want to provide him with that?

MR. CONNORS: No, I will take it from whatever he has.

BY MR. CONNORS:

Q Could you identify for us what you are looking at, Doctor?

MR. FRICKER: Show it to him.

MR. CONNORS: Let the record reflect Dr. Liang has just given me a document on the top of which reads: "C-5A SN 68-218 4 April 1975." It appears to be a chart of the accident area.

BY MR. CONNORS:

Q May I ask if this chart was taken from Dr. Morain's report?

A Yes, I think it is from Morain's report. I also have a copy of Morain's report here. I am trying to find some dimension references.

I cannot give you an answer to your question

without careful measurements. As I said, I really did not make the measurements. However, I would say it is plowed into the rise.

BY MR. CONNORS:

Q Doctor, we have been discussing the rise which you believe you see at the forward end of the troop compartment in the various photographs you have examined. In the course of our discussion, you refer to the diagram which was part of Dr. Morain's report which we have now pulled out separately and will be marked Defendant's Exhibit DD-2724.

I am going to give you a red pen and ask you to please mark on there the area of elevation that you have been referring to.

[Diagram from Morain report was marked Defendant's Exhibit No. DD-2744 for identification.]

MR. FRICKER: Let the record reflect he has placed a small red X on there.

BY MR. CONNORS:

Q I will ask you to initial that, if you would, please, Doctor.

A [Deponent complies.]

Q Would you indicate on there also the extent of the elevation, that is, its length, where it appears to run from and to. You can indicate in blue the extent of the elevation.

A [Deponent complies.]

Q Will the same initials do for that, too?

A Yes, I would hope so.

Q Did you have any criticisms at all of the methods employed by Dr. Morain in his analysis?

A Not particularly. I focused my attention on those points. He dwells a lot in the other areas which I did not pay too much attention to.

Q Doctor, you have indicated that you apparently have some criticism with Dr. Welch's use of stereo analysis techniques with regard to the pictures he reviewed and which you have now reviewed also.

What, precisely, is the problem with Dr. Welch's use of stereo analysis in this case?

A We often give students examples of stereo paths to look at. You can align those stereos in the proper direction. You could give two stereoscopic views and you move into another position and you can see the 3-dimensional view

change. You could move farther. You could see no flat. You could move farther and you could see the reverse of the topography. You could see low point and high.

Now, this is even with the same pair of stereoscopic photos. Then we experimented in the early days with the moon photos by earlier explorations. You found find that if you do not know the exact locations of your camera or your mode, you could have all sorts of differing failures come out from the stereo viewing. So, we have been very careful in using the still views of unknown camera positions, unknown focal lengths.

In this particular case, since the stereo view made you feel it was flatter than the other numerous photos indicate, then I think we should be rather critical about them.

As I mentioned, it is probably worth trying but maybe the results would be taken very carefully and you might even need to reconstruct other stereo models.

Q You are not equating Dr. Welch with the students in your class, are you, in terms of their experience to use stereo photography?

A What was that?

Q Are you attempting to compare Dr. Welch to your students in your class with the experience and training he has in use of stereo photography?

A I am not comparing him. I am comparing my experience with the stills.

Q My question is, what is your criticism of Dr. Welch's use of stereo photography in this case?

A Because the camera positions and the focal length and the optical geometry of the situation were unknown.

Q For what purpose would you have to know the focal lengths, the topical geometry, et cetera?

A Because you want to find out the third dimension, which is the rise from all of the geometric relationships.

Q In other words, to measure the height of the elevation?

A Right.

Q Doctor, you are familiar with rice paddy agriculture, are you not?

A Yes.

Q And you have experience in rice paddy areas?

A Yes.

Q If a heavy object weighing several thousand pounds

impacted in a rice paddy at a high rate of speed, what type of mark would it leave in the soil?

A It depends on the stage of the rice cultivation.

Q Let's assume that there was water in the rice paddy. What would be the mark that would be left on the soil by such an object?

A If the rice paddy is filled with water, there is no mark there.

Q In making his measurements, Dr. Morain took what he believed to be the dimensions of known objects and then scaled up to the longer dimensions he was trying to calculate; is that correct?

A I recall there were some discrepancies about the calculations, the measurements, the marks, and so on. I did not really go into much of the dimensions of the aircraft, but certainly the dimensions provided, if I recall, were provided by Lockheed, the aircraft manufacturer. That would be the more dependable data. I have no argument with that.

Q If Dr. Morain used incorrect measurements, then his eventual measurements would be incorrect?

A Yes.

Q Isn't it also correct that when Dr. Morain made

his measurements, he used photographs which he selected by his rough estimation that the objects in the photos were the same distance from the camera lengths?

A I do not recall at this moment.

Q Doctor, when you are attempting to make a measurement on a line or a physical feature that runs at an angle to the margins of the picture, you use something called a cosine correction; is that correct?

A That is correct.

Q When Dr. Morain attempted to make his measurements, he did not use the cosine correction for angles estimated at less than 10 degrees; is that correct?

A I think so.

Q Doctor, what is the distance in feet or percentages between the results obtained by Dr. Morain and Dr. Welch and Mr. Atkins with regard to the distance the troop compartment traveled from the river bank until its final resting place?

A I believe the Morain report gave the final track was 165 feet. He said it could stretch to something like 260. These are just my rough figures. I believe the other report is much longer. Offhand, I have to depend on filed

information that is much longer.

Q There is considerable difference in the two figures, is there not?

A Yes.

Q That would indicate that one or the other is not correct. Would you agree?

A Yes.

Q Do you have any opinion regarding the distance measurements which were done by Mr. Atkins of the pictures which he examined?

A Not specifically.

Q Do you have any criticism of his techniques? Would you agree they are valid?

A I think the difference probably would be in one argument about the way you consider the track, if one considers the continuous or discontinuous track, and then if I reconstruct, the argument was that Mr. Atkins tried to argue for the longer track because he thought that the enhanced photo would indicate that; whereas, Morain's report was based on earlier review of the photo which was shorter, and my conclusion was as stated there that the enhanced photo, regardless of the argument that I had already been

given, it does not convince me of a continuous track.

Q Doctor, my question was really addressed to the distance measurements done by Mr. Atkins.

Specifically, let's talk about the distance from the west river bank side of the Saigon River to the place where the troop compartment eventually came to rest. Do you have any disagreement with his conclusions regarding that distance?

A I am in favor, as I say, of Dr. Morain's conclusion of the continuous track quite near to the final resting place.

Q Doctor, I am not talking about the continuity of the track but, rather, the total number of feet from the river bank to where the troop compartment came to rest.

A The distance?

Q Right.

Q I don't have total recollection, but I have a lot of faith in the measurements as far as the physical distance from the river bank to the resting place.

I have no argument with either Mr. Atkins' or Dr. Welch's measurements.

MR. CONNORS: Just for the record, we would like

to note that immediate prior to the commencement of this deposition, we were presented with the report of Dr. Ta Liang dated April 26, 1982, which has now been identified as Defendant's Exhibit DD-2743. The document was presented to us by Mr. Fricker.

We would note that the production of this document is more than a year late and certainly was covered by various requests regarding production of experts engaged in this litigation.

I would also like to note that on several occasions today, Dr. Liang advised us that he no longer had any recollection of particular facts, and we regard the late production of this document and, thus, the late deposition of Dr. Liang as perhaps the cause of that, and that concludes my statement.

MR. FRICKER: Let me make a brief reply statement.

The record will speak best for what questions posed Dr. Liang indicated less than total computer-like recall. The only one of any significance that I remember having been asked dealt with specific distances, the length of the troop compartment or the distance as measured by one of Lockheed's experts from the bank of the river to the final

resting place of the troop compartment.

These are matters which if, indeed, opposing counsel felt important to ascertain on this record, they were quite capable of producing their own experts' reports and asking if this is the document you saw and if this is the measurement. I don't think any expert is required to have total recall of all figures.

The timing of the deposition of Dr. Liang, as I understand it, was in effect worked out, albeit with some difficulties following his identification in the pleadings submitted by Plaintiff's counsel. It was the first of a series of depositions to be taken in this case. I don't see anything untoward or suspect about the timing of his being presented as an expert or anything about the manner in which he conducted himself today. He has been quite forthright and candid so far as I can determine with his report which, admittedly, was dated sometime ago and, I think, substantially before the decision was made that the doctor would be offered as a witness at a trial, namely, the Kurth trial.

MR. CONNORS: For the record, my statement was not intended to criticize Dr. Liang.

MR. FRICKER: I don't think he or I took it that

way.

MR. CONNORS: Thank you very much, Doctor.

[The deposition was concluded at 12:30 p.m.]

I, Dr. Ta Liang, do hereby certify that I have read the foregoing 64 pages of my deposition and attest to the accurate transcription of my answers given to the questions propounded.

_____

[Signature of Deponent]

Sworn and subscribed to before me this _____ day of _____, 1983.

_____

NOTARY PUBLIC

My Commission expires:

_____

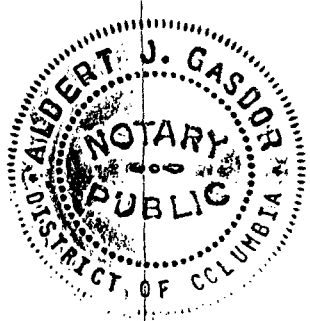
CERTIFICATE OF NOTARY PUBLIC/REPORTER

UNITED STATES OF AMERICA |
| ss.
DISTRICT OF COLUMBIA |

I, Albert J. Gasdor, a Notary Public in and for the District of Columbia, the officer before whom the foregoing deposition was taken, do hereby certify that the witness whose testimony appears herein was duly sworn by me; that the testimony of said witness is a true and accurate transcription of the stenographic notes taken by me and thereafter reduced to typewritten form by me.

I further certify that I am neither counsel for, related to, nor employed by any of the parties to this action in which this deposition was taken; and, further, that I am not a relative or employee of any attorney employed by the parties hereto, nor financially interested in the outcome of this litigation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this 4th day of August, 1983.



Albert J. Gasdor

Notary Public in and for
the District of Columbia

My Commission expires:

July 31, 1985

Biographical Summary of Ta Liang

Education	B.E. 1937, Tsing Hua University, China, M.C.E. 1948, Ph.D. 1952, Cornell University.
Professional Experience 1970 to date	Professor of Civil and Environmental Engineering, Cornell University, Ithaca, New York, teaching courses and directing research in Airphoto Interpretation, Remote Sensing, and Physical Environment Evaluation.
	Principal Investigator, NASA-sponsored Remote Sensing Program, Cornell University, 1972-date.
	Co-investigator, Puerto Rico Natural Resources Inventory Project, Cornell University, 1971-73.
	Visiting Professor, Colorado School of Mines, Golden, Colorado. Co-investigator, Colorado Natural Resources Inventory Project, 1970.
	Consultant to national and international governmental and industrial organizations in the use of airphoto and remote sensing methods in national inventory and planning, location for power plants, superport, Arctic gas line, transportation routes, and other engineering, agricultural and land development projects in the United States, Canada, Puerto Rico, Barbados, Chile, southeast, south and southwest Asia, China, and west Africa.
1963-1970	Professor of Civil Engineering, Cornell University.
	Visiting Professor, Cornell Aeronautical Laboratory, Buffalo, N.Y., 1966-67.
	Visiting Lecturer, Graduate School of Planning, University of Puerto Rico, 1965-66.
	Director, Tropical Soils Airphoto Research Project, Cornell University (sponsored by the Air Force Cambridge Research Laboratories) 1961-65.
	Consultant to governments and industries in engineering and airphoto projects, in the U.S., Canada, Caribbean area, Central and South America, the Middle East, Southeast Asia, North, West, East, and Central Africa and Western Australia.
1957-1963	Associate Professor of Civil Engineering, Cornell University.
	Consultant in engineering and airphoto projects in various parts of U.S. and abroad.
	Chairman, Photographic Interpretation Committee, American Society of Photogrammetry, 1960-61.

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1955-1957	Senior Soils and Foundation Engineer, Tippetts-Abbett-McCarthy-Stratton, New York. Airphoto and field investigation of soils, foundations and construction material sources in projects of dams, highways, railroads, airfields, and ports, in various parts of U.S. and abroad. Lecturer in Engineering Interpretation of Aerial Photography, City College of New York, 1957.
1954-1955	Field Director and Visiting Associate Professor, Cornell University Airphoto Team in Burma, sponsored by the U.S. State Department Foreign Operations Administration. The team was composed of experts in the fields of engineering, geology, agriculture, forestry, and city planning to train Burmese government officials.
1950-1954	Research Associate in Civil Engineering, Cornell University, conducted research projects sponsored by U.S. Navy, U.S. Army, and C.A.A. in the fields of soils and aerial photography. Did field work in the United States, Canada, Pacific area, and the Philippines.
1946-1950	Research and graduate work at Cornell University in Airphoto Interpretation, Soils Engineering, Engineering Geology, and Transportation Engineering.
1942-1945	Senior Engineer, U.S. Armed Forces in China-Burma-India Theater. Supervision of design and construction of roads, airports, and housing facilities. Awarded U.S. War Department Meritorious Civilian Service Emblem, 1945.
1937-1942	Highways and railroads survey, design, and construction, China and Burma.
PUBLICATIONS AND REPORTS	Analysis of Landfills with Historic Airphotos (co-author) ASCE/ASP Specialty Conference on Civil Engineering Applications of Remote Sensing. American Society of Civil Engineers, New York, N.Y. 1980. Airphoto Interpretation for Engineering Applications, Historical Perspective and Future Evaluation: V. Tropical Regions, invited paper, American Society of Photogrammetry symposium, Washington, D.C. 1979. Landslides: Analysis and Control, Recognition and Identification Chapter (co-author), Transportation Research Board, National Academy of Sciences, Washington, D.C. 1978.

PUBLICATIONS AND REPORTS (continued)

The use of Airphoto Interpretation and Remote Sensing in Soil Resources Inventories (co-author), invited paper, Soil Resources Inventory Workshop, Cornell Agricultural and Life Sciences College, sponsored by the U.S. Agency for International Development, Ithaca, N.Y. 1977.

Image Interpretation (contributing author), Chapter in Manual of Remote Sensing, American Society of Photogrammetry, Washington, D.C. 1975.

Airphoto Analysis in the Tropics: Crop Identification (co-author), Proceedings, Tenth Symposium on Internationa Remote Sensing of Environment, Ann Arbor, Michigan, 1975.

Land Inventory Systems - The Cornell Experience (co-autho invited paper in International Symposium on Aerial Inventory of Natural Resources, Mexico City, Mexico, 1973.

Remote Sensing of the Physical Environment, invited paper American Society of Programmetry national symposium, Washington, D.C. 1972.

Forest Environments in Tropical Life Zones (co-author), Pergamon Press Inc., Oxford and New York, 1971.

Airphoto Interpretation of Engineering Soil in Tropical Environments, Proceedings, Third Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, 1965.

Application of Airphoto Interpretation in Route Location, (co-author), International Archives of Photogrammetry Vol. XIV, Delft, The Netherlands, 1963.

A critical Review of Engineering Uses of Airphotos in the Quebec Cartier Mining Railway Project, Canada (co-author), presented at the Semi-Annual National Meeting, American Society of Photogrammetry, New York, 1961.

Landslides and Engineering Practice (co-author of Airphoto Interpretation Chapter), Highway Research Board, National Academy of Sciences, 1958.

Technical Project Reports on national airphoto and remot sensing program; soil survey; railroad, highway, and pipeline route location; site evaluation; construction material search; and landslide investigation, in various parts of the world, 1955 to date.

Research Project Reports on: Remote Sensing Program, NASA, 1972-80; Natural Resources Inventory, Puerto Rico (co-author), 1973; Natural Resources Inventory, Colorado (co-author), 1971; Tropical Soils Airphoto Research, U.S. Air Force, 1964; Airphoto Interpretation, Burma, U.S. FOA, 1955; Long-Range Photography Research, U.S. Army, 1954; Soil Moisture and Density Research, CAA, 1952; Key to Aerial Photographic Determination of Ground Conditions, Landform Series, Six Volumes (co-author),U.S. Office of Naval Research, 1951.

TA LIANG
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PHONES: 607 256-5074
607 257-0484

April 26, 1982

Charles R. Work, Esquire
Peabody, Lambert & Meyers
1150 Connecticut Avenue, N.W., 12th Floor
Washington, D. C. 20036

Dear Mr. Work:

I have had the opportunity to review the deposition and trial testimony of Mr. Atkins, the computer-enhanced photographs he created and relied upon, the report of Dr. Welch, the photographs he relied upon, and two motion pictures (Tarbell-1 and 75 CRK-DC-2184). I have also reviewed the report of Dr. Morain and the photographs he relied upon.

I was asked to review these materials and determine the significance, if any, of computer enhancement and stereoscopic analysis by Mr. Atkins and Dr. Welch respectively to the issue of the lengths of the tracks of the troop compartment and the existence of a ground rise at the forward end of the troop compartment, at the point of last impact.

Upon review of these materials, and upon consideration of the task before me, I have an opinion regarding the use of the technologies employed by Mr. Atkins and Dr. Welch.

1. Regarding the use of computer enhancement techniques as employed by Mr. Atkins, I have the following opinion: Computer enhancement, an increasingly used technique, has not produced significantly different results in this case. The generally agreed-to continuous track by the troop compartment is clear in all original photographs. The cause of discontinuous "track" or disturbance is subject to debate and has not been enhanced convincingly. The use of computer enhancement, meanwhile, has its limitations and should be used with caution. In digitizing the original photographs (in contrast to the original data being digital), one always loses some information ("one generation away"). Furthermore, in computer manipulation, one may inadvertently overlook details in the photographs that might provide useful information. For practical purposes, given the quality of the original photo prints, the improvement, if any, of measurements by "pixels" is negligible.

2. Regarding the use of stereoscopic analysis by Dr. Welch, I have the following opinion: An attempt to create some stereo view for topography is always commendable. However, it could be misleading or even erroneous for visual analysis, particularly in not-rugged terrain, when the position and attitude of the camera for each photo is unknown. Thus, a small rise of the topography in front of the final resting place of the troop compartment, as suggested by Dr. Morain, (the evidence provided by several ground and air oblique photos is rather convincing) could possibly

be missed with the proposed "stereo" by Dr. Welch. In other words, without properly created stereo models, the terrain condition suggested by Dr. Morain cannot be disproved. Rigorous analytical solution in stereo would require such information as camera focal length, tangential distortion, and the like.

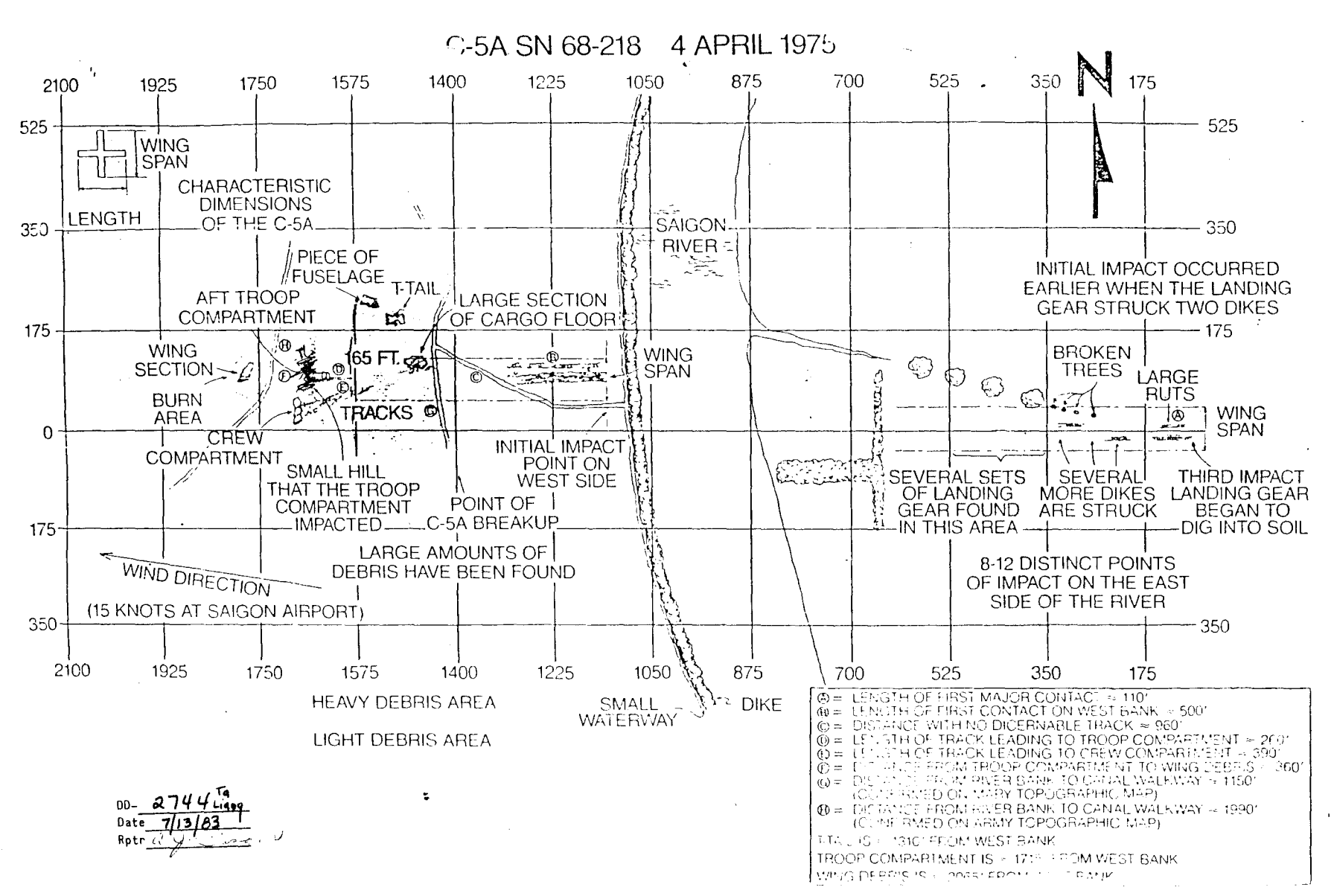
Altogether, the use of computer enhancement and stereoscopic analysis as employed by Mr. Atkins and Dr. Welch does nothing more to answer the issue of the length of the tracks, the severity of the impact, or the non-existence of a ground rise than do more standard methods. Further, their approaches could be misleading and confusing to the layman.

Finally, upon review of these materials, I find nothing to contradict the conclusions reached by Dr. Morain in his report. I believe there is sound photographic evidence upon which to base Dr. Morain's opinion regarding the impact of the troop compartment with the ground, and I concur with his findings.

Very truly yours,

Ta Liang

Ta Liang
Consultant



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